Use of Computers and the Internet to Facilitate Export of Prefabricated Housing from Canada

Cyrus M. Bilimoria

School of Architecture

McGill University

Montréal

July 1999

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirement of the degree of Master of Architecture

Abstract

Shifting demographics and economic factors have recently necessitated the export of prefabricated homes. With respect to trade in the global market, home manufacturers can greatly benefit by using E-commerce and digital networks to communicate with their foreign clients.

The author proposes a software application to assist Canadian home prefabricators and manufacturers of building components to display their services and products in an interactive and electronic format. This tool would help these companies by increasing the size of their potential client base and the speed of their business interactions.

The study concludes that specialised software to facilitate the export of prefabricated homes can easily take advantage of the Internet's speed and accessibility as a download or Website as well as be available on CD-ROM.

Résumé

Les nouvelles réalités démographiques et économiques de notre société ont récemment favorisé l'exportation de maisons préfabriquées. Les manufacturiers de ces maisons peuvent grandement bénéficier de l'utilisation du commerce électronique et des nouvelles technologies de l'information pour demeurer compétitifs au sein des marchés globaux.

L'auteur propose un logiciel permettant aux manufacturiers et fabricants de maisons préfabriquées de présenter leurs produits et services de façon électronique et interactive. Ces compagnies pourraient alors atteindre une clientèle potentielle élargie et améliorer la vitesse de leurs interactions avec celle-ci.

L'étude conclue qu'un tel logiciel pourrait être accessible par téléchargement, via un site Internet ou bien sur CD-ROM. Ces moyens permettraient de prendre avantage de la vitesse et de la facilité d'accès de l'Internet.

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Acknowledgements

I would like to thank Prof. David Covo and all of his colleagues, both faculty and staff, in the McGill School of Architecture who have taught, helped and supported me over the years allowing me to complete both my undergraduate and post-graduate work here. I will also name only a few of those who have been involved as teachers or resources for me: Dr. Donald Chan, Prof. Virkram Bhatt and his wife Susie, Marcia King, Helen Dyer, Dr. Annmarie Adams, Prof. Bruce Anderson, Prof. Pieter Sijpkes and Nadia Meratla; similarly from the Department of Electrical Engineering: Don Pavlasek, Scott Manktelow and Jozsef Boka.

My advisor, Dr. Avi Friedman, has shown incredible patience and motivation, allowing me to finish this project while also giving me the chance to assist with his OMB course. His ongoing provision of ideas and advice was essential in completing this thesis.

With respect to the work itself, I have had tremendous amounts of help from people such as the other members of the Next Home team, the employees of Modulex and the team at K-OS Multimédia, Sakis Spyrou, Marco Gervasio and Eugenio Zuniga, who produced the prototype of the software tool. Chrystian Guy provided me with an invaluable understanding of the Internet through his professionalism and expertise. I also thank Isabelle Girard for translating my abstract and her partner Matthieu Quiviger for being a good friend throughout this decade.

I would also like to mention the friendship and assistance of the Wright-Rousham and Hausler-Krawitz families: Lynne, for editing the thesis while I would watch Samantha; David for constantly giving me assistance and technical advice; Jon for encouraging me to finish, helping with my OMB and workshop tasks and providing me with much needed and rewarding work; and Christine and Charlie for being entertaining.

My friends deserve thanks for making my time at McGill unimaginably enjoyable and fulfilling. As well, my association with the McGill Track and Field programme and its athletes and coaches has been an especially rewarding and truly enriching part of my education and life.

Lastly, I thank my parents, Katy and Minoo, and my brother, Darius, for their love, knowledge and support which has influenced and benefitted almost everything I have had the pleasure of doing as well as affecting all the simple, little things I have accomplished and experienced over the years.

CHAPTER ONE: INTRODUCTION

1.1 Rationale for the Study

With the proliferation of the computer and Internet technologies, the manner in which companies conduct many standard business dealings is constantly evolving. In order to stay competitive, the prefabricated housing industry, despite a foundation in manufacturing of quality and expertise, must similarly adapt to a contemporary era of advanced communication. This is particularly relevant to the multitude of prefabricated housing manufacturers who wish to expand their businesses into the export market thus benefiting from the potential gains of trading within the global economy. Over the course of the last five decades, Canada has experienced a steady decline in the number of housing starts, a trend from which Québec is no exception. The reasons for such radical shifts in housing requirements can be to demographics and economics.

1.1.1 Demographics

A foremost consideration in the approach to contemporary housing recognises that while the number of families and households in Canada is increasing, the size of these domestic arrangements is decreasing. It is also essential to distinguish that fewer Canadians are living within families. The subsequent effect is realised in a demand for smaller housing units to accommodate a smaller number of occupants. The diverse array of household compositions correlates accordingly with these demographic shifts. The disruption of the traditional family is exemplified by the increased incidence of divorce in Canada and the consequent increase of

single-parent households, a number which rose by over 31% between 1986 and 1991.[1] Further defying the definition of the "universal family" is the increase in common-law households, a composition that accounts for one in ten families.[2] The single-person household is also a rising trend that challenges the range of potential investors in the home-buying market. Cultural factors also amplify household diversity, such as the cohabitation of multiple generations within a single household.

Furthermore, as Canada progresses toward the 21st century, the impact of the population's age structure upon the housing industry is an inevitable criterion for future consideration. As the youth bracket recedes, the baby-boomers (i.e. those born between 1946 and 1966) validate the prospect that fewer numbers of young people will be "supporting" a greater number of older people. In anticipation of this surge, many baby-boomers are now taking active measures to safeguard against a precarious future of insufficient or non-existent government pensions (e.g. the uncertain future of tax-deductible RRSP contributions), unstable job markets and shortages of viable housing options.[3]

The diverse array of dynamic household types undergoes numerous changes in composition in natural progression from stage to stage in their evolving life cycles. In order to accommodate the fluctuations and transitions in contemporary households, responsive and adaptable housing forms are required. Additionally, effective communication, using computer technology to access the global markets, is a pertinent element through which to supplement the decreasing local housing demand and increased activity within the Canadian housing industry.

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[1] Statistics Canada, *Age, Sex and Marital Status* (Ottawa: Supply and Services Canada, 1992) Catalogue no. 96-304E.

[2] Statistics Canada, *1991 Census Highlights as Released by the Daily* (Tuesday, 11 May, 1993: "Education, Mobility and Migration, and Shelter Costs") (Ottawa: Supply and Services Canada, 1994) Catalogue no. 96-304E.

[3] David J. Krawitz, "The Canadian Housing Affordability Challenge," *Open House International* 22.4 (1997): 6.

1.1.2 Economics

The upheavals in the global economy in the last fifteen years have taken their toll on both international markets and the individual citizen. Government budgeting for deficit reduction has led to dramatic cutbacks in social services and jobs; recessions and limited economic growth have deterred potential investors, employers and the average consumer; and the restructuring of many traditional arenas of commerce has resulted in redundancies and precarious employment security. With the average Canadian annual family income at $56,269,[1] combined with declining economic confidence, the number of housing starts has consistently decreased with a 30% differential between 1993 and 1997.[2] Given these parameters and an estimated median value of an owner-occupied dwelling in Montréal at $120,000, the home ownership bracket is significantly narrowed.[3] The slow-down in the Canadian real-estate market of the late 1980s and early 1990s, combined with the doubling of land prices and infrastructure costs, is characterised by companies no longer willing or able to take bold financial risks in local housing developments and exposing the global market as a significant potential supplement to decreasing local activity.

The "move-up" market of Canadian homeowners is also smaller now than ever before, instilling the renovation sector as a more viable alternative than the new-house market. First-time owners who are reluctant to sell their starter homes in a depressed market are opting instead to renovate with the ready availability of products and technologies as a means to home improvement. Renovations made for the purpose of energy efficiency alone increase the comfort of the residents and enable energy cost savings of between 15% and 35% annually.

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[1] Statistics Canada, *Average Annual Income* (Ottawa: Supply and Services Canada, 1997) Catalogue no. 13-207-XPB.

[2] Statistics Canada, *Housing Starts* (Ottawa: CANSIM, 1998) Matrix 9715.

[3] Statistics Canada, *Occupied Private Dwellings* (Ottawa: Supply and Services Canada, 1992) Catalogue no. 93-314.

During economic slumps, competition for renovation work is eminently prevalent in all segments of the housing industry (building material manufacturers, distributors and retailers, renovators, contractors and traders), creating a buyers' market where homeowners can plan low-cost renovation projects.[1]

1.1.3 The Need to Export

Housing manufacturers must react to dramatic changes in the domestic housing market and focus their efforts on the export potential of Canadian housing and building products. The global economic climate is presently well-suited to new trading opportunities and must take advantage of large-scale issues such as freer trade between international economic and political barriers and the increased accessibility of long-distance communication and interaction.

The high demand of housing in overseas markets and the projected decline of the local Canadian housing industry provide the framework for an intriguing alternative to the traditional, conservative conventions of the current industry norms. This transition to the international market has been greatly facilitated by conducive global geopolitical changes such as NAFTA, whereby an open trade corridor was implemented to simplify trade procedures. In addition to the multitude of fundamental demographic and economic shifts in Canada, an expansion of the housing industry during the 1980s witnessed an increase in new companies who are now willing to compensate local volume deficiencies with activities abroad.

The variety and abundance of natural resources, a high quality of workmanship for cold-climate construction, relatively inexpensive hydro-electric power and efficient communication

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[1] National Housing Research Committee (NHRC), *Housing Research Priorities Identified by the NHRC in 1990-92 with Additional Issues for 1995* (Ottawa: CMHC, 1995) 16.

and transport systems combine to advocate Canadian products as highly competitive on the international market.

The author suggests that it is essential that Canadian housing manufacturers react to the dramatic changes in the domestic market and focus their efforts and direct attention on the export potential of housing and building products. The global economic climate is prime for innovative trading opportunities passed, not only by more liberal international trade barriers, but also by the increased accessibility of long-distance communication and critical interaction through various established electronic networks.

1.1.4 Three Tested Arguments

Argument 1: Due to the lack of local residential construction activity, Canadian home manufacturers must gain full advantage from export in the global market, by introducing or restructuring their utilisation of electronic media, in order to survive.

Test 1: Considering the rebound of the housing market and the increased demand for the construction of new dwellings across Canada, there is little need for Canadian housing manufacturers to invest their energies into developing a highly sophisticated network for trading in the global housing-export market.

Argument 2: The Internet is a promising medium for the global marketing and trade of Canadian pre-manufactured homes.

Test 2: Due to the complex and non-specific nature of selling and marketing homes, prefabricated housing manufacturers may find it hard to justify the increased cost and effort required to export on the Internet as a substitute for traditional methods.

Argument 3: Interactivity between the customer/client and the builder/developer is essential for the home manufacturer to trade successfully in the global export market of housing.

Test 3: In the process of providing prefabricated homes, builders can sacrifice valuable time and productivity when allowing clients to be too involved in the design phase of a project.

1.2 Previous Research and Development

This section will examine the ventures undertaken by other companies involved in the prefabricated housing industry which are being implemented to facilitate export opportunities. In addition, precedents of companies involved in various areas of industry and business who already utilize the World Wide Web or Internet as a global trading and communication tool will be established.

Based on the literature review, the majority of the research executed by housing export consultants (either performed by academic institutions or private consultants who have a grasp of market conditions due to their interaction with the industry) is accomplished by observing previous market trends and socio-economic factors relating specifically to home buyers. Canada Mortgage and Housing Corporation (CMHC) is a government-funded agency which undertakes and supports research in various housing-related areas. Due to increased activity within the field of export, CMHC has recently documented numerous projects concerning the export of housing by Canadian manufacturers. These reports focus their objectives on the study of individual aspects particular to the multitude of fundamental issues pertaining to the export of housing. Consequently, a brief analysis of a selection of recent publications will enhance the perspective and understanding of the specific problems and requirements pertinent to this field of research.

Canada is one of the key players in the housing export market. The abundance of natural resources, a well-developed economy and the inherent ability to efficiently transport and deliver housing and related products across a large, geographically and climatically diverse nation has enabled Canada to make the transition into foreign housing markets with relative ease. Fundamental to export potential is the need to assess the role of competition prevalent in the export market. *Canada's Competitors in International Housing Markets* examines three rudimentary aspects of competition:

> "• Factors driving companies and countries to enter international housing markets today, and the ways in which they are doing so;
>
> • Ways in which other governments support their firms in entering international markets; and
>
> • The state of competition in target markets of interest to Canada, both from domestic and foreign firms."[1]

To address these topics, the study provides an analysis of six international competitors in the market by reviewing the framework and structure of export strategies, the impact of corporate subsidies from their respective governments and the political stability and housing demand in countries of potential interest to Canadian firms.

An additional prime area of concentration in the research of housing export is to examine the existing structure of government programmes and services which are currently available to support the international commercial endeavours of Canada's housing industry.[2] These resources relate to areas such as data and market research, export promotions, financing and insurance provided by federal and provincial departments and agencies, as well as by the academic and business (private on non-profit) communities.[3] In terms of past experience, the transfer of technology through traditional channels by suppliers has, in many instances, led to a

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[1] Canada Mortgage and Housing Corporation, *Compendium of Research* (Ottawa: CMHC, 1984-) 84.
[2] Ibid., 85.
[3] Ibid., 87.

series of critical asymmetries in the export process. Studies on experiences with individual developing countries have documented the indiscriminate export of technology that involved high costs and inefficient management and construction procedures.[1] By extension, further studies provide strategic frameworks through which a context can be developed in order to deploy the government's housing-related export support activities and resources.

The appropriate nature with respect to exporting housing is also a topic of concern, analysed by researchers in various CMHC documentation. Issues that require attention are the suitability of Canadian technologies in specific markets and the determination of specific regions which are most promising for this form of trade. *Overview of Housing Export Opportunities for Canadians* (1996) provides analyses of both international housing opportunities and the successful markets for sales of Canadian housing-related products, technologies and services. These are studied through the compilation of data which is displayed as charts and tables illustrating how companies can position their assets in relation to global trading possibilities.

Considering the widespread use of the Internet has increased tremendously in only the last few years, justifying the abundance of current studies published of this phenom. The focus, with respect to doing business on the Web, is approached from different areas of concentration: the most distinct division is that between concerns of technical and marketing natures. Clearly, housing exporters must address both these issues with perhaps a balance different to that of companies in other areas of business also using the Web for trading purposes. For example, since building a house is far more complex a task that has a greater client input than marketing and selling other products, home manufacturing companies would be more likely to consider sophisticated features such as interactive modes to allow the client or user to make choices, or the potential for users at both ends to communicate with the advantage of being able to update information on each other's screens. These capabilities may require specialised equipment but

[1] Singer et al., *Technology Transfer by Multinationals* (New Delhi: Ashish Publishing Co., 1988) 8.

could allow for savings in time and money. Ultimately, another effective method of researching in this field is to simply surf the Web and observe what companies are doing, especially those involved in the housing and building product industries, and the ways in which these uses are changing.

There is also research currently being undertaken relating the marketing and selling of Canadian manufactured homes in the global electronic network, such as a feasibility study for the establishment of a housing export Website at CMHC. Much can also be learned from companies that produce housing or manufacturing housing-related building products who have already created a presence on the Web, even if the current function of these sites is simply an electronic catalogue. The development of this potential will no doubt increase in order to allow housing exporters to benefit from the evolving utilisation of the Internet as a business medium.

1.3 Research Question

1.3.1 The Main Question

How can the use of computers and the Internet facilitate the export initiatives and practises of prefabricated housing manufacturers in Canada?

1.3.2 Sub-Questions

How can the introduction or restructuring of the use of computers and Internet technologies facilitate the export of prefabricated homes from Canada?

Is there a need for manufactured Canadian homes to have a presence in the electronic global market?

Should customer or client interactivity and input be considered in the export of prefabricated homes from Canada?

1.3.3 Glossary of Key Words

The following is a list of definitions of key words with a particular application to housing:

computer:	computers and computer networks are used by home builders and prefabricated home manufacturers as tools for design, costing, correspondence, payment and shipping.
Internet:	global digital communication and information network; used for transferring electronic data.
export:	trading and shipping of goods/technologies to foreign markets.
prefabricated homes:	residential building modules or units manufactured under controlled conditions in a factory (i.e. off site) typically using standard wood frame construction techniques (other modular or standardised methods are also used).
interactivity:	in this case, user involvement in the design of a house with respect to layout, choice of materials and finishes, components (e.g. fixtures, hardware), and time schedule.
customer:	buyer of home; could be a developer, builder, general contractor or private home buyer.

1.4 Objectives

The author wishes to study:

- Prefabricated housing process and its ability to be adapted for export purposes.
- Associated tasks and responsibilities of a prefabricated home manufacturer.
- Export practises of companies involved in this industry.
- The potential and limits of Internet technology with respect to doing trade locally and internationally, in fields as complex and technical as the housing and building product industries.
- Analyse and study systems for displaying and ordering housing and building products in the local and foreign housing markets using computers and the Internet. The required use or purchase of software, hardware and expertise will also be addressed.

1.5 Scope of the Study

The author will address the issues of the prefabricated housing market in Canada (with a specific case study taken from within Québec) and its associated practises using computer and Internet technologies in the context of trading in both local and foreign export markets. While Chapters 2 and 3 are based on research and observation in the previously stated fields, Chapters 4 and 5 deal with specific solutions or proposals which can be applied to these areas of research. Chapter 5 consists of the description of a software tool whose logic and layout was designed and prepared by the author

1.6 Methodology

A possible approach to the development of a methodology is to perform an analysis of a study which has documented the present conditions and future outlook for Canadian housing exporters. Therefore a review will be made of *Canada's Housing Export Experience and Prospects* (Ottawa: CMHC, 1996) written by C. David Crenna. This report provides information on three main approaches relating to the study of the business ventures of Canadian home builders who trade in the global market; it documents the recent expansion of Canada's housing exporters, describes the factors contributing to their success in an international context and gives a forecast of the increasing potential gains for companies entering or still trading in this field in the future.[1] The study concludes by reviewing how the private sector and governmental bodies can cooperate by working together to seize export opportunities that have little precedent in the history of the global economy.

The author introduced the major players involved in the field. By studying the local and foreign markets of home builders and the related businesses, it is noted that the financial basis of Canada's housing exporters is domestic construction and renovation activity. The local industry is valued at approximately $40 billion annually, providing as many as 300,000 jobs through 15,000 home builders and land developers involved in residential construction, along with 66,000 trades contractors (e.g. plumbers and electricians).[2] All of these businesses are supplied with materials and components by 4,500 Canadian-based and foreign manufacturers. The decline in the demand for domestic housing creates a more competitive local marketplace and higher standards, which prepares these companies for foreign competition in the international market. This latter trade is even more important during slow periods in the local home-building economy.

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[1] C. David Crenna, *Canada's Housing Export Experience and Prospects* (Ottawa: CMHC, 1996) iii.
[2] Ibid., 1.

Through surveys of 100 of Canada's largest housing exporting companies, the authors clearly recognised that companies engaged in exporting homes or investing in foreign residential development form only a small part of the industry as a whole. The main success is business done by companies trading housing-related commodities and products ($14.5 billion a year) with a strong contribution made by companies involved in licensing manufacturing and building technologies and others which sell services such as design and project management (Table 1.1).[1] Examples of these successful building products are items such as plywood and OSB (oriented strand board or Aspenite) sheathing both of which rely on Canada's large forestry resources and wood product manufacturing industries (Figure 1.1). Marketable building technologies, such as steel frame residential construction and permanent insulated formwork and concrete systems, are developed in Canada, motivated by the desire to have more energy efficient buildings with a reduction in construction time Figures 1.2 and 1.3).

A detailed statistical analysis is shown of the breakdown of the international activities of the Canadian housing industry and its companies. Quantitative data, such as volume of business, number of employees and business shares, are compiled and displayed graphically. In addition, specific examples of companies are given. Again factors, e.g. employment, production and manufacturing outputs and sales distribution, are quantified and explained with respect to possible influences. A broad range of companies are looked at in order to give an indication of the variety of company sizes and the associated practices and trade which occur as a result of facilities and financing available.

Through devoting a chapter to housing export trends, the author determined which housing-related exports are the most successful, and prepared extensive tables of the annual trade values of individual building products and services from the years 1990 to 1996 inclusively. The

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[1] Crenna, *Canada's Housing Export*, 2.

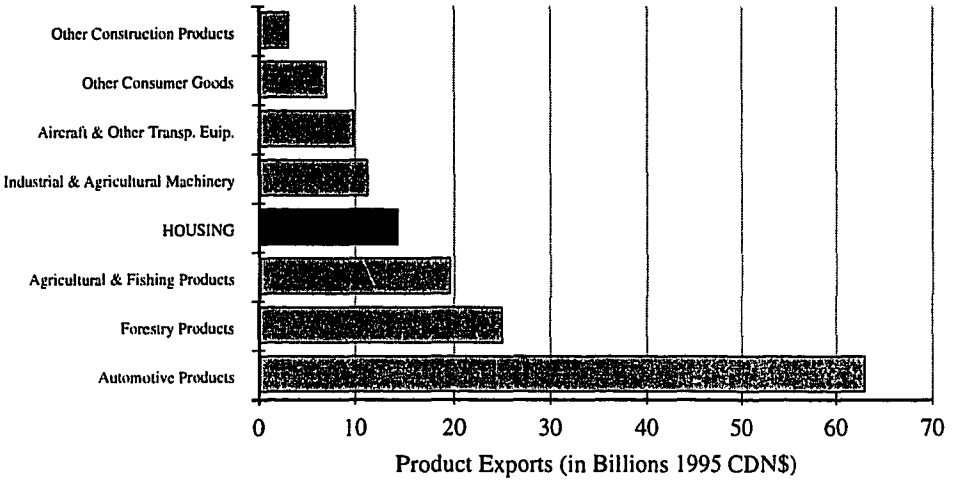

Table 1.1 Export of housing products compared with other groupings (Statistics Canada, 1995)

Figure 1.1 Wood-based sheathing (Norbord Industries, 1996)

Figure 1.2 Steel frame construction (Canadian Sheet Steel Building Institute, 1993)

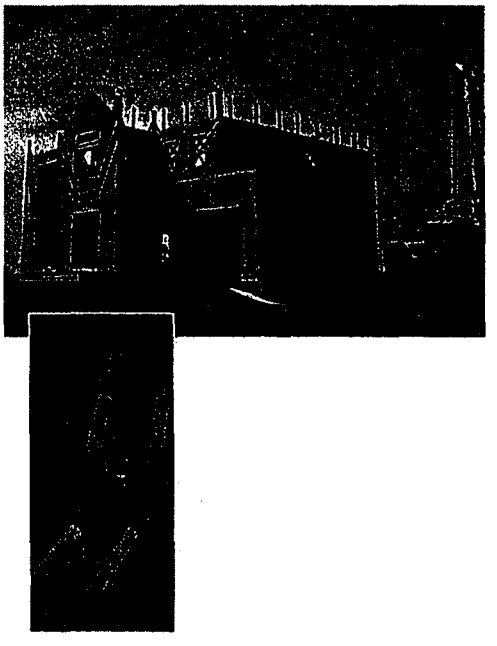

Figure 1.3 Permanent insulated formwork/concrete systems (Polycrete Industries/AAB Building Systems, 1995)

fastest-growing exports of housing products and commodities are highlighted in order to observe any trends which may be apparent. The role of higher value-added products is also examined. These products use raw materials that are turned into items many times more valuable in terms of cost than the original materials, (e.g. appliances and electronic equipment), and have also exhibited rapid rates of growth in sales. Overall, the United States is still the predominant importer of Canadian building products and of softwood lumber (including 2x4 wood frame construction systems) accounting for approximately 70% of sales in both areas.[1]

In order to gauge the prospective markets for Canadian housing exports, all of Canada's existing trading destinations are studied with respect to political and economic climate, housing trends and policies, previous trade with Canada, and the emergence of freer trading arrangements.[2] In many cases, specific occurrences in the global landscape, such as conflicts or mass migrations, can have a direct effect on Canada's role in housing exports. This concept is reinforced through the analysis of Canada's advantages in international housing markets. According to the study, some of Canada's strengths are its efficient and relatively low-cost manufacturing processes, highly developed transportation systems, large reserves of natural resources, the support of stable financial institutions, high regulatory and quality control standards (e.g. the National Building Code) and a worldwide reputation for honesty and quality in its business practices.[3]

Through the use of detailed, up-to-date surveys and analyses, the author has provided an accurate picture of the situation that Canada's housing exporters face. The understanding of which building products, commodities and technologies are appropriate for specific markets is invaluable for gaining an understanding of how the industry may approach the business of selling homes across the world. Therefore, the main chapter of this thesis will describe a tool

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[1] Crenna, *Canada's Housing Export*, 14.
[2] Ibid., 20.
[3] Ibid., 29.

that has been proposed to benefit housing exporters in their task of displaying and communicating specific building products and housing systems for foreign markets. This tool was specifically developed as a software application to showcase the Next Home™ demonstration unit, which was built as a research project undertaken by the Affordable Homes Programme in the Master's Housing Department of the McGill University School of Architecture in 1996.

1.7 Structure of the Thesis

The proposed area of interest can be simply isolated into two distinct fields of study: housing and Internet technologies. The former encapsulates the following disciplines of the Canadian housing market: its history, the use of prefabricated systems, Canada's housing export strategy, export of housing with an emphasis on modular and panelised systems, and adapting housing to suit foreign contextual requirements.

The latter incorporates an in-depth analysis of the evolution of the Internet and the facilities and functions available through this technology. The ways in which companies in other fields utilize Internet potential (i.e. for exposure, marketing or selling products) will be examined in order to develop a similar methodology relating to prefabricated housing manufacturers. Requirements in terms of software and hardware will be determined, as well as the specific expertise needed in order to establish, maintain and trouble-shoot any systems that are developed or implemented for these types of companies. There also will be a description of the future prospects and possibilities of business procedures performed on-line incorporating the specific requirements of housing manufacturers.

CHAPTER TWO: CANADA'S EXPORT OF PREFABRICATED HOUSING

2.1 The Housing and Building Product Market

2.1.1 Historical Background

With the increased demand for housing in post-World War II Canada, the home-building industry had to adapt to the specific requirements of a construction boom. In the period since the late 1940s, Canada tripled its housing stock with the addition of six-and-a-half-million new dwellings.[1] Large suburban developments of single-family homes required the use of a prototype that could be constructed quickly and at low cost to both developers and buyers. This prototype also had to be energy efficient, especially with rising energy costs, in order to provide comfort during the extreme weather conditions experienced in our country. The industry also needed to rely on local resources to develop a strong domestic industrial base in building products which could also become a key aspect of foreign trade. The result was an efficiency, with respect to construction techniques and practices, that has evolved and been refined over the second half of this century, allowing builders to construct homes which are simply and inexpensively built to relatively high standards of quality and low energy consumption.

Canada is a vast country with an abundance of natural resources. Historically, Canada's economy has relied on these resources to create jobs and to prosper financially in the global market. Because forestry is one of the largest industries in the country, Canada's housing

[1] Canada Mortgage and Housing Corporation, *Housing in Canada, 1945 to 1986: an Overview and Lessons Learned* (Ottawa: CMHC, 1987) 33.

stock has relied almost exclusively on wood-frame construction. This framing system profits from the cheap availability of small sectional timber framing members, with the added advantage of its inherent modularity and ease of construction (Figure 2.1). As well as being lightweight and structurally integral, standard wood-frame construction also allows for high thermal insulating properties and is flexible in terms of future adaptations to the structure or to interior partitions, and lends itself well to the use of prefabricated components. Now, more than ever, prefabrication of wood-frame wall panels and building modules is becoming more popular, as financial and timing concerns are of greater importance to both developers and consumers. Prefabrication allows for even more standardisation, better quality control and a reduction in costly site construction time (Figures 2.2 and 2.3).[1]

2.1.2 The Shift in the Market

A number of factors are changing the Canadian home-building industry. As housing starts across the country become more infrequent, the industry has to find different alternatives in order to survive, especially in the winter months when residential construction activity varies seasonally, slowing down in Canada's cold and harsh winter climate. With the decreased demand for domestic housing and the increase in homeowner renovations and upgrading, housing manufacturers are anxious to expand into international markets. The slow population growth, shifting demographics and family profiles, and political and economic uncertainties all contribute to the weakening of the industry's traditional base of domestic home-building in Canada.[2]

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[1] Jonathan F. Hutchings, *Builder's Guide to Modular Construction* (New York; London: McGraw-Hill, 1996) 6.

[2] Canada Mortgage and Housing Corporation, *The Housing Industry: Perspective and Prospective: Summary Report: the Changing Housing Industry in Canada, 1946-2001* (Ottawa: CMHC, Public Affairs Centre, 1988) 4.

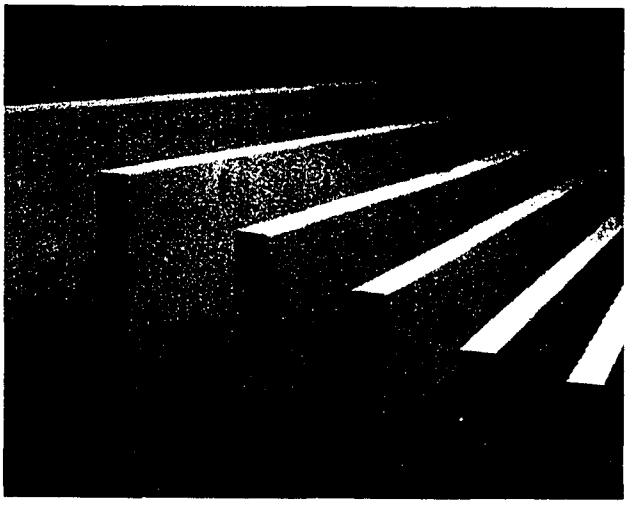

Figure 2.1 "2 by" wood members (Rustad Brothers & Co., 1993)

Figure 2.2 Erecting wall panel (CMHC 1995, 5)

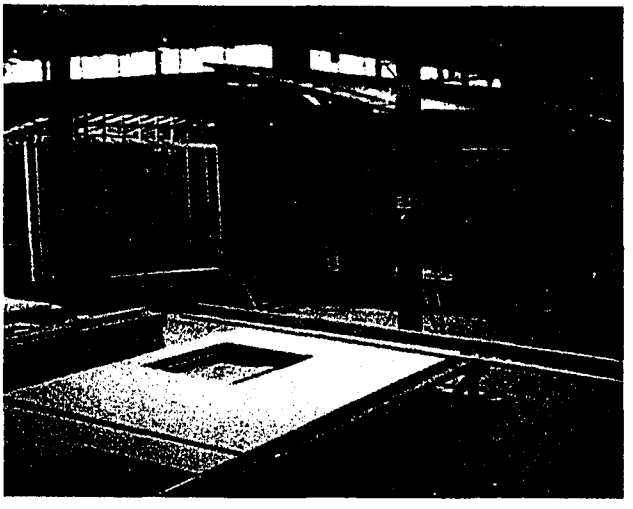

Figure 2.3 Modular plant (CMHC 1995, 3)

Homeowners can easily upgrade and renovate their homes. This is due mainly to the inherent simplicity of wood-frame construction and the recent increase in availability of building materials at large home renovating stores, such as Réno-Dépôt or Rona l'Entrepôt in Québec. These large building suppliers sell all the raw materials required to perform most types of residential construction and renovation. They also provide the knowledge and techniques required to perform simple construction tasks through the availability of "how-to" books and videos, as well as by offering customers the chance to participate in workshops and seminars. These courses provide do-it-yourself homeowners with expert advice and residential building tips relating to all aspects of house technologies, and cover a range of topics, from proper detailing to ways of improving the energy efficiency and thermal performance of one's home.

2.1.3 Prefabrication

The prefabrication of homes is a rapidly expanding segment of the Canadian home building industry, and is a key element of trade for those also wishing to compete in the home export market.[1] The modular nature of wood-frame construction allows for a very flexible and simple approach to residential home building. Each structural member is of a standardised dimension (e.g. wood studs and plywood sheets) and the regular spacing of the wood studs (either eighteen or twenty-four inches) directly relates to the standard four-foot width of plywood and gypsum sheets (Figure 2.4). A similar flexibility is also evident in the accommodation of many building components (e.g. doors, windows and kitchen counters) which are also manufactured to standardised dimensions. These prefabricated building components, specifically kitchen counters and roof trusses, are manufactured by many home building companies and are marketed individually, thereby increasing the opportunity for more export dollars for Canadian manufacturers (Figure 2.5).

[1] C. David Crenna et al., *Canada's Housing Export Experience and Prospects* (Ottawa: Advance Copy prepared for CMHC, 1996) 7.

2.2 The Potential of the Export Market

The downturn in housing starts has had a negative impact on the construction industry, causing down-sizing and layoffs. Tapping into new markets overseas is one way for companies involved in the home building and building products industries and those entering the export market, to create jobs in Canada, even when there is little demand for homes in the domestic residential sector. Building prefabricated units to fill orders destined for other markets also helps keep manufacturers busy in production during the winter months, when domestic orders tend to drop off (production smoothing), allowing them to keep their staff employed year-round. This also ensures that the factory is constantly busy and that the machinery is maintained in a well-oiled condition.[1]

Canada already has a highly respected image overseas as a leader in various aspects of building technology. It is important for manufacturers to take advantage of this reputation to generate more trade and to confirm Canada's role as a provider of efficient, inexpensive and well-manufactured housing solutions.

Prefabricated building units, regardless of whether they are of modular or panelised construction, are designed for easy and streamlined transportation. The standard width of prefabricated building modules allows them to fit onto a flatbed truck, which is similar to the size of a typical freight container (Figure 2.6). Various combinations of these narrow modules can achieve many types of successful floor plan layouts. Similarly, prefabricated wall panels are usually made to a standard height of eight feet, allowing them to be shipped at a high density, since they can easily be stacked horizontally to a given height while keeping the pile at

[1] Personal interview with Dr. Donald Chan; discussion about industrial production systems.

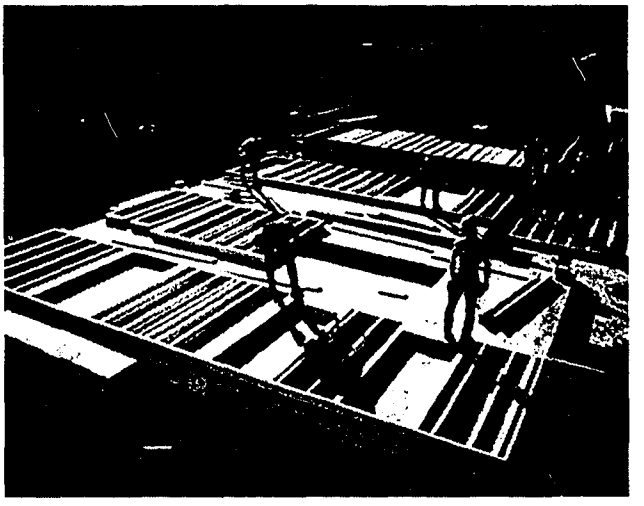

Figure 2.4 Standardised members in wood frame construction (CMHC 1995, 5)

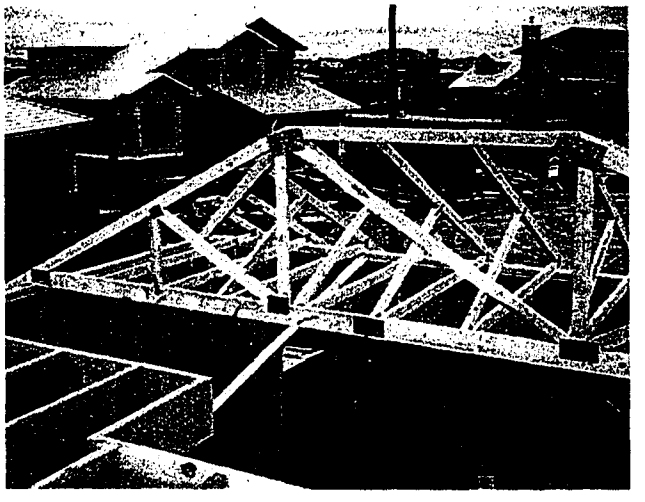

Figure 2.5 Use of prefabricated roof trusses (Lincolnberg International, 1994)

Figure 2.6 Transporting modular units (Scanada Consultants, 1996)

a maximum width of approximately eight feet – well under the maximum width for transport on road or rail systems (Figure 2.7).

