# RESEARCH REPORT

## AFFORDABLE, ADAPTABLE HOUSING

**HOUSING AFFORDABILITY AND FINANCE SERIES**

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HOME TO CANADIANS

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# *AFFORDABLE, ADAPTABLE HOUSING*

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# ABOUT THIS REPORT

The purpose of this publication is to promote and demonstrate the practical and economic advantages of affordable, adaptable housing.

The report discusses various types of housing and adaptability and includes scenarios to illustrate the economic advantages of the various adaptability options.

It also contains a detailed analysis of six Canadian projects selected to demonstrate the range of adaptability options which the authors are attempting to illustrate as well as the different options currently available.

This publication is designed for developers, architects and consumers looking for housing which can be adapted to changing household requirements to enable occupants to stay in the same location for a longer time.

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This study was done in collaboration with Colin Davidson, architecture professor, Jules Hurtubise, economist and the Hanscomb firm. The work was supervised by Fanis Grammenors, Canada Mortgage and Housing Corporation (CMHC) Research Division.

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# INTRODUCTION

## Purpose of the Report

In view of marked changes in lifestyles and household composition, growing economic disparity, changing expectations with respect to housing quality and new ways of living, the time has come to rethink our homebuilding methods substantially.

Adaptable housing (i.e., upgradeable, expandable, divisible, versatile and flexible housing) appears to be an intelligent response to this rapid change, especially in terms of owners' and tenants' demands for space and their financial means.

The approach harmonizes well with the imperatives of sustainable development since these homes foster residential stability within neighbourhoods and communities. In fact, because this type of housing can be easily adapted to changing household needs, it allows families to stay in the same neighbourhood for a longer period of time and helps to promote stability within these living environments. Furthermore, because this approach generally encourages denser housing, it results in more efficient use of infrastructure and neighbourhood resources, which helps make these homes more affordable.

This report is part of a Canada Mortgage and Housing Corporation (CMHC) publication series on this approach, including *New Made-to-Convert Housing, Habitable Attics* and *Sprout: the Versatile, Dynamic House*. CMHC has also helped finance other ACT affordable, adaptable housing publications, the Flex Housing and the Art de vivre en ville design competitions, which encourage new residential solutions that can be easily adapted to the changing needs and economic situations of today's family.

The report explains and consolidates the project results. It also promotes adaptable housing and demonstrates the short- and long-term economic benefits of this type of housing for occupants and community alike.

## Key Observations and Analysis

The survey of the literature and consultation results enabled identification of 175 projects worldwide: 91 European, 54 Canadian and 25 American. Most of the Canadian projects consisted of detached single-family dwellings or row houses. In the literature, there were also about 40 theoretical papers and articles dealing with the concept of adaptability. Analysis of the projects and of the literature enabled us to pinpoint five types of adaptability, described in Chapter 1.

## Report Structure

Developers, builders, architects, planners and consumers should find the report useful.

Chapter 1 reviews the various housing and adaptability options. It discusses the principles of design that may be implemented to achieve the different options. It also discusses practicality, short- and long-term impact on housing costs and the effect of design on the type of adaptability. The first chapter also contains a number of scenarios to illustrate the economic advantages of each of the five types of housing and adaptability discussed.

Chapter 2 offers a detailed analysis of the 10 Canadian projects that were selected to demonstrate a range of adaptability options in conjunction with the various forms of housing. A bibliography at the end of the document lists the main works used to prepare this report. An appendix follows, showing typical projects and design strategies whose cost should be considered before implementing the suggested adaptability options.

# 1. REVIEW OF HOUSING AND ADAPTABILITY OPTIONS

This chapter is divided into five sections, each discussing one form of housing adaptability:

- upgradeable housing;
- expandable housing;
- divisible housing;
- versatile housing; and
- flexible housing.

Each subsection deals with seven topics:

- concept;
- design principles;
- practicality;
- short-term impact on cost of housing;
- long-term impact on cost of housing;
- indirect economic effects;
- scenarios showing the economic benefits of each adaptability option; and
- impact of design on adaptability.

The contents of this chapter are based on a review of several hundred projects and articles, as well as on detailed analysis of 10 Canadian projects (discussed in Chapter 2). In reading about each of these projects, we noted that the various adaptability concepts are often complementary and that a home could be simultaneously upgradeable, expandable, divisible, versatile and flexible. We noted, too, that the notion of adaptability has advantages, particularly over the long term, for both residents and the community.

## Upgradeable Housing

### Concept

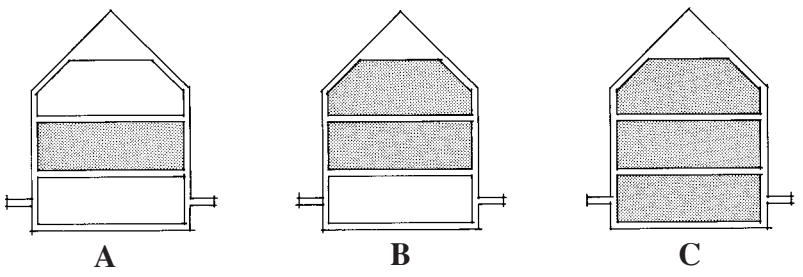
These consist of housing units with some unfinished areas that may be completed at a later date. In these types of homes, potential for growth and change is an integral feature of the house from the outset (Figure 1.1).

### Design principles

The principles of design which help to lower the initial costs of upgradeable housing include the following.

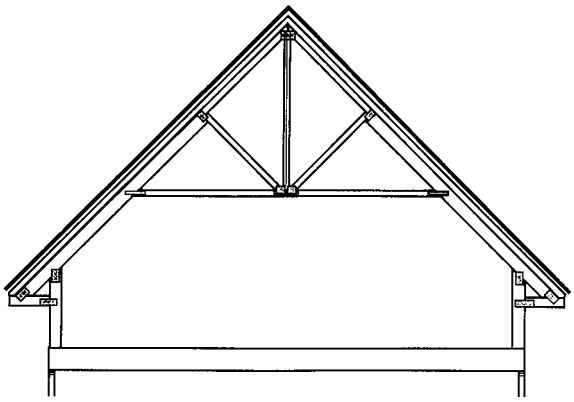
- Maximize beam span (frame) to minimize the number of load-bearing walls.
- Partition the home as little as possible at the outset.
- Use roof trusses which make the attic space liveable (Figure 1.2).
- Leave some unfinished spaces, such as basement and attic.
- Leave exposed or unfinished components such as concrete block walls, joists and roof trusses.
- Allow the buyer to purchase or build certain components, such as counters, kitchen cupboards and closets.

**Figure 1.1: Three-phase development of upgradeable house**




A. Original house
B. Expansion into attic space
C. Expansion into the basement

**Figure 1.2: Example of a truss for development of habitable attic space**



Source: *Habitable Attics: New Potential for an Old Idea* (CMHC, 1991).

- Rough in certain systems (e.g., electrical, plumbing and mechanical systems) to enable later construction in basements, attics or elsewhere.