2.3 Practises and Difficulties in the Export Market

There are other important issues that manufacturers need to consider. One of the major concerns with the export of homes to foreign countries is the need to conform to local requirements, whether they be standards based on regulatory or on cultural principles. The building's structure and envelope should physically relate to factors such as the local climate and building codes, while its layout and form must satisfy the human needs of the context in which the building is being constructed. While considering the local environmental conditions, the housing exporter must also look at the energy performance of the home. Building products are selected through a process of fulfilling such criteria as cost and energy efficiency. In many cases, mechanical systems may be needed to take better advantage of the building's thermal performance and to enhance interior conditions such as indoor air quality (Figure 2.8).

When considering factors such as the presence of running water, sanitary facilities, central heating and space per person, Canada is seen by many countries, including itself, as providing its citizens with one of the highest standards of living in the world. Boosted by its reputation for quality in these areas, the demand for Canadian housing-related products in other countries has grown. The Canadian housing export market has thrived in the past few years: in 1993 the total value of manufactured housing factory shipments was $778 million, with approximately 147 manufactured housing producers nationwide.[1] Another important factor in the increase of

[1] C. David Crenna et al., *Canada's Housing Export Experience and Prospects* (Ottawa: Advance Copy prepared for CMHC, 1996) 1.

manufactured housing exports is the current state of the local housing economy. With the decline of housing starts in Québec and across the country, housing companies are relying on their clients abroad to keep their manufacturing lines in production. Considering that housing construction is a seasonal venture, many companies depend on export markets to maintain financial security during the winter months. The controlled environment of a plant ensures quality control during the production stage, regardless of the exterior conditions, as no site work is undertaken during that time (Figure 2.9). Because few other countries in the world have access to such a wealth of lumber as a natural resource, and because of our high production standards, Canadian home manufacturers have a great deal to offer foreign buyers in terms of prefabricated homes and housing-related building products.

2.3.1 Response to Cultural Situations

The Canadian low-rise residential construction market is based upon wood framing, or stick-built, technologies. The acceptance of this technique may be considered difficult in other countries due to many factors, some of which require a determined and appropriate effort by manufacturers to overcome. In order for Canadian home manufacturers to successfully export to these countries, a structured response must be established to address these issues. This response can be categorised under two main headings: structure and the environment.

Structural stability:

- structural properties of materials used in home building;
- fire-resistance rating (i.e. knowledge of countries' codes and standards is required);
- seismic resistance through additional design (i.e. knowledge of countries' building and design techniques for earthquake zones is required).

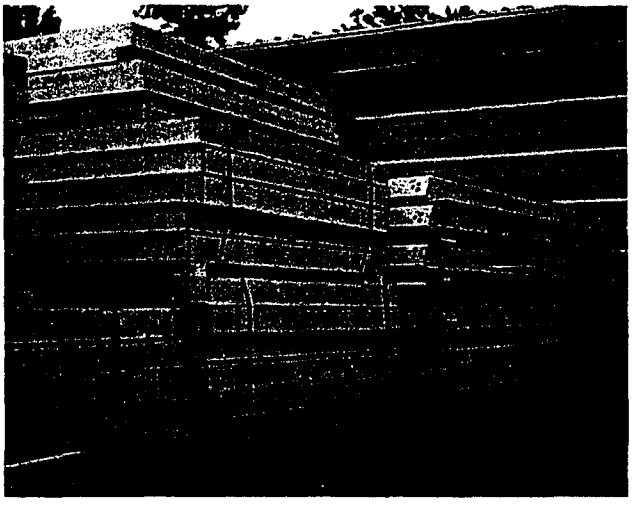

Figure 2.7 Prefabricated wall panels (SRI Homes International, 1996)

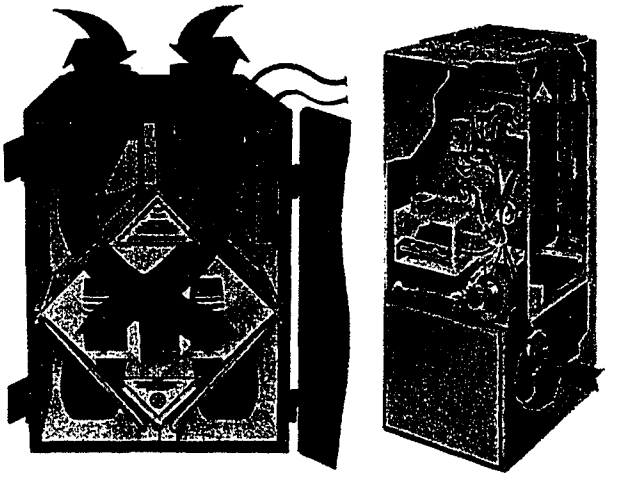

Figure 2.8 Residential mechanical systems (Venmar Ventilation/DMO Industries, 1996)

Figure 2.9 Factory built modular homes (Canadian Manufactured Houising Association, 1992)

Environmental responsibility:

- renewal of forests (i.e. is it possible to maintain a steady supply of lumber without depleting Canada's stocks; the responsibility and economic viability of the sustenance of forests through replanting and selective logging practices);
- abuse of old-growth forests (i.e. issues of heritage and conservation versus profits and the protection and creation of jobs);
- comparative amounts of energy needed for production of wood versus metal studs and concrete frames (i.e. profits and jobs at the expense of more pollution and the depletion of non-renewable energy sources).

General environmental issues concerning housing:

- energy efficiency (i.e. requirements for different climates; value-added features that raise the cost of production may affect the products' ability to compete in the global market);
- recycling programmes – recycled products used in construction and recycling of construction site waste (i.e. the potential market for such products; realistic methods of cost-effective production);
- indoor air quality (important for areas with high pollution quotient and for specialty markets, e.g. allergy-sufferers);
- materials (i.e. toxicity; gassing off; the environmental cost of production and shipping);
- water usage.

Canadian manufacturers must learn the subtleties of how to conduct business with foreign buyers, otherwise tensions can arise that can result in a loss of potential clients and jeopardise existing contacts. The proper way to conduct business can vary greatly from country to country, and any Canadian manufacturer who wishes to succeed in export trade would be wise

to research the business protocol of each new foreign market. It is also important that Canadian business people understand the social concerns of foreign cultures. Products built to suit a North American lifestyle may not be appropriate in other contexts. Factors such as how families are structured, and how day-to-day activities unfold within the private realm of the home (and in the more public aspect of the community at large) may place different demands on the design of prefabricated homes.

How, then, does a domestic company from Canada, or specifically Québec, deal and interact with businesses and peoples of different values, economies and languages? Manufacturers must commit the time and invest the funds to make first-hand investigations of their targeted overseas markets, and be willing and able to take years building solid professional relationships with foreign buyers if they wish to succeed.[1] This can be achieved through active means such as having trade representatives visit the countries with which the company is trading as well as placing professionals (i.e. builders or architects) in these countries to learn specific cultural and technical details.

There are also moral issues to consider when selling homes and housing products abroad. As previously mentioned, the Canadian standard of living is envied by many, especially by people in developing countries. Should our manufacturers hurry to exploit foreign markets for profit, if it means selling products that may not be appropriate, in the long term, for the people who buy them? In other words, is it morally responsible to profit from giving people what they desire, even if it may contribute to the gradual potential loss of their culture and natural resources? Canada's international image is key to sustaining the high regard and expectations of domestic companies and expertise, in the eyes of our trading partners.

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[1] Personal interview with employee of Modulex Inc.; discussion about forging economic and professional ties with foreign clients.

2.3.2 Climate and Energy

The local climatic conditions have a major impact on the typical construction methods used in the fabrication of a building. Whereas in Canada houses must be built to withstand extremely harsh winters, other regions of the world have very different environmental conditions to respond to. These factors must be studied in order to develop a tested system whose thermal performance is appropriate to the local environment (Figure 2.10). There are also some aspects of different climates which result in the utilisation of similar building practises and construction details: for example, a deep wall section is required in cold climates to allow for adequate placement of a sufficient amount of insulating material, while a hot climate will also necessitate thick walls to act as a heat sink that at night will give off heat that has built up during the daytime.

Wall sections may vary considerably due to different weather conditions, and the ideal choice of materials will also differ accordingly. Canada's winters dictate that high insulating values are required; for energy efficient housing construction, a value of RSI 5.1 (R29) is recommended for areas in which there are up to 3,500 degree days.[1] However in more temperate zones of the world, a lesser RSI value is permissible, so wall sections must be adapted accordingly. In some cases, it may be considered undesirable to reduce the wall thickness, as a large wall mass in warm climates can be beneficial. Again, acting as a large thermal mass, a thick wall will retain heat gained during the day through active solar gain and radiate the stored heat throughout the cooler nighttime hours. Other construction practises that are affected by climatic conditions are construction techniques, work schedules, seasonal practises and transportation routes.

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1 Canada Mortgage and Housing Corporation, *Energy-Efficient Housing Construction* (Ottawa: CMHC, 1982) 10.

Similarly, there are environmental and climatic factors which are closely related to code requirements and may affect them in certain ways (as shown in Table 2.1).

2.3.3 Building Codes

Any intervention, either initiated by foreign developers or designed abroad and carried out by local labour, must conform to all local building and municipal codes. Therefore, individuals and companies involved in building homes in foreign markets must gain a working knowledge of this fundamental stage of the construction process. This can be achieved through field study and by communicating with local experts and professional trades people. Examples of the issues relating to building codes and municipal regulations are shown in Table 2.2.

2.3.4 Transportation

The mode and system of transportation is determined after a consideration of the time factor versus the cost factor. For example, a company must decide between using shipping (water) routes or air routes in conjunction with an appropriate land or ground-shipping method (i.e. using truck or rail). The local site-access conditions and transportation facilities must be studied. A balance must be achieved between the expense in terms of money and the time spent. If shipping is used to save costs, needless use of air freight to rush a missing or broken component is a wasteful additional cost (Figure 2.11).

The coordination of materials and arrival times must be anticipated before the construction stage to ensure that all materials arrive at the appropriate times. They must also be organised in terms of their location. This requires that a company representative be involved in organising and

Figure 2.10 Measuring thermal performance (National Research Council, 1995)

Figure 2.11 Shipping modular units (Scanada Consultants, 1996)

Environmental Factor	Effect on Code Requirements
sun angles/conditions	no. of windows/sizes/location
wind/earthquake loads	wall foundation construction
rain, wind conditions	roofing materials, overhangs
temperature/humidity	insulation, moisture and vapour barriers

Table 2.1 Effects on environmental factors on code requirements

Strucutral Criteria	Code/Regualtory Criteria
Wall/foundation constuction/insulation	Density
Structural capacity	Zoning
Building height	Window size/daylight requirements
Seismic loads	Ventilation/indoor air quality
Flood areas	Plumbing/electrical
Ground/soil conditions	No. of families/occupancy
	Fire codes
	Exit/entrance requirements

Table 2.2 Criteria to be addressed through building codes

overseeing the schedules and tasks to be performed. Packaging the prefabricated panels is a process which most be carried out in the most efficient manner to ensure that shipping costs are kept to a minimum. The containers must be organised beforehand, so that the panels can be transported in the most efficient arrangement, with units loaded in the appropriate order to facilitate the process of unloading the parts in the correct sequence. Similarly, the containers and their contents must be organised such that breakages and omissions are kept to a minimum.

CHAPTER THREE: A CASE STUDY, MODULEX INC.

3.1 Company Background

Modulex Inc. is an experienced prefabricated home building company and has been conducting its business out of Québec City for over thirty years. Over that time period, it has constructed over 11,000 prefabricated homes and is currently involved in selling its prefabricated homes to 18 foreign countries including the United States, Japan, Russia, South Africa and Israel. Modulex is a member of the Canadian Home Builders Association (CHBA) and the Association provinciale des constructeurs d'habitations du Québec inc.(APCHQ). In 1977, Modulex developed a highly energy efficient type of construction called the Thermo-Plus system for applications in areas of extreme cold, e.g. developments in Northern Canada above the Arctic Circle.[1] The experience of producing such specialised systems has helped Modulex adapt to the specific requirements of producing prototypes for sale in the export market. For example the Thermo-Plus wall system uses a 2" x 7" stud wall (which is larger than the standard thickness) to allow for six inches of mineral insulation and an air space, within the wall cavity, in conjunction with a horizontal anti-torsion system. This panelised wall assembly was easily adapted for the Japanese market where a similar section was needed to withstand the required earthquake design loads. The author will analyse Modulex's mode of operation as well as specific design and technical issues which have been developed or adapted in order to successfully manufacture homes for foreign markets.

Although the export market and potential for increased growth is promising to the Canadian prefabricated housing industry, the future of this industry can by no means be considered

[1] Modulex Inc., *Showcase of Homes and Cottages* (Québec: Modulex Inc., 1996), 1.

stable. The importance of diversity of products and services is essential when considering that the practise of exporting turnkey developments may well become less feasible economically. While the sudden growth in the export of prefabricated houses to foreign markets seems exciting, the advantage of the North American home building construction system will lose its edge. The technology of wood-frame construction and other prefabricated panelised wall systems for residential use will soon become locally available for many countries interested in the benefits of these systems. Due to the inherent qualities of these systems (e.g. low cost, fast turnover, high energy efficiency and excellent quality control), the industry in many foreign countries may adopt these building practises and manufacture these components themselves. Thus it is the prerogative of Canadian builders to shift their service and product responsibilities to respond to the emerging demand for supplying new technologies, raw materials and specific products, as opposed to the complete and final product.[1] It is for these reasons that Modulex is involving itself more and more with the export market. It still relies heavily on local clients and those in the Unites States for the majority of its business; however Modulex is counting on the favourable demand for Canadian housing, and associated housing technologies and systems, in order to increase its production capacity.

3.2 Current Mode of Operation

3.2.1 Marketing Stage

After all the factors relating to environmental and cultural contexts are analysed by the company, a marketing approach must be developed in order to build a relationship with

[1] Personal interview with employee of Modulex Inc.; discussion about the importance of establishing a large presence in foreign markets so that, in the future, Canadian prefabricated home builders can manufacture wall panels in factories built in these countries, thus saving money due to lower transport and labour costs.

Modulex's clients, whether they be foreign investors, developers, builders, architects, or others. Modulex has forged links with home builders' associations, government agencies (such as the Canada Mortgage and Housing Corporation) and foreign trade missions (e.g. Team Canada) which has helped the company build up a presence in the global market.[1] Similarly, their well developed Website gives the company a valuable presence on the Internet which can provide exposure for the business to potential clients all over the world. Further Internet links on other Web pages, such as Provincial and National home builders associations, can also give a useful prominence for the company.

3.2.2 Project Development and Design Stage

Once clients are found, the development of the design occurs, consisting of feasibility studies and the preliminary design. The company is involved in various capacities, depending on the circumstances and scope of the project. For example, a complete design of house could be done from the client's specific requirements, or could be taken from an existing model in the company's own catalogue (Figure 3.1). Similarly, the company often executes a redesign of a house taken from the catalogue or from an existing set of drawings. The most common situation, which occurs during projects targeted for export, is to create a set of working drawings of a design the latter of which has been supplied by the client and has been conceived by the client's own architect in the country in which client is based, thereby conforming to the local context (e.g. cultural requirements, building codes, municipal regulations and climatic conditions).[2] This process in itself is a large component of the company's business as Modulex must ensure that its designers have a good knowledge of the required design parameters and be able to communicate these issues quickly and efficiently to a client who is often located far away.

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[1] Personal interview with employee of Modulex Inc.
[2] Ibid.

3.2.3 Obtaining Financing and Permits

Financing is the most important factor in realising the feasibility of export of Canadian housing abroad. Housing export projects tend to be small and financed almost entirely by government loans. The Export Development Corporation (an organisation within the Canadian government) finds foreign developers who are interested in using Canadian technologies to build new housing developments. Loans are available from the Government of Canada to allow domestic home builders to find foreign clients. These foreign developers are in the business of building property developments for profit, which results from the quick sale or lease of a majority of the units. The financial risk for the developers is usually balanced by a high return on their initial investment. This trade allows domestic builders to have projects ongoing even when local starts in Canada are low or the cold winter months have slowed domestic orders, and guarantees them a good profit. The Canadian government also gains in this process as a result of taxes collected from the profits of the home building company. The local economy also benefits, since the Canadian company will have more business and therefore require the services of more local people in a variety of job positions, ranging from carpenters to architects and engineers to financial experts.[1]

3.2.4 Final Design

Many financial aspects need to be addressed, including the establishment of a line of credit through foreign banks. The correspondence of quotes and costs throughout the design stage is facilitated through the use of computers to transfer and update this information (Figure 3.2).

[1] Personal interview with employee of Modulex Inc.

Other tasks which need to be completed in-house, by the company's engineers, architects and administrative staff, are:

- obtaining building permit (i.e. project conforms to code);
- preparation of construction schedule (i.e. time is an important consideration when shipping items over long distances);
- resolution of the final design;
- completion of the working drawings (i.e. structural drawings; materials, finishes and doors/windows schedules; electrical; mechanical);
- preparation of the final cost breakdown.

3.2.5 Production

A house intended for export is prefabricated into individual wall panels inside the factory. This method is modular, economically competitive, ensures a high and controlled level of quality, and gives flexibility for custom designs. A sophisticated method of tracking wall panel components is used to keep an up-to-date and accurate inventory of parts (Figure 3.3).

3.2.6 Packaging and Transportation

Typically, door-to-door trucking is the industry standard for the transportation of prefabricated homes within the North American market. For overseas shipment, the main criterion is the time factor versus the cost factor. A balance must be achieved between expense and time when determining whether to use shipping or land routes versus air land routes (if and where possible). The scheduling and coordination of materials and arrival times must be anticipated before the construction stage, so that all building materials and wall panels are organised to

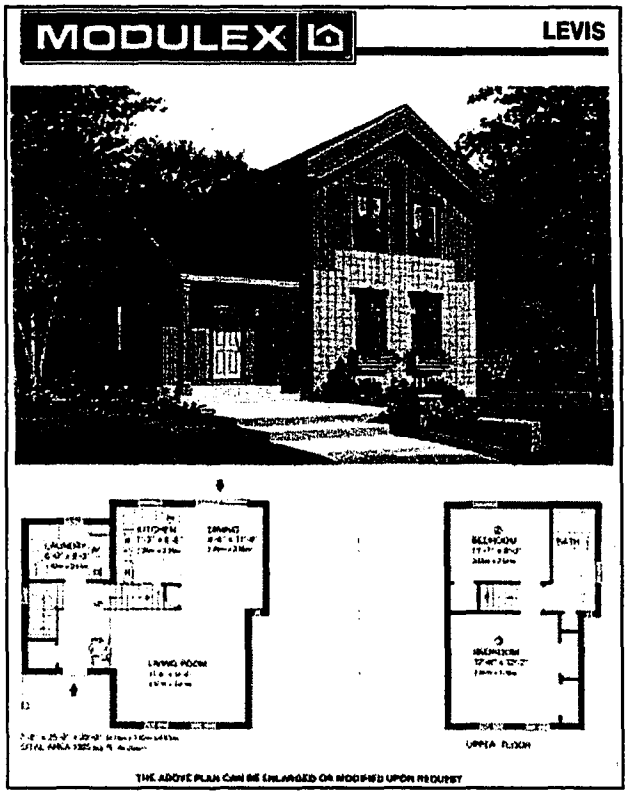

Figure 3.1 Example of model home in company's catalogue (Modulex Inc., 1997)

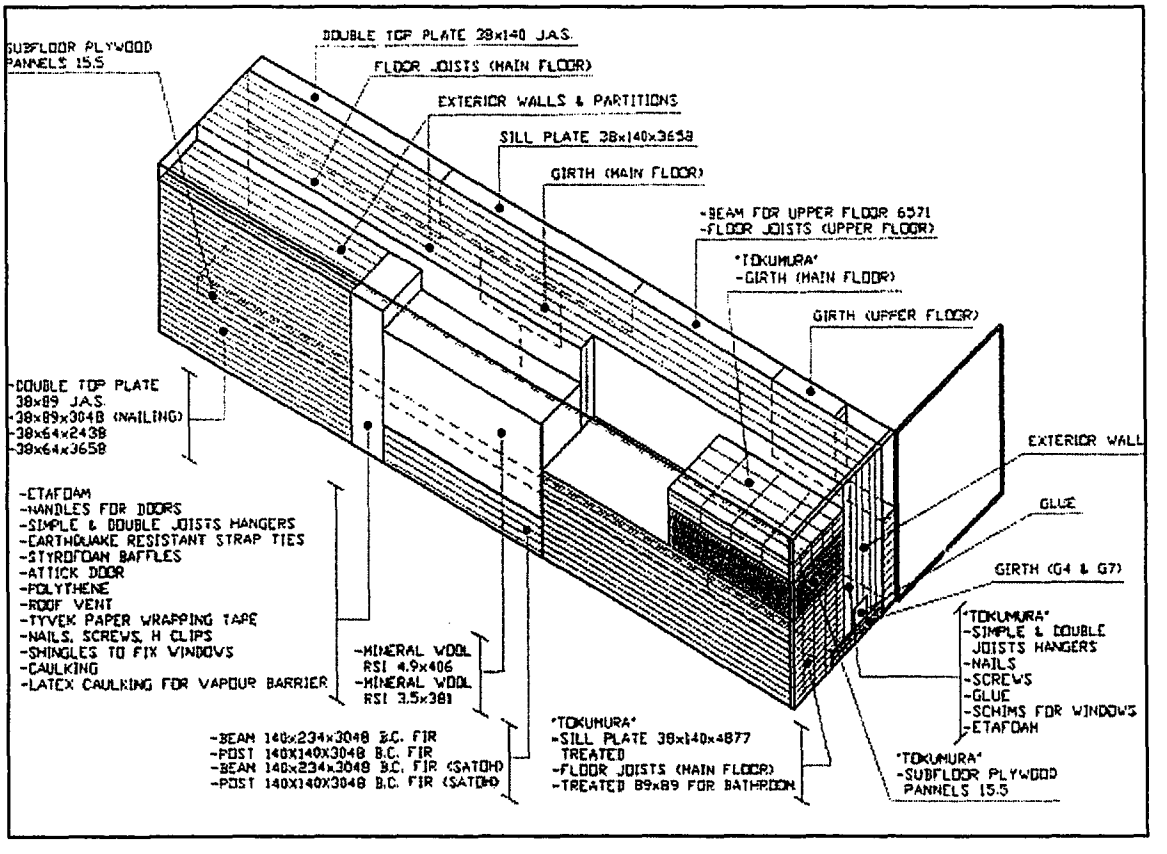

Figure 3.4 CAD drawing for arrangement of shipping container (Modulex Inc., 1996)

MODULEX Inc.

MODULEX inc

3090 Blv.Hamel
Quebec
G1P-2J1
(418) 681-0133

SELLER :	Modulex Inc	**FILE**	Japon
	KE-2034	**Customer**	Kenyu Kogyo
DATE :	**09-Sep-96**	**MODEL. :**	Matsuda House
			29'-6" x 24'-6"

2 EXTERIOR FINISHES QUOTE	TOTAL	**$562**

Exterieur Finishes based Upon

#18	Metal flashing for the roof edges.
#20	Aluminum soffit fully vented.
#21	Aluminum Facia 140 mm

3 EXTERIOR CANOPY QUOTE	TOTAL	**$2 301**

Exterieur Canopy based Upon

Aluminum Post 18'Height (2)
Fypon moulding # 876
Aluminium handrail

4 WINDOWS / GLASS QUOTE	TOTAL	**$6 547**

Low-E Glass with removable grille / Ext Vinyl Cladded #POLAR

	Code	Qty	Total
W1	BGBA8056-2	2	$ 1 667
W2	B2VA3956-1	7	$ 2 660
W3-OBS	B1VA2048-OBS	3	$ 692
W4	BIVA2048	2	$ 435
W8	F71T3816 without grille	1	$ 133
W9	B1VA2024	1	$ 160
PVC DECORATIVE SHUTTER		3	$ 800
			$ 6 547

5 EXTERIOR DOORS QUOTE	TOTAL	**$955**

Insulated Steel Door with Vinyl Cladded wood frame #POLAR

	Code	Qty	Total
ED1 DOOR	LSBBA101-G	1	$ 955
ED1 SIDELITE	LS4BA11-G	1	INCLUDED
			$ 955

KE-2034.XLS

Figure 3.2 Extract from proposed quote (Modulex Inc., 1996)

NO DOSSIER: 4/15
FILE NO: 96-439/
NOM DU CLIENT:
CUSTOMER'S NAME: KENYU KOGYO(S.G. TRADING)

MODULEX

MURS EXTÉRIEURS
EXTERIOR WALLS

IDENTIFICATION DES MATÉRIAUX / MATERIAL DESCRIPTION	QUANTITÉS REQUISES / QUANTITY REQUIRED	CHARGÉES / LOADED A	A VENIR / TO DELIVER B
MURS 2" X 6" Contreplaqué TYVEK LATTES X J.A.S. HAUT	PL	PL	PL
WALLS 2" X 6" PLYWOOD TYVEK Strapping X 8' HEIGHT	0 LF	0 LF	0 LF
MURS 2" X 6" Contreplaqué SEUL 3/8" J.A.S. X J.A.S. HAUT	PL	PL	PL
WALLS 2" X 6" PLYWOOD X 8' HEIGHT	221 LF	221 LF	0 LF
MURS 2" X 6" Contreplaqué X J.A.S. HAUT	PL	PL	PL
WALLS 2" X 6" PLYWOOD X 8' HEIGHT	0 LF	0 LF	0 LF
MURS 2" X 6" Contreplaqué X J.A.S. HAUT	PL	PL	PL
WALLS 2" X 6" PLYWOOD X 8' HEIGHT	0 LF	0 LF	0 LF
MURS 2" X 6" Contreplaqué X J.A.S. HAUT	PL	PL	PL
WALLS 2" X 6" PLYWOOD X 8' HEIGHT	0 LF	0 LF	0 LF
SABLIERE DOUBLE EN 2" X 6" J.A.S.	PL	PL	PL
DOUBLE TOP PLATE 2" X 6" J.A.S.	240 LF	240 LF	0 LF
Contreplaqué 3 1/2" "X 8' J.A.S. HAUT MUR HAUT	Mcx	Mcx	Mcx
PLYWOOD 3 1/2" "X 8' TOP OF UPPER WALLS	0 Pcs	0 Pcs	0 Pcs
Contreplaque 13 1/2" "X 8' J.A.S. BAS DE MURS REZ-CH	Mcx	Mcx	Mcx
PLYWOOD 13 1/2" "X 8' BOTTOM OF WALLS	0 Pcs	0 Pcs	0 Pcs
Contreplaqué 3/8" 12" "X 8' J.A.S. BAS DE MURS	Mcx	Mcx	Mcx
PLYWOOD 12" "X 8' BOTTOM OF WALLS	28 Pcs	0 Pcs	28 Pcs
LATTES 1" X 3" X 16' BAS DE MURS	Mcx	Mcx	Mcx
STRAPPING 1" X 3" X 16' BOTTOM OF WALLS	0 Pcs	0 Pcs	0 Pcs
CONTREPLAQUE 1/2" X 4' X 8' J.A.S. (POUR MURS)	FL	FL	FL
PLYWOOD 1/2" X 4' X 8' J.A.S. (FOR WALLS)	0 FL	0 FL	0 FL
TYVEK EN VRAC POUR MURS	PL	PL	PL
TYVEK BUILDING PAPER	300 PL	0 PL	300 PL
LATTES 1" X 3" X 8'	Mcx	Mcx	Mcx
STRAPPING	0 Pcs	0 Pcs	0 Pcs
TYVEK EN VRAC POUR BRIQUE	PL	PL	PL
TYVEK BUILDING PAPER (BEFORE BRICK)	0 LF	0 LF	0 LF
Contreplaqué 4' X 8' J.A.S. POUR PIGNONS ET LUCARNES	Fles	Fles	Fles
Contreplaqué 4' X 8' FOR GABLE END & DORMER	0 Sht	0 Sht	0 Sht
TYVEK POUR PIGNONS ET LUCARNES	PL	PL	PL
TYVEK BUILDING PAPER FOR GABLE END & DORMER	0 LF	0 LF	0 LF
LATTES 1" X 3" X 16' POUR PIGNONS ET LUCARNES	Mcx	Mcx	Mcx
STRAPPIN(1" X 3" X 16' FOR GABLE END & DORMER	0 Pcs	0 Pcs	0 Pcs
LATTES 1" X 3" X 12' POUR MURS (INTÉRIEURS)	Mcx	Mcx	Mcx
STRAPPIN(1" X 3" X 12' FOR WALLS (INTERIOR)	160 Pcs	0 Pcs	160 Pcs
MOUSSE URETHANE	Mcx	Mcx	Mcx
POLYURETHANE	0 Pcs	0 Pcs	0 Pcs
MOUSSE 5/8" X 5/8" X25'	RL	RL	RL
COMPRESSED SEAL 5/8" X 5/8" X25'	0 RL	0 RL	0 RL

Figure 3.3 Extract from packing list (Modulex Inc., 1996)

arrive at appropriate times. This is ensured through the carefully designed packing arrangement of the container (Figure 3.4). The local access conditions to the building site and local transportation facilities must be known to avoid any additional problems.

Containers are designed to:

- save space (efficiency of space minimises the high cost of shipping);
- keep track of all pieces/components;
- to facilitate order of site construction through packing arrangement;[1]
- protect fragile components (i.e. reduce the risk of breakage);
- avoid omissions which are costly due to extra shipping time and money for extra transport, and that hold up construction schedule (e.g. if shipping is used to save costs, needless use of air freight to rush a missing/broken component is a wasteful additional cost).

3.2.7 Construction and Supervision

The on-site work involves the preparation or leveling of the building site, the excavation for the development of the infrastructure, pouring the concrete slabs, foundation walls and retaining walls, and executing the landscaping. The materials manufacturing company will most likely work, in conjunction with the local labour force, in a capacity focused on supervision. Having a trained expert on site, who is knowledgeable with respect to the local language and customs, is a necessary investment.

The final stages of the project include resolving problems which occur during construction (e.g. a panel that does not fit, omissions of required parts, lack of knowledge or unfamiliarity

[1] Modulex Inc., *Packing Instructions for Container* (Québec: Modulex Inc., 1996) 1.

of construction details by local workers). The long distances involved make communication of specific problems or questions costly and difficult: the use of a video phone through Internet could facilitate this procedure.

3.2.8 Additional Changes and Call-Backs

Additional changes, considered as extras, could be made by a client, who would be billed accordingly. The process of obtaining final approval from the client may also require additional work and is part of satisfying the demand for any call-backs or deficiencies which may have arisen during or after the completion of the project. The company is also bound to respect the guarantee that it gives to the client, and is therefore responsible for any servicing of problems which may arise in a certain time period after the client has approved the building.

3.3 Existing Export Structure

3.3.1 Specific Construction Details

Modulex Inc. manufactures prefabricated wall panels for their houses based on typical wood frame construction principles. The company has also developed and adopted additional details which enhance the building's performance with respect to energy efficiency and structural properties. These details are important when preparing working drawings for a house which is used for export purposes (Figure 3.5).

An analysis of these additional details was undertaken by the author and are described as follows, starting from the roof and including wall treatment and interior finishes. Air deflectors are placed in the roof and provide better ventilation, thereby reducing the risk of ice dams resulting from snow melting and freezing as ice. The trusses are spaced at twenty-four inch centres to increase the amount of insulation and decrease the potential points of thermal bridging. These trusses are factory built by the company and are designed to exceed snow load requirements. The stringer at the ridge line is beveled and jointed flush. The notched connection increases roof strength and simplifies assembly procedures. Strapping, using one-by-threes (one-inch-by-three-inch nominally sized wood framing members), provides an air space behind the exterior siding and is used in combination with an air barrier to provide adequate air flow behind the building envelope. The exterior sheathing is wafer-board with insulsheathing™ (a more water-resistant plywood) at the corners to provide better shear capacity and rigidity for the wall.[1]

The walls are constructed using two-by-sevens, which allow a full six inches of mineral wool insulation, leave room for an air space, and give greater strength to the wall. The windows are triple-glazed with a low-E glazing and are filled with argon gas for greater energy efficiency. One-by-three furring, installed on the interior of the wall and ceiling framing members, reduce the potential perforations of the vapour barrier during the installation of electrical boxes and interior gypsum wall finish. The furring also allows for easier passage of electrical wires behind the drywall without having to drill holes into the studs. Grooves are notched into the bottom (or sole) plates, the top and bottom of the header joists and the double top plates of the wall to allow for the insertion of a compression seal. This seal prevents air leakage and infiltration due to possible, yet typical, imperfections in the wood framing and connections. The two-by-five sill plate is anchored to the concrete foundation wall and is set with a spray foam sealant. The double two-by-X (where $X \in I$ and $4" \leq X \leq 14"$) headers of the window

[1] Modulex Inc., *Showcase of Homes and Cottages* (Québec: Modulex Inc., 1996), 2.

lintels are pre-installed with mineral wool insulation to reduce thermal heat loss. The same is done between two studs wherever this occurs, e.g. the double studs of the rough openings of doors and windows which accept the jambs. Lastly, an anti-torsion system braces the stud walls and increases their shear capacity.[1]

Many of these details are used for construction in the houses which are developed for export, in this case for a Japanese client, Mr. Kenyu Kogyo.[2] Japanese building standards require a very high level of structural stability, especially due to the high seismic activity in the region. Equally important is the notion of quality: typical residential construction in Japan is done using traditional wooden post and beam construction or masonry systems because of the perception that the applications of these material and their associated systems are more solid and will better withstand the forces of earthquakes than typical Canadian stick-frame construction, which uses much smaller wood members than the traditional post and beam method. This belief is often quite inaccurate, especially when considering the long-term success of many heavy timber and wood-frame designs of both the Japanese and North American contexts. Similarly, wood-frame houses have a reputation (once the initial stigma against them has been overcome) for being more comfortable than other residential construction systems and also have a higher resale value, in addition to having a lower life-cycle cost.