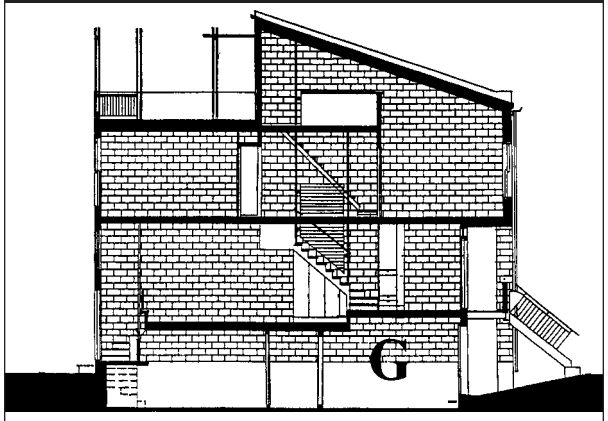
**Practicality**

- Residents can gradually adapt their homes according to their needs (e.g., additional bedroom, family room, play or exercise room, work space, extra apartment, etc.). (+)
- Residents can customize their homes. (+)
- Residents play a more active role in building their own homes and finishing them at their own pace. (+)
- Changes can be made to certain parts of the home without interrupting occupants' activities (see Figure 1.3a and Figure 1.3b). (+)

**Short-term impact on cost of housing**

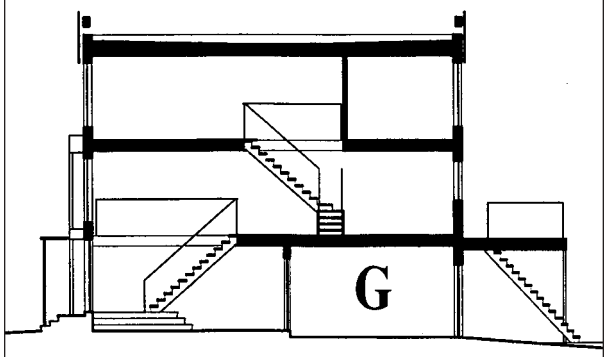
- The initial purchase cost is lower (see Scenario 1, below), enabling some families or households to acquire property more quickly. (+)
- Some components may cost more (e.g., frame for a liveable attic space). As well, rough concrete block walls require more extensive finishing; floor joists use better quality wood (e.g., pine rather than spruce) since the frame is visible. (-)

**Figure 1.3a: Petites Maisons Delanaudière**




Source: Casault and Delisle, Architects}

**Figure 1.3b: Europa Town Homes**




Source: Boutros + Pratte, Architects.

Longitudinal cross sections of the Petites Maisons Delanaudière and Europa Town Homes, showing that some alterations which could be made to these homes without interrupting daily routine. In both cases, the location of the garage (G) in direct line with the street permits easy entry of materials and allows this space to serve as a temporary workshop.

- It is possible that some buyers may initially pay for certain pre-installed facilities but later decide not to complete unfinished spaces while living in the home. (-)
- It is possible that some buyers may pay unnecessarily at the outset for horizontal or vertical fire walls for future partitioning of the home, but will not continue with the subdivision. (-)

- Lending institutions are often hesitant to finance homes left partially unfinished at time of purchase. (-)

**Long-term impact on cost of housing**

- Residents can improve the quality of their living space or increase the size of their home as income grows, without the additional cost of moving. (+)

- Residents with carpentry skills and free time can realize considerable savings by installing certain partitions and doing finishing work themselves; this is an excellent way for young owner-occupants to turn their labour into capital. (+)

- Residents without such skills, who later decide to have their home finished by a third party, must pay an additional premium. In fact, it is less expensive to hire a general contractor to finish the interior during original construction than to hire a third party at a later date. For some people, quick access to ownership—a main objective—is the key consideration. (-)

**Indirect economic effects**

There are many advantages in owning a home with space for future inclusion of an accessory apartment or office area.

Including a home office may:

- save rental costs, travel expenses and time; (+) and
- provide the owner with extra income through renting out the space. (+)

Including an apartment may:

- enable occupants to house relatives who need care, thus saving the time and travel expenses associated with this responsibility; (+)
- enable a person to live closer to a relative who provides child care; (+) and
- enable an individual to earn extra income by renting out the space. (+)

**Scenario 1: Upgradeable housing means lower initial down payment**

Peter and Christine paid $887 per month as tenants. They decided to purchase a home to save money. A young couple in their 30s who hoped one day to have one or two children, they were looking for roughly 120 square metres (habitable space) in a neighbourhood near the downtown area. Their combined annual income ($34,000) and savings ($5,000) would enable them to purchase a property worth roughly $100,000; unfortunately, the average cost of the homes they liked in this neighbourhood was $125,000. After many weeks of intense research, they met a developer who offered them a new, two-storey upgradeable house (80 $m^2$) with unfinished basement (20 $m^2$) and attic (20 $m^2$). This house, priced at $103,000, would allow them to become owners immediately and finish the unfinished areas at a later date. Peter and Christine did not hesitate to purchase the home, once they had made the following calculations.

- Situation before purchase
  - Monthly rental.....($887)

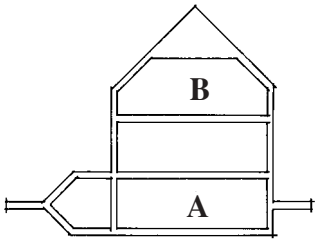
- Situation after purchase
  - Monthly mortgage payment[1] .....($641)
  - Monthly tax payment.....($172)
  Total.....($813)

- Monthly savings resulting from the purchase of an upgradeable home
  - Reduction in monthly after-purchase payments .....$74
  - Potential property appreciation/ month[2].....$343
  - Payment on principal/month.....$141
  Total.....$558

**Impact of design on upgradeability potential of the home**

The potential to upgrade a home may vary significantly depending on the size of the lot and the configuration of the unfinished spaces. It also depends on the location of these spaces (see Figure 1.4).

**Figure 1.4: Potential depends on location**




The unfinished area near ground level (A) lends itself well to construction of an additional apartment or office with outside access for clients; the unfinished attic space (B) is better suited for private use.

If the space is directly at ground level (e.g., ground floor or half basement), it is relatively easy to build an extra apartment or office, each with direct outside access. Owners have to keep in mind, however, that such construction must be permissible under current zoning regulations and must comply with building codes and regulations, especially with respect to interior layout, fenestration, fire resistance and soundproofing.

If it is away from the ground (e.g., upper floor or attic), this space is better suited to private uses, such as an extra bedroom or family room.

The following structural features will considerably reduce the amount of effort required for expansion.

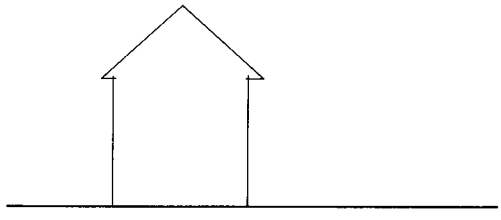
- Concentrate all plumbing pipes in the same wall on all levels to allow for later expansion or renovation.
- Frame the attic stairwell without installing the staircase immediately.
- Install attic windows large enough to allow entry of construction materials, especially plasterboard sheets.

## Expandable Housing

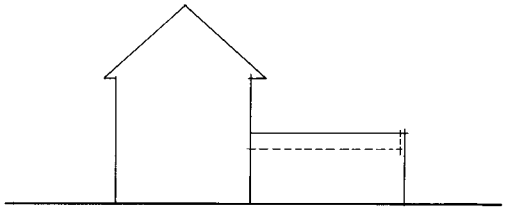
### Concept

These are minimal homes, which initially contain only the main living areas, but which may be enlarged later as household needs change and financial position improves. (Figure 1.5).

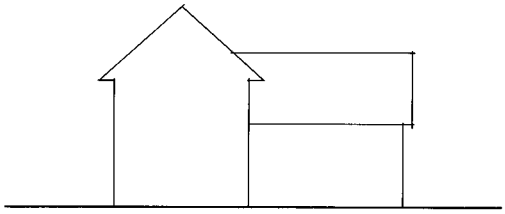
**Figure 1.5: Three-phase development of expandable house**



Original home



Adding a garage and patio



Adding a family room or bedroom over the garage

### Design principles

The design principles, or key strategies for later expansion, include the following.