For the Japanese market, the company specifically focuses on a few details which enhance the building's structural performance (Figure 3.6). Steps taken to increase the rigidity of the wood-frame construction are the most important with regard to this issue. For example, the use of two-by-sevens in the stud wall system, as opposed to two-by-fours or two-by-sixes, are not only larger members, but are also manufactured from an exceedingly high-quality grade of lumber (called JAS lumber), which seems rather excessive for this application. The same results with respect to the structural performance could be achieved by using either regular

[1] Modulex Inc., *Showcase of Homes and Cottages* (Québec: Modulex Inc., 1996), 3.
[2] Modulex Inc., *Working Drawings: Matsuda House* (Québec: Modulex Inc., 1996) 1.

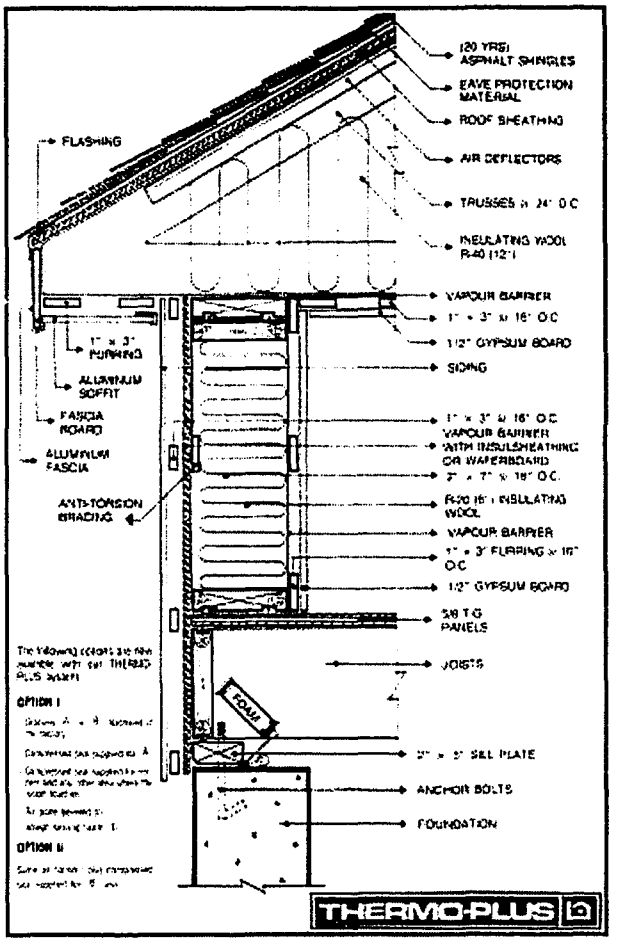

Figure 3.5 Wall section of prefabricated model home (Modulex Inc., 1997)

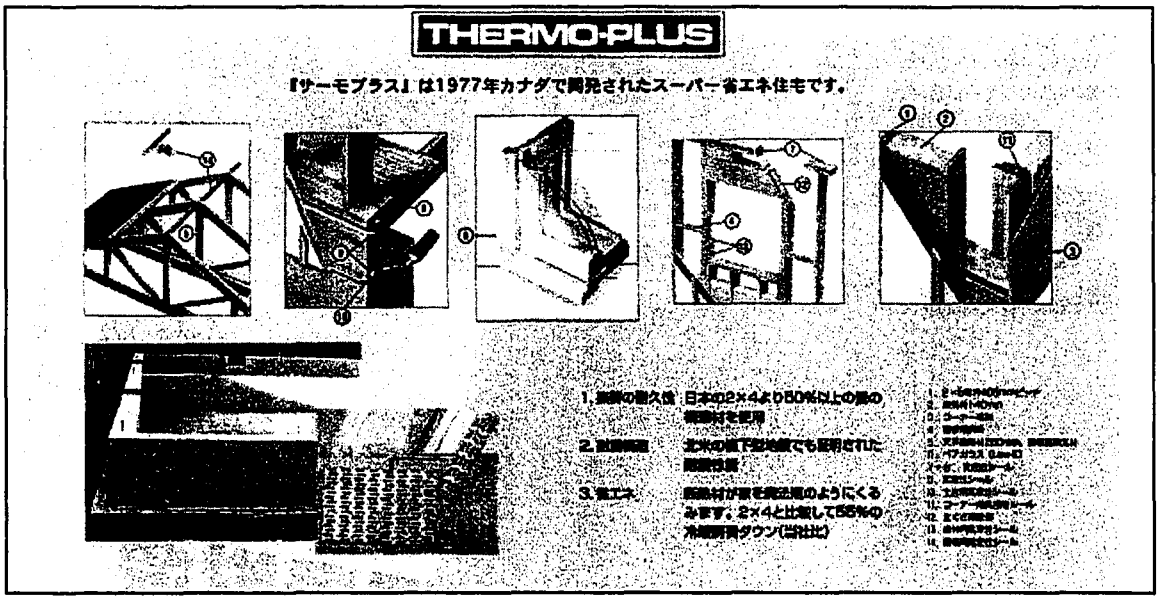

Figure 3.6 Specific construction details used for the Japanese market (Modulex Inc., 1997)

construction grade lumber (which is far less expensive) with closer spacing or in conjunction with more solid top and bottom plates of the stud wall. Similarly, the shear strength of the stud wall is increased using plywood at the corners (where the need for shear resistance is the greatest) in combination with wafer-boards as sheathing in the middle of the wall to help reduce the cost.[1]

3.3.2 Analysis of Plans and Working Drawings

The working drawings were also analysed by the author. They were drawn by Modulex Inc. for a house developed for Japanese clients. The use of two-inch-by-seven-inch JAS lumber for construction of stud walls ensures that the wood will contain no knots and the amount of warping and cupping of the members will be greatly reduced, thus leaving fewer areas of imperfections for the possibility of air infiltration through connections in the structure. This use of lumber is very expensive in relation to construction grade two-inch-by-four-inch or two-by-six-inch studs used in typical North American home construction. The exterior is clad with aluminium siding, with the exterior posts and handrails made using the same material (Figure 3.7). The pitched roofs are reminiscent of many suburban homes built on the domestic market.[2]

The kitchen has a very small amount of counter space but provides a large area for eating, with the possibility of having family meals on the floor of the adjoining dining room (Figure 3.8). The main bathroom is on the ground floor, away from the bedrooms: the bathtub is located in a different area and is separated with a door from the rest of the bathroom utilities. However, the bathroom only includes a vanity with sink and room for a hot water tank and laundry

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[1] Modulex Inc., *Brochure*: advertising Modulex homes to be developed in Yurigaoka and printed for the Japanese market (Québec: Modulex Inc., 1996) 2.

[2] Modulex Inc., *Working Drawings: Matsuda House* (Québec: Modulex Inc., 1996) Elevation.

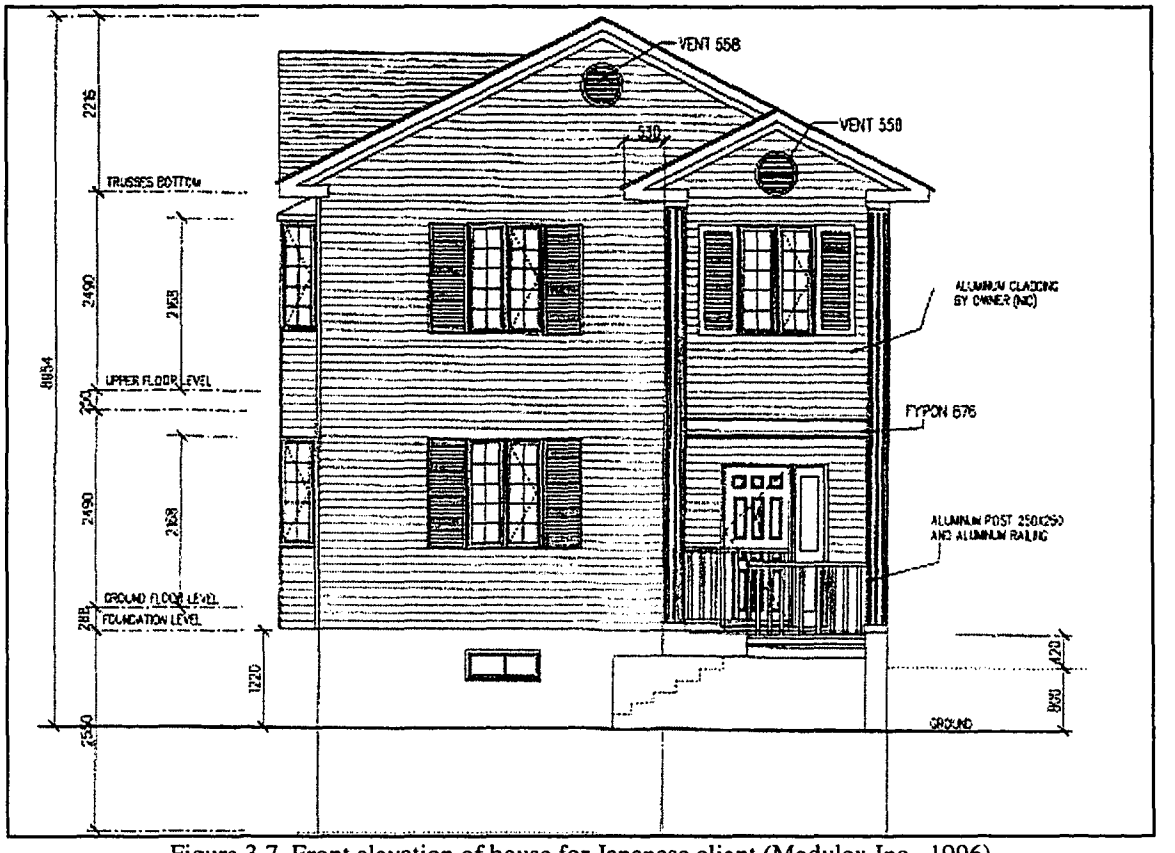

Figure 3.7 Front elevation of house for Japanese client (Modulex Inc., 1996)

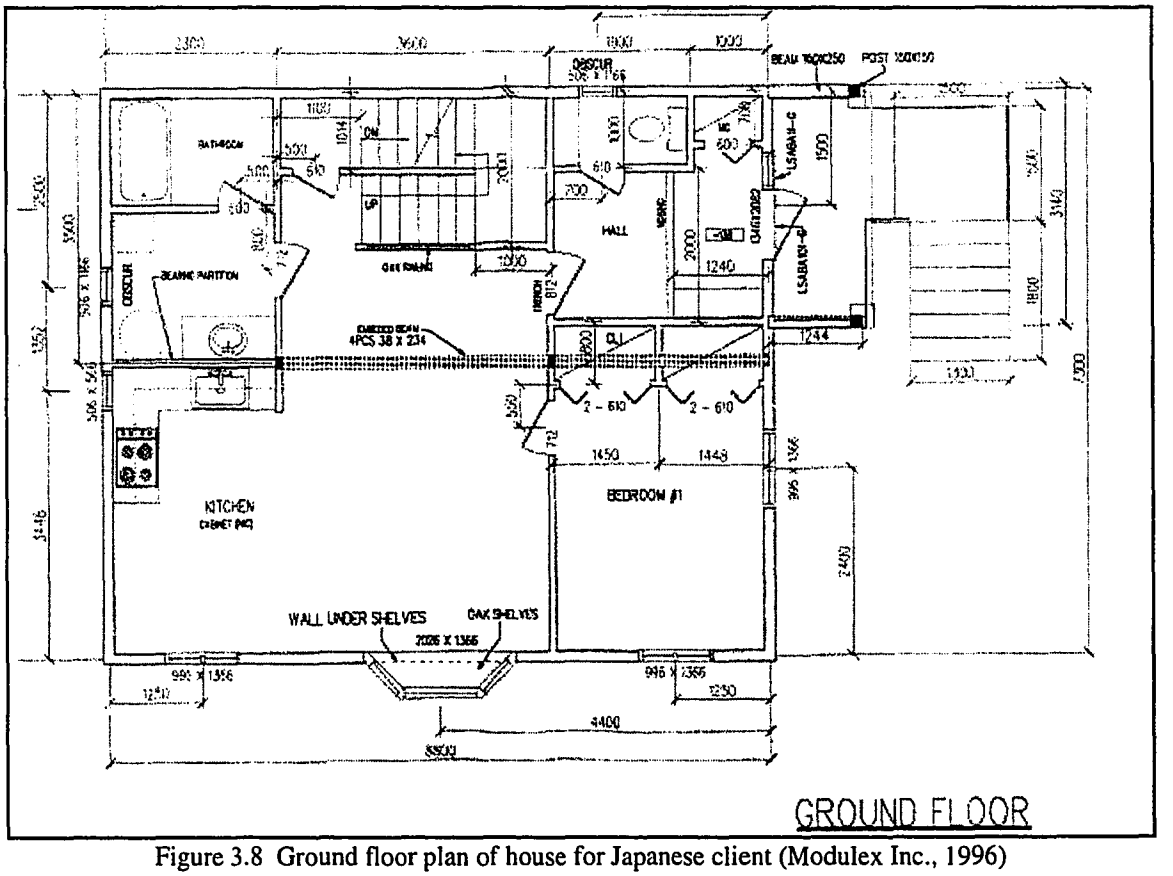

Figure 3.8 Ground floor plan of house for Japanese client (Modulex Inc., 1996)

equipment without the presence of a toilet. The toilet is located in a separate room off the entry hall and contains a storage cabinet. The entry hall is separated from the rest of the ground floor by a door, creating an isolated entrance space.[1]

Upstairs, among the bedrooms, is a second toilet in a room by itself (i.e. without a sink) (Figure 3.9). This upper toilet is stacked vertically above the bathroom of the ground floor which simplifies the passage of services (hot and cold water supply and waste water and solid drainage) to the floor above and is a common practise in domestic housing units. The bedrooms are all located in the upstairs area and thus is more private, similar to North American zoning within the home.[2] The construction details are typical wood framing details, commonly used throughout the North American home building industry.[3] The structure and purpose of the joints, connections and details of North American wood-frame construction, are identical to those used in traditional Japanese joinery, but appear different only due to ornamentation. This is not a direct result of the response to cultural influences but merely the only way to successfully deal with the physical properties of wood.

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[1] Modulex Inc., *Working Drawings: Matsuda House* (Québec: Modulex Inc., 1996) Ground Floor Plan.

[2] Ibid., Upper Floor Plan.

[3] Ibid., Details.

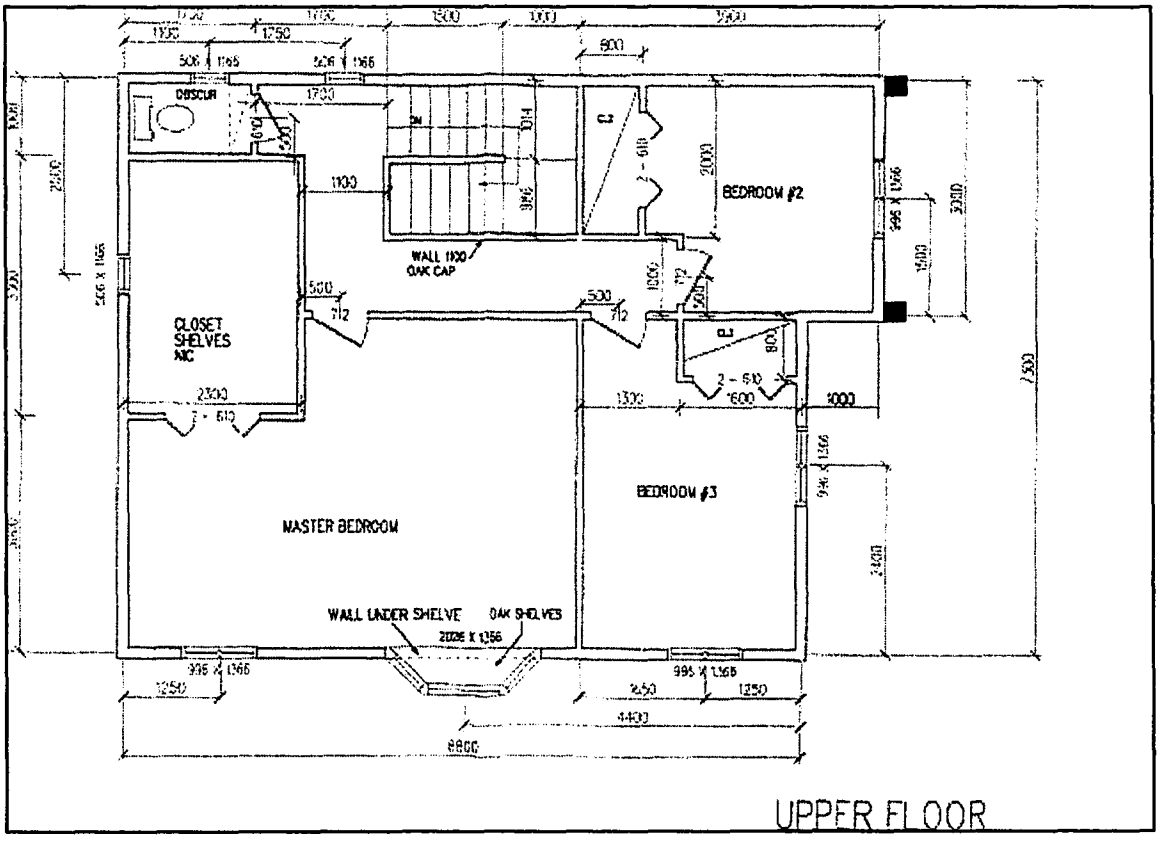

Figure 3.9 Second floor plan of house for Japanese client (Modulex Inc.,1996)

CHAPTER FOUR: THE USE OF COMPUTERS AND THE INTERNET AS A BUSINESS AND COMMUNICATION TOOL IN HOUSING

4.1 Background

4.1.1 Potential of the Internet

With the globalisation of world economies, the efficient transfer of information is essential. Technology has facilitated communication between different regions of the world using various modes and media, ranging from fast long-distance transportation to voice and video communication systems. The increased necessity for carrying out all these functions at a constantly accelerating pace has required the development of high-speed electronic communications based on faster personal computers and using new and existing telecommunications networks to transfer this data and new data types.

Through the use of personal computers, the potential exists for people to communicate with one another through written, verbal and visual means. These revolutionary methods allow people to interact and exchange information regardless of physical and political obstacles such as distance and culture. The implications of such communication can be applied to professional areas in business and trade. In the past, trade has been limited more to local markets due to the high cost of transportation and the difficulties of setting up markets in foreign places. Although the use of highly developed communication systems does little to influence factors such as transportation costs, they allow companies to tap into the global market by increasing their exposure to different cultures and their business practises.

The use of the World Wide Web can also give a company an international presence through the development of a Website, with an electronic catalogue available on-line (Figures 4.1, 4.2 and 4.3). Another useful application of the Web and its potential is the ability to communicate cheaply and quickly over long distances. Unfortunately, many networks are unreliable and can cause systems to crash: important and confidential information could be lost or appear in the wrong place. Search engines, used to find information on the Web, are still weak. At best many are only capable of searching through 39% of the information available, with a large portion of the search results linking to inactive or dead sites.[1] The traditional ways to search for information, such as using printed catalogues or phoning companies to obtain Website addresses, remain reliable.

4.1.2 Some Useful Definitions

Internet

• a digital communication network connecting other smaller networks across the globe, using a standard protocol to transfer data (Table 4.1).

WWW (World Wide Web)

• an extensive network of documents that are linked together, whose working system is defined by a set of protocols (Table 4.2).

TCP/IP (Transmission Control Protocol/Internet Protocol)

• a standardised set of rules for computer communication which allows different types of computers and networks connected to the Internet to communicate.

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[1] *http://www.news.com/News/Item.*

Figure 4.1 Viceroy's prefabricated homes for Korea (http://www.viceroy.com/html/korean.html, 1997)

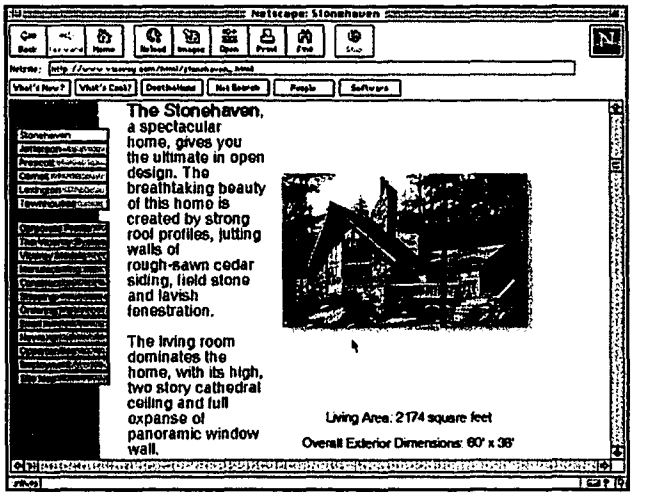

Figure 4.2 A Viceroy model home (http://www.viceroy.com/html/stonehaven_.html, 1997)

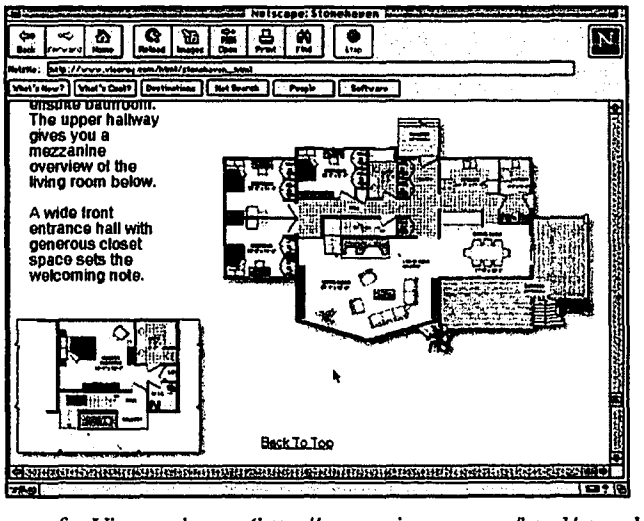

Figure 4.3 Floor plans of a Viceroy home (http://www.viceroy.com/html/stonehaven_.html, 1997)

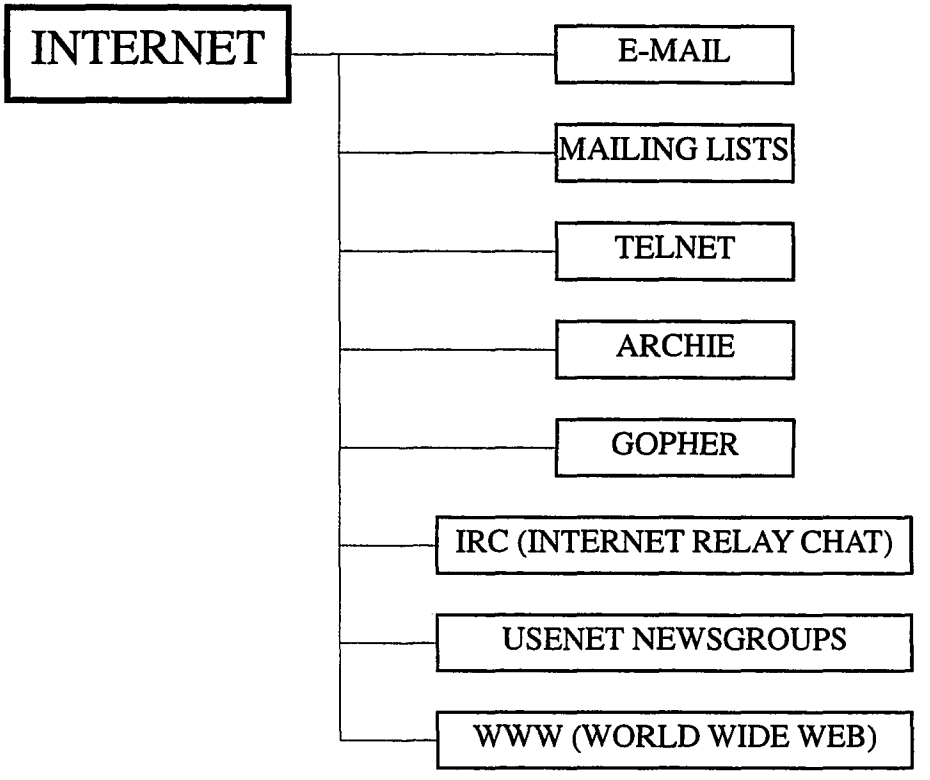

Table 4.1 Components of the Internet (Ellsworth, 96)

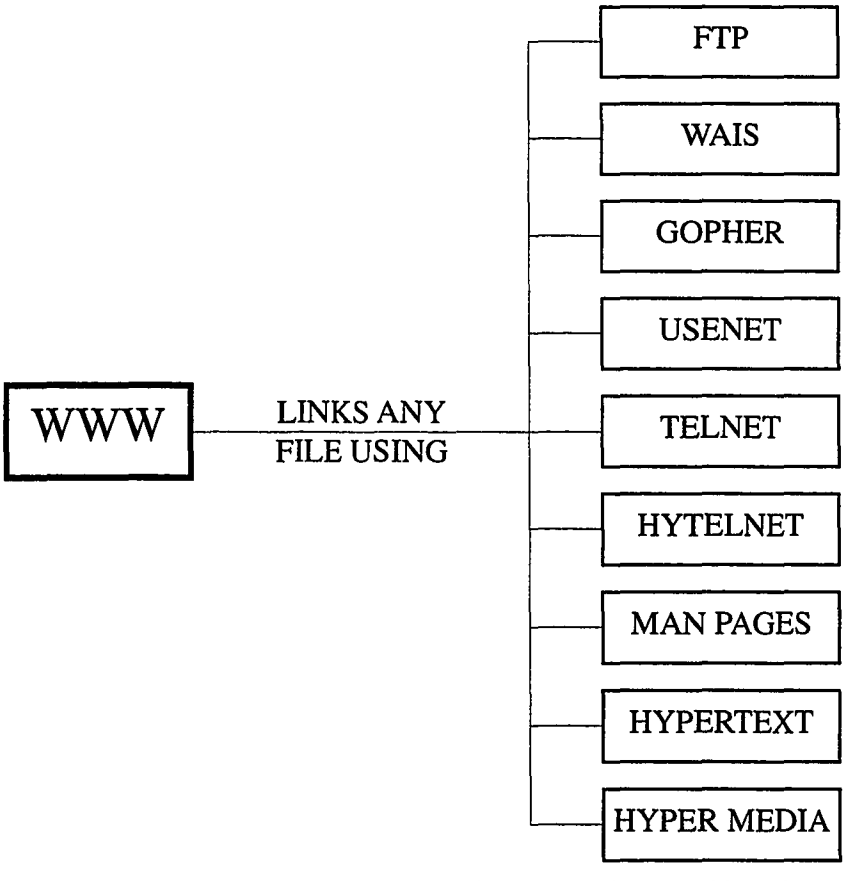

Table 4.2 Document types available on the World Wide Web (Ellsworth, 96)

HTML (HyperText Markup Language)

• a language with a standardised set of commands and syntax used for encoding text files with formatting and document linking information, for use on the WWW and viewed using a Web browser.

HTTP (HyperText Transfer Protocol)

• a standardised set of rules for transferring and processing HTML and other types of documents on networks.

Web Browser

• software applications used for retrieving and viewing HTML documents (e.g. Netscape Communicator, Microsoft Internet Explorer and Ascii Lynx).

URL (Uniform Resource Locator)

• an addressing system that uniquely names files in the Internet; includes a protocol name (e.g. gopher, ftp or http), a site name, a sub-directory path and a filename.

FTP (File Transfer Protocol)

• a system used to transfer copies of a file from one computer on the Internet to another.

Gopher

• a tool for finding and retrieving files of all kinds throughout the Internet.

E-mail

• private messages delivered via networks to another individual's E-mail account.

HyperText

• text in an HTML document that is coded to provide a (hyper)link to other locations within the document or to other documents.

Telnet

• a system that allows access to remote computers on the Internet.

Server

• a server programme maintains a database and provides information to client programmes through the network when requested.

IP address

• groups of numbers used by Internet routers to direct packets of information to the correct sites.

VRML

• language for describing multi-participant interactive simulations.

4.1.3 The Internet Environment

The Internet is still in a developmental stage when considering many practical applications. However, the tremendous growth of this network has attracted many businesses and institutions to this technology. One study claims that the Internet is growing at a rate which doubles its size every nine months.[1] In order to better understand the present form of the Internet, it is necessary to study its origins. This also provides a more complete knowledge of

[1] Ellsworth, The Internet Business Book, xxi.

the rules and etiquette of the Internet and its layers of technical protocols. Although the Internet is changing rapidly, it is still fundamentally based on its original foundation.

The Internet evolved from a network set up by the United States Department of Defense (DOD) in the early 1970s. This network was developed by a specific body of the DOD called the Advanced Research Projects Agency (ARPA) in order to connect a number of military and research sites. Named the ARPAnet, this communications system was also an experiment in how to build reliable networks. The research resulted in the development of a protocol allowing dissimilar computers and computer systems to communicate over the same network, and a method of transferring data in packets (with their own destination addresses) through multiple paths.[1] The success of these research projects resulted in other networks using the same standards, known today as TCP/IP (Transmission Control Protocol/Internet Protocol), which is the mechanism that transmits information across the different networks of the Internet.[2]

In the late 1980s, the National Science Foundation (NSF) expanded its own NSFNET using ARPAnet technologies and a high-speed backbone linkage. This network allowed university campuses and research centres access to NSF's supercomputers. Soon afterwards, the network began to be used for E-mail and the transfer of data and information files between sites. This network, the Internet, grew with the inclusion of commercial interests and private individuals who could not obtain access through government or academic institutions. Providing high-speed links, the Internet is funded by the NSF and is managed by Advanced Network System (ANS).[3]

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[1] Ellsworth, The Internet Business Book, 3.
[2] Melanie Hills, Intranet Business Strategies, 11.
[3] Ellsworth, The Internet Business Book, 4.

In 1989, the World Wide Web (WWW) was created by Tim Bernes-Lee at the European Laboratory for Particle Physics (CERN). The Web uses HyperText to link information; HyperText allows users to select a highlighted button (either text or graphics) which links to that information regardless of where it is stored on the network. Home pages form the basis of the Web and provide starting points for gathering information. In general, Web pages use HyperText links to provide access to information in the form of text, graphics, sound and video.[1]

In 1993, Marc Andreessen, with the help of fellow students, created Mosaic, the first popular graphic Web browser, at the University of Illinois' National Centre for Supercomputing Applications. Due to its graphic user interface, Mosaic made the Web easy to use, and since it was possible to download it from the Internet at no cost, access to the Web became inexpensive.[2]

4.1.4 The Requirements for Getting On-Line

Individuals do not sign up for an Internet account directly, but obtain an account on an organisation's host computer that is connected to the Internet in one of a number of ways. The organisation may be providing this service to its customers for profit or, as in the case of many academic institutions, free of charge. An individual can be connected to the organisation's computer either by having a hard-wired link from the user's network card to the server (or via one of its switches or hubs) or by using a phone line in conjunction with a personal computer and a modem.[3]

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[1] Melanie Hills, Intranet Business Strategies, 5.
[2] Ibid., 6.
[3] Ellsworth, The Internet Business Book, 6.

4.1.5 The Available Audience

The Internet is a rapidly increasing medium whose size is directly related not only to the number of users accessing the Web, but also to the volume of information available for use in this medium (i.e. the number of Web pages and Websites). There are over 36 million host computers connected to the World Wide Web (Table 4.3), and approximately 320 million Web pages on the Internet (Table 4.4).[1]

In the international and North American context, the United States remains the leader in Internet usage and development, including the number of Internet users and businesses on-line, and the number of home PCs in use (Tables 4.5 and 4.6). However, many other countries, including Canada, have a higher Internet usage in relation to their total populations, and a larger percentage of people in these countries have access to computers with Internet capabilities (Table 4.7). In addition, Canada's network backbone is one of the most highly developed in the world – the CA*net II links the country from the Pacific to Atlantic coasts with the OC 12, one of the fastest, optically based high-speed networks.[2]

English is the predominant language used on the Web, with 68% of Internet users communicating and exchanging information in English (Table 4.8).[3] However, the use of Japanese, German and Chinese is on the rise, and these languages will remain an important factor in international trade and communication, eventually reducing English's majority usage to less than 50%.

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[1] State of the Internet (www.pegasusri.com).
[2] CANARIE Inc., 3rd Annual Advanced Network Workshop.
[3] Demographics (www.pegasusri.com).

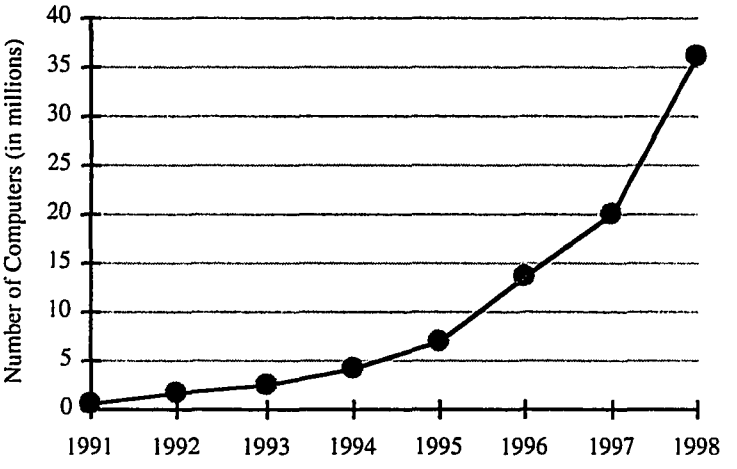

Table 4.3 Number of computers, or hosts, linked to the Internet (Network Wizards, 1998)

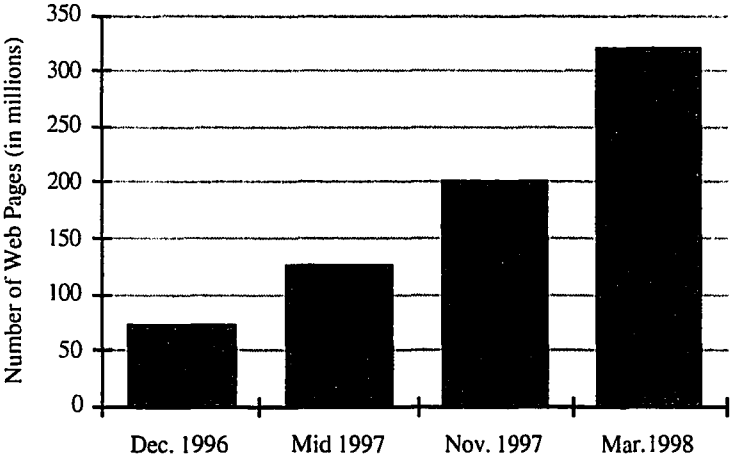

Table 4.4 Number of Web pages on the Internet (IDC, AltaVista, NEC, 1998)

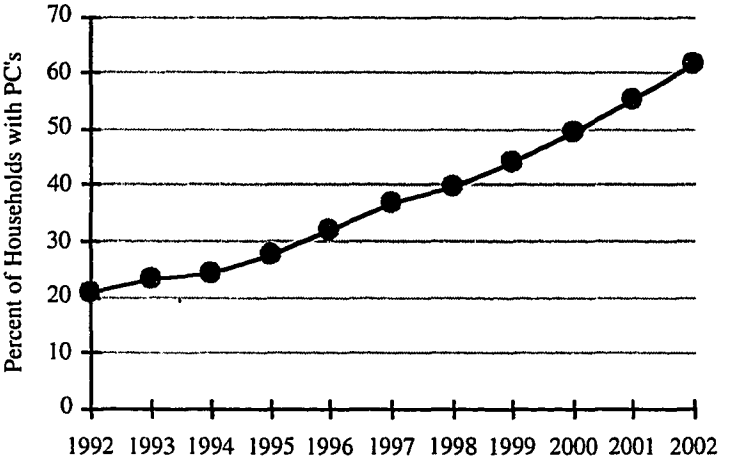

Table 4.5 Percent of US households with PCs (NTIA/US Census Bureau, 1999)

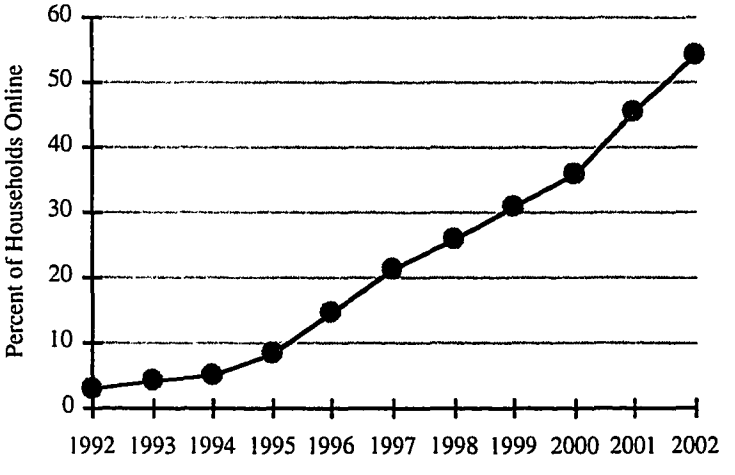

Table 4.6 Percent of US households on-line (Pegasus RI, 1999)

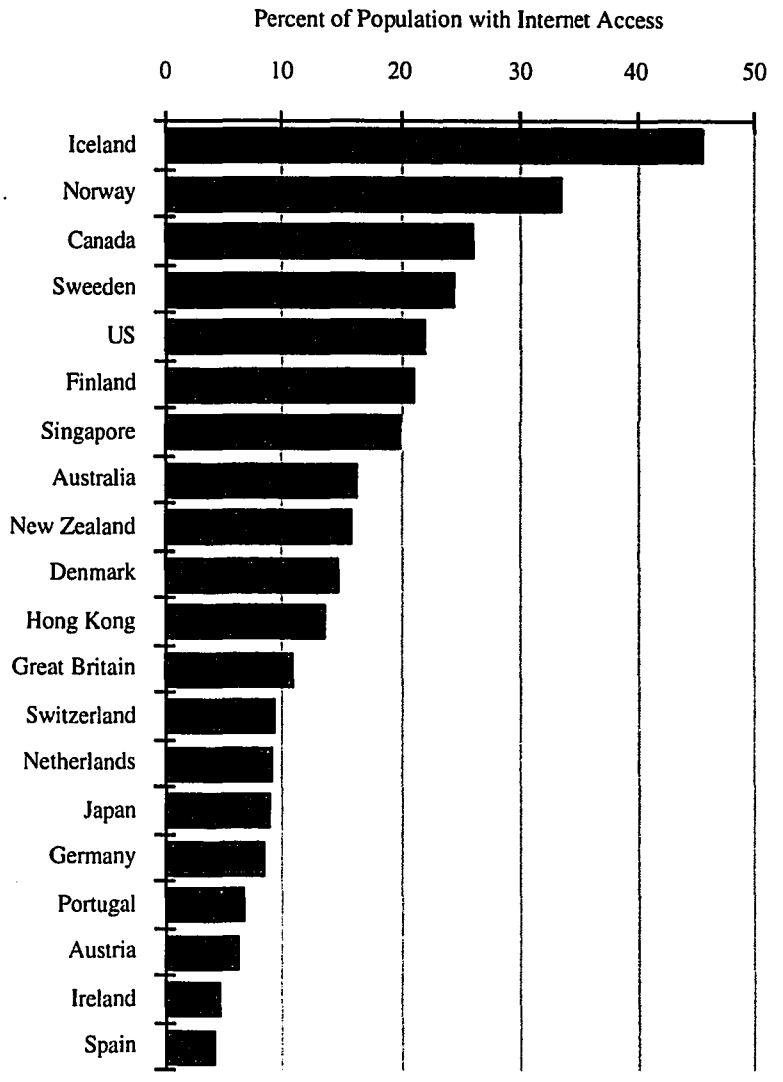

Table 4.7 Top countries in Internet usage (Pegasus RI, 1998)

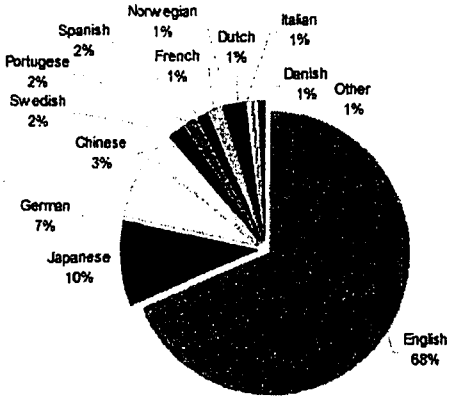

Table 4.8 Languages used on the Internet (Pegasus RI, 1997)

4.1.6 Levels of Interactivity

The level of interactivity in a Website depends on what the site is intended to do. If, for example, the Website is designed as a simple showcase of products, the level of interactivity is low, since users only get information about specific products or product lines. But if the site is also intended to allow users to buy products on-line, the level of interactivity must be high enough to complete a full business transaction: that is, to have a full ordering process, a link to inventory and shipping information and, in some cases, on-line credit card verification.

Some sites also allow users to try out computer products, like CD-ROMs, databases and software applications. The Website then becomes a platform to learn more about a specific product. These try-outs are mainly on-line simulations of the real products. Some software developers also integrate a Website as a complement to their product: for example, an updated database or additional features like Web content browsing through the CD-ROM (software).

4.1.7 The Speed of Transmission

The speed of transmission, or bandwidth, is the rate at which data is transmitted to the end user. The bandwidth is usually very high between servers and very low between modem users and servers. Bandwidth is key in business data transmission, because a large amount of data is involved. Servers often work in parallel and need to be up-to-date in real time. Bandwidth becomes a major concern when transferring large images (like house plans drawn in CAD software) or multimedia content such as sound and video. These types of data use large computer files that are very slow to transfer. Some files are compressed before the transfer process. Compression often allows users to drastically reduce the size of the file, from less than 2:1, to 16:1 in the best cases. Compressing files has its downside, since it requires the

end user to decompress the data received. This requires that the user has the expertise and software to do so.[1]

4.1.8 Technical Support

Generally speaking, end users are only familiar with a small fraction of their computer's workings, which is why technical support is crucial. Websites are good declinations of value-added technical support. This kind of on-line support is usually intended for more advanced users who already know how to use the Internet as a tool.

4.1.9 Updating Information

In the Internet's rapidly growing world of information, updating content is key. Many Websites are not maintained, and their information is outdated or completely obsolete. Information on business Websites must be published in real time so that customers or partners can access it quickly and reliably. Most Websites are built in a two-fold fashion: one part containing static content about the company (i.e. mission, areas of work, locations) and a more dynamic part comprised of breaking news about the business and press releases. Updating the content in a Website requires little knowledge about programming, and many user-friendly tools exist to help users add, modify or delete content in Web pages. Many industry standards in word processing software include sections inside the programme which allow users to create and edit Web pages for display on the Internet.[2]

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[1] Personal interview with Chrystian Guy, Web specialist.
[2] Ibid.

4.2 Marketing Using the Internet

4.2.1 "E-Commerce"

"E-commerce" is a term applied when companies engage in the business of Internet-based sales; this includes companies selling merchandise through electronic catalogues on the Web, or businesses performing everyday transactions such as ordering supplies or selling stock to their distributors. E-commerce is one of the fastest-growing sectors of the economy, with an annual growth rate of approximately 100% (Table 4.9). Although it still represents less than 0.5% of the total retail sales market (Table 4.10), E-commerce is expected to increase its market share steadily, especially in catalogue-based consumer sales.[1] Transactions between business, however, comprise the majority of electronic commerce activity. Business-to-business E-commerce accounts for 75% of all the Internet financial transactions and is expected to increase even faster than consumer retail sales on the Web.[2]

4.2.2 Effective Marketing Strategy and Exposure

A company interested in exploiting the Internet for business uses must determine whether it wants to use its Website in an active or passive role. The Internet can be used to assist in the marketing of products and to communicate with clients and suppliers on customised Websites (active), or simply to allow users to browse through a catalogue of products or advertising (passive). Regardless of how it does business, a company may require an Intranet setup to facilitate communication within its own ranks. Many companies are also motivated by the fear of falling behind the times by not having a presence on the Internet, even though no one can

[1] E-Commerce (www.pegasusri.com).
[2] E-Commerce; Business to Business (www.pegasusri.com).

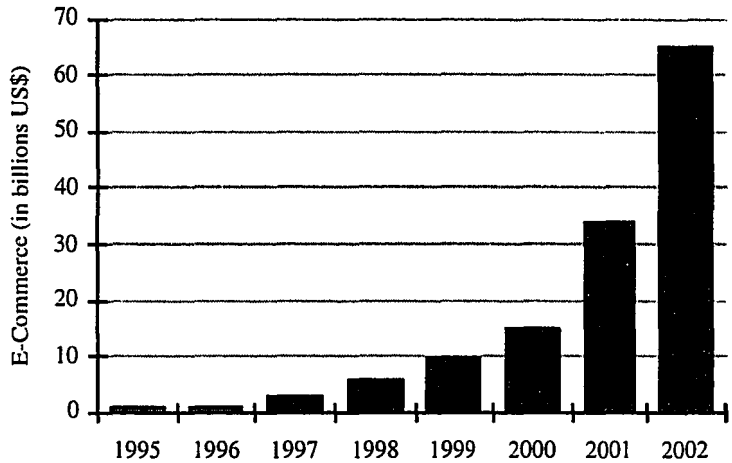

Table 4.9 E-commerce: business to consumer sales (Pegasus RI, 1999)

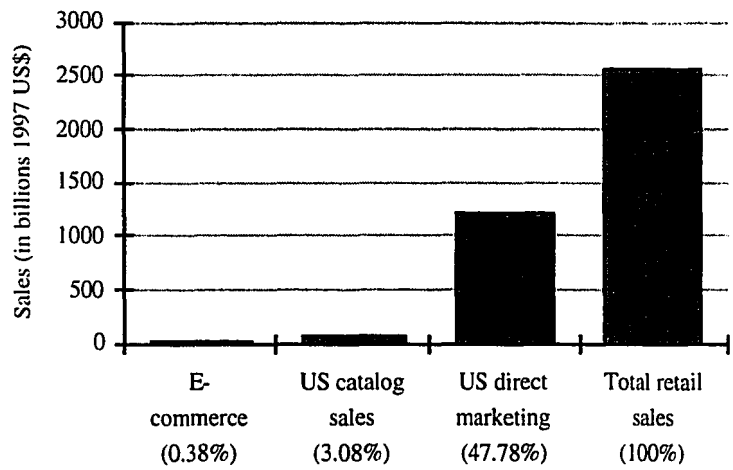

Table 4.10 E-commerce sales in relation to total retail sales (Pegasus RI, 1999)

predict whether or not the Internet will prove to be a tool necessary for all companies in the coming years.[1]

Once a company has decided to go "on-line", its requirements, in terms of the use and future use/expansion of its Website, must be determined through consultation with a Web expert experienced in dealing with companies of differing backgrounds. This consultant must prescribe the correct approach based on the company's business strategy and targeted audience, (client base). In addition, the consultant must advise the company on purchasing the appropriate hardware/software and be available for future troubleshooting and updating of information.

4.2.3 Website Design

Website design should reflect the firm. It is mandatory that the corporate image of the firm is integrated in the Website design for branding matters. Websites should be constructed in an ergonomic fashion, so that information is easily accessible and navigation is fluid. It is important that users are able to find what they are looking for while having a good feeling about the Website. Using attractive graphics to support the content helps maintain user interest.

Navigation within a Website is a procedure that should be carefully planned; Websites that are difficult to browse through or make it difficult to return main starting points can be frustrating and a waste of users' time. Similarly, the graphic content of the site, while being interesting and appealing, must maintain a level of clarity and legibility. For instance, text should not be placed on a graphic background of a similar colour or a distracting pattern that would make the text illegible. Another example of good Web page design relates to the display of images; if a

[1] Personal interview with Chrystian Guy.

large number of images is available for viewing, an index showing a thumbnail version of the full image should be provide rather than displaying a Web page with each image given in its full size format. This saves time loading the page and also provides a summary of the images.

4.3 Security of Confidential Information

4.3.1 Access to Information

A Website is a public information publishing tool. Even in Intranet mode, where users need to register or be part of a private group to access information, the underlying structure is one of public content display. That is why precautions need to be taken when putting information on-line. For example, secret information about products or business plans should not be put on a Website. Also, for security matters, on-line databases should be replications of the real databases: a company might want to display the content of its database, but would want information to be deleted or tampered with by an 'info-terrorist' or a hacker. In a corporate Website, only the Web master (or design team) should be able to publish content, a precaution that prevents unauthorized display of erratic or false information about the company and/or its products.

Logging in can provide limited access to some content to a specific group of users. This procedure requests that a user enter their user name and a password before they can go any further. The most common piracy cases come from social engineering, whereby unauthorized users gain access to passwords through unscrupulous means such as bribery, looking over the shoulder of co-workers, or the "I forgot my password, please give me yours" trick.

But for public information, the Web is a great vehicle for publishing content. And since it uses the same technology as common software (a computer), it is an efficient complement to any piece of software. For example, the protocol for accessing information is rather simple and easy to integrate in a CD-ROM software title. Most Web content can be resumed in text form and can be browsed with a simple and easily distributed software, since most Web browsers are free.[1]

4.3.2 Confidentiality of Client's and Manufacturer's Correspondence

Data about users, clients and partners must be recorded in protected databases, which should not be accessible via an ordinary http protocol, which is designed for the transmission of public information. A corporate Web master should instead use the http-s protocol, which stands for "secure" http. This protocol uses data encryption to prevent unauthorized access to information. Encryption is a process that scrambles data before it is sent, and an encryption key is needed by the end user to decrypt (unscramble) the data. It is also recommended that E-mails be encrypted when they contain confidential information. Contract documents rarely need to be displayed on-line, except in an Intranet environment, so they should also be protected by a secure http.[2]

4.3.3 Methods of Payment

On-line payment can be processed in many ways. The most primitive method is to send an order form via E-mail or a Web page with the information concerning the transaction. This process is very similar to, but less secure than, fax orders since the data can reside on Web

[1] Personal interview with Chrystian Guy.
[2] Ibid.

servers or mail servers for some time before it is delivered to the addressee. One of the most common ways of processing on-line transactions is through a Web-driven order form with data encryption, using Secure Socket Layer (SSL). This method allows users to order the products they want to buy and provides the seller with the customer's credit card information.

Another option is to process the credit card transaction on-line while the ordering process is taking place, made possible through on-line payment software. In this method, the user's credit card is automatically charged for the transaction. Some business-to-business models also use tokens to make on-line transactions, allowing customers to make numerous purchases on account. The tokens are tallied on a regular basis and a billing process is then initiated through standard mail.[1]

4.4 Example of a Web Search

4.4.1 Introduction

The following search was undertaken to explore what sort of presence housing manufacturers have on the Internet. When searching the Internet, it is important to develop a methodology, which can be seen as simply a structured order while navigating within the Web and other habits, allowing for a better grasp of the material that needs to be examined and retrieved. An example of a Web search methodology is the systematic compilation of site addresses visited. Although Web browsers have bookmark features, it is equally simple to cut and paste useful addresses into categories laid out in a text application that can be kept running in parallel with the browser application. This allows the user to produce a hard copy of Web pages that can be

[1] Personal interview with Chrystian Guy.

sorted and used as an index for later use, or to distribute to other users interested in the same area of study.

4.4.2 Lists of Websites

The purpose of the search was to compile a comprehensive, if not complete, list of prefabricated housing manufacturers and retailers in the province of Québec. The list was expanded to include the rest of Canada and the United States to allow a better understanding of the results found and to give a relative impression for local companies in the North American context.

The search was initiated by using a commercial search engine. Many variations of keywords and word combinations were used over the course of the research. Specific Web search syntax and protocol were followed, such as using quotation marks and the plus symbol in combination with keywords to maximise the search efficiency, by removing as many unnecessary hits (Websites containing a match of search topics or keywords) as possible. Browsing through irrelevant search results wastes time and creates for work for the user.

Table 4.11 shows a list of manufactured housing companies whose Internet home pages were found on the Web. The information was found with varying degrees of ease and rapidity – some companies were found through a simple investigation using a commercial search engine (e.g. AltaVista™ or Lycos™) and through links from Websites belonging to one of the many prefabricated housing associations or regional organizations involved with manufactured housing. Other companies were harder to find, requiring specific searches with the addition of the location to the search keywords, while others could not be found even when the company's name was included in the search description.

WEBSITE ADDRESS	COMPANY NAME	LOCATION
http://www.alouettehomes.com	**(Les Maisons) Alouette Homes**	**QC**
http://www.2ianet.com/amhi	Anderson Manufactured Homes	NM
http://www.arontec.com	**Arontec Inc.**	**QC**
http://www.astrohomes.com	Astro Homes	PA
http://www.bentonhomes.com	Benton Homes Inc.	MO
http://www.boweshomes.com	Bowes Manufactured Housing Inc.	**MB**
http://www.brilliant-homes.com	Brilliant Homes	TX
http://www.britco.com	Britco Factory Built Buildings	**BC**
http://www.buccaneerhomes.com	Buccaneer Homes	AL
http://www.burlingtonhomes.com	Burlington Homes of Maine	ME
http://www.buy-ritehomes.com	Buy-Rite Homes	WA
http://www.cambonihomes.com	Camboni's Manufactured Homes	IL
http://www.symweb.com/cardinal	Cardinal Homes	VA
http://www.cavalier-homes.com	Cavalier Homes of Alabama	AL
http://www.castle-homes.com	Castle Homes	CO
http://www.clayton.net	Clayton Homes, Inc.	TN
http://www.cmvilleray.com	**Club Maisons Villeray**	**QC**
http://www.directory.reddeer.net/chiles.htm	Chiles Homes Ltd.	**AB**
http://www.crestlinehomes.com	Crestline Homes, Inc,	NC
http://www.emeraldlifestyle.com	Emerald Lifestyle Homes	OR
http://www.factoryhomes.com	Factory Homes	OR
http://www.thegrid.net/yreka/Fairlane.html	Fairlane Manufactured Homes	CA
http://www.lasvegasfleetwood.com	Fleetwood Home Center	NV
http://www.fourseasonshousing.com	Four Seasons Housing	IN
http://www.fuquahomes.com	Fuqua Homes	OR
http://www.goldmedalhomes.com	Gold Medal Homes	NC
http://www.goldenvilla.com	Golden Villa Homes	CO
http://www.guildcrest.com	Guildcrest Homes	**ON**
http://www.harthousing.com	Hart Housing Group	USA
http://www.heartlandtexas.com	Heartland Homes	TX
http://www.vtinet.com/heritage	Heritage Homes of the Valley	CO
http://www.highdeserthomes.com	High Desert Homes	OR
http://www.highmountain.com	High Mountain Homes	OR
http://www.willerby.com	Holiday Homes	UK

Table 4.11 List of manufactured housing companies on the Internet (Canadian companies in bold)

WEBSITE ADDRESS	COMPANY NAME	LOCATION
http://www.hhs.net/homes	Homes by Sturge	PA
http://www.homescanada.net	Homes Canada Inc.	**AB**
http://www.homesofmerit.com	Homes of Merit	FL
http://www.hmstead.com	Homestead Homes	GA
http://www.modularcenter.com/homeworks	Homeworks Modular Homes	NY
http://www.hortonhomes.com	Horton Homes	GA
http://www.ind.bonneville.qc.cq	**Les Industries Bonneville**	**QC**
http://www.thekarstenco.com	The Karsten Company	CA
http://www.kenthomes.com	Kent Homes	NB
http://www.kitmfg.com	KIT Manufacturing	ID
http://www.libertyhomesinc.com	Liberty Homes, Inc.	IN
http://www.maisonsbondu.com	**Les Maisons de pièces Bondu inc.**	**QC**
http://www.hestia.net	**Maisons Hestia**	**QC**
http://www.marcoux.qc.cq	**Maisons Marcoux Inc.**	**QC**
http://www.multigon.qc.ca	**Maisons Multigon**	**QC**
http://www.manufacturedhomesofmi.co	Manufactured Homes of Michigan	MI
http://www.mlhomes.nb.ca	Maple Leaf Homes Inc.	**NB**
http://www.maplehomes.com	Maple Homes Canada	**BC**
http://www.modularconnection.com	The Modular Network, Inc.	USA
http://www.modulex-international.com	**Modulex Inc.**	**QC**
http://www.moduline.com	Moduline Industries	**CAN**
http://www.busdir.com/mthou	M.T. Housing, Inc.	WA
http://www.nevadamobilehomes.com	Neavada Mobile Homes	NV
http://www.nelson-homes.com	Nelson Homes	**AB**
http://www.normarkhomes.com	Normark Homes	BC
http://www.normerica.com	Normerica Building Systems	**ON**
http://www.nerealty.com/modular.htm	Northeast County Homes	CT, MA
http://www.oakwoodhomes.com	Oakwood Homes Corporation	NC
http://www.palmharbor.com	Paml Harbor Homes	TX
http://www.parkavehomes.qpg.com	Park Avenue Homes	WA
http://www.patriothomes.com	Patriot Homes, Inc.	IN
http://www.qmh.com	Quality Manufactured Homes	**BC**
http://www.qualityhiomes.on,ca	Quality Manufactured Homes Ltd.	**ON**
http://www.realenghomes.com	Real Engineered Homes	**BC**

Table 4.11 (Cont.) List of manufactured housing companies on the Internet (Canadian companies in bold)

WEBSITE ADDRESS	COMPANY NAME	LOCATION
http://www.redmanhomes-nw.com	Redman Homes	OR
http://www.rochesterhomesinc.com	Rochester Homes, Inc.	IN
http://www.wave.park.wy.us/~rushmore	Rushmore Homes	WY
http://www.schulthomes.com	Schult Homes Corporation	IN
http://www.showplacehomes.com	Showplace Homes	OR
http://www.silvercrest.com	Silvercrest Western Homes Corporation	CA
http://www.westernhomes.com	Silvercrest Western Homes Corporation	CA
http://www.swmanufacturedhomes.com	South West Manufactured Homes	AZ
http://www.hhs.net/houmes/systemsmain.htm	System Homes Inc.	WV
http://www.seahawkhomes.com	Sea Hawk Homes	**ON**
http://www.skylinehomes.com	Skyline Manufactured Housing	IN
http://www.srihomes.com	SRI Homes, Inc.	**BC**
http://www.eeehomes.com	Triple E Homes	**AB**
http://www.valleyridgehomes.bc.ca	Valley Ridge Manufactured Home Centre	**BC**
http://www.viceroy.com	Viceroy	**ON**
http://www.woodhillestatesinc.com	Woodhill Estates, Inc.	NY
http://www.symweb.com/yellow.html	YellowHammer Homes	AK

Table 4.11 (Cont.) List of manufactured housing companies on the Internet (Canadian companies in bold)

4.4.3 Description of the Results of a Specific Search

The first step involved using a search engine available on the WWW called AltaVista™ and entering the words *manufactured housing*. The partial results of the search are shown in Figure 4.4. A total of 139,816 documents were found, many of which would prove to be of little relevance to the topic if all these documents were visited. At the time of research, the search engine happened to be displaying an advertisement for amazon.com, which is an electronic bookstore that is one of the most wealthy companies in the United States in terms of its stock value. A list of titles on manufactured housing was obtained using this service (Figure 4.5). Again, many of the titles listed were only tangentially related to the search topic, and many publications that are normally available from local bookstores, such as books by home-manufacturing organisations, were notably absent.

AltaVista™'s search engine allows the user to refine a search to include only relevant subject headings. In this case, the following subjects were selected to narrow the search: 'manufactured,' 'residential' and 'exports', resulting in a list of 1,277 documents. One document was selected (Figure 4.6), and by using the translation service offered by the AltaVista™ search engine, a Spanish version of the same document was immediately retrieved (Figure 4.7). This has tremendous implications and usefulness in the global context, considering that the WWW is still predominantly an English-speaking domain used by people around the world. In this case, many of the HyperLink buttons and titles remain in English as they are HyperText graphic links and not pure text (i.e. the files are comprised of images rather than text).

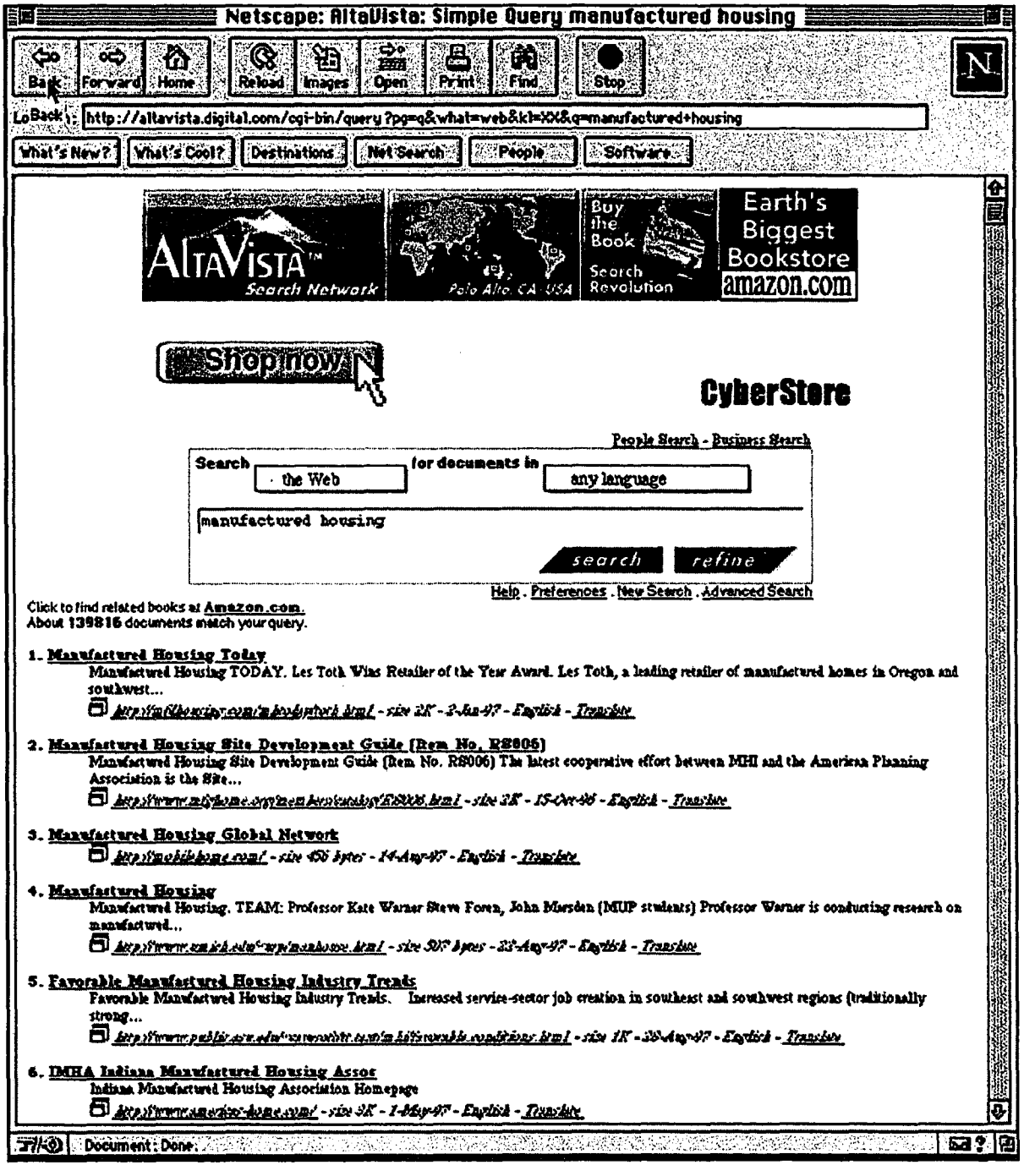

Figure 4.4 Results of search using AltaVista™ search engine (http://altavista.digital.com/sgi-bin/query?pg=q&what=web&kl=XX&q=manufactured+housing, 1997)

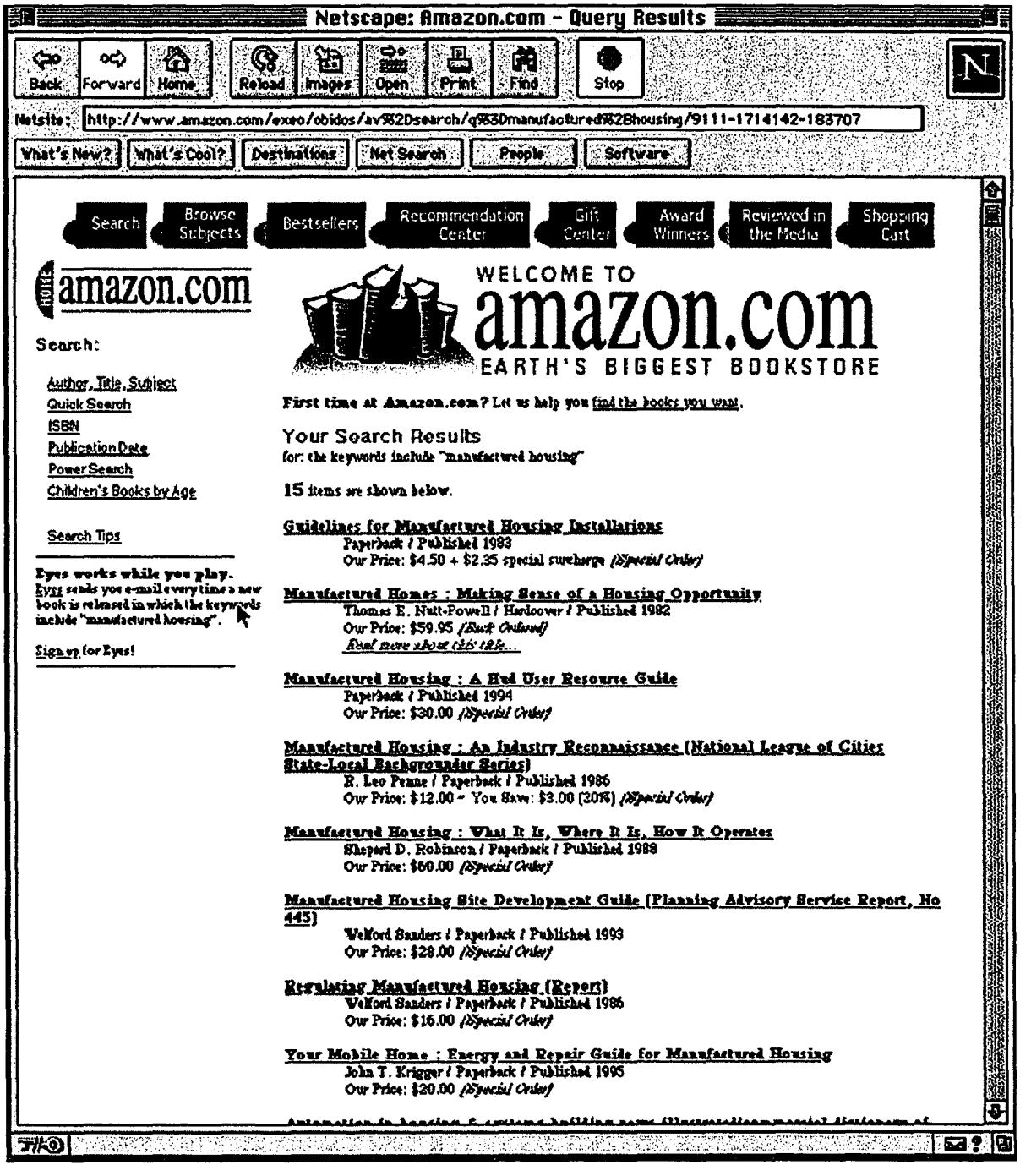

Figure 4.5 List of reference material given by amazon.com(http://www.amazon.com/exec/obidos/av%2Dsearch/q%3Dmanufactured%2Bhousing/9111-171412-183707, 1997)

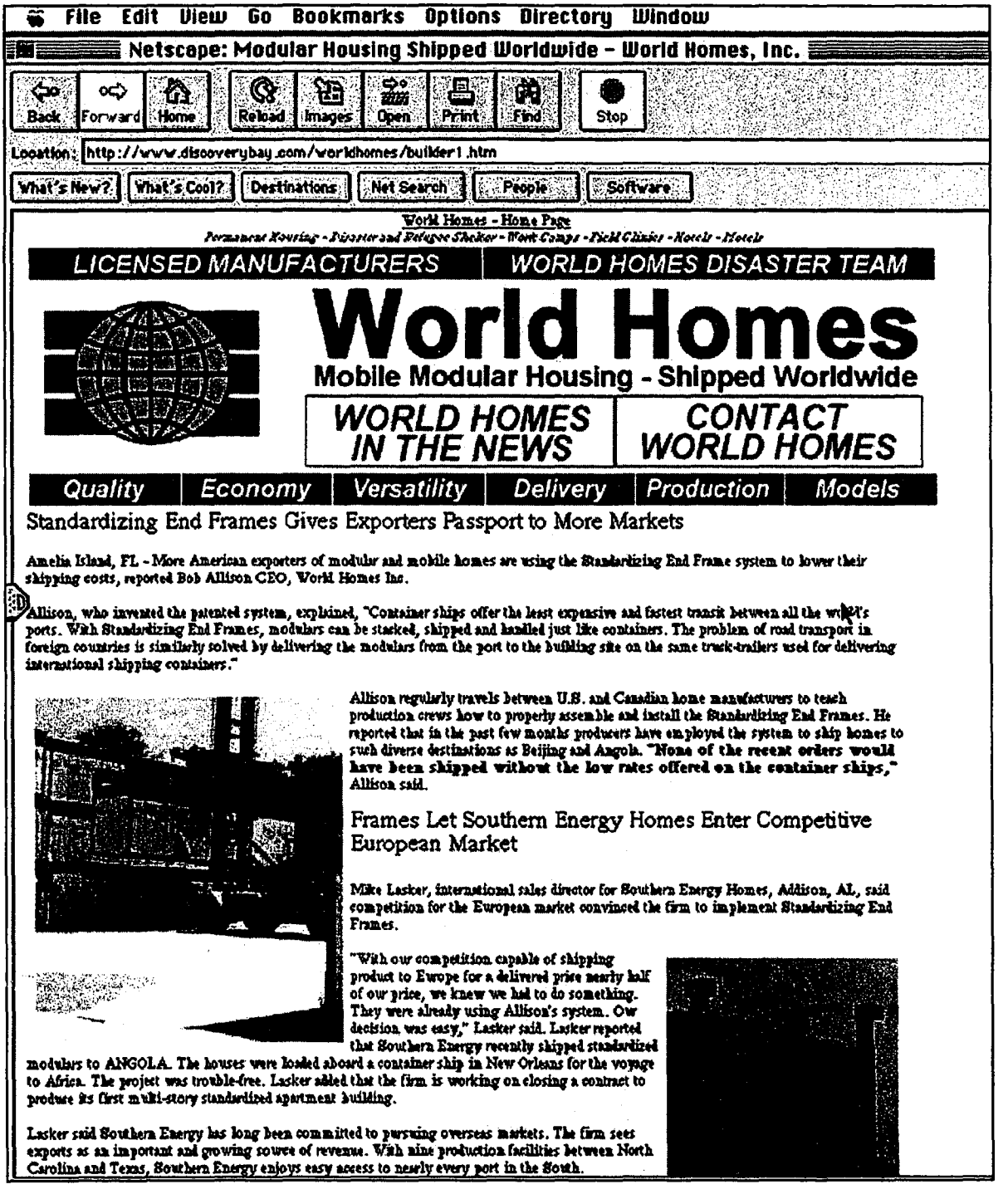

Figure 4.6 Example of Web page found through search engine (http://www.discoverybay.com/worldhomes/builder1.htm, 1997)