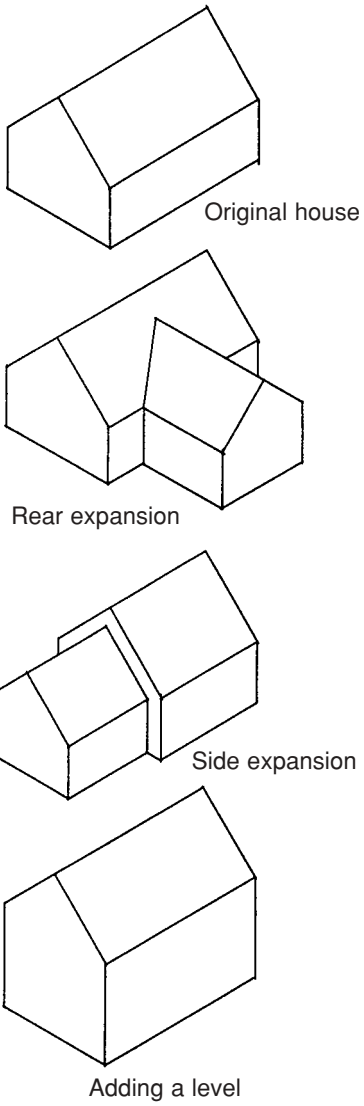
For single-family dwellings (see Figure 1.6):

- Expand to the side.
- Expand to the rear.
- Expand upward (e.g., add a floor or cover and enclose a rooftop terrace).

For multi-family dwellings (see Figure 1.7):

- Expand into an adjacent apartment — beside, above or below. This strategy is possible when neighbours' needs are complementary. For condominiums, property title amendments require legal consultation.

**Figure 1.6: Main expansion strategies for single-family homes**



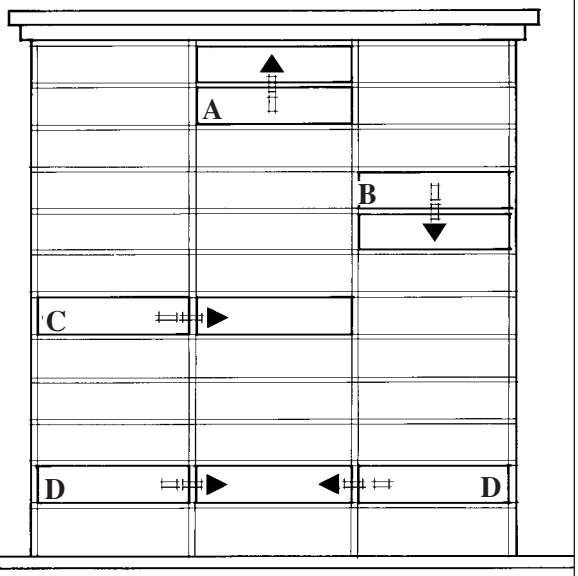

- Expand into a "float" space between apartments. For condominiums, title transfer also requires legal consultation.

When these dwellings are sold, model plans (regarding future use) should be made available to potential buyers to indicate units' growth potential and possible options.

**Practicality**

- Expandable housing offers young families a chance to own their own homes, with access to private outdoor space, and enables them to extend their homes, as required (e.g., for an additional apartment to house elderly parents or for working space). (+)

**Figure 1.7: Main expansion strategies for multi-family dwelling**




A. Expansion into an upper apartment
B. Expansion into a lower apartment
C. Expansion into a side apartment
D. Expansion into a "float" space between apartments

- Since most expansion starts at ground level,[3] this type of adaptability is particularly well suited to functions requiring direct outside access (e.g., additional apartment or office). (+)

- Residents may finish their homes at their own pace. (+)

**Short-term impact on the cost of housing**

- Initial purchase cost is kept to a minimum, thus enabling some families or households to acquire property sooner. (+)

- The buyer does not have to spend additional funds at the time of purchase for certain systems pre-installed for future expansion. (+)

- The original, small, habitable space limits energy costs and taxes. (+)

- Where a wider lot is necessary, the purchase cost for a larger lot may decrease the affordability of the home. (-)

**Long-term impact on the cost of housing**

- Residents may increase the size of their dwelling as income allows, without incurring moving expenses. (+)

- This type of adaptability is not as well suited to self-construction as upgradeable housing, although occupants with special skills may still participate; nevertheless, in most cases, the occupant can save money by acting as the general contractor. (+)

- It takes significantly more effort to expand than simply to complete unfinished spaces (upgradeable housing). In some instances, construction involves professional fees to prepare plans and specifications, general contracting costs and expenses related to post-construction site repair. (-)

**Indirect economic effects**

There are numerous advantages to owning an expandable home.

Building a home office may:

- save rental costs, travel expenses and time; (+) and
- provide extra income to the owner through rental of the space. (+)

Building an apartment may:

- enable a couple or an individual to earn extra income by renting out additional existing space or by adding space (In fact, parents whose children have left home and seniors living in their own homes often need less living space and more income.); (+)
- enable occupants to bring relatives who need care closer to them, thus saving the travel time and expense associated with this responsibility; (+) and
- enable a person to live closer to a relative who may provide child care (see Scenario 2, below). (+)

**Scenario 2: Expandable housing reduces child-care expenses**

Nicholas and Valerie have $10,000 in savings. They live in a small, single-family home, which they own, in the suburbs. They are both in their mid-30s, with an eight-month old daughter. They are caught up in their jobs, and one of them must, by necessity, devote about an hour a day to transporting their daughter to day care. The grandmother lives alone and is available. She would like nothing better than to care for the child in return for a few services, if she could find an apartment in the neighbourhood. However, there simply aren't any. Nicholas and Valerie, therefore, decided to enlarge their home to house the grandmother. They added roughly 55 square metres in an extra apartment, for construction costs of $45,000. Here is the balance sheet for this decision.

- Annual situation before adding the apartment
  - Day-care expenses (240 days at $20) .....($4,800)
  - Transportation to day care (2,400 km at $0.38) .....($912)
  Total.....($5,712)

- Annual situation after adding the apartment
  - Annual loss of income on uninvested $10,000 .....($700)
  - Mortgage[4] .....($2,760)
  - Heating costs .....($400)
  - Municipal and school taxes (two per cent of the value of the apartment) .....($900)
  - Yearly revenue from additional apartment[5].....$4,500
  - Potential appreciation of extra apartment .....$1,476
  - Payments on principal per annum[6] .....$627
  Total .....$1,843

Impact of design on potential use of expansion

The use of expanded areas may vary significantly, depending on the location. When the expansion is situated:

- Directly at ground level (e.g., ground floor or half basement), it is relatively easy to build an additional apartment or office, each with

direct access to the exterior. Owners have to keep in mind, however, that such construction must be possible under current zoning regulations and comply with building codes and regulations, especially with respect to interior layout, fenestration, fire resistance and soundproofing.

- Away from the ground (e.g., upper floor or attic), it is better suited to private use, such as an extra bedroom or family room.

The following structural features will considerably reduce the amount of work required for expansion.

- Build a main entrance area large enough to accommodate two separate doors in the event that an apartment is added (see Figure 1.8).

- Anticipate future connections between the main house and extensions by installing some windows, for example, using the framing required for a door.

## Divisible Housing

### Concept

These dwellings may be subdivided into smaller apartments as residents' space requirements decrease or merged as space requirements increase (see Figure 1.9).

### Design principles

The design principles, or key strategies, that may be used for later expansion include the following.

For single-family dwellings (Figure 1.6):

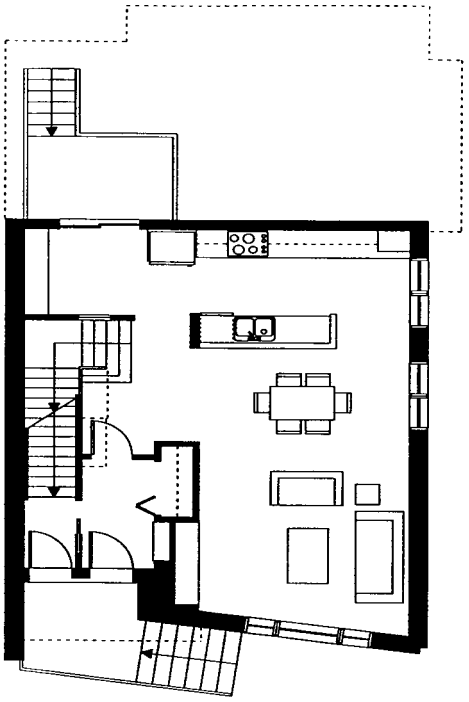
- Subdivide vertically.

- Subdivide horizontally.

For multi-family dwellings:

- Reduce the size of the home by subdividing into two separate apartments. This type of renovation requires legal consultation in the case of condominium housing.

**Figure 1.8: Main entry built to accommodate two doors**



The main entry of *Sprout: the Versatile, Dynamic House*, has been built to accommodate two separate doors in the event that an extra apartment is added.

Source: Sevag Pogharian, architect (scale 1:100)

### Practicality

- Residents can reduce some of their habitable space as needs decrease (e.g., once children leave home or when they retire). (+)

- Residents can subdivide their space according to new requirements (e.g., household size decreases, owners decide to build a home office). (+)

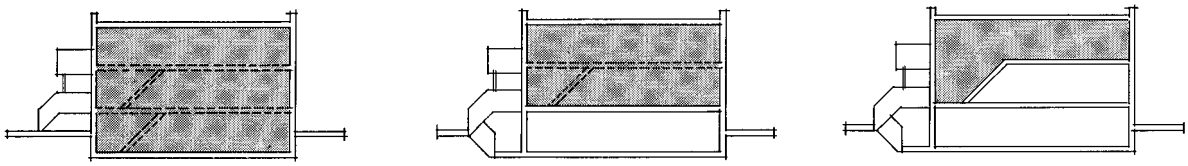
### Short-term impact on the cost of housing

- Monthly home ownership expenses are reduced, and there is no need to incur moving expenses. (+)

- Subdividing may generate extra income through rental of the space. (+)

- Subdividing involves construction or demolition costs that vary according to the use of the space (e.g., office or separate

**Figure 1.9: Three-phase development of divisible home**



**Phase 1**
Peter and Louise purchase a duplex that has been converted into a single-family dwelling: the parents and two teenagers live on the upper floors, and the grandfather lives in the basement.

**Phase 2**
The grandfather dies and one child marries; the basement is converted into an independent studio apartment for the young couple, who become tenants.

**Phase 3**
The second child leaves home: Peter and Louise decide to convert the house back into a duplex, rent out the main floor and live on the upper floor.

apartment) and according to the initial design of the home (see Impact of design on divisibility potential, below). (-)

Some buyers, at time of purchase, may pay unnecessary additional construction fees for potential divisibility, should they decide to forego renovations (i.e., pre-installed ducting, fire walls, etc.). (-)

**Long-term impact on the cost of housing**

- Eliminates moving expenses (i.e., transportation, commercial and legal fees, etc.) (see Scenario 3, below). (+)

**Indirect economic effects**

There are many advantages to owning a home that can be subdivided into two apartments, or into an apartment and an office.

- Subdividing a home into an apartment and home office could save rental fees, travel expenses and time. (+)

- Subdividing a home into two apartments may bring people closer together (relatives, children, friends) and permit exchange of services (e.g., day care) and social and emotional support. (+)

**Scenario 3: Divisible housing reduces frequency of moving**

Guy and Suzanne are in their mid-50s. They purchased a duplex and lived there for 17 years. At the time, this was the only affordable type of housing which would give them each a working space in the home (they were both teachers) and enough space to accommodate the five children in their blended family. To turn this duplex into a single-family dwelling, they had only to remove part of a wall, permitting direct access to the upper floor via the main floor living room. When the last of the children left home, Guy and Suzanne decided to turn their home back into a duplex. They rebuilt the wall section which had been removed and rented out the upstairs apartment.

The cost for the work was not substantial. However, the resulting savings from their ability to keep the property, to find smaller accommodation and to avoid a move were considerable.

Realty fees for sale (six per cent of $230,000) .....($13,800)
Sale-related legal fees .....($200)
Notary fees to purchase a new home.....($900)
Fee for architectural evaluation of new home.....($400)
Moving expenses .....($1,000)
Decorating costs for new home .....($3,500)
Total (savings due to avoiding a move).....$19,600

**Impact of design on divisibility potential**
The degree of ease in subdividing a home and the costs involved vary considerably depending on layout and type of construction. Generally, it is easier to subdivide a home initially designed as a "plex" than to subdivide a single-family dwelling or apartment building unit. This is due to certain features of the dwelling.

- Possible separate access for a second apartment is anticipated in the design.
- Horizontal and vertical fire walls are already in place.
- Soundproofing is already in place.
- Mechanical and electrical ducting is already in place for future installation of the kitchen and bathroom.

Note that subdividing into two separate apartments depends on current zoning by-laws and must comply with construction codes and regulations, especially with respect to fenestration, interior construction, fireproofing and soundproofing.

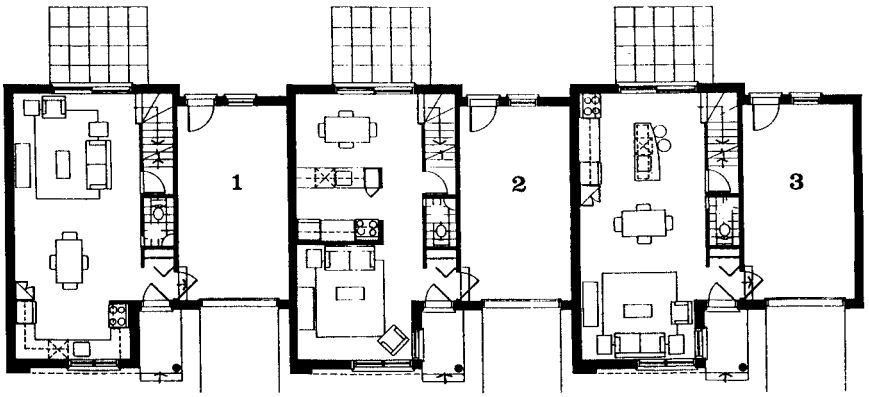
## Versatile Housing

**Concept**
These are homes which may suit various types of households and whose habitable spaces may be used for a variety of purposes without spatial alteration (see Figure 1.10).

**Design principles**
The principles of design which help make housing versatile include the following.

- Locate fixed systems, such as kitchens, bathrooms, stairwells, chimneys and various ducting, in one area to maximize the layout potential of the living areas.
- Design homes that are at least 4.9 metres wide, since it is extremely difficult to avoid encroachment of traffic areas on living areas when dimensions are smaller (see Figure 1.11).

**Figure 1.10: Three versions of versatile home, example of adaptable house**

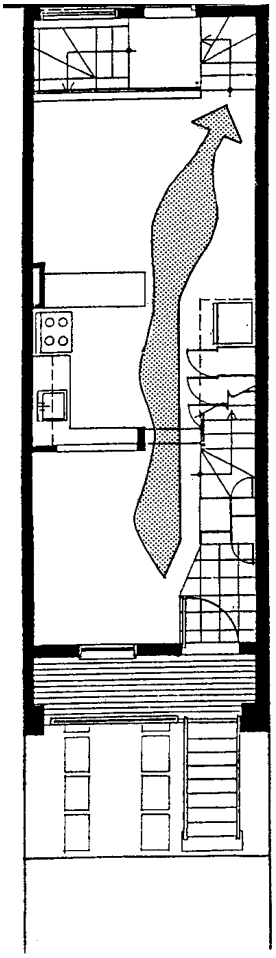



1. Office/workshop
2. Family room
3. Garage

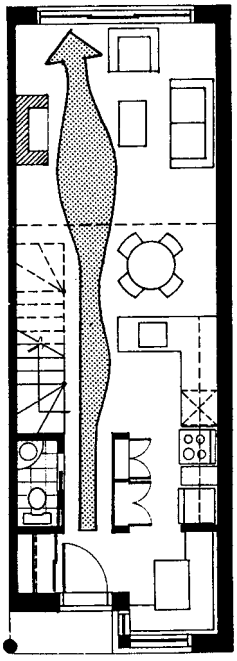
Source: Jocelyn Duff, architect

**Figure 1.11: Avoid encroachment of traffic areas on living spaces**

Petites Maisons Delanaudière and Adaptable Townhouses



Source: Casault Delisle, architects.