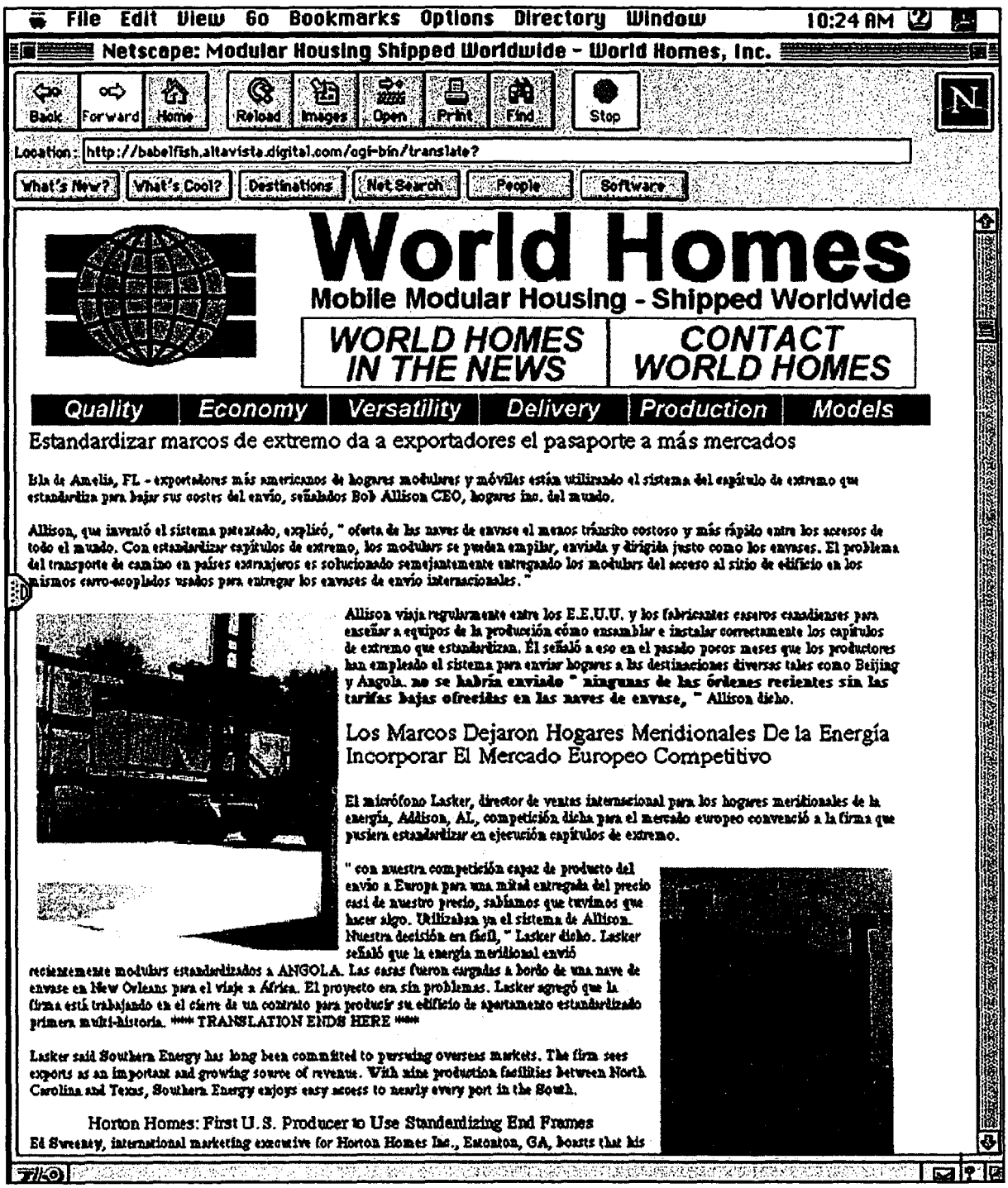

FIgure 4.7 Translation into Spanish of previous Web page (http://babelfish.altavista.digital.com/cgi-bin/translate?, 1997)

One of the main problems with sourcing information through search engines of this type is that most of them can only access a very small portion of the Internet. AltaVista™'s search engine is limited to a maximum penetration of 28% of the Internet, and many of the sites listed in the search results are Websites that are no longer active.[1] Other search engines such as Lycos™ have a lower number of 'hits,' but tend to find a larger percentage of active sites, resulting in a comparable number of useful sites that may contain the desired information (Table 4.12).

Another common problem with Internet searches is having to browse through sites that are not relevant to the user's search topic, that appear in the search results because of similar or ambiguous keywords or unclear search parameters. The use of specific and precise keywords and proper search syntax will reduce the number of irrelevant results.

After visiting a number of sites, a list of useful Website addresses was compiled. In order to assess what extent of exposure manufactured housing companies have on the WWW, a table format was developed to display a list of these companies with an overview of what information was offered on their sites. Table 4.13 gives a partial outline of the various aspects that could be analysed.

An example of one company's Website (Figures A.4.1, A.4.2 and A.4.3) is given in Appendix A.4 along with examples of Web pages from other companies that are involved in manufacturing building products (Figures A.4.4, A.4.5 and A.4.6). Similarly, the Website of the Ontario Manufactured Housing Association (OMHA) was visited to demonstrate the type of information made available on the Web by home manufacturing associations. In this example (Figures A.4.7, A.4.8 and A.4.9) the OMHA had chosen to subscribe to the LinkExchange™ to increase its exposure on the Internet. In addition, the OMHA provides its own compilation of links.

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[1] State of the Internet (www.pegasusri.com).

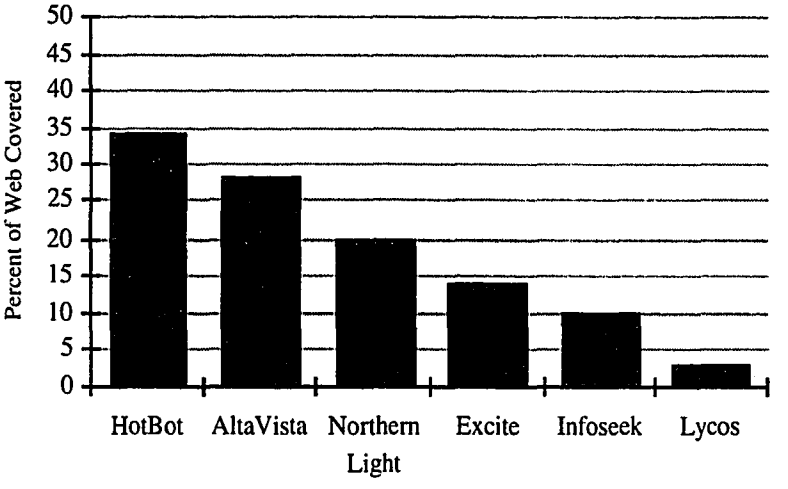


Table 4.12 Web coverage obtained by commercial search engines (Pegasus RI, 1998)

WEBSITE	# OF PAGES/ OPTIONS	BACKGROUND	TECHNICAL SPECS.	SHIPPING/ ORDERING	E-MAIL	GRAPHICS	DRAWINGS	LINKS
http://www.advantagehomes.com	5	Y	N	N	Y	Y	Y	N
http://www.coastlineconst.com								
http://www.fuquahomes.com								
http://www.net-magic.net/worldhomes								
http://www.mfghomes.com/brconstruction								
http://www.santiagohomes.com								
http://www.silvercrest.com								
http://www.thekarstenco.com								
http://www.timbertruss.com/main.htm								
http://www.viceroy.com								

Table 4.13 Information to be compiled for housing manufacturers' Websites

CHAPTER FIVE: THE PROPOSED TOOL

5.1 Introduction

As part of the research for the Next Home™ project[1], a prototypical software demonstration was developed by the author as part of the Next Home™ design team. Demonstrated in the exhibition, this software application displayed a variety of building products and services to the user. Some degree of interactiveness was introduced to allow for greater user participation in the selection of materials and layouts. This aspect shows a potential advantage of the electronic format as a display option. The user can control and view exactly what is required while the opportunity to browse as with a traditional catalogue still exists.

The goal was to produce a software package, whether available on a CD-ROM or through the Internet, which would showcase Canadian (and specifically Québec) companies involved with the manufacturing and exportation of prefabricated housing units. These companies would include not only home builders and building product manufacturers, but also architects, developers and real estate agencies, governmental housing research and housing export organisations, building technology specialists and home manufacturing associations. Each of these companies would benefit in various ways from having a database of prefabricated housing models and building products that would be easy to update and expand when compared to traditional paper-based catalogues. It would also be readily available and accessible for simple, reliable and fast communication across the world due to the inherent nature of electronic media.

[1] The Next Home™ is a mid-rise housing unit which could be built as a detached, semi-detached or row unit. It offered both the homeowner and home builder flexibility with respect to the internal layout (i.e. whether it was made for one, two or three families or the location of the entrance and interior stairs) and the external features (i.e. exterior cladding, roof form and shape, balcony arrangement or window treatment).

Section 5.2, Design of Software, will explain the logic and basic design of the software as proposed by the author and will also include intended schematics and descriptions of the desired functions, menus and options. Section 5.4, Description of the Demonstration Software Tool, will show the programme in its final form as the demonstration prototype of the software. This was a result of the initial design relating to the logic and structure of the tool by the author in conjunction with the programming skills of K-OS Multimédia, a multimedia software company.

5.2 Design of the Software

This section describes the criteria and suggestions for the logic, manipulation, and visual design of the programme.

5.2.1 Introduction

The programme is divided into three main parts:

Part A: Background to Companies;

Part B: Catalogue and Interactive Mode: Housing;

Part C: Catalogue: Building Products.

Each part can be accessed directly from the main menu (or introduction screen) or in series by following each part consecutively. Part A is essentially a database of company *brochures,* in that there is background information and brief descriptions of the companies' products, production methods, shipping and packaging information, economic and financial aspects, safety and quality controls, use of recyclable products, energy conservation programmes and

environmental considerations. Part B contains information relating to housing products and allows the user to choose various options with respect to the specific design choices and house layouts. Part C can be considered as a tool to finish the house chosen in Part B, or as a catalogue for simply viewing and ordering certain building products.

5.2.2 Screen Layout

The display has a top menu bar with pull-down menus for the *file, search* and *print options.* The file menu allows the user to perform standard application file functions, such as quitting the application, saving screen information (either graphics or text) to a file and opening previously saved information. The bottom part of the display is comprised of the *path tree*, the *movement buttons* and the *information buttons.* Each of the five components (given in italics) of the display will be explained in more detail in the relevant sections. A sketch of the display is shown in Figure 5.1.

5.2.3 Search Option

The search option is engaged through a pull-down menu from the top menu bar. The keyword search prompts the user to enter the desired word in the search entry box. The search tool treats the entered characters as if there were a "wild card" preceding and following the entry. For example, if the user enters *windo* in the search entry box, the search tool will display all the occurrences of *windo* as part of a word or series of words. So in this case, the search tool might find *windo*ws, casement *windo*ws and *windo*ws and doors. The user then selects one of the listed findings of the search to bring up a list of all the occurrences of the selected finding. Each occurrence of the selected finding is listed, showing in which index it can be

found and thus accessed. Selecting a specific occurrence takes the user to the appropriate part of the programme.

5.2.4 Print Option

The print option is engaged in a similar way to the search option (i.e. through the top menu bar). The user can print a single screen or a range of screens at any time during the use of the programme. There is also an option on the file menu of the top menu bar allowing portions of text or graphics to be copied and pasted onto a clipboard. The print option allows the clipboard to be printed at any time.

5.2.5 Path Tree

The path tree is the index on the lower left part of the screen which shows the specific area of the programme that the user is viewing. It can also be used as a directional tool: for example, if the user is in the index for the model listing of a certain product and another company's product is desired, they can immediately select the company index from the path tree rather than reversing manually through each screen or using the search option.

5.2.6 Movement Buttons

These buttons allow the user to flip backward and forward through the screens, which is necessary if an index or information window is too long to fit on one screen. Similarly, users can retrace their steps using the direction (arrow) buttons. The home and start buttons take the

user back to the beginning of a section (either Parts A, B or C) or the main menu (Introduction screen).

5.2.7 Information Buttons

Once a model has been selected and the user is in the housing or building product information mode in Part B or C respectively, the user can toggle back and forth between the four information categories: information/specifications, drawings, costing sheet and additional information.

5.2.8 Indexing System

Each main index lists the major headings for that section. When one of the major headings is selected or highlighted, the secondary index (located below the main index) displays a list of all the minor headings associated with the selected major heading. This allows all the major headings to be continuously displayed on the screen while browsing through the minor headings of any major heading. This layout is applicable if a third index of subheadings is required in conjunction with the main and secondary indices. An illustration of the logic behind the indexing system can be seen in Figure 5.2.

5.2.9 Database for Part A: Background to Companies

In Part A: Background to Companies, the user can search for information on companies involved in prefabricated house construction and building products used in all areas of standard

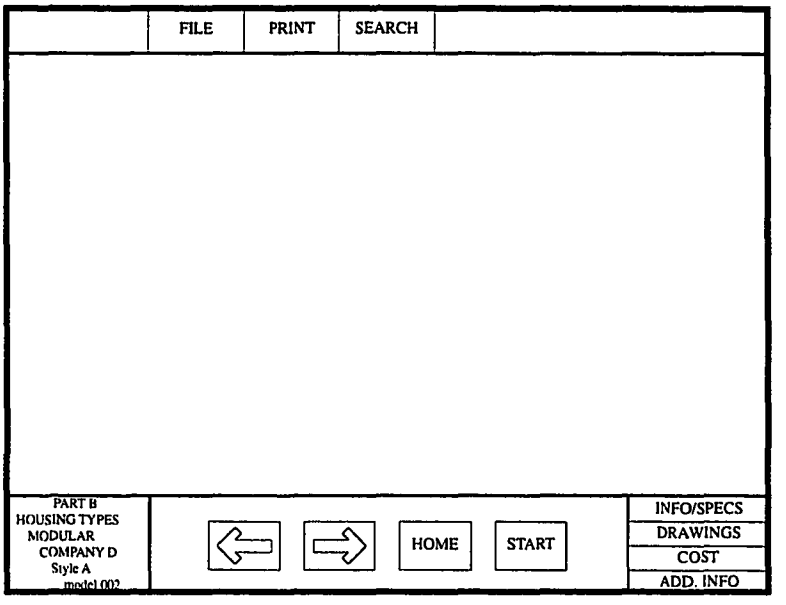


Figure 5.1 Sketch of proposed screen layout with file commands, path tree and movement and information buttons

INDEX OF HOUSING TYPES
PANELISED
LOG PROFILED
MODULAR
MOBILE
LOG-HANDCRAFTED
TIMBER FRAME
STEEL SYSTEM
INDUSTRIAL

INDEX OF COMPANIES FOR SELECTED HOUSING TYPE
MODULAR
COMPANY A
COMPANY B
COMPANY C
COMPANY D
COMPANY E
COMPANY F
COMPANY G

INDEX OF MODELS FROM COMPANY OF SELECTED HOUSING TYPE
MODULAR
COMPANY D
Style A
model 001
model 002
model 003
Style B
model 011
model 012
model 013

Figure 5.2 Sketch of indexing system menus

residential and commercial construction. Figure 5.3 outlines the logic and layout of this part. This section allows the user to browse through two indices; the first is an index of housing types (Table 5.1) and the associated companies involved in that area, while the second index contains a list of building products (arranged by MasterFormat Divisions, Table 5.2) and the companies manufacturing these construction materials. In the former case, the user can select a specific housing type (e.g. modular), and view all the prefabricated housing manufacturers who build modular type homes. Similarly, the user can select a specific building product from any of the MasterFormat Divisions or Sub-divisions (e.g. 08 Doors and Windows or 08630 Casement Windows) and browse through a list of all the companies that manufacture that specific building product. In both these cases, as in the previous examples, the user can select a company, whether it be a modular type home manufacturer or a casement window manufacturer or supplier .

The software displays information on the selected company. A detailed company profile contains information such as the company's history, shipping and packaging information, quality control and safety and environmental standards. In addition, links would be provided so that the user can directly access that company's, through a Web browser application, or even send electronic mail to the company via the Internet. A brief product list is also shown, which provides the link to Parts B and C. Otherwise, the user can continue browsing through the database of company profiles.

5.2.10 Database for Part B: Catalogue and Interactive Mode: Housing

Figure 5.4 demonstrates the logic behind Part B: Catalogue and Interactive Mode: Housing. The user can select a prefabricated home through two methods of searching: by housing type or by company name. Each index is similar to the search indices found in the housing section of

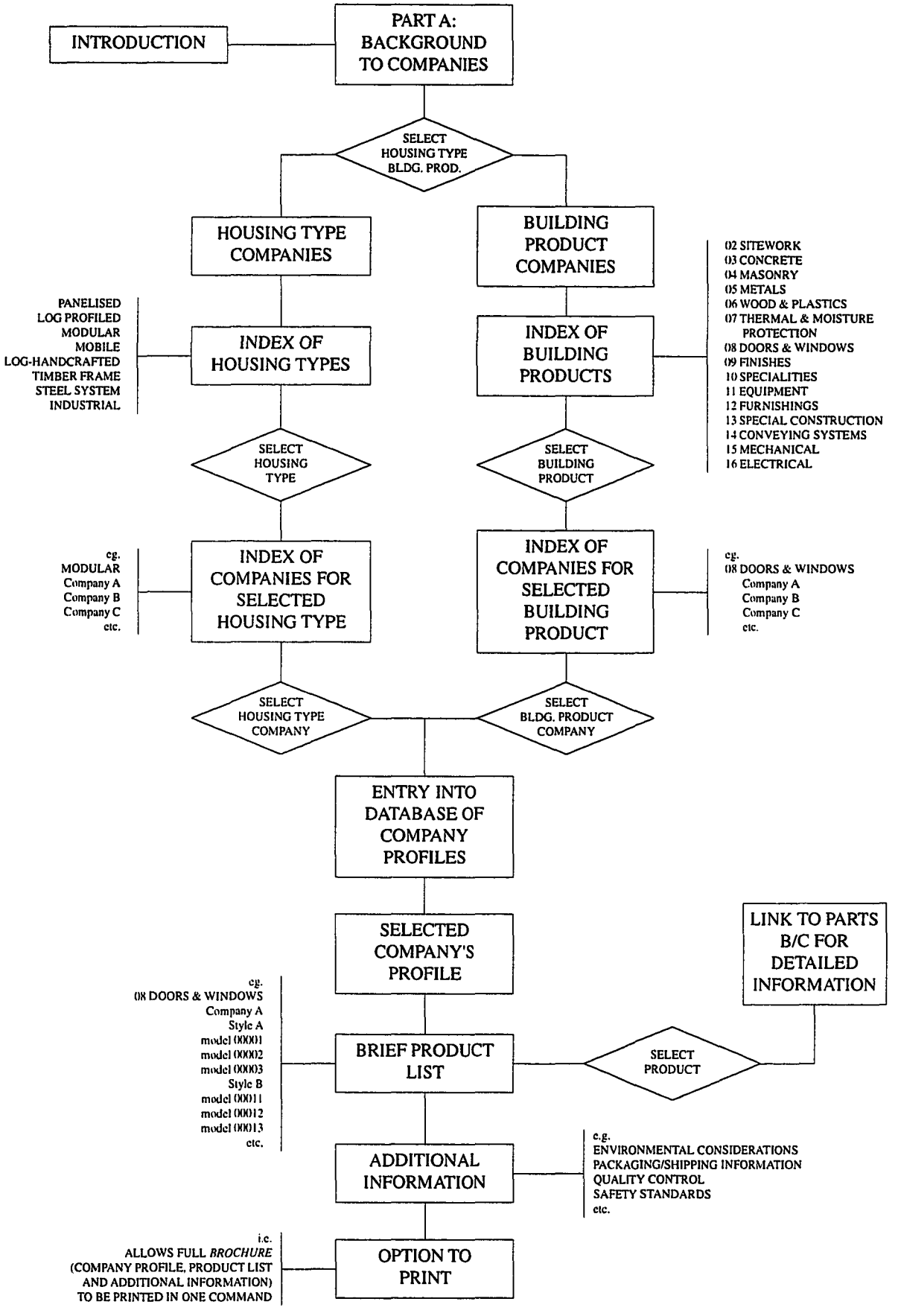


Figure 5.3 Flowchart of layout and logic of Part A: Background to Companies

HOUSING TYPES
Panelized
Log-Profiled
Modular
Mobile
Log-Handcrafted
Timber Frame
Steel System
Industrial

Table 5.1 List of prefabricated housing types

BUILDING PRODUCTS: MasterFormat Divisions	
No.	NAME
02	Sitework
03	Concrete
04	Masonry
05	Metals
06	Wood & Plastics
07	Thermal & Moisture Protection
08	Doors & Windows
09	Finishes
10	Specialities
11	Equipment
12	Furnishings
13	Special Construction
14	Conveying Systems
15	Mechanical
16	Electrical

Table 5.2 List of MasterFormat Divisions

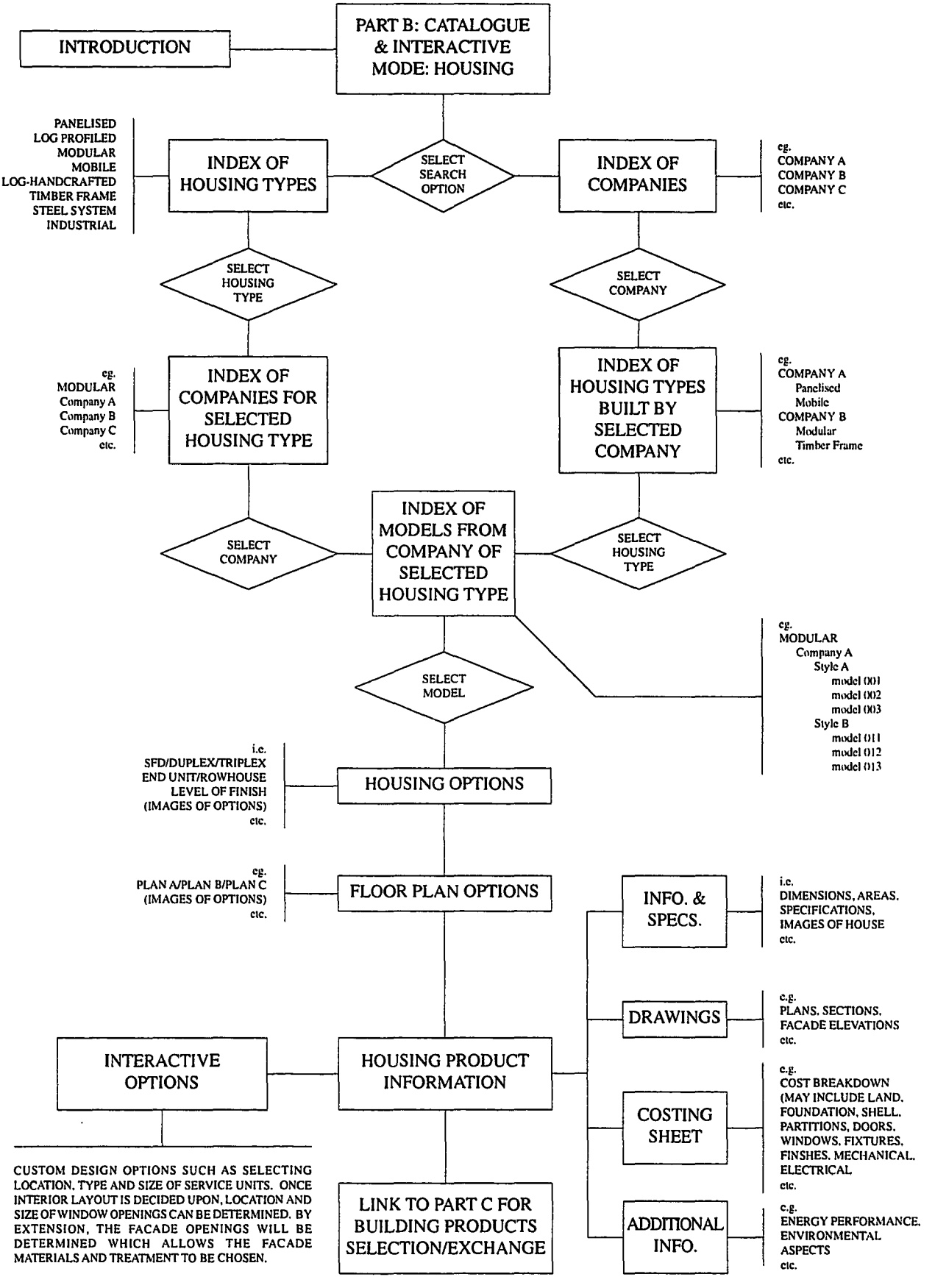


Figure 5.4 Flowchart of layout and logic of Part B: Catalogue and Interactive Mode: Housing

Part A. When searching for a specific housing type, the user can select a company that manufactures that housing type, and vice versa in a case where the user initially searches by company name. In other words, both search methods result in a list of individual home models of a certain prefabricated housing type manufactured by a specific home building company. Using this list, the user can then select a specific model of the desired housing type built by a certain company.

Once the preferred model of prefabricated home has been selected, the user then undertakes a series of choices of exterior features (Table 5.3). The programme offers only those choices relevant to the specific model chosen. This is important because the choices available from one manufacturer to another, as well as from one model to another, are often very different and can not be standardised into a general list of options. Similarly some exterior options may become unavailable due to the choice of previously selected exterior options, e.g. if a unit built on grade is initially chosen, the software will not allow to user to select a garage for that unit. Table 5.4 shows summaries for the selected exterior options of two examples of homes of the specified model built by the chosen company.

The user can also choose from a selection of floor plan options. These floor plan options, while being few and limited, offer a wide range of flexibility and choice. The floor plan options are limited because of the obvious but essential requirement of being consistent with the previously chosen options for the exterior features. Once the final floor plans are chosen, the software displays a summary of all the options (i.e. displays all the floor plans and elevations of the house). The building specifications and costing breakdown and summary are also available. The programme also allows for certain additional options where the user can interactively choose to replace certain interior and exterior elements, e.g. windows, or the type and size of service units such as the kitchen and toilet. Similarly there is a link to Part C so that the user can re-select or exchange standard building products which are part of the finished

HOUSING TYPE		(Panelised/Log Profiled/Modular/Mobile/etc.)
COMPANY		(Fermco)
MODEL		(The Next Home)
HOUSE TYPE		(Detached/Semi-Detached/Row)
LOCATION[1]		(Left Unit/Middle Unit/Right Unit)
ENTRANCE LOCATION		(Left Side/Right Side)
GROUND LEVEL		(On-Grade/Basement)
TOP FLOOR		(Mezzanine/Attic Crawl Space/Cathedral Ceiling)
GARAGE[2]		(None/Basement Floor)
BAY[3]	Location	(None/2nd Storey/3rd Storey/2nd and 3rd Storeys)
	Roof	(Pitch/Slope/Vault)
ROOF ELEMENT	Type	(None/Pitch/Square)
	Size	(Small/Large)
	Location	(Left/Centre/Right)
OCCUPANCY[4]		(Triplex/Duplex/Single Family)
HOME OFFICE[5]		(None/Ground Floor)

NOTES:

[1]These locations are applicable as follows:

Detached	None
Semi-Detached	(Left Unit/Right Unit)
Row	(Left Unit/Middle Unit/Right Unit);

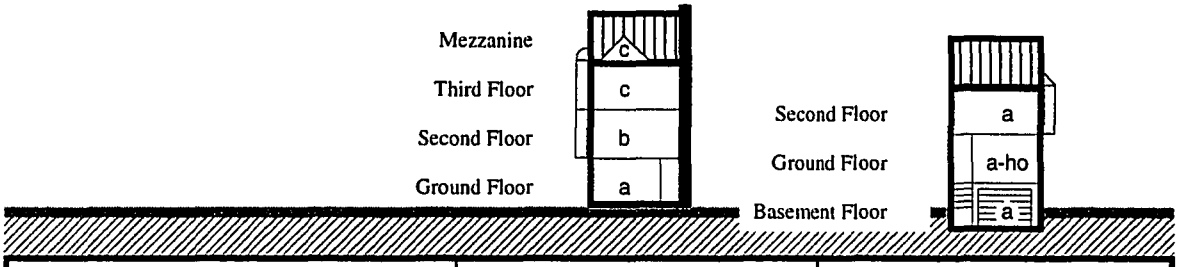
[2]Garages are located on the basement floor of a Basement Unit as long as the basement floor is not a single storey unit;

[3]Bays are located on the opposite side to the entrance;

[4]There can be two types of duplex units, i.e. aab or abb; however if we have abb-B or abc-B (basement units) the basement floor can not have a garage;

[5]Home Offices are located on the ground floor.

Table 5.3 Options available for customisation of external features in Part B: Catalogue and Interactive Mode: Housing



		EXAMPLE 1	EXAMPLE 2
HOUSING TYPE		Panelised	Panelised
COMPANY		Fermco	Fermco
MODEL		The Next Home	The Next Home
HOUSE TYPE		Row	Detached
LOCATION		Left Unit	
ENTRANCE LOCATION		Right Side	Left Side
GROUND LEVEL		On-Grade	Basement
TOP FLOOR		Mezzanine	Attic Crawl Space
GARAGE		None	Basement Floor
BAY	Location	2nd and 3rd Storeys	3rd Storey
	Roof	Vault	Slope
ROOF ELEMENT	Type	Pitch	None
	Size	Large	
	Location	Left	
OCCUPANCY		Triplex	Single Family
HOME OFFICE		None	Ground Floor

Table 5.4 Customised features of two examples chosen in Part B: Catalogue and Interactive Mode: Housing

house, e.g. door hardware and roof shingles. In both of the pervious cases, the drawings and cost breakdown will be adjusted accordingly.

5.2.11 Database for Part C: Catalogue: Building Products

The functioning of Part C: Catalogue: Building Products is initially identical to Part B (Figure 5.5). The user can search for models of building products either by selecting the type of building product (using the MasterFormat Divisions and Sub-divisions) or by choosing a company which manufactures the desired building product. If the user has initially selected the product, the selection of a specific company must then be chosen, and vice versa in a case where a company has been selected initially.

Once a specific model of a building product has been chosen, the user can view its specifications, drawings and images of the item and pricing information. Other products can be chosen in the same way and added to a 'shopping list'. Similarly if the user has arrived in this part from the interactive housing mode, they can select or exchange products in order to customise their prefabricated housing unit.

5.3 Preparing to Use the Demonstration Software Tool

5.3.1 Hardware and System Requirements

The tool was programmed specifically for PC-based machines and will only run on computers with a Windows-based platform, either Microsoft Windows® version 3.1 or Windows 95. A

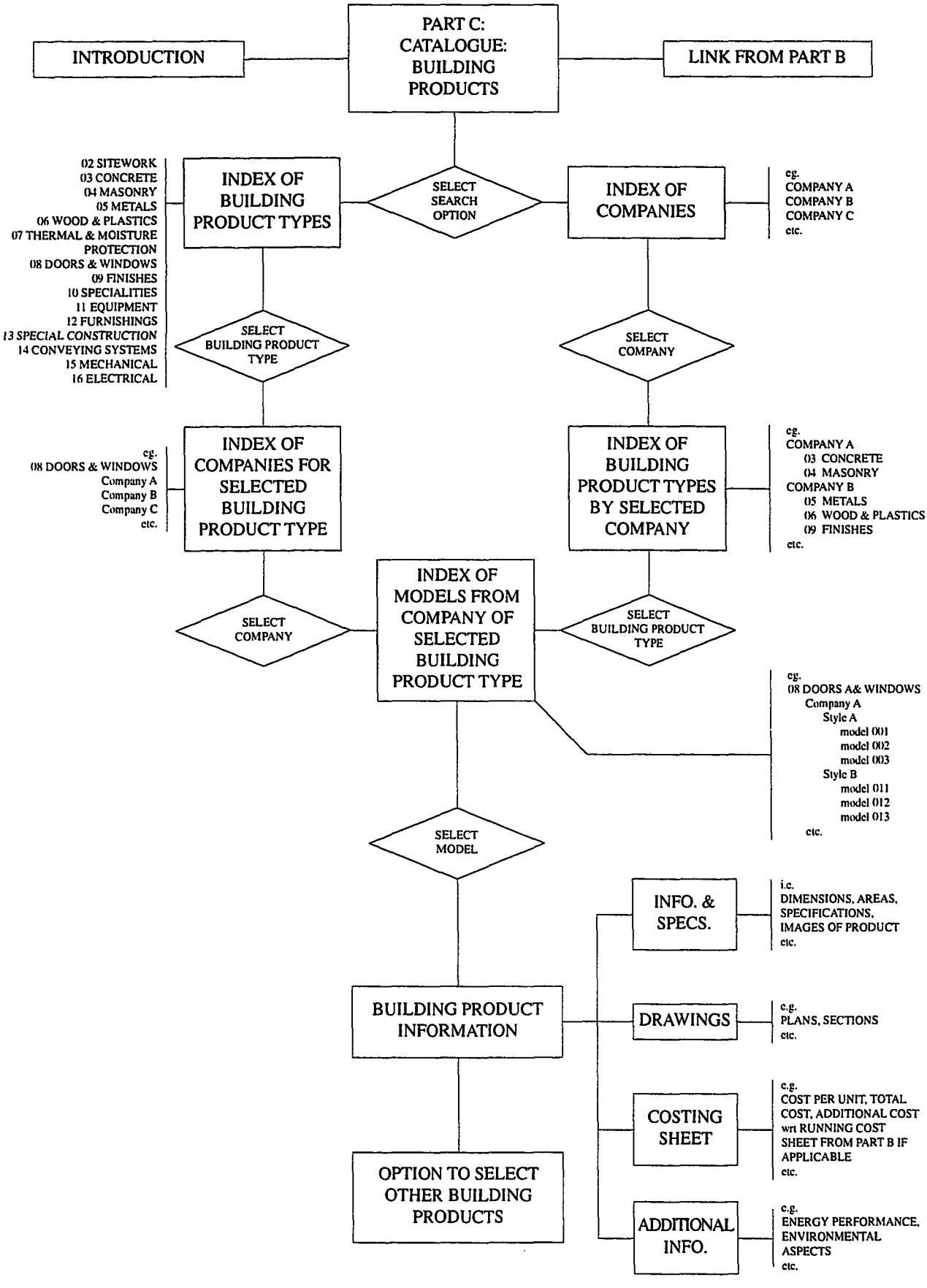


Figure 5.5 Flowchart of layout and logic of Part C: Catalogue: Bulding Products

CD-ROM drive is required for both the installation and use of the software programme. A minimum of 16 MB of RAM (random access memory) is recommended, and 2.75 MB of free hard drive space or ROM (read only memory) is required for the installation of the application. In order to have the window for the programme take up the full screen, the display area should be set at a screen resolution of 640 pixels by 480 pixels, horizontal number by vertical number respectively. The display area control is accessed by clicking on a blank portion of the screen, then clicking on properties and then settings or by going to Start Menu\Settings\Control Panel\Display\Settings or Desktop\My Computer\Control Panel\Display\Settings.