Source: Casault Delisle, architects.

- Eliminate or reduce the number of posts and load-bearing walls to a minimum to maximize layout potential of living spaces.
- Make all rooms larger than minimum standard size to maximize potential use, such as by adding 3 $m^2$ to an 11.5 $m^2$ bedroom to allow space for secondary activities, for example, an office, sitting room or dining area.
- Give each room a neutral, ambiguous shape (i.e., avoid including specific components such as closets, etc.) in the room design to avoid predetermining use of the space.
- Give each room a simple shape, preferably more square than rectangular, to maximize furniture arranging possibilities.
- Locate doors and windows in each room to maximize possibilities for furniture arrangements.
- Design passages as living spaces (see Figure 1.12) rather than as mere entryways (i.e., exceed minimal standards and build enough space to allow various activities to take place in these areas and encourage their use).

- Include double-width doors in walls between rooms or between rooms and passages to allow merger or separation of areas, as desired.

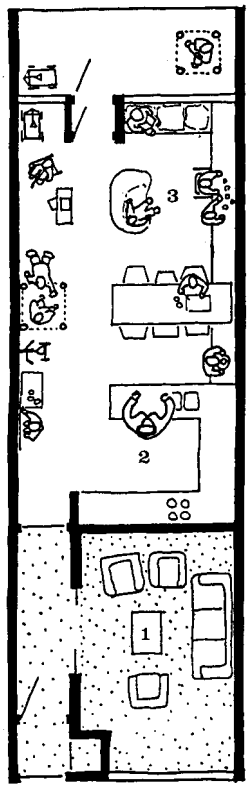
**Practicality**

- Versatile housing can adapt to the needs of various events in the life of a family or household over the years (e.g., birth of a child, child becomes an adolescent, divorce, remarriage, return to the job market, etc.). (+)

- Versatile housing can adapt to the various types of households which may successively live in a home (i.e., roommates, lone-parent families, blended families, etc.). (+)

- Versatile housing can adapt to the increasingly diverse lifestyles of households which may successively occupy the home (i.e., social, family or private lifestyle; focus on work, leisure, etc.). (+)

**Figure 1.12: Traffic areas designed as child play areas rather than entryways**




In this home, traffic areas are designed to be used as child play areas rather than entryways.

1. Living room for adults
2. Kitchen
3. Family room

Source: Clemenko Johnson, Shack and Oster (1980)

**Short-term impact on cost of housing**

- The purchase cost of a versatile home is generally higher than that of a builder home, i.e., a typical suburban suite designed for the nuclear family (couple with two children). In fact, a home's degree of versatility largely depends on the size (preferably more generous) of its component spaces, the number and width of openings connecting these spaces, the absence of load-bearing walls, etc. Obviously, there are additional costs which accompany some of these benefits. (-)

**Long-term impact on cost of housing**

- Versatile housing can be distinguished from common housing by its longevity, its durability (i.e., potential for longer use without requirement for renovation). Production homes, being more inflexible, may, at some point, no longer meet our needs—a fact that triggers a move. Since there are costs associated with each move (packing, transportation, decorating, etc.), being able to stay in the same place for an extended period means considerable savings. (+)

**Indirect economic effects**

- Adapting the home to changing household needs (see Scenario 4, below) may not necessarily require transforming the space. (+)

**Scenario 4: Versatile housing reduces office expenses**

John and Sylvia were a couple in their 50s, married for approximately 10 years. Sylvia had a teenaged child from a former marriage and John was a bachelor. They decided to rent a two-bedroom, 90 square metre, "mingle-style" apartment in an apartment tower. In this type of apartment, the bedrooms are located as far as possible from each other and each has direct hallway access, private bathroom and balcony. They chose this type of apartment with the idea that it would afford each family member a greater sense of privacy. They also anticipated that, once the child left home, Sylvia, a notary, could move her office into the home. The two-bedroom mingle apartment cost them $10,704 per year, while a standard apartment of equal quality would have cost $10,200 per year.

The young adult recently left home. Sylvia took advantage of the occasion to leave her rented downtown office and move into a home office. Thanks to the two separate entrances, the mingle-style apartment suited her perfectly. In fact, it enabled her to deal with some clients in her home without disturbing her spouse. Having a home office also resulted in annual savings.

Savings (office rental) 15 m² at $150/year ..$2,250
Savings (transportation to office) 1,920 km at $0,38 km .....$730
Savings (office parking) 11 months at $100/month .....$1,100
Additional annual cost of living in a mingle-style apartment.....($504)
Annual savings resulting from moving to a home office .....$3,576

#### Impact of design on versatility

Adopting as many as possible of the aforementioned design principles will help maximize the versatility of the home.

## Flexible Housing

#### Concept

These homes have certain components, such as roof trusses, floor beams and doors which facilitate adaptation.

#### Design principles

The principles of design, which help to make housing flexible, include the following.

- Use floor and roof beams that do not require intermediate support, to eliminate interior load-bearing walls and thus enable various spatial arrangements.
- Use open-web floor joists to allow easy installation of electrical and mechanical wiring and permit a variety of spatial arrangements.
- Use a type of roof truss that frees up space and allows full use of attic area.
- Use double sliding doors in some areas rather than partitions to separate or merge certain spaces (see Figure 1.13).

#### Practicality

- The absence of load-bearing walls enables the developer to arrange interior space according to the specific needs of each client purchasing plans. (+)

If the width of the doorway between rooms or between rooms and corridors is variable, it is possible to alter the connections between these spaces. Figure 1.13 illustrates examples of doors which may increase the flexibility of a home.

- An absence of interior load-bearing walls enables the occupant to make fairly significant changes (e.g., remove a partition and combine two spaces) without compromising the structural integrity of the frame. (+)
- Using sliding double doors instead of conventional doors in some areas enables the occupant to rearrange interior space instantly. (+)
- Using open-web joists facilitates replacement of obsolete electrical or mechanical systems as well as enabling various interior arrangements within a fixed perimeter; it also makes it easier to add new, technologically advanced systems related to health, safety, efficiency, comfort and working in the home. As well, it allows a variety of interior arrangements within a fixed perimeter. (+)

#### Short-term impact on the cost of housing

- With this type of adaptability, builders selling from plans can offer buyers customized homes without additional major expense. (+)

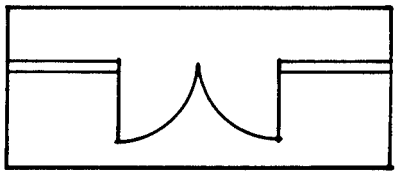
#### Long-term impact on the cost of housing

- With this type of adaptability, buyers are aware at time of purchase that they will be able to make later changes to interior spatial arrangements in the home at a reasonable cost (see Scenario 5, below), since the structure will be unaffected. (+)
- For all these reasons, occupants can live in the home for longer periods of time, thus avoiding the expense of moving. (+)

**Figure 1.13: Examples of doors which increase flexibility**

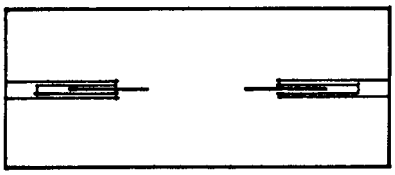
**1. Double hinge-mounted doors**
Advantages:
- Allows visual combination of two spaces
- Less expensive than double pocket doors.

Disadvantage:
- Clutters the room.



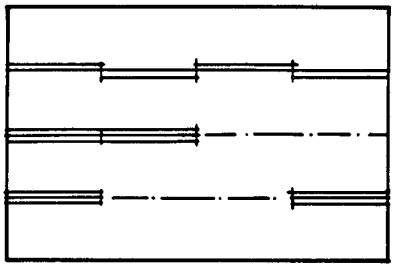
**2. Double pocket doors**
Advantages:
- Allows visual combination of two spaces
- Allows subtle variations in width of opening
- Does not clutter.

Disadvantage:
- Higher cost.



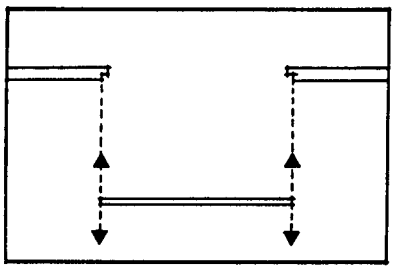
**3. Sliding doors**
Advantages:
- Allows visual combination of two spaces
- Allows subtle variations in width of opening
- Opening location can vary
- Does not clutter.

Disadvantage:
- More costly to improve poor acoustic performance.



**4. Sliding panel**
Advantages:
- Allows visual combination of two spaces
- Removes any trace of a doorway.

Disadvantages:
- Difficult to store
- Poor acoustic performance for lightweight panels
- Difficult to transport heavy panels.



Source: Teasdale and Wexler (1986)

### Scenario 5: Flexible housing reduces moving costs

Michael and Jean were looking for a single-family home. With the help of a real estate agent, they discovered two three-bedroom homes they liked. Since they had only one child, they intended to combine two of the three bedrooms to create a larger master bedroom, including an ensuite bathroom. Before making the final selection, they asked the architect to suggest which of the two homes would be less costly to renovate. The floors in House A were built with open-web wood joists, and the house had no load-bearing interior walls, while the two bedrooms the couple wished to combine in House B were separated by a load-bearing wall. The choice was not difficult, since their architect told them that renovating House A would cost $11,000 and renovating House B would cost $18,500. The $7,500 difference was due to the extra work required for House B, as follows:

- adding a beam and posts to transfer the weight of the load-bearing wall;
- pouring two concrete footings to support the posts; and
- demolishing and repairing larger floor and ceiling surfaces to connect mechanical and electrical ducting.

It is important to note also that, for 3.6-m to 6.7-m spans, construction costs using open-web

joists are comparable to, if not lower, than those of other traditional methods.

**Impact of design on the flexibility of the home**
Using as many of the aforementioned design principles as possible will help to maximize the flexibility of the home.

## Conclusions

This review identifies the short- and long-term impact of the various housing and adaptability options, which were analyzed. It also demonstrates that the notion of adaptability offers many benefits, especially over the long term, both to occupants and to communities.

**Advantages for occupants**
From the occupant's point of view, it is clearly apparent that:

- The purpose of the housing may change many times during the lifetime of a household. In fact, as the household progresses through its various stages, events result in the development of new needs, which, in turn, require adaptation.

- The life cycle of the housing unit inevitably extends beyond that of the original occupants, which means that the housing must be able to adapt to needs and lifestyles, often vastly different, as successive households occupy the space.

For the same reasons, these new housing units must be able to adapt to systems based on new technology in the areas of health, safety, comfort, leisure and work in the home.

**Advantages for the community**
From the community perspective, it is important to emphasize that adaptable housing:

- Allows families to stay in the same location for longer periods of time, and, therefore, better integrate into the neighbourhood.

- Helps reduce urban sprawl by consolidating existing communities.

- Means more efficient utilization of community infrastructures and resources.

- Decreases excessive car dependency and the associated traffic congestion and pollution.

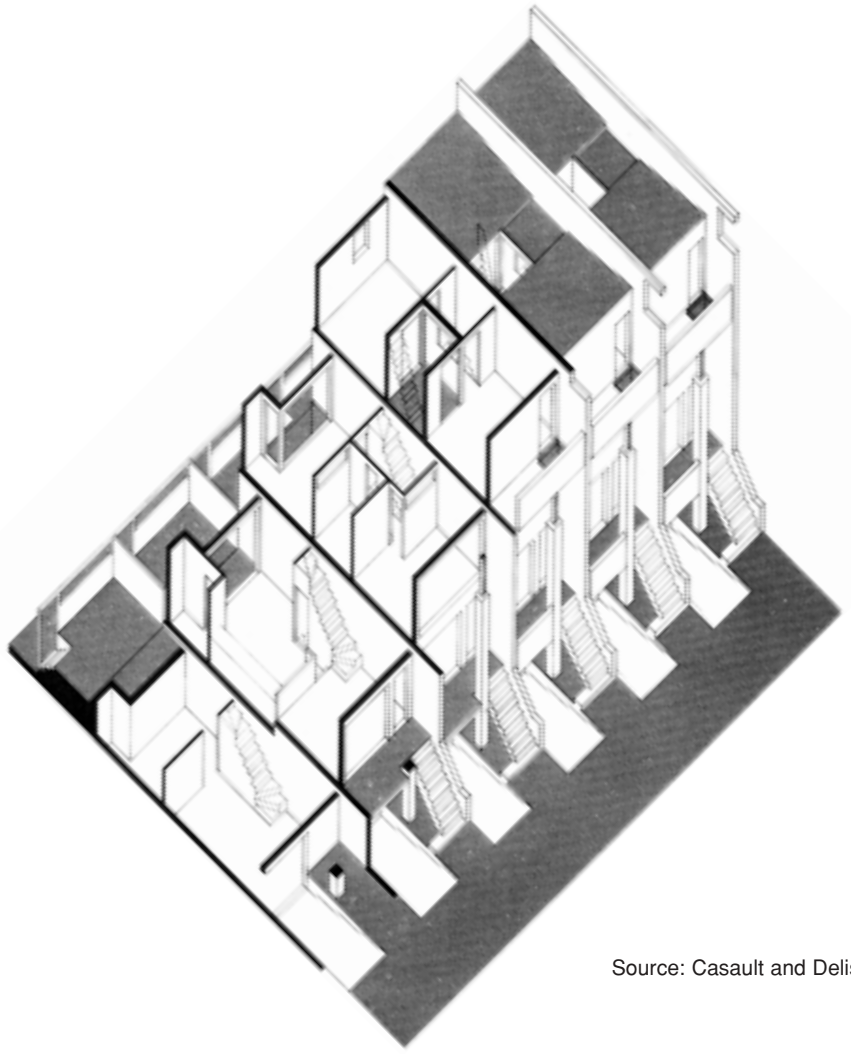
- Potentially increases the municipal tax base.

## Petites Maisons Delanaudière, Montréal

These two in-fill homes occupy a standard 7.6 m-wide lot on the Mount Royal Plateau, near downtown Montréal. They are largely a result of Montréal's 1991 Art de vivre en ville national design competition, organized in cooperation with the Société d'habitation du Québec and CMHC. The designers of these two homes received honourable mentions for a 14-apartment project intended for young families purchasing a first home but having little capital to invest. The Petites Maisons Delanaudière Project is a smaller, adapted version, designed for the same clientele as the original concept.

Figure 2.1 provides an axonometric drawing of the project submitted by architects Casault and Delisle for the Art de vivre en ville national

**Figure 2.1:**
**Axonometric drawing of project by architects Casault and Delisle**



Source: Casault and Delisle, architects.

design competition. The concept can be described as a series of narrow townhouses separated by shared walls that extend edges to the front and rear. In this way, occupants may personalize the facade of each unit.

Each house sits on a narrow (3.8 m), vertical section of the lot (see Figure 2.2). Each is offered as a beneficial alternative to *horizontal housing*, a sort of "habitable box," since it enables each owner to have a *complete house* with private entrance, basement, superimposed living quarters, yard and roof (see Figure 2.3).

Both houses (see figures 2.4 and 2.5) consist of two storeys, a third-level mezzanine and split-level basement, including a garage. They were built at the same time by a couple and by a bachelor who wanted affordable downtown accommodation and were willing to finish the homes at a later date.

**Upgradeable features**

These homes were designed to be finished gradually, as shown in the planning schedule we received from the couple.