5.3.2 Installation

The installation is simple: insert the Québexport CD in the computer's CD-ROM drive and run the installation application titled Setup 95. The appropriate drives for both the destination and source folders must be specified and the correct version of Windows must be selected. The setup application now loads the appropriate files from the CD-ROM onto the specified destination drive, typically the computer's hard drive. This process takes a few moments and once completed the software is ready to be used. During use, the user must ensure that the Québexport CD-ROM is still available in the CD-ROM drive, since the application needs to access information, such as graphics and link buttons, from the CD-ROM.

The CD-ROM contains 20.6 MB of information in 20 folders and 758 files. The installation setup puts 2.75 MB of information in 5 folders and 204 files on the computer's hard drive (drive C in this case) with paths C:\WINDOWS\SYSTEM\ and C:\SHQDEMO\. A shortcut is also created with the path C:\WINDOWS\Start Menu\Programs\SHQDEMO\ so that the application can be easily accessed through the Windows' Start Menu.

As with many prototypical designs, this software is not exempt from minor problems, such as bugs which cause the application to crash, not only unexpectedly but also predictably, under certain circumstances. These problems can be resolved by erasing all the installed files from the hard drive and by reinstalling the programme from the CD-ROM.

5.4 Description of the Demonstration Software Tool

5.4.1 Introduction

The first screen which appears upon loading the application introduces the software with the title Québexport. The top menu bar displays buttons for the software credits, three language choices and a Quit option (Figure 5.6). The credits list the writers of the software programming as well as the designers of the software logic. The language option is a pertinent feature for the tool, as its inherent use is related to the export of housing which directly implies that it will be available to audiences around the world. The targeted user may be proficient in languages other than English and French, the two languages of business in the Canadian housing industry, so the prototype displays a button for Spanish as an example of a foreign tongue. The idea is that this software can be upgraded to include any language desired so that international users can use the programme. In this prototype programme, only the French language option was made available.

There are two principle modes in this software: the purchasing mode *(achat)*, and the catalogue mode *(catalogue)*. Initially the user may typically browse through the catalogue mode in order to become familiar not only with the products included for display but also to understand how the software works, especially with respect to the navigation within the programme and the

search methods available. For example, the user may look through the catalogue to examine products and then go into the purchasing mode to select a house. However, users familiar with the software may directly enter the purchasing mode and choose a house before browsing for associated products, or toggle back and forth between the two modes in order to customise their selected house with specific building products available through the catalogue mode. In this chapter, a description of the catalogue mode will be given first, as it has a more basic structure than the purchasing mode. The purchasing mode is more easily explained once familiarity has been achieved with the catalogue mode, as it involves previous user knowledge of the catalogue.

5.4.2 Catalogue Mode

When the catalogue button (*catalogue*) on the introduction screen is clicked on, a screen that shows the basic graphic structure of the catalogue mode. The information areas are blank, but the main parts of the catalogue mode are visible. Each of these three main parts of the catalogue mode have their individual buttons: prefabricated building systems (*systèmes*); building and construction products (*produits*); and related building, construction and architectural services (*services*). Each of the three parts has a slightly different methodology for searching for information, which is performed using the menus or indices at the bottom of the screen (found below the buttons for the three main parts of the catalogue mode).

5.4.2.1 Systems

The systems part, or database, can be searched by company, system or model (Figure 5.7). For example, when looking for a specific prefabricated building system, the user can search

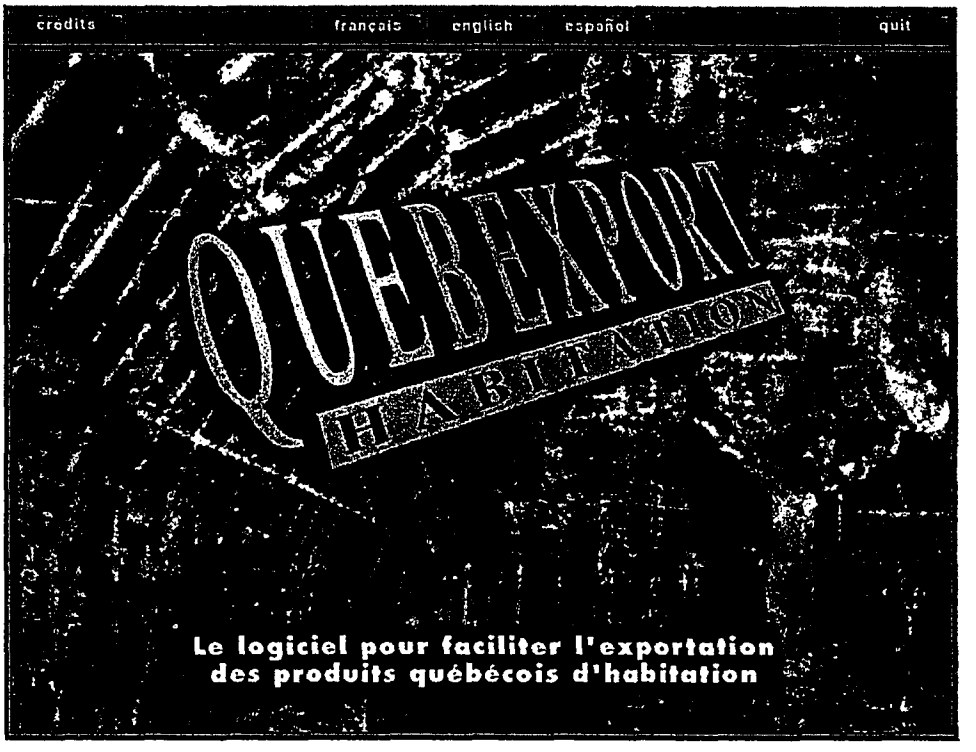


Figure 5.6 Introductory screen

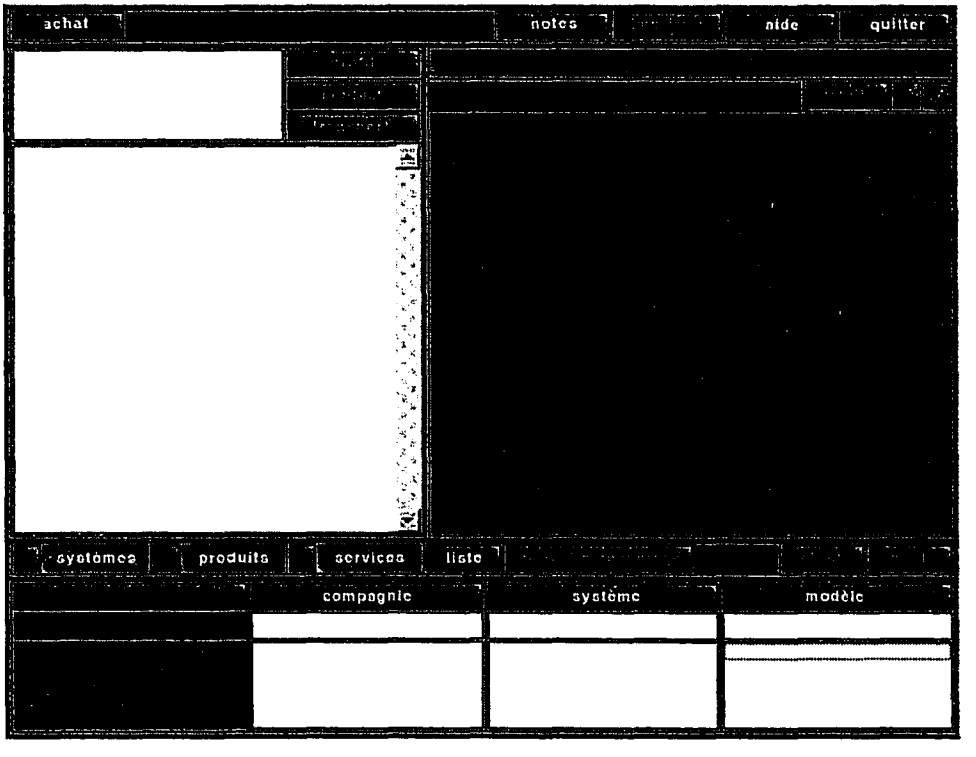


Figure 5.7 Systems part screen layout

either by looking for a company involved in manufacturing prefabricated building systems, by selecting a particular building system (e.g. panelised or modular), or by searching through a list of model names of individual prefabricated buildings which are manufactured by all of the companies involved in this area of construction. Table 5.5 displays the information available in the systems part of the demonstration software.

5.4.2.2 Products

The products part has a slightly more sophisticated search process. The three basic components or indices of the systems part are present as before, with the addition of a fourth index which allows the user to search for building products using the MasterFormat Divisions (Figure 5.8). This system is the construction industry standard for the classification of all building products and construction materials into categories and sub-categories. This results in a standardised solution for organising these items into a format that is consistent and convenient, so that builders and architects across Canada and the United States have a simple way of listing materials for preparing specifications or cost analyses.

The MasterFormat index is divided into two columns: one for searching using the MasterFormat Divisions, and another for listing the MasterFormat Sub-Divisions. Since each MasterFormat Division contains many Sub-Divisions – in many cases well over a hundred – the programme allows the user to search using Sub-Divisions which are more specific. For example, if a certain MasterFormat Sub-Division is known, the user can access it without having to know which MasterFormat Division it is in.

As with the systems part, users can search for a building product either through the company index, by looking for a particular building product name, or by searching through the index

listing of specific model names or numbers of individual building products. Table 5.6 displays the information available (i.e. company names with models produced) in the products part of the demonstration software.

5.4.2.3 Services

The services part has only two indices with which to perform a search: by company and by the type of building service offered (Figure 5.9), e.g. architectural services, computer-related services (CAD, networks and Websites, etc.) and landscape architecture. Table 5.7 displays the information available in the services part of the demonstration software.

5.4.2.4 Examples of Searching within the Systems Part

In this section, two examples of a search will be described using the systems part of the software prototype. The first will be undertaken through the company index and the second will use the building system index.

5.4.2.4.1 Search by Company Name within the Systems Part

In this example, it is assumed that the user would like to use a specific home manufacturing company. This might be desirable if the user has a connection to that commune, or has been advised to use that company. Similarly distance may be a factor: the user might want to choose a company that is located nearby so that they can meet with the builders in person and follow the home manufacturing process in the factory. If the user is familiar with a company that

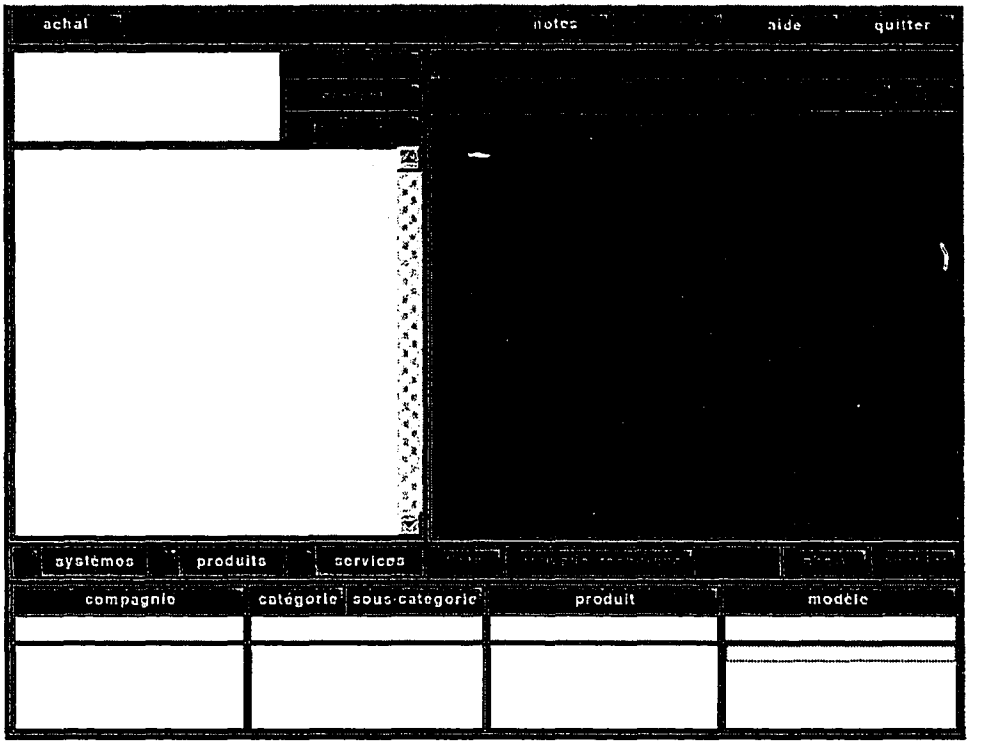


Figure 5.8 Products part screen layout

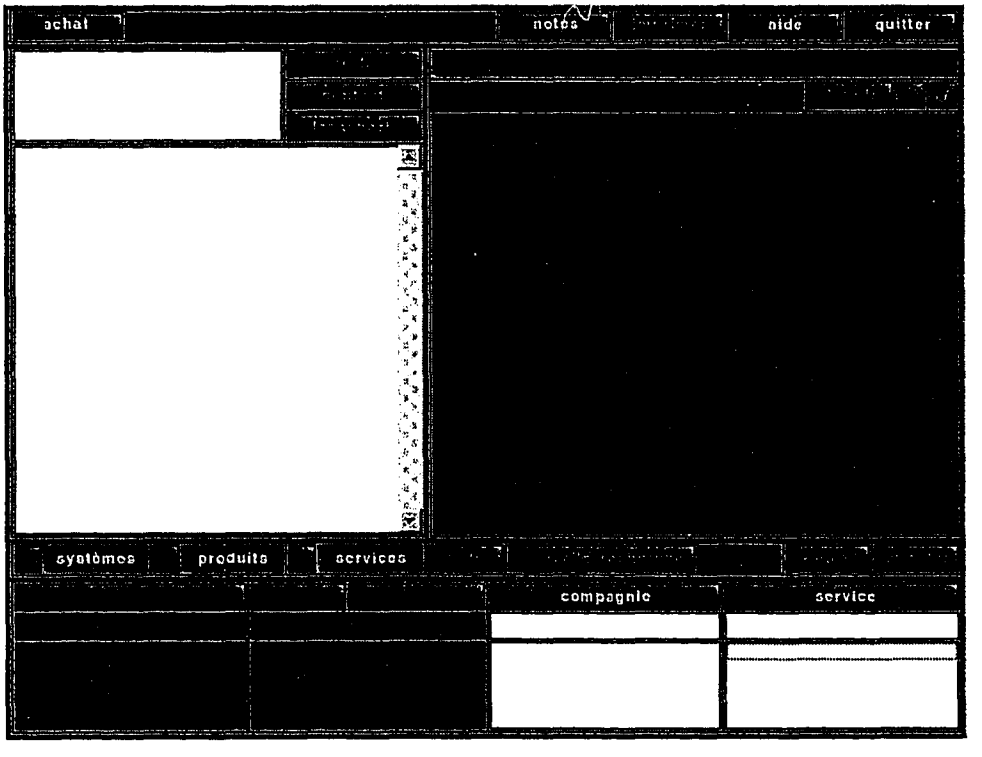


Figure 5.9 Services part screen layout

compagnie	système	modèle
Fermco Industries Ltd.	Panneaux usinés et composants	Maison Rédecouverte
		Le Geai Blue
XYZ Inc.	XYZ (demo)	XYZ (demo)

Table 5.5 Tabulation of entries in system indices (*systèmes*)

compagnie	service
Gérard Gingras	Désigner-Intérieur
K-OS Multiledia Inc.	Logiciels Spécialisés en Habitation

Table 5.7 Tabulation of entries in service indices (*services*)

Categories des Produits	
No.	NOM
02	Aménagement de l'Émplacement
03	Béton
04	Maçonnerie
05	Métaux
06	Bois et Plastique
07	Isolation et Étanchéité
08	Portes et Fenêtres
09	Finition
10	Produits Spéciaux
11	Équipement
12	Ameublement
13	Installations Spéciales
14	Systèmes Transporteurs
15	Mécanique
16	Électricité

Table 5.9 List of MasterFormat Divisions

compagnie	modèle
B.P.C.O. Inc.	**Vert Forêt (B.P.C.O.)**
	Bleu Cristale (B.P.C.O.)
	Gris Antique (B.P.C.O.)
	Tourquoise (B.P.C.O.)
Benjamin Moore & Cie Ltée.	**Latex Regal Wall Satin (215)**
	Latex Regal AquaGlo (333)
	Latex Regal AquaPert (310)
	Latex Regal AquaVelvet (319)
Edge Hardware Inc.	**Suzuka**
	Estoril
	Magny
	Sebring
Electroménagers Sans Frontières	**St-George VE0 7C5**
	Plaque au Gaz 60cm C660 2CNS
Forbo Industries Inc.	**Marmoleum 3844 Jade**
	Marmoleum 3845 Blue
Gérard Crête & Fils Inc.	**2" x 2" x 8'**
	2" x 10" x 14'
	2" x 6" x 14'
Geberit Manufacturing Inc.	**Geberit 150.165**
	Geberit 150.156
	Geberit 150.157
	Geberit 150.158
GranitiFiandre SpA	**AT036 Blue Bay**
Industries Jager Inc.	**Spacejoist^{MD}**
Les Bois de Plancher P.G. Inc.	**2-1/4" x 25/32" (57 x 19mm)**
	1-3/4" x 25/32" (44 x 19mm)
	2-1/2" x 25/32" (63 x 19mm)
	2" x 25/32" (51 x 19mm)
Les Industries Melco Ltée.	**T2V-0906 35-9/16" x 23-5/8"**
	T2V-0908 35-7/16" x 31-1/2"
Les Rangement Idées-Range Inc.	**Rangement 001**
	Rangement 002
Matériaux Cascades Inc.	**Panneau Sonopan 4' x 4'**
	Panneau Sonopan 4' x 10'
	Panneau Sonopan 4' x 8'
	Panneau Sonopan 4' x 9'
Sarnafil Inc.	**Membrane Sarnafil S 327-12**
	Membrane Sarnafil S 327-13
Uniboard Canada Inc.	**Érable Forêt**
	Érable Bourgogne
	Érable Naturel
	Récif
Westroc Inc.	**W-1001**
	W-1002
Wiremold Canada Inc.	**Access 5000**
	Access 6000

Table 5.6 Companies with active (in bold) and non-active models

manufactures prefabricated buildings, specifically houses, they can find the desired company in two different ways. The first is to click on the company button (*compagnie*) and browse through the company index (which lists all the home manufacturing companies in alphabetical order) in order to find the desired company whose name can then be selected from the index by highlighting it with a click of the mouse. The second way to select the company requires that the user know the name of a desired company. The user begins by typing the first few letters of the company name in the blank space below the compagnie button (*compagnie*) and above the company index.

In both cases the company's screen will appear: the left half of the screen contains the company logo and a text window (Figure 5.10). The text window's default setting shows the company's profile (its history and background) accessed by clicking on the first of three buttons appearing next to the company logo. Pressing either of the two other buttons, *contact* and *transport*, will display the corresponding information in the text window. When the contact button is selected, the company's address, telephone and fax numbers, contact person, E-mail address and location are displayed. The E-mail address is an active HyperText link button which, when clicked, opens an electronic mail application such as Pegasus Mail, allowing the user to send E-mail directly to that company while using the software tool. A similar link exists with the location; clicking on the location: automatically opens a Web browser application, such as Netscape Navigator/Communicator or Microsoft Internet Explorer, allowing the user to view the selected company's.

The right half of the screen displays an image of the company, either an example of one of the prefabricated homes that this company manufactures, or simply an image of the company's plant. In this example, the assumption is made that the user is familiar with a company called Fermco (Figure 5.10). As mentioned above, the user can either click on the company button (*compagnie*) and browse through the alphabetical list of home builders or start typing the name

of the desired company: i.e. the user would enter an 'F' (in the blank space under the company button), followed by an 'e,' which would automatically display companies whose names begin with 'Fe'. This would highlight Fermco Industries Ltd. and display all available building systems that this company uses in home manufacturing, in this case only panelised wall construction (*Panneaux usinés et composants*).

5.4.2.4.2 Search by Building System within the Systems Part

The second example of searching for a prefabricated home within the systems part of the catalogue mode, involves looking for a specific building system. A complete list of building systems is given in Table 5.1 List of prefabricated housing types. The demonstration software tool displays only one active building system (as shown in Table 5.5 Tabulation of entries in system indices), which is panelised wall construction (*Panneaux usinés et composants*). Therefore in this example, the user can only select panelised construction, and Fermco Industries Ltd. is the only manufacturer of that system (Figure 5.10). The original intention was to make other systems available for browsing by giving one example of each system. For example, a model manufactured by a certain company could have been an example of a building type such as a log-profiled home.

5.4.2.4.3 Results of Both Search Methods: List of Models

By either searching by company name (as in section 5.4.2.4.1) or by type of building system (as in section 5.4.2.4.2), the user chooses both a company and a building system (the order determined by the method of search) and is given a list of models built by a selected company of a specific building system. In this case, the Next Home™ (*Maison Redécouverte*) is the

only model available built by the selected company, Fermco Industries Ltd., and of the selected building system type – that is panelised construction or factory built panels (*Panneaux usinés et composants*, Figure 5.10). This model can be selected, and thereby added to the 'shopping list' using the *liste* function (explained in section 5.4.2.6 Adding to the List Function), for later use when customising a house in the Purchasing Mode, or *achat* (section 5.4.3).

5.4.2.5 Examples of Searching within the Products Part

In this section, three different products will be selected using three different search methods. The procedure is similar to that of the services part, however the indices used are different reflecting the more specific and varied structure of organisation used for building products.

5.4.2.5.1 Search by Company within the Products Part

The first example demonstrates how to search for a desired building product using the company index (Table 5.8a shows the information in the products part arranged alphabetically by company name). The user must select the product part (*produits*) of the catalogue mode (*catalogue*). In this example, it is assumed that the user is searching for a certain company which manufactures specialised toilet equipment. The user can't remember the full name of the company but knows that the first letter of its name is 'G'. The user can either click on the company index button (*compagnie*) and scroll through the alphabetical list of company names, or can begin to type the company name in the blank window, located underneath the company index button (*compagnie*) and above the company index window. If the user types a 'g' or 'G', they will access the company profile of Geberit, which in this case is the desired company (Figure 5.11). Similarly, if the user types 'gr' or 'Gr', they will access the company profile of

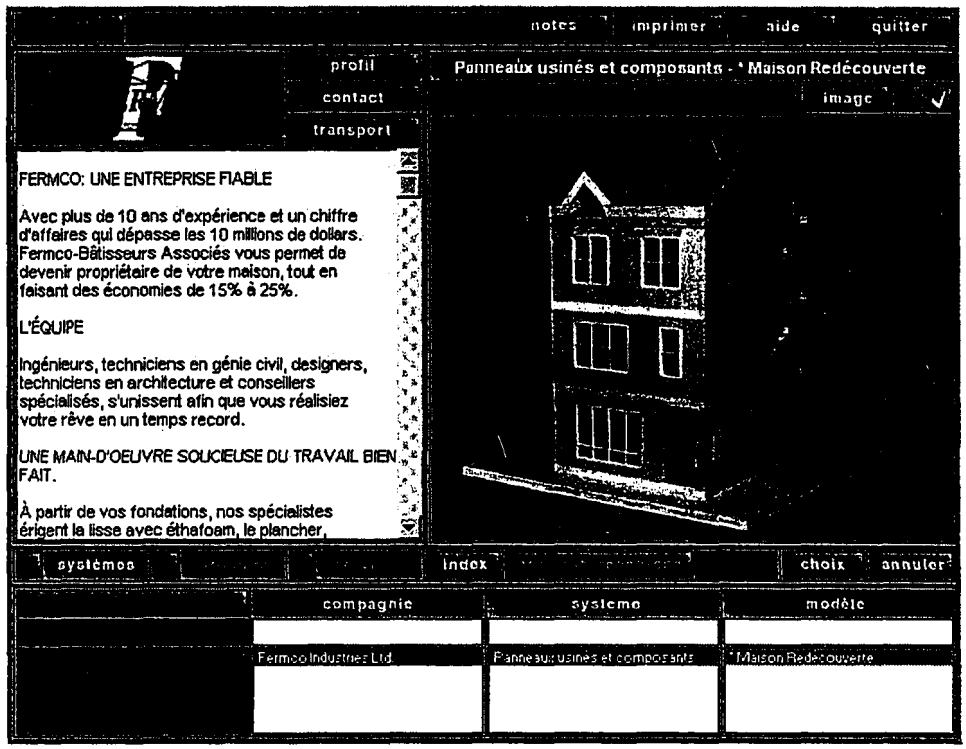


Figure 5.10 Example of a company profile within the systems part

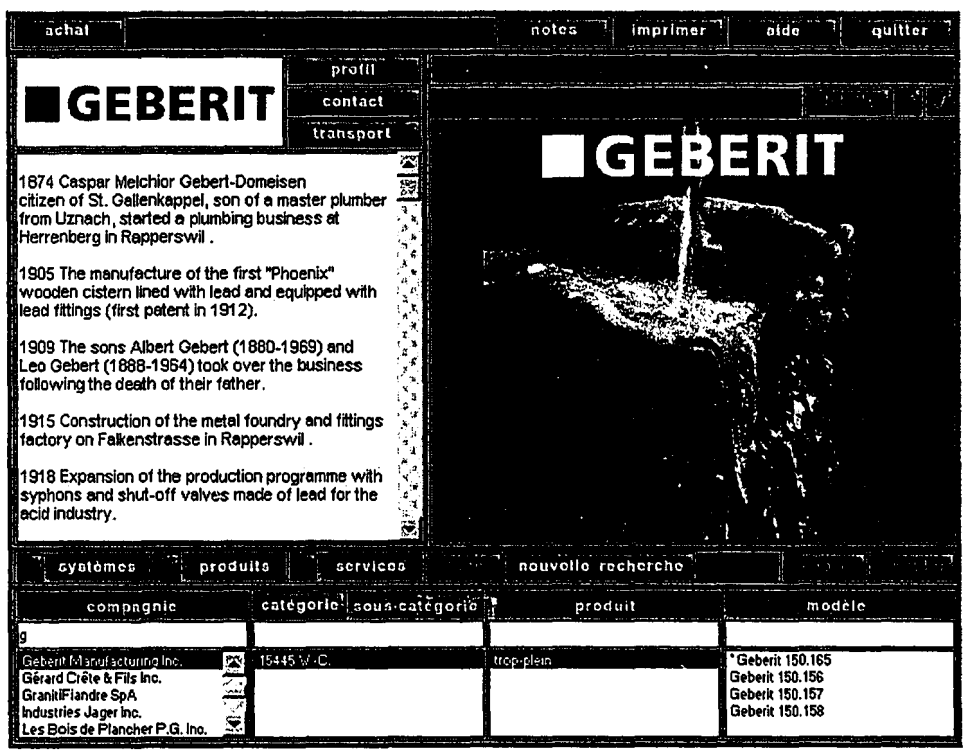


Figure 5.11 Example of a company profile within the products part

compagnie	sous-catégorie	produit	modèle
B.P.C.O. Inc.	07311 bardeau d'asphalte	bardeau	Vert Forêt (B.P.C.O.)
Benjamin Moore & Cie Ltée.	09920 peinture interieure	latex-interieure	Latex Regal Wall Satin (215)
Edge Hardware Inc.	08700 quincaillerie	poignée	Suzuka
Electroménagers Sans Frontières	11451 équipement de cuisine	four multi-fonction	St-George VE0 7C5
Forbo Industries Inc.	09650 revêtement de sol résilient	revêtement de sol linoleum	Marmoleum 3844 Jade
Gérard Crête & Fils Inc.	06101 bois d'œuvre	bois de construction	2" x 2" x 8'
Geberit Manufacturing Inc.	15445 W.-C.	trop-plein	Geberit 150.165
GranitiFiandre SpA	09310 carreaux de céramique	carreaux de céramique	AT036 Blue Bay
Industries Jager Inc.	06151 assemblage de poutrelles	poutrelle ajourée	Spacejoist^{MD}
Les Bois de Plancher P.G. Inc.	09550 plancher en bois	lamelle de bois franc	2-1/4" x 25/32" (57 x 19mm)
Les Industries Melco Ltée.	08630 fenêtres en vinyle	fenêtres à battant	T2V-0906 35-9/16" x 23-5/8"
Les Rangement Idées-Range Inc.	12600 mobilier et accessoires	meubles de rangement	Rangement 001
Matériaux Cascades Inc.	09530 isolation et écrans acoustique	panneau acoustique	Panneau Sonopan 4' x 4'
Sarnafil Inc.	07500 couvertures à membrane	membrane	Membrane Sarnafil S 327-12
Uniboard Canada Inc.	09700 revêtements de sol spéciaux	couvre-plancher laminé	Érable Forêt
Westroc Inc.	09111 panneaux de gypse	panneau de gypse	W-1001
Wiremold Canada Inc.	16110 canalisations	prise electrique	Access 5000

Table 5.8a Tabulation of entries in product indices (*produits*) according to company name (*compagnie*); index of MasterFormat Divisions, *catégorie*, omitted for clarity.

GranitiFiandre, another company which is part of the database. This text entry feature can be useful for gaining direct access to the desired company's profile by typing the first few letters of the company's name, as opposed to scrolling through the complete list of company names.

Once the user is in the company profile of Geberit, they can access contact and transportation information (using the *contact* and *transport* buttons respectively), as well as the company history as seen previously in the systems part of the catalogue mode (section 5.4.2.4.1). Similarly, once a model is selected from the appropriate MasterFormat sub-division (in this case the Geberit 150.165 overflow, trop-plein, from 15445 W.-C.), an image and technical specifications of that model are displayed.

5.4.2.5.2 Search by MasterFormat (Sub-)Division within the Products Part

The second example will show how the user can locate a building product by searching through the MasterFormat Division and Sub-division headings (Table 5.8b shows the information in the products part arranged numerically by MasterFormat Sub-divisions). It will be assumed that the user is looking for vinyl windows. In order to perform a new search and discard the information from the previous example, the user clicks on the *nouvelle recherche* button, then clicks on the MasterFormat Division button (*catégorie*) to display a full list of all the MasterFormat Divisions (Figure 5.12 and Table 5.9). When each of the individual MasterFormat Divisions is selected, a list of companies that manufacture products from that division are displayed. If the MasterFormat Sub-division button (*sous-catégorie*) is clicked on, all the active sub-divisions within the selected division are displayed and the user can toggle between the individual division or a list of associated sub-divisions (Table 5.10). For example, if division 06 Woods & Plastics (*Bois et Plastique*) is selected, Industries Jager Inc.

sous-catégorie	produit	compagnie	modèle
06101 bois d'œuvre	bois de construction	Gérard Crête & Fils Inc.	2" x 2" x 8'
06151 assemblage de poutrelles	poutrelle ajourée	Industries Jager Inc.	Spacejoist[MD]
07311 bardeau d'asphalte	bardeau	B.P.C.O. Inc.	Vert Forêt (B.P.C.O.)
07500 couvertures à membrane	membrane	Sarnafil Inc.	Membrane Sarnafil S 327-12
08630 fenêtres en vinyle	fenêtres à battant	Les Industries Melco Ltée.	T2V-0906 35-7/16" x 23-5/8"
08700 quincaillerie	poignée	Edge Hardware Inc.	Suzuka
09530 isolation et écrans acoustique	panneau acoustique	Matériaux Cascades Inc.	Panneau Sonopan 4' x 4'
09111 panneaux de gypse	panneau de gypse	Westroc Inc.	W-1001
09310 carreaux de céramique	carreaux de céramique	GranitiFiandre SpA	AT036 Blue Bay
09550 plancher en bois	lamelle de bois franc	Les Bois de Plancher P.G. Inc.	2-1/4" x 25/32" (57 x 19mm)
09650 revêtement de sol résilient	revêtement de sol linoleum	Forbo Industries Inc.	Marmoleum 3844 Jade
09700 revêtements de sol spéciaux	couvre-plancher laminé	Uniboard Canada Inc.	Érable Forêt
09920 peinture interieure	latex-interieure	Benjamin Moore & Cie Ltée.	Latex Regal Wall Satin (215)
11451 équipement de cuisine	four multi-fonction	Electroménagers Sans Frontières	St-George VE0 7C5
12600 mobilier et accessoires	meubles de rangement	Les Rangement Idées-Range Inc.	Rangement 001
15445 W.-C.	trop-plein	Geberit Manufacturing Inc.	Geberit 150.165
16110 [illegible]alisations	prise electrique	Wiremold Canada Inc.	Access 5000

Table 5.8b Tabulation of entries in product indices (*produits*) according to MasterFormat Sub-divisions (*sous-catégorie*)

Distribution des Categories des Produits	
catégorie	**sous-catégorie**
02 Aménagement de l'Émplacement	
03 Béton	
04 Maçonnerie	
05 Métaux	
06 Bois et Plastique	06101 bois d'œuvre
	06151 assemblage de poutrelles
07 Isolation et Étanchéité	07311 bardeau d'asphalte
	07500 couvertures à membrane
08 Portes et Fenêtres	08630 fenêtres en vinyle
	08700 quincaillerie
09 Finition	09111 panneaux de gypse
	09310 carreaux de céramique
	09530 isolation et écrans acousitque
	09550 plancher en bois
	09650 revêtement de sol résilient
	09700 revêtements de sol spéciaux
	09920 peinture interieure
10 Produits Spéciaux	
11 Équipement	11451 équipement de cuisine
12 Ameublement	12600 mobilier et accessoires
13 Installations Spéciales	
14 Systèmes Transporteurs	
15 Mécanique	15445 W.-C.
16 Électricité	16110 canalisation

Table 5.10 List of MasterFormat Divisions with active MasterFormat Sub-divisions

and Gérard Crête & Fils Inc. will appear in the company index window, while clicking on the MasterFormat Sub-division button (*sous-catégorie*) displays the two active sub-divisions within division 06 Woods & Plastics (*Bois et Plastique*): they are 06101 Construction Lumber (*bois d'œuvre*) and 06151 Prefabricated Wood Trusses (*assemblage de poutrelles*). The same can be done for each MasterFormat Division, which is useful for searching for products of an unknown MasterFormat sub-division. For example, when searching for a type of flooring it is useful to look through all the sub-divisions of Division 09 Finishes (*Finition*) to view all available choices for interior finishing products. In this software tool, a few of the MasterFormat Divisions do not contain any products or companies (as can be seen in Table 5.10).

Now we shall return to the search for vinyl windows. The user selects MasterFormat Division 08 Doors & Windows (*Portes et Fenêtres*) and a list of companies within that division appears. Since the user is not familiar with any of these companies, they can click on the MasterFormat Sub-divisions button (*sous-catégorie*) to view a list of all the sub-divisions within 08 Doors and Windows. Once the desired sub-division is selected, in this case 08630 Vinyl Windows (*fenêtres en vinyle*), only the companies that produce items in this specific sub-division remain in the company index window. Les Industries Melco Ltée. is the only company entered in the demonstration software that manufactures vinyl windows, so the user is directed to that company's profile (Figure 5.13). Casement windows (*fenêtres à battant*) are the only product type offered by this company in the vinyl window category. Again, a list of models is given with only the first, asterixed model being active, in this case model number T2V 0906, which is a casement window in vinyl of dimensions 35-7/26" by 23-5/8" (Figure 5.14). If the user clicks on the technical specifications and details button (*détails*), they can view the associated information (in this case certain physical properties are described) relating to the selected model (Figure 5.15).

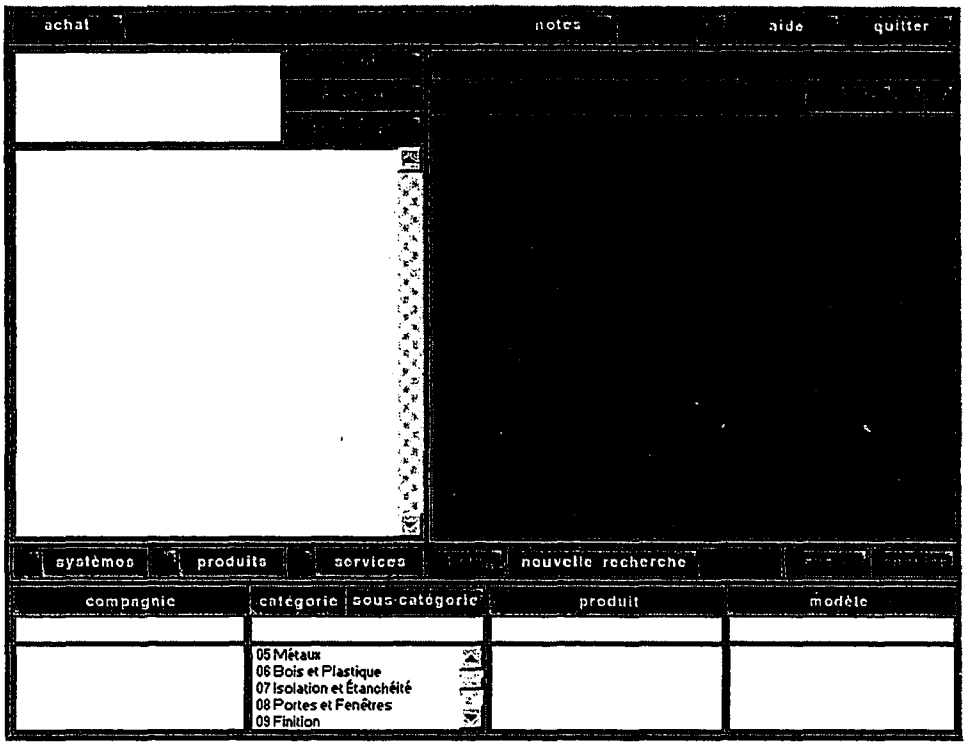


Figure 5.12 Index of the MasterFormat Divisions

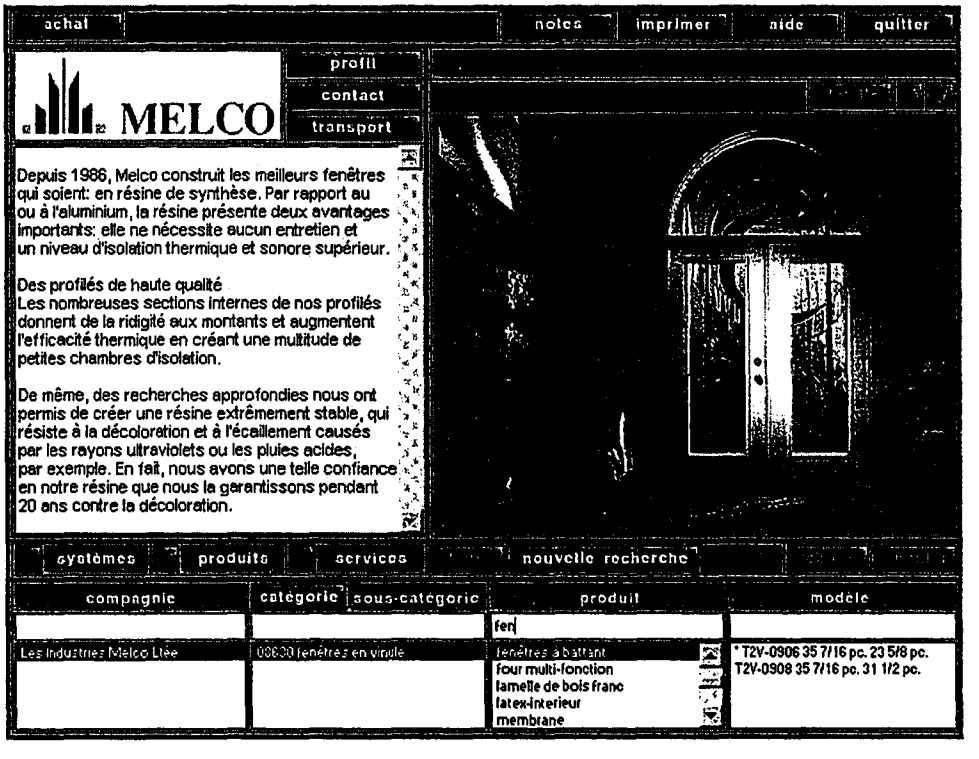


Figure 5.13 Company profile of vinyl window manufacturer

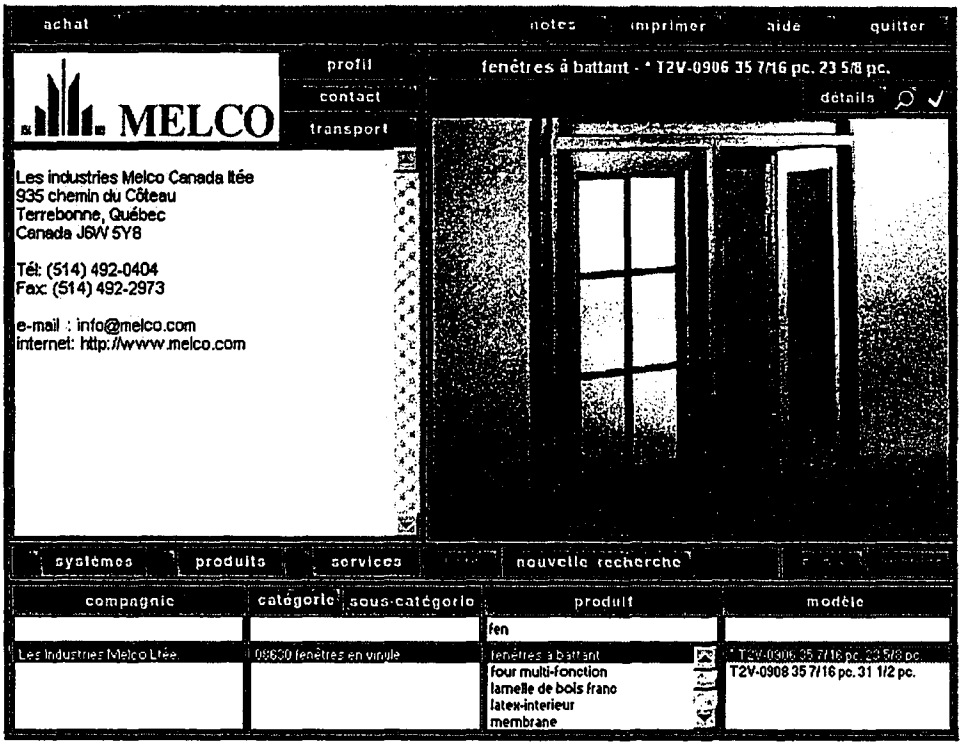


Figure 5.14 Example of a specific model of vinyl windows

Figure 5.15 Technical specifications for selected model of vinyl window

5.4.2.5.3 Search by Building Product Type within the Products Part

The third and last example of searching for a building product in the products part of the catalogue mode involves a search by product type. A complete alphabetical list of building product types, available in the products part of the demonstration software is shown in Table 5.8c. In this example, it is assumed that the user is looking for ceramic floor tiles. The first approach could be to search the MasterFormat Division and Sub-division indices (as was demonstrated in section 5.4.2.5.2 Search by MasterFormat Division or Sub-division within the Products Part). It is assumed that the user does not know which MasterFormat Division or Sub-division contains. ceramic floor tiles. After clicking on the *catégorie* button, the user scrolls through the MasterFormat Divisions index and guesses that ceramic floor tiles are categorised in Division 09 Finishes. After clicking on that division, the index of MasterFormat Sub-divisions within Division 09 Finishes is displayed. Since this list would be rather long and unfamiliar to the user, an alternate search method would be more useful.

The user performs a new search (by clicking on the *nouvelle recherche* button), then clicks on the building product button (*produit*) for a list of all building products. To locate ceramic tiles, the user can begin to type in 'ceramic floor tiles' (*carreaux de céramique*). As soon as the 'c' is entered, the building product named *carreaux de céramique* is highlighted, since it is the first building product beginning with the letter 'c'. The user clicks on *carreaux de céramique* for a list of all the companies that manufacture or distribute ceramic floor tiles (in this case the software displays only one company, GranitiFiandre, Figure 5.16). Furthermore, once the building product has been selected by clicking on the building product name, (*carreaux de céramique*), the corresponding MasterFormat Division and Sub-division of that building

produit	sous-catégorie	compagnie	modèle
bardeau	07311 bardeau d'asphalte	B.P.C.O. Inc.	Vert Forêt (B.P.C.O.)
bois de construction	06101 bois d'œuvre	Gérard Crête & Fils Inc.	2" x 2" x 8'
carreaux de céramique	09310 carreaux de céramique	GranitiFiandre SpA	AT036 Blue Bay
couvre-plancher laminé	09700 revêtements de sol spéciaux	Uniboard Canada Inc.	Érable Forêt
fenêtres à battant	08630 fenêtres en vinyle	Les Industries Melco Ltée.	T2V-0906 35-7/16" x 23-5/8"
four multi-fonction	11451 équipement de cuisine	Electroménagers Sans Frontières	St-George VE0 7C5
lamelle de bois franc	09550 plancher en bois	Les Bois de Plancher P.G. Inc.	2-1/4" x 25/32" (57 x 19mm)
latex-interieure	09920 peinture interieure	Benjamin Moore & Cie Ltée.	Latex Regal Wall Satin (215)
membrane	07500 couvertures à membrane	Sarnafil Inc.	Membrane Sarnafil S 327-12
meubles de rangement	12600 mobilier et accessoires	Les Rangement Idées-Range Inc.	Rangement 001
panneau acoustique	09530 isolation et écrans acoustique	Matériaux Cascades Inc.	Panneau Sonopan 4' x 4'
panneau de gypse	09111 panneaux de gypse	Westroc Inc.	W-1001
poignée	08700 quincaillerie	Edge Hardware Inc.	Suzuka
poutrelle ajourée	06151 assemblage de poutrelles	Industries Jager Inc.	Spacejoist^{MD}
prise electrique	16110 canalisations	Wiremold Canada Inc.	Access 5000
revêtement de sol linoleum	09650 revêtement de sol résilient	Forbo Industries Inc.	Marmoleum 3844 Jade
trop-plein	15445 W.-C.	Geberit Manufacturing Inc.	Geberit 150.165

Table 5.8c Tabulation of entries in product indices (*produits*) according to building products (*produit*)

product is displayed in the division (*catégorie*) and sub-division (*sous-catégorie*) index windows. This example demonstrates how using the building product index can simplify looking for specific building products of an unknown MasterFormat classification.

5.4.2.6 Adding to the List Function

In this section, the previously chosen examples of building products will be used as examples to demonstrate how items can be selected from the catalogue and added to a 'shopping list' using the list function (*liste*). As soon as a system, product or service (from a specific company) has been selected from the catalogue mode, a list of either prefabricated housing models, building product models or services (in that order), is displayed. When one of these prefabricated housing models, building product models or services is highlighted (by clicking on the name in the index window), three buttons above the graphics window on the right hand side of the screen become active. They are the details and specifications button (*détails*), the graphic magnification button (an icon of a magnifying glass) and the product selection button (a check mark). It is the last of these three functions that will be described in this section. When clicked on, the details button will display various technical details and specifications about the selected building product as provided by the manufacturer. The graphic magnification button enlarges the product image to fit the entire application screen, to display the product image at a size of 640 by 480 pixels.

The product selection button allows the user to compile a 'shopping list' in each of the three parts of the catalogue mode. In other words, the systems, products and services parts of the catalogue mode each have a separate list for adding selected items. As indicated previously, the product selection button only becomes active once a prefabricated housing model, building product model or service has been selected in one of the systems, products and services parts.

To select a prefabricated housing model, building product model or service, the user must click on the active check mark button. As soon as the first item has been added to the list, the list button (*liste*) becomes active and is highlighted. This happens independently for each of the three parts of the catalogue mode – if a prefabricated housing model is added to the list in the systems part, the list button will only appear highlighted in the systems part and not in either the products or services parts until an item has been added to the list of one of those parts.

The user can add as many items as they choose to the list and can access the list for each part any time they are working in a part. To do so, the user clicks on the list button; for example in the products part, the list of selected building product models appears and the list button is replaced by an index button (*index*) which allows the user to leave the list function and return to searching within the catalogue mode. If the user clicks on any of the model names in the model index window, the product information and company profile of that selected model will appear (Figure 5.17). All of the models selected to the list can be viewed in this way. Clicking on the index button allows the user to browse for other products. While in the list function, the user can view the lists of each of the other parts of the catalogue mode by clicking on the desired part button, e.g. when looking at the list of building product models created in the products part, the user can view the list of prefabricated housing models selected from the systems part by simply clicking on the systems button (*systèmes*).

5.4.3 Purchasing Mode

The purchasing mode can be entered through the introduction screen or any time when browsing through the catalogue, by clicking on the purchasing mode button (*achat*), which is located in the top left corner of the screen. This button allows the user to toggle between the catalogue mode and the purchasing mode, so the button will always display the mode that is

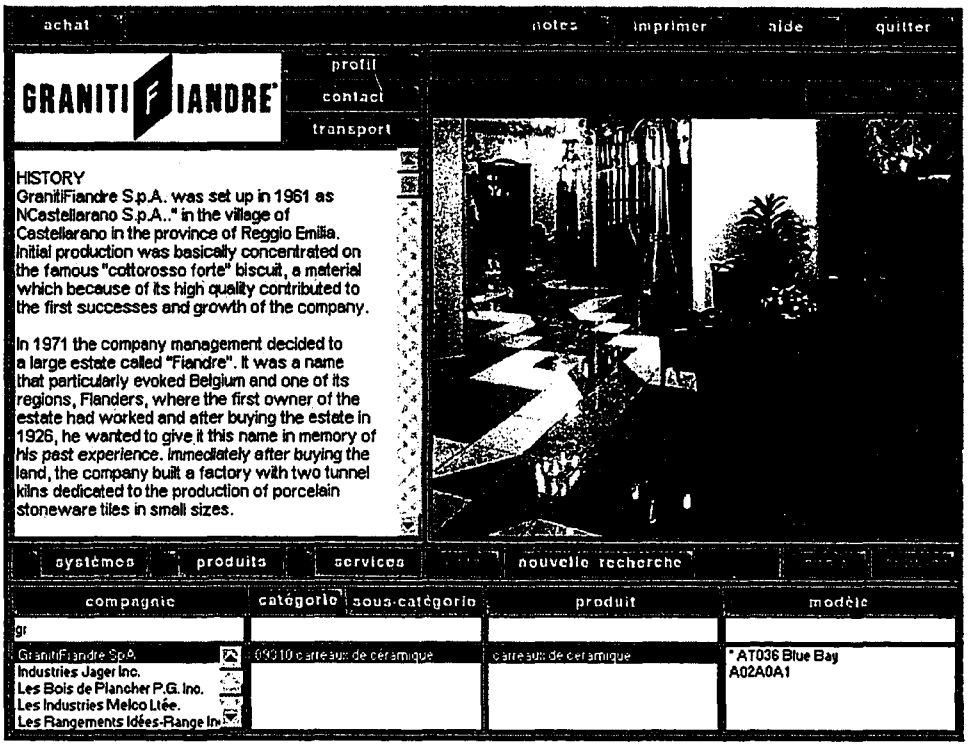


Figure 5.16 Result of search for ceramic tile manufacturer

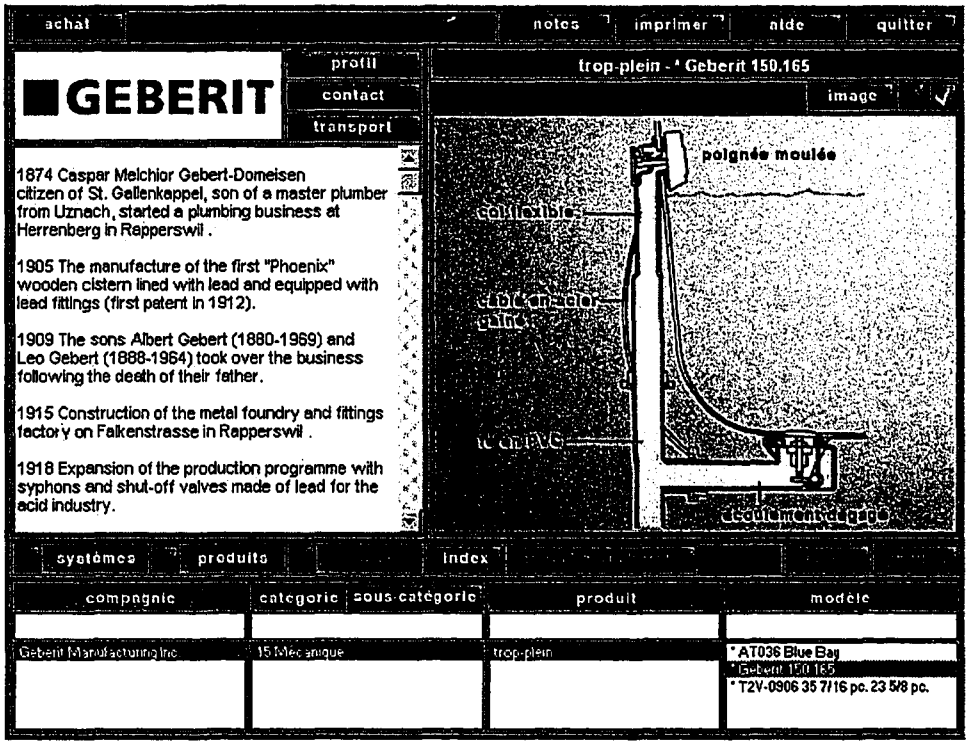


Figure 5.17 Compilation of different products using the list function

not in use. These two methods of entry into the purchasing mode relate to two distinct and different intentions by software users.

5.4.3.1 Entering the Purchasing Mode

The first method of accessing the purchasing mode (by clicking on the purchasing mode button from the introduction screen) would most likely be undertaken by users familiar with the software who are looking primarily for interest in a prefabricated housing unit that they intend to customise. When the purchasing mode button is clicked, the blank screen of the purchasing mode appears (Figure 5.18). The user selects a prefabricated housing model by clicking on the model selection button (*modèle*), which temporarily takes them to the catalogue mode where only the systems part is active. The products and services parts can only be used by returning to the proper catalogue mode. The user can browse through either the company, system or model indices (as explained previously with the systems part of the catalogue mode in section 5.4.2.4) to select a model of a prefabricated housing unit. Any number of these models can be added to the list using the select item button (*liste*) or similarly retrieved from there for use in the purchasing mode. Whenever the user is looking at a specific model (in the systems part of this partial catalogue mode) the choose button (*choix*) becomes active and highlighted, allowing the user to select that model for customisation within the purchasing mode, becomes highlighted or active.

The second method of entering the purchasing mode for users who are unfamiliar with either the software programme or the models listed in the catalogue is achieved by browsing through the systems part of the catalogue mode and finding the desired prefabricated house model. Once the desired model has been chosen (the user has either added that model to the list or highlighted that model so that it appears on the screen), the user can click on the purchasing

mode button (*achat*). The blank screen of the purchasing mode will appear, as in the first method of entering the purchasing mode. However ,when the model selection button (*modèle*) is clicked so that the user can enter the systems part of the partial catalogue mode and choose a prefabricated housing unit, the previously highlighted model appears on the screen and the choose button (*choix*) becomes active. Similarly, if a list was compiled previously in the systems part of the catalogue mode, the user can select one of those housing unit models for customisation in the purchasing mode. The user can un-select and re-select different models using the cancel (*annuler*) and choose (*choix*) buttons respectively.

5.4.3.2 Choosing Options for the Selected Housing Unit

At this stage the user has chosen a prefabricated housing model for customisation from the options part of the purchasing mode. This function can be started by clicking on the options button (*options*), which becomes active once the user has selected a housing model using the model selection and choose buttons. The only active model in the systems part of the demonstration software programme is the Next Home™ (*Maison Redécouverte*), so that model will be used as the example to demonstrate the options available for customisation of a prefabricated housing unit (Figure 5.19).

The main series of options (using the *options* button) relate to the exterior features of the house as shown in Table 5.11. These options relate specifically to the Next Home™ (*Maison Redécouverte*) and would be different to the individual requirements of each prefabricated model offered by a variety of companies that manufacture factory-built homes. In many cases, companies offer models that have very little flexibility in terms of exterior features so that they can mass-produce them more efficiently without spending time on customisation. In addition, certain options may be invalid: for example, if the user selects an on-grade unit with the main

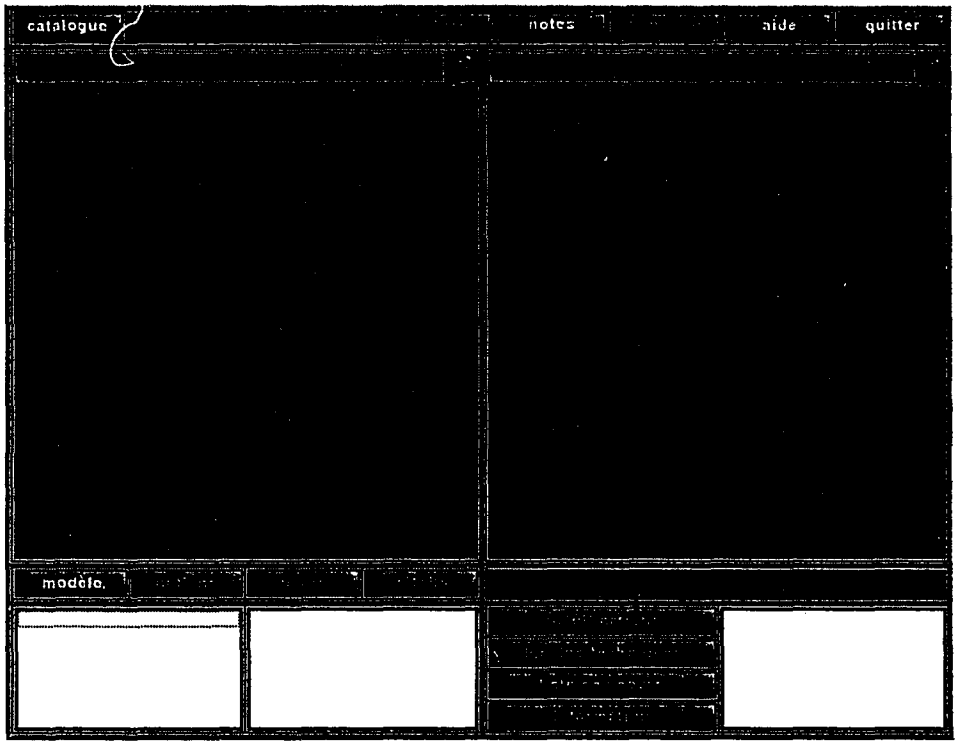


Figure 5.18 Screen layout of the purchasing mode

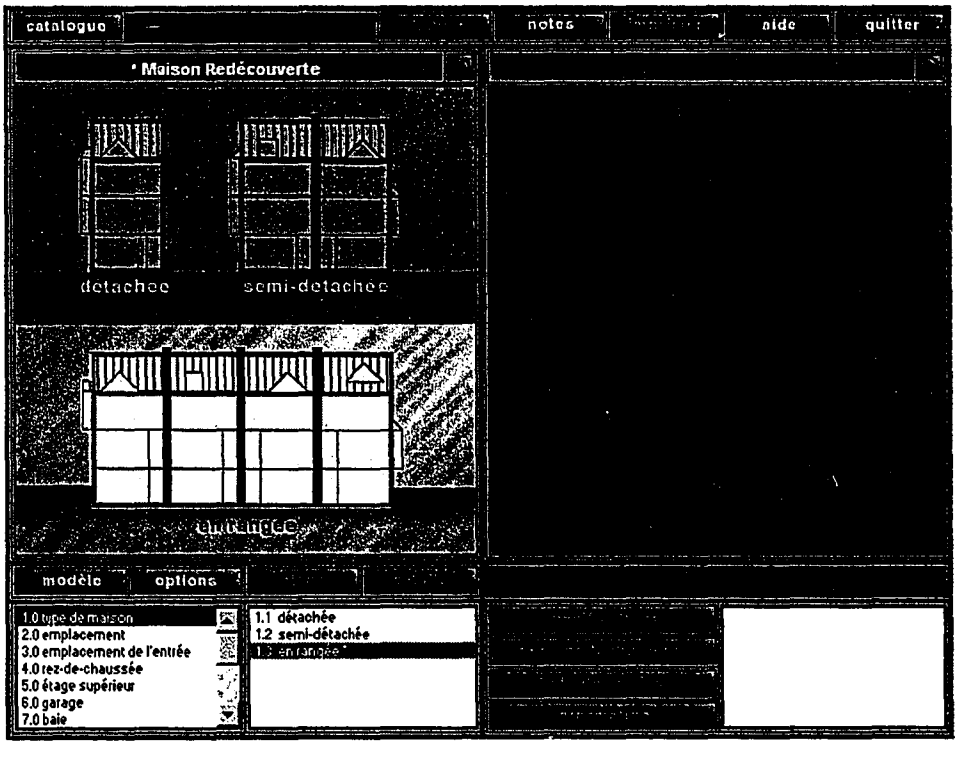


Figure 5.19 Selected housing unit to be customised

compagnie	Fermco Industries Ltd.	
système	Panneaux usinés et composants	
modèle	Maison Redécouverte	
1.0 type de maison	1.1 détachée	
	1.2 semi-détachée	
	1.3 en rangée	
2.0 emplacement	**2.1 unité de gauche**	
	2.2 unité de droite	
	2.3 unité du milieu	
3.0 emplacement de l'entrée	**3.1 côté droit**	
	3.2 côté gauche	
4.0 rez-de-chausée	**4.1 niveau du sol**	
	4.2 sous-sol	
5.0 étage supérieur	**5.1 mézzanine**	
	5.2 vide sanitaire de grenier	
	5.3 plafond cathédrale	
6.0 garage	6.1 au sous-sol	
	6.2 aucune	
7.0 baie	7.1 endroit de la baie	7.1.1 aucune
		7.1.2 2ième étage
		7.1.2 3ième étage
		7.1.2 2ième et 3ième étage
	7.2 toiture de la baie	7.2.1 en pente
		7.2.2 incliné
		7.2.3 en voûte
8.0 élément du toit	8.1 type d'élément	8.1.1 aucun
		8.1.2 en pente
		8.1.3 carré
	8.2 taille	8.2.1 petit
		8.2.2 grand
	8.3 emplacement	**8.3.1 à gauche**
		8.3.2 au milieu
		8.3.3 à droite
9.0 occupation	**9.1 triplex**	
	9.2 duplex A	
	9.3 duplex B	
	9.4 unifamilial	
10.0 bureaux à domicile	**10.1 aucun**	
	10.2 rez-de-chaussée	
	10.3 2ième étage	

Table 5.11 List of exterior features which can be customised using the option function, *options*

entrance on the ground floor, it is not possible to also choose a garage for that unit (Figure 5.20).

Once all the exterior features of the house have been chosen, the software can determine the final specifications for the entire building, such as the number of floors, the occupancy and the location of bays and dormers. These options all have implications affecting the interior layout of the building and must be determined before the user can choose between interior plans. As soon as the option function is complete, the interior plans (*plans*) and details (*détails*) functions become active with their corresponding buttons becoming highlighted (Figure 5.21).

Through the former function, the software offers the user a choice of layouts for each floor of the building (using the interior plans button, with each plan relating to the occupancy and features selected for that specific unit). For example, if the user selects a single-family dwelling with the entrance on the left side of the first floor of a unit with a basement, the floor plan options available will reflect the nature of this storey with all of its unique features. All the floor plan options will show the front door on the left side with the stairwell on the right without any stair enclosure wall, due to the nature of the building's selected occupancy (i.e. a single family house will have an open stairwell), and so on. In this example, the Next Home™ offers the user three different layouts for each of the four floors of the building (Table 5.12). These plans were drawn on AutoCAD® and can be easily updated by the manufacturer to offer any additional layouts of customisation possibilities (Figures 5.22, 5.23 and 5.24).