Phase 1: Structure, envelope and main floor (May to September 1991)
Phase 2: Finish upstairs, mezzanine and terrace (1993 to 1995)
Phase 3: Finish basement (1998)

The birth of a child prompted the couple to finish the house themselves, while the bachelor did not significantly alter the original plan.

**Figure 2.2:**
**Each home on narrow (3.8 m) vertical section of lot**

The rear facade appears on the left, while the front facade is pictured on the right.

Source: Casault and Delisle, architects

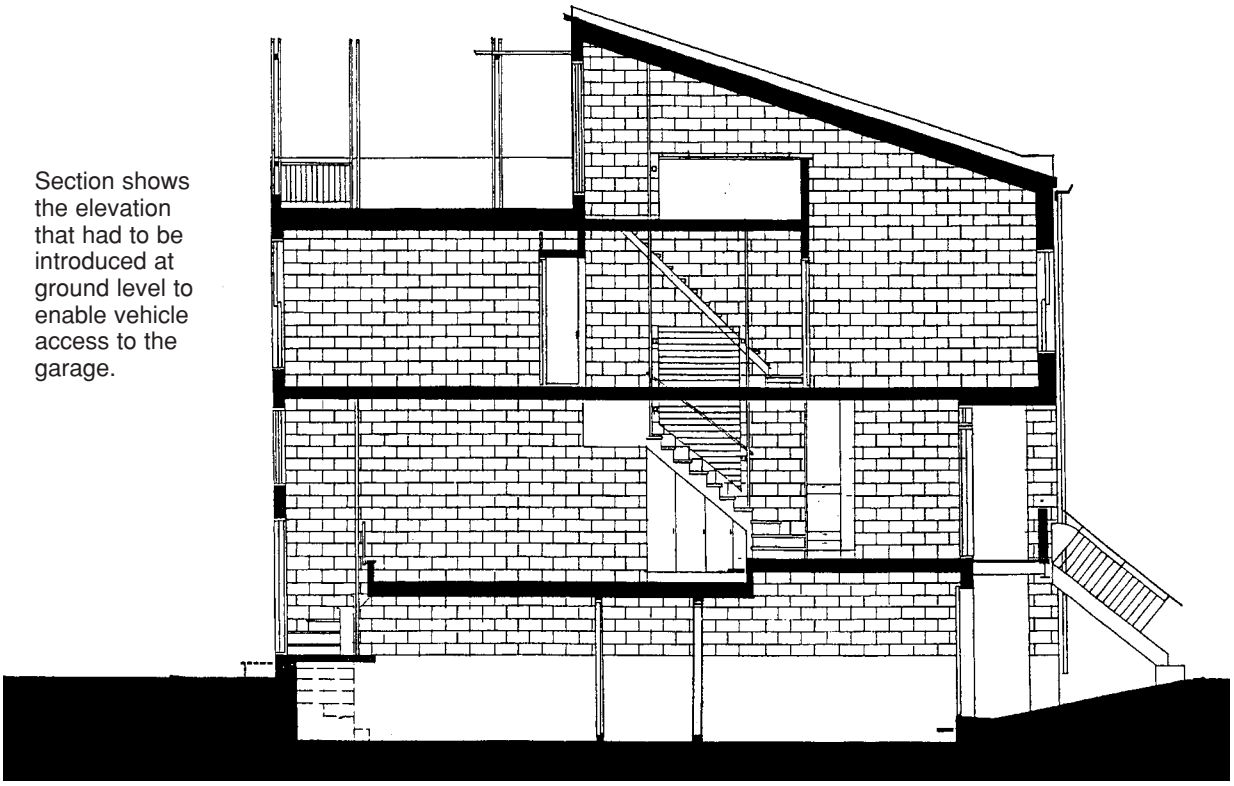
**Figure 2.3: Petites Maisons Delanaudière, an alternative to "plex" housing**

The Petites Maisons Delanaudière are an alternative to neighbouring "plex" housing, a sort of "habitable box," since they allow each owner to have a private entrance, basement, stairs, yard and roof.

Photo: Casault and Delisle, architects.

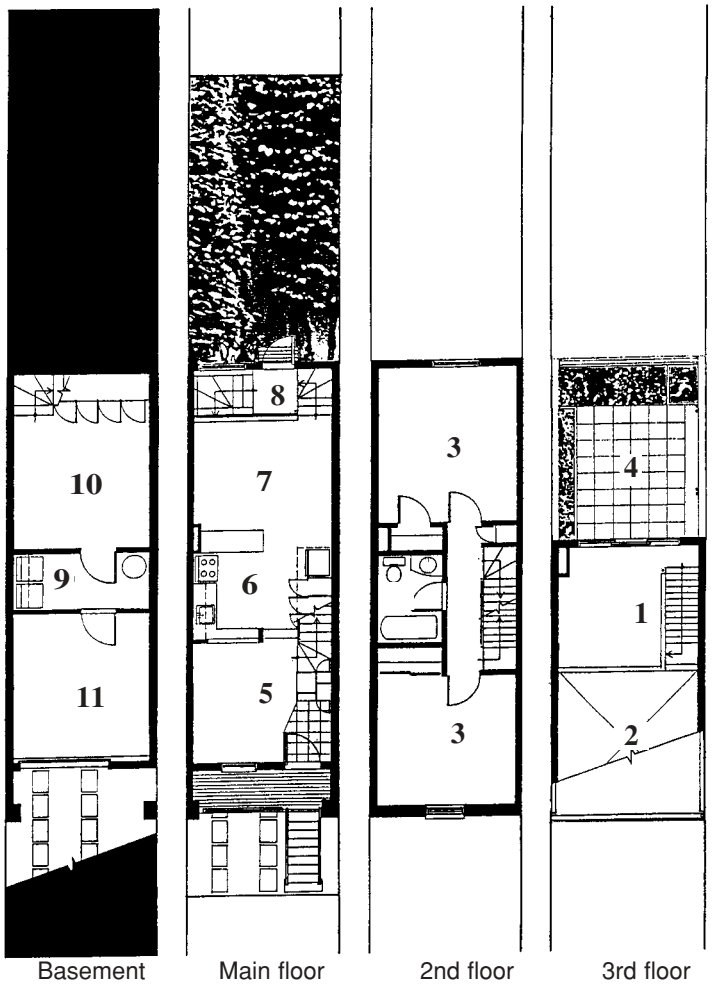
**Figure 2.4: Typical longitudinal section of Petites Maisons Delanaudière**

Section shows the elevation that had to be introduced at ground level to enable vehicle access to the garage.



Source: Casault and Delisle, architects

**Figure 2.5: Basic plan for each floor in Petites Maisons Delanaudière**




1. Mezzanine
2. Rooftop terrace
3. Bedroom
4. Bathroom
5. Main entrance and living room
6. Kitchen
7. Dining room
8. Stairwell
9. Laundry and utility room
10. Family room
11. Garage

Source: Casault and Delisle, architects

It is interesting that the couple's garage made the work considerably easier for them. This space became a workshop for prefabricating the various components for the upper floors without disturbing the rest of the house with noise and dust. Having a garage door with direct access to the street also greatly simplified stocking of materials.

*Special considerations regarding upgradeability and affordability features*

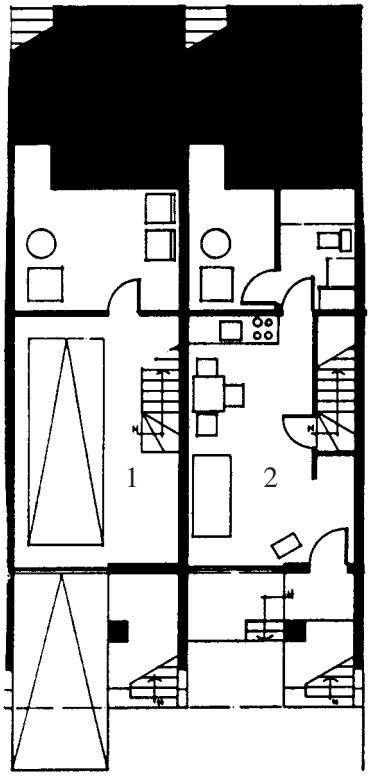
There are two approaches to complete an upgradeable home. The first involves delivering a complete home with rough finishing; the second entails delivering a complete home with careful finishing, thus avoiding the impression that the house is poorly built. The Petites Maisons Delanaudière chose the first option while the Fonteneau Homes used the second approach. (See Figure 2.6 for a photo of staircase from the main floor to the upper floor, showing the roughly finished concrete block walls in the Petites Maisons Delanaudière.)