The second function allows the user to select specific details. Clicking on the details button (*détails*) displays a menu of different elements of the house that have been specifically selected by the manufacturer as those which can be modified or have their products exchanged. This function provides the principle link between the purchasing and catalogue modes, with respect to the selection or customisation of individual building products used in the construction of the

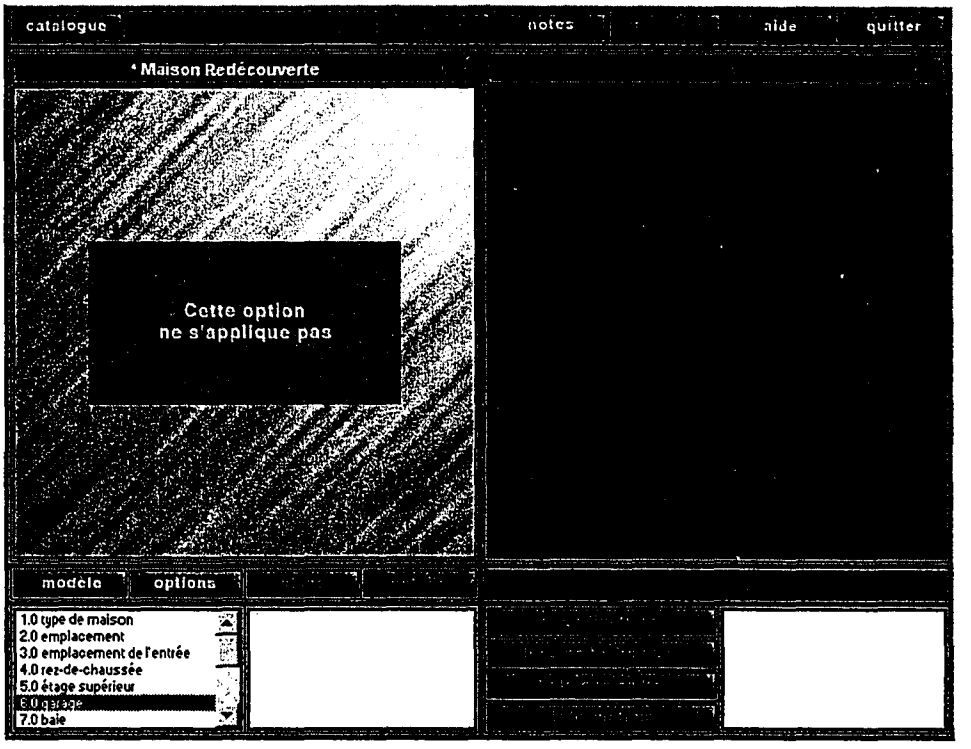


Figure 5.20 Message to indicate inapplicability of potential option

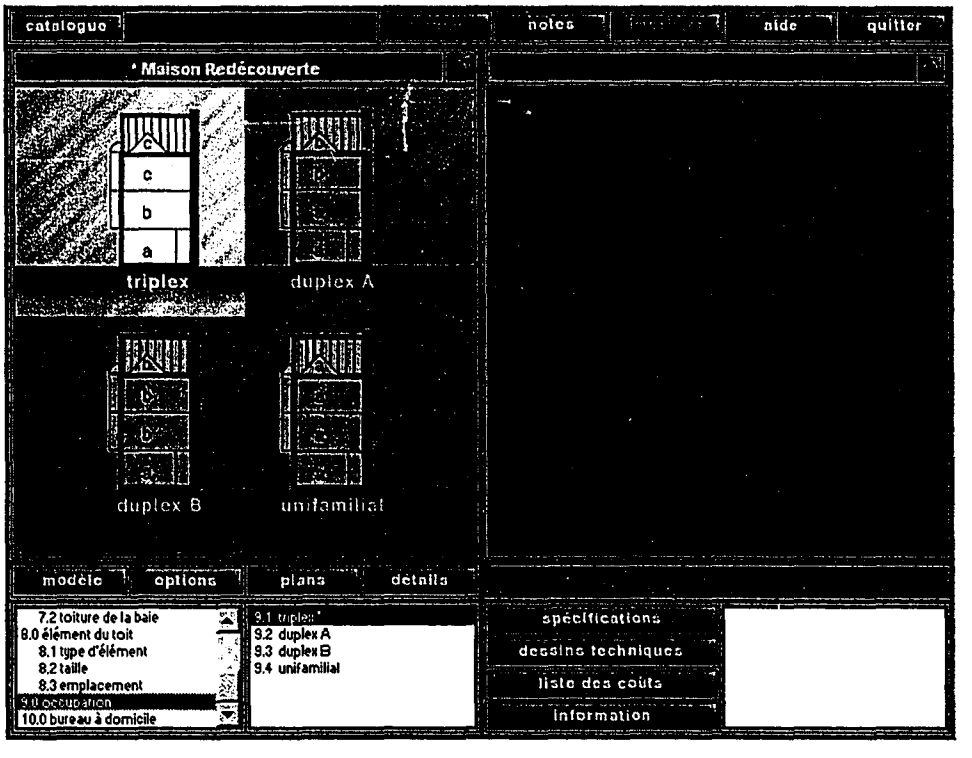


Figure 5.21 Example of available exterior features

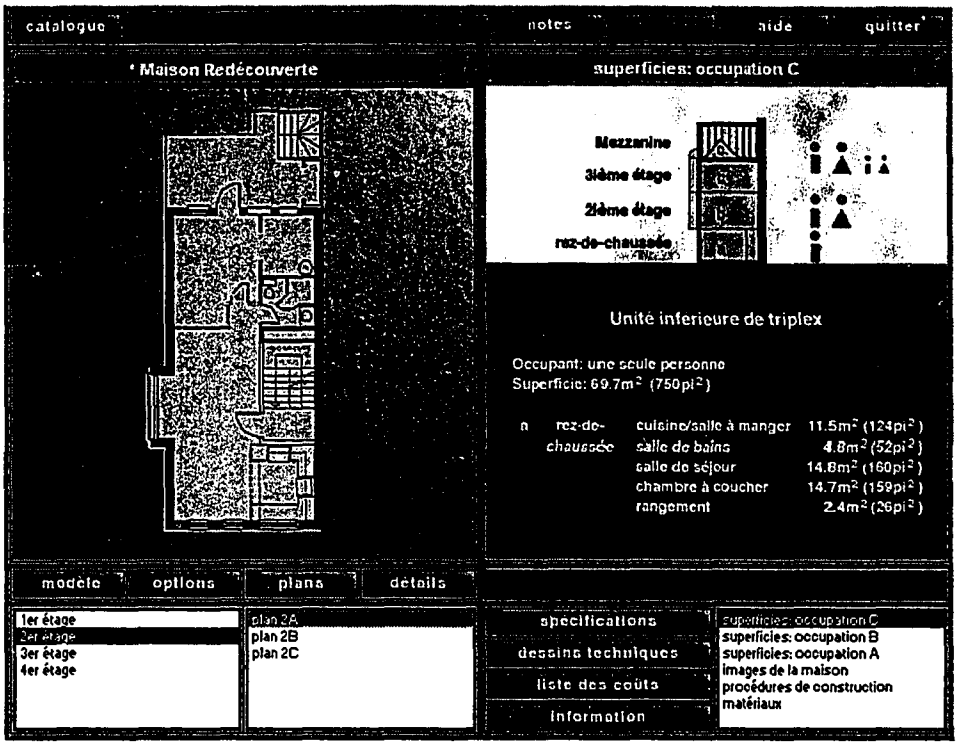


Figure 5.22 Floor plan options and summary of selected exterior features

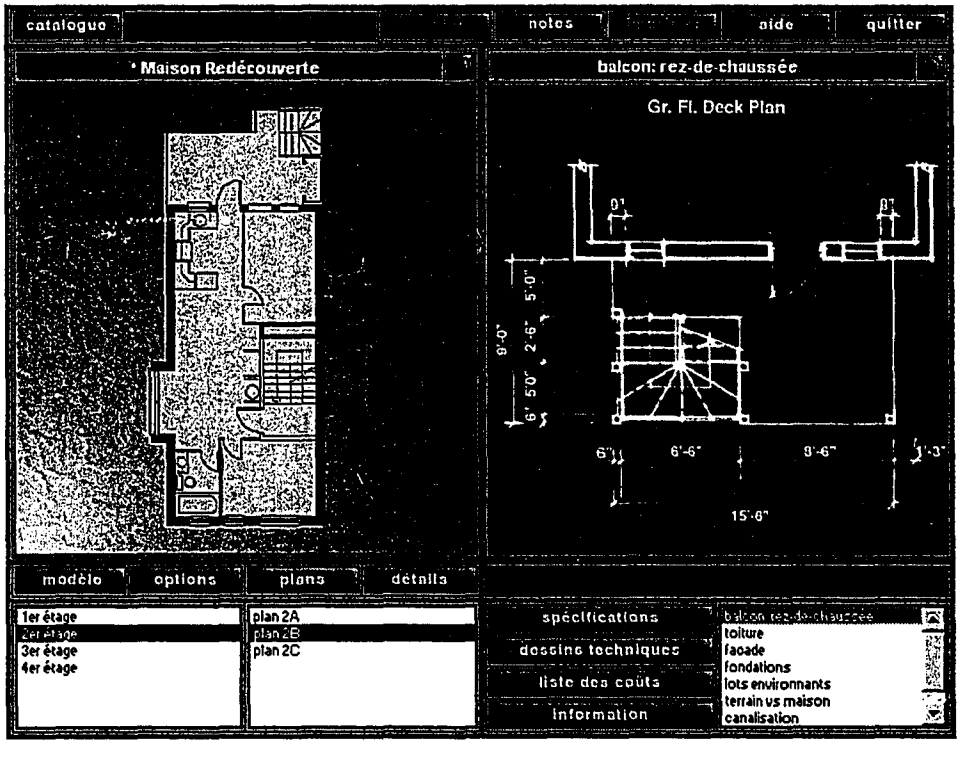


Figure 5.23 Floor plan options and construction drawing of exterior feature

prefabricated home. The example of the Next Home™ shows only one example, with a list of other possible user-selected details; the main exterior door can be chosen from a given door manufacturer, les Industries Melco Canada ltée., who provides a list of appropriate choices the user can select as desired (Figure 5.25). Table 5.12 gives the other details that can be offered to the user for customisation.

There are four other functions that also become active once the selection of the exterior features has been completed: specifications (*spécifications*), technical drawings of specific construction details (*dessins technique*), costing summaries (*liste des coûts*) and general information on the housing unit (*information*), in this case the Next Home™ (Figure 5.25). Table 5.13 lists the available and active categories within each of these four functions. The specifications function gives a summary of the building (i.e. the selected exterior features and occupancy) as well as floor areas for all of the rooms on each of the floors (Figure 5.22). The technical drawings section shows a construction drawing of the ground-floor balcony (Figure 5.23). The costing section shows a summary of the overall pricing structure of the building. This section can be expanded to include cost summaries for a variety of different breakdowns, such as site preparation and foundation work, electrical and mechanical services and structure (Figure 5.24). These costing analyses would be integrated with the option functions so that the addition or exchange of features, such as a bay window or a different front door, would be appropriately accounted for in the cost breakdown.

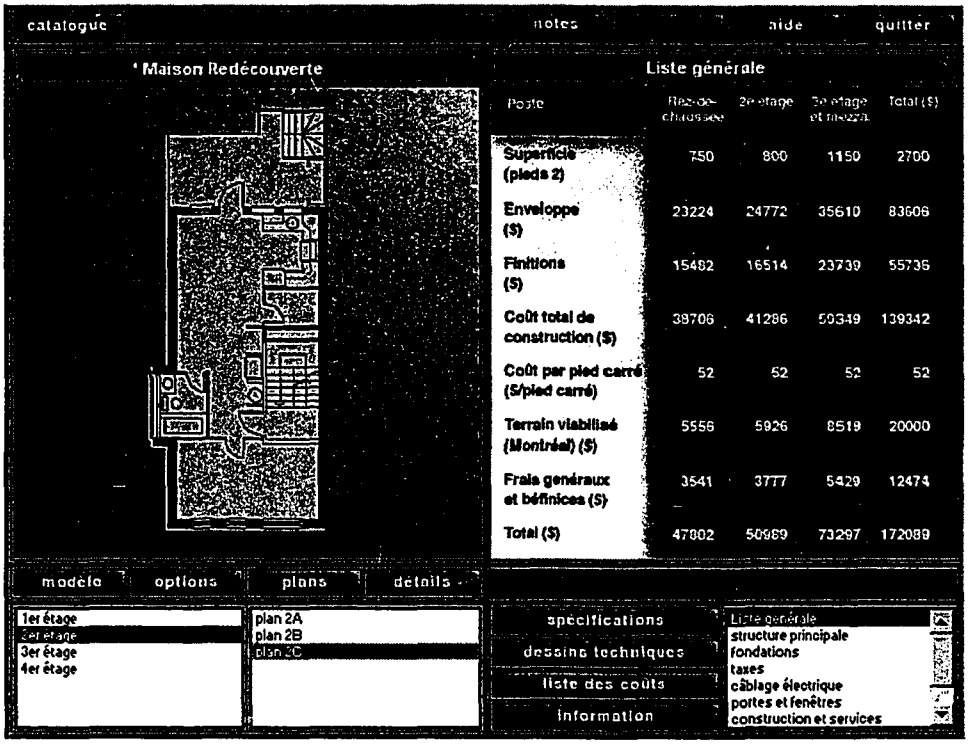


Figure 5.24 Floor plan options and cost breakdown summary

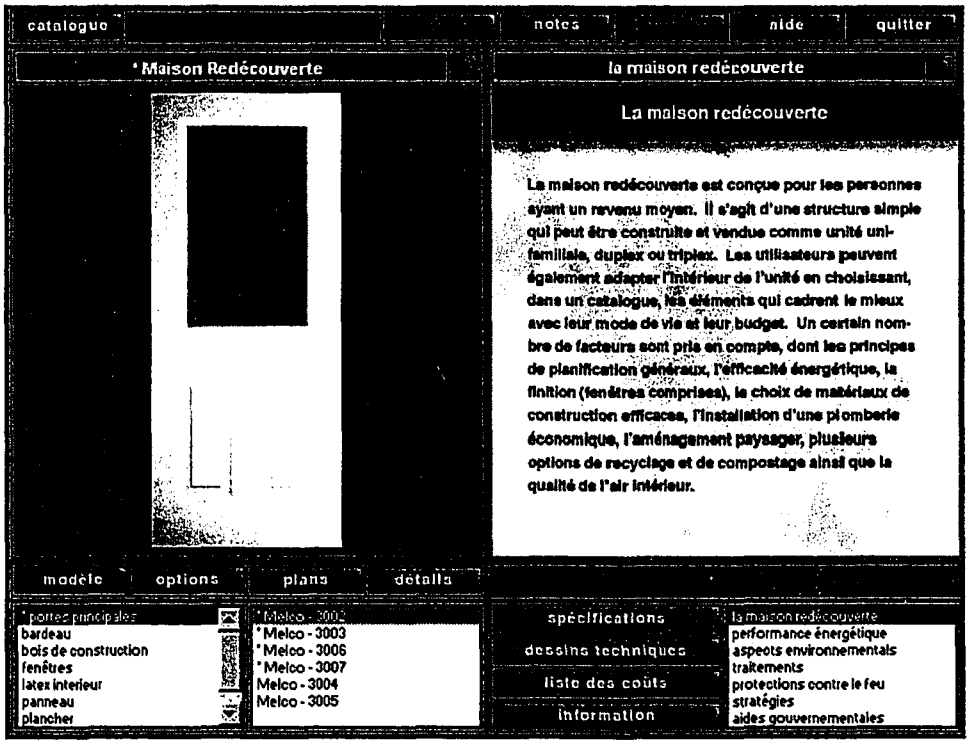


Figure 5.25 Option to select alternate details from the catalogue mode

plans	
1er étage	plan 1A
	plan 1B
	plan 1C
2ième étage	plan 2A
	plan 2B
	plan 2C
3ième étage	plan 3A
	plan 3B
	plan 3C
4ième étage	plan 4A
	plan 4B
	plan 4C

détails	
bardeau	
bois de construction	
fenêtres	
latex intérieur	
panneau	
plancher	
portes principales	**Melco-3002**
	Melco-3003
	Melco-3004
	Melco-3005
	Melco-3006
	Melco-3007
prises electrique	

Table 5.12 Choices available using the floor plan option function (*plans*) and the details function (*détails*)

spécifications
superficies: occupation C
superficies: occupation B
superficies: occupation A
images de la maison
procédures de construction
matériaux

dessins techniques
balcon: rez-de-chaussée
toiture
façade
fondations
lots environnants
terrain vs maison
canalisation
design intérieur

liste des coûts
Liste générale
structure principale
fondations
taxes
câblage electrique
portes et fenêtres
construction et services
maintenance
assurances

information
la maison redécouverte
performance énérgetique
aspects environnementals
traitements
protection contre le feu
stratégies
aides gouvernementales

Table 5.13 Lists of specifications (*spécifications*), technical drawings (*dessins techniques*), cost analyses (*liste des coûts*) and related information (*information*) displayed in the purchasing mode

CHAPTER SIX: CONCLUSION

6.1 Applicability

A software tool, as proposed in Chapter 5, can be a very useful application for prefabricated home manufacturers. Such companies can benefit tremendously from this software by engaging in commercial activity on the Web. Even without such a specialised tool, it is essential for home builders to develop a presence on the Internet as it is imperative for companies of all areas of the economy to take advantage of the evolving facilities offered by the World Wide Web. This may go against the traditional nature of the construction industry which operates on a basis of making changes solely to increase productivity and decrease operating costs: technological advances are constantly occurring but only make significant inroads once they have been proven to be an improvement on the previous technology and not just an innovation which has no benefits in terms of economics or performance.

The author suggests that prefabricated builders have much to gain by having a Website; this can be a well developed site or a homepage at the very least. The Website should contain information such as a company profile (i.e. a brief history, its policies and philosophies, environmental concerns and related programmes it is involved in) and the company 's coordinates (i.e. location, telephone and facsimile numbers and E-mail address). The Website should also function as an electronic catalogue, allowing the user to browse through all of the prefabricated model homes that the company has available. Images and drawings (i.e. elevations, plans and details) can be displayed for each model as well as qualitative information (i.e. floor areas, room functions). Internet links with other companies (e.g. suppliers of building products and components that the prefabricator uses) as well as government

organisations and home builders' associations are useful for the user visiting the Website but also provide a positive appearance of collaboration among these companies and organisations which reinforces the way in which the Internet is an excellent medium for reducing the barriers of distance and borders.

6.2 Adaptability with Changing Needs and Times

The benefit for home prefabricators to have a well established presence on the Internet can be seen with both the short term and the long term strategies. The former causes a direct impact by having the company have exposure to a much larger client base. This is true for any business on the Web and although the percentages of on-line business-to-business and business-to-consumer transactions are still low relative to the total amount of sales, the figures are increasing dramatically. Similarly the short term advantage of companies getting on-line can be noticed in the speed of doing business: not only can companies communicate with suppliers and clients in local and distant places almost instantaneously, but they can also improve their own internal communication systems through the implementation of an Intranet network. The potential for high-speed and long-distance communications ranges from sending construction drawings or cost analyses to using Web phones and video conferencing via the Internet to communicate in real time in order to obtain a very high level of interaction between users, e.g. streaming video files can be essential in the case of a builder immediately solving a technical problem with a client without having to be present. Internal communication can also be improved through better distribution networks and storage of information such as working drawings and other computer developed files, e.g. financial statements and other correspondence. A successful Intranet will allow a home prefabricator to have an efficient system of updating drawings thus avoiding costly errors of discarding the most recent versions of documents or of performing repetition of changes to the same file.

The long term benefits of prefabricated home manufacturers having a well developed Website and Internet exposure will be realised in conjunction with the increased growth of the Internet as an appropriate and essential medium for commerce. As the use of the Internet and E-commerce grows, as predicted by current studies, the experience of present Internet users will be valuable in order to allow these businesses to increase their Web literacy and implement the most recent features and applications available.

6.3 Customisation for Different Company Needs

The tool can be suited for the specific needs of the company, whether they be a home prefabricator or a building product or component manufacturer. The software prototype described in Chapter 5 allowed only a limited number of choices for each available option, whereas the company can determine the level of flexibility offered to the user. The company may decide to allow the user to not only browse through the catalogue of predetermined selections but also to give the user the opportunity to use their own drawings or specifications to update an existing model or to create an altogether new design, e.g. in the case of an export situation where the foreign client is relied upon by the company to provide a house design that will conform to the local codes and regulations. The user can give these suggestions and changes in real time to the company; the use of CAD software in conjunction with Internet browser plug-ins allows the client to update drawings and work on the same file with the user on the other end of the network connection.

The home manufacturer also can decide the method by which the tool can be accessed by users. The tool can be distributed by the company as a CD-ROM which can be sold and marketed on a Website (as a download) or through exposure in other media, e.g. builders' journals and

magazines or with the help of home manufacturers' associations. A major task however is the process of updating the material. If the company decides to use such a tool directly through an Internet Website, they must engage the services of a Web programmer to create a site which can easily be changed. Many applications to create Web pages exist which require little programming experience or knowledge, however a complex and interactive tool can call for specialised know-how. Similarly the information database must be designed to be easily updated.

With respect to the proposed tool, the author concludes that with the existing state of the Internet, it is more important for companies to develop their Websites (in order to reach more potential client through greater exposure) and to increase their use of electronic networks (in order to communicate at a much higher rate and to take full advantage of the flexibility, speed and simplicity of computer systems and applications). However the suggested Internet tool is a mechanism that would allow companies to communicate and do business at a much more interactive level with the participation and involvement of the user or client whatever their position be, e.g. developer, foreign builder or architect.

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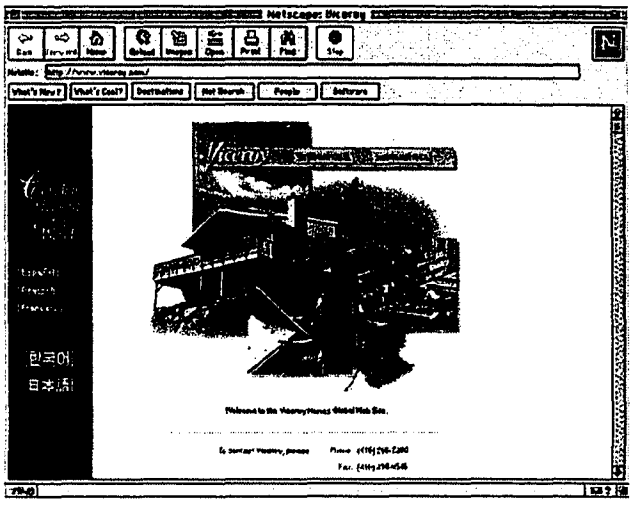

Figure A.4.1 Homepage for Viceroy prefabricated homes (http://www.viceroy.com, 1997)

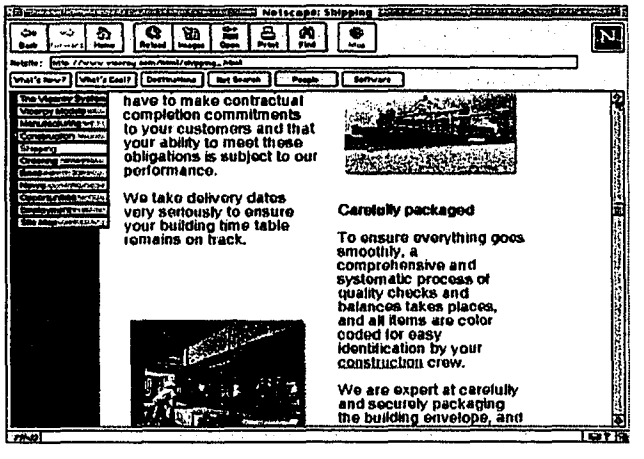

Figure A.4.2 Shipping information Web page (http://www.viceroy.com/html/shipping_.html, 1997)

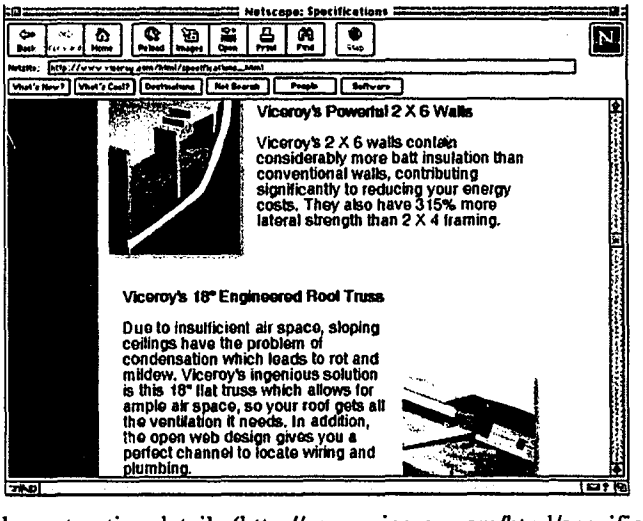

Figure A.4.3 Typical construction details (http://www.viceroy.com/html/specifications_.html, 1997)

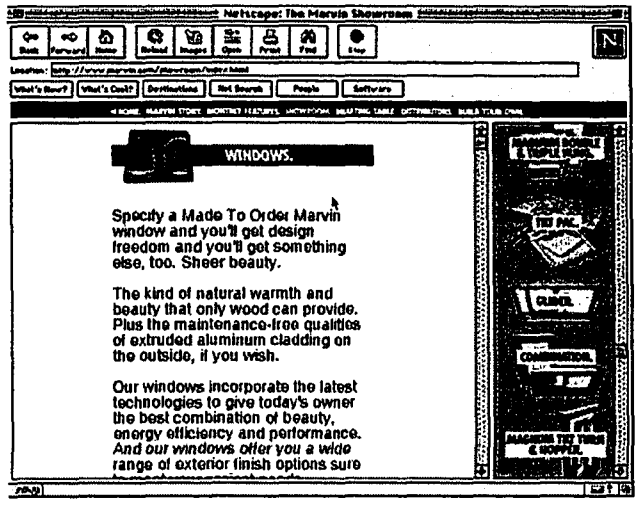

Figure A.4.4 Window manufacturers catalogue (http://www.marvin.com/showroom/index.html, 1997)

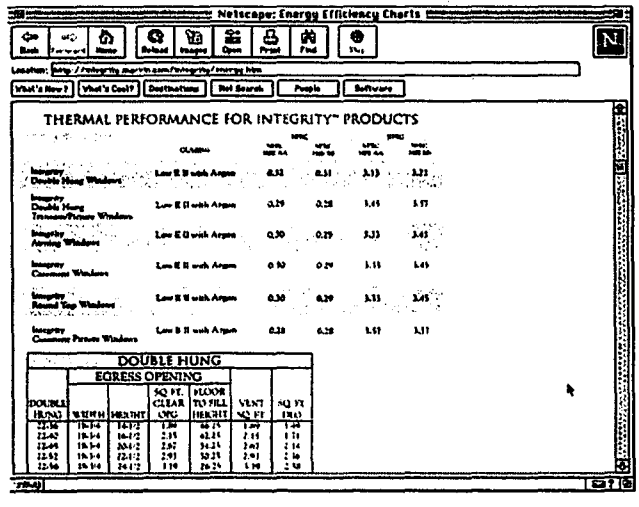

Figure A.4.5 Specifications sheet Web page (http://www.marvin.com/integrity/energy.htm, 1997)

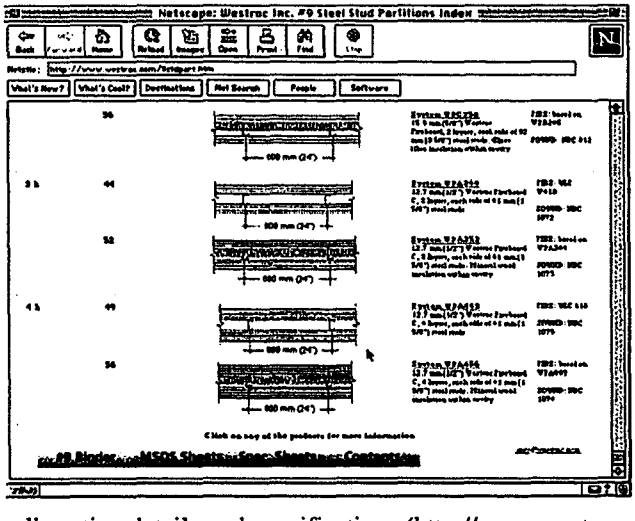

Figure A.4.6 Standard wall section details and specifications (http://www.westroc.com/9stdpart.htm, 1997)

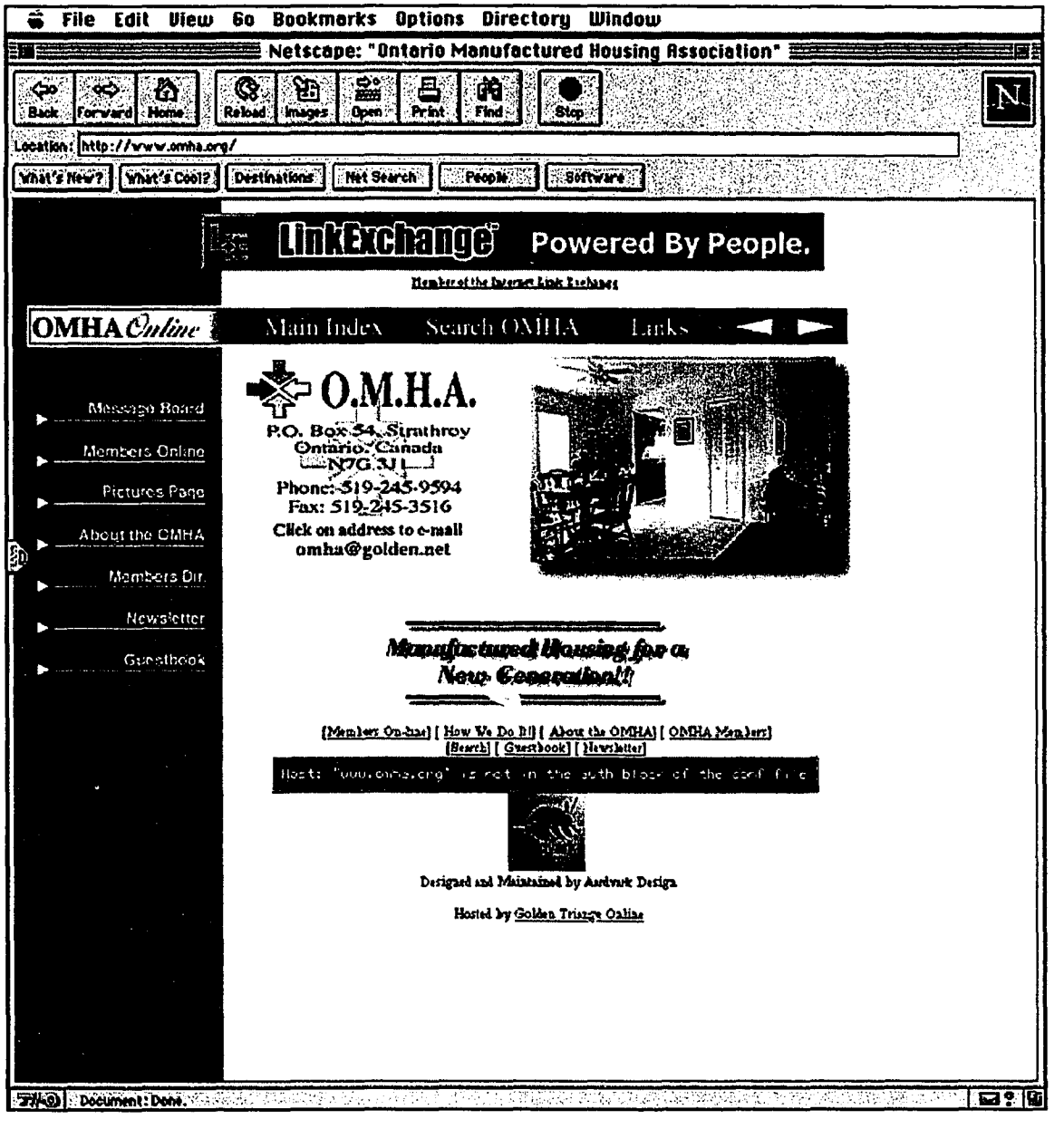

Figure A.4.7 The Ontario Manufactured Housing Association's homepage (http://www.omha.org, 1997)

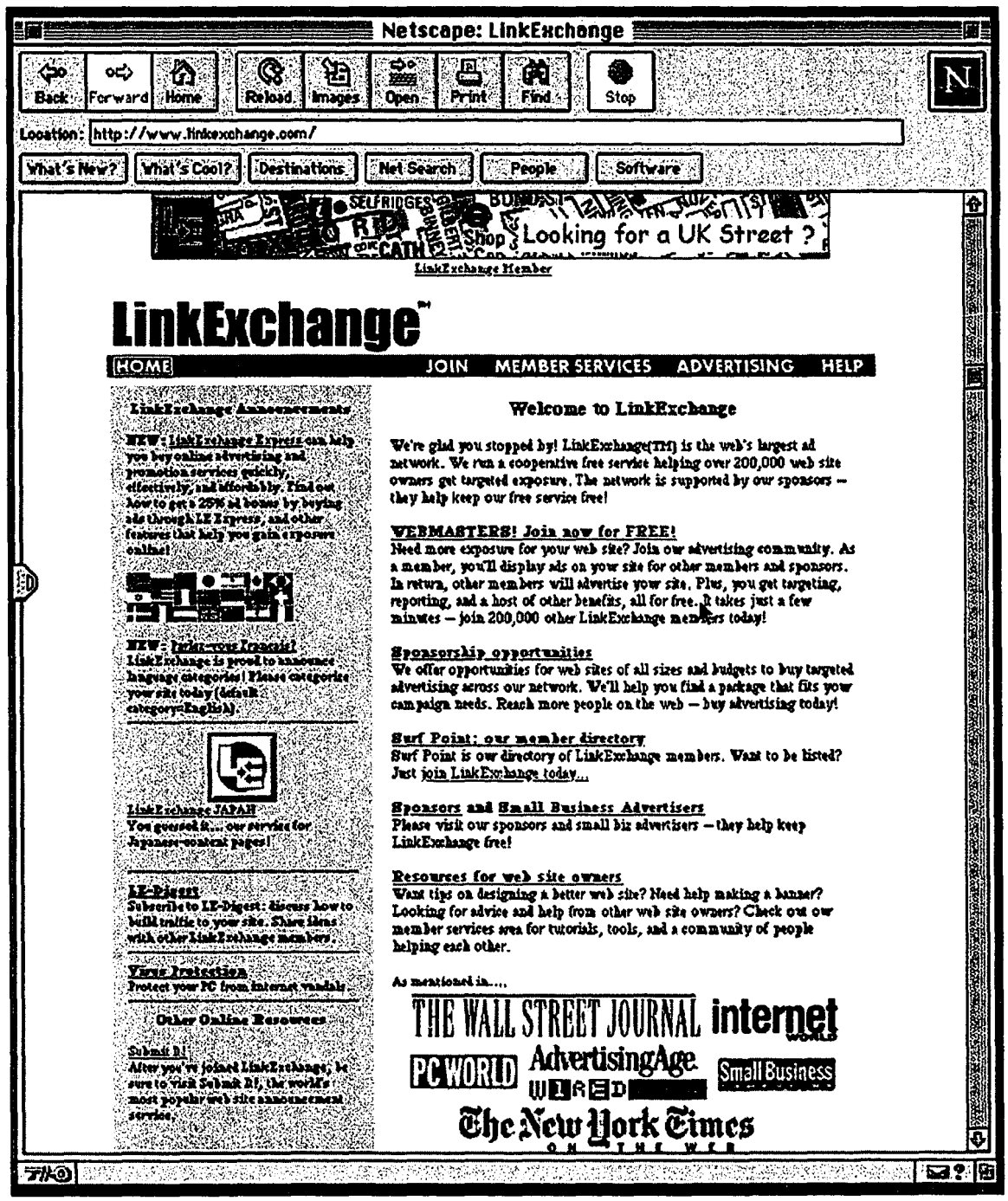

Figure A.4.8 LinkExchange™ Website provides companies with Internet links (http://www.linkexchange.com, 1997)

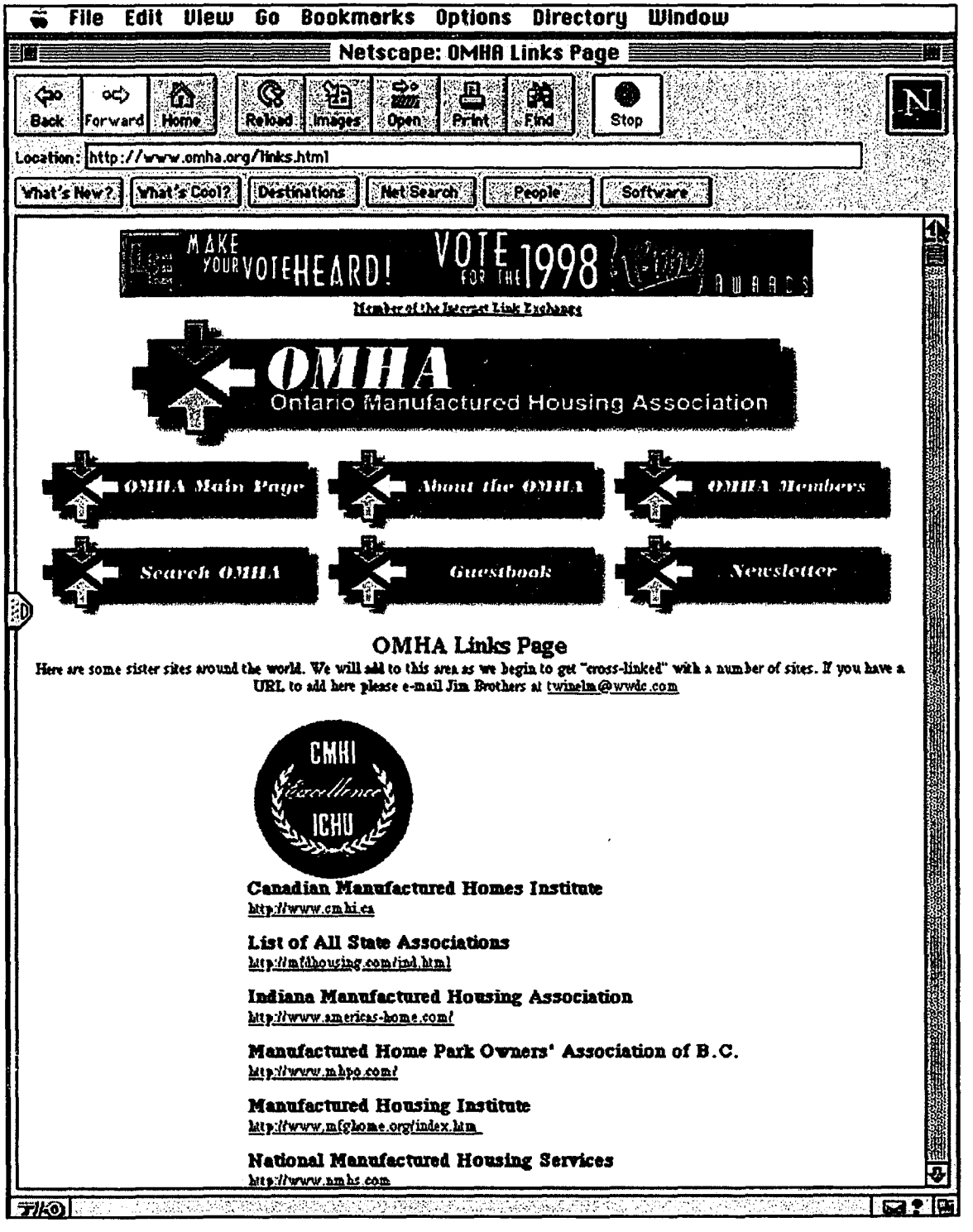

Figure A.4.9 Links for the OMHA as provided by the LinkExchange™ (http://www.omha.org/links.html, 1997)