The first approach enables delivery of the home at a more affordable price than the second. However, it appears to be more difficult to sell roughly finished homes, since some buyers feel that these dwellings are poorly built. This type of upgradeable home is therefore better suited to people or households who decide to build their own homes and are willing to live for several years in a home which appears to be unfinished than it is to developers who must lure demanding customers.

**Figure 2.6: Staircase from main to upper floor**

Photo: Casault and Delisle, architects.

**Figure 2.7: Project version for the Art de vivre en ville competition**




The house is designed to allow the basement to be used as a garage (1) or studio (2) without having to alter basic spaces or structure.

Source: Casault and Delisle, architects

**Divisible features**

As shown in Figure 2.7, the house was designed to allow the basement to become a studio. The area can be rearranged without altering the basic spaces or structure.

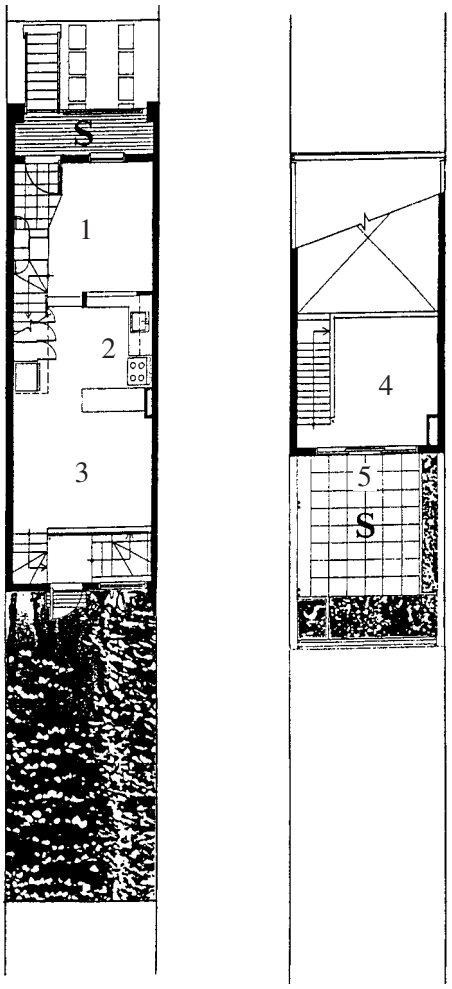
**Expandable features**

The house plan allows space to add solariums over the porch above the garage and on the mezzanine-level rooftop terrace (see Figure 2.8).

**Versatile features**

As shown in Figure 2.9, each floor may be interpreted in a number of ways. Note, however, that the narrowness of the home and the split-level, which had to be added on the ground level (see also Figure 2.4) to allow access to the garage, limit the versatility of this plan.

**Figure 2.8: Addition of solariums**




The house plan allows the addition of solariums (S) on the ground and mezzanine levels.

1. Living room
2. Kitchen
3. Dining room
4. Mezzanine
5. Rooftop terrace

Source: Casault and Delisle, architects

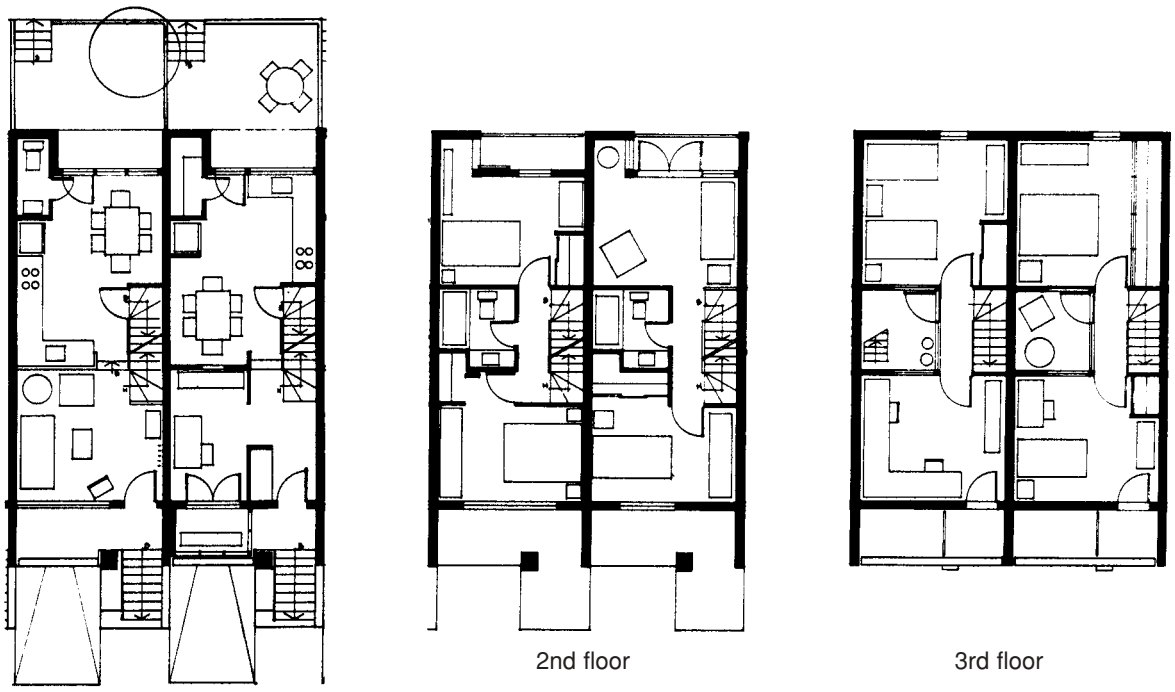
**Data sheet**

| | |
|---|---|
| Project: | Petites Maisons Delanaudière |
| Developer: | Building residents |
| Architects: | Casault and Delisle, architects |
| Builder: | Adhoc Construction |
| Project address: | 5178 Delanaudière, Montréal. QC |
| Housing type: | Single-family row housing |
| Number of units: | 2 |
| Number of floors: | 2 + basement + mezzanine |
| Unit size: | 139.0 m$^2$ |
| | Main floor: 38.5 m$^2$ |
| 2nd floor: | 48.0 m$^2$ |
| 3rd floor: | 12.5 m$^2$ (mezzanine) |
| Basement: | 40.0 m$^2$ |
| Key dimensions of each unit: | |
| Width: | 3.8 m |
| Depth: | 13.0 m |
| Key dimensions of lot: | |
| Width: | 3.8 m |
| Depth: | 22.4 m |
| Lot surface: | 85.1 m$^2$ |
| Market cost[7] of each unit, including lot, in 1995: | |
| Main floor, 2nd floor and lot: | $82,364 (before tax) |
| Mezzanine, stairway and terrace: | $5,000 (before tax) |
| Basement finishing: | $5,000 (before tax) |
| Use: | Condominium |
| Target clientele: | Young households |
| Construction year: | 1992 to 1998 |

Type of adaptability:

( • ) Upgradeable
( • ) Expandable
( • ) Divisible
( • ) Versatile
( ) Flexible

**Figure 2.9: Project version for the Art de vivre en ville national design competition**



Main floor

2nd floor

3rd floor

Furniture and appliance arrangements may vary from one home to the next.

Source: Casault and Delisle, architects.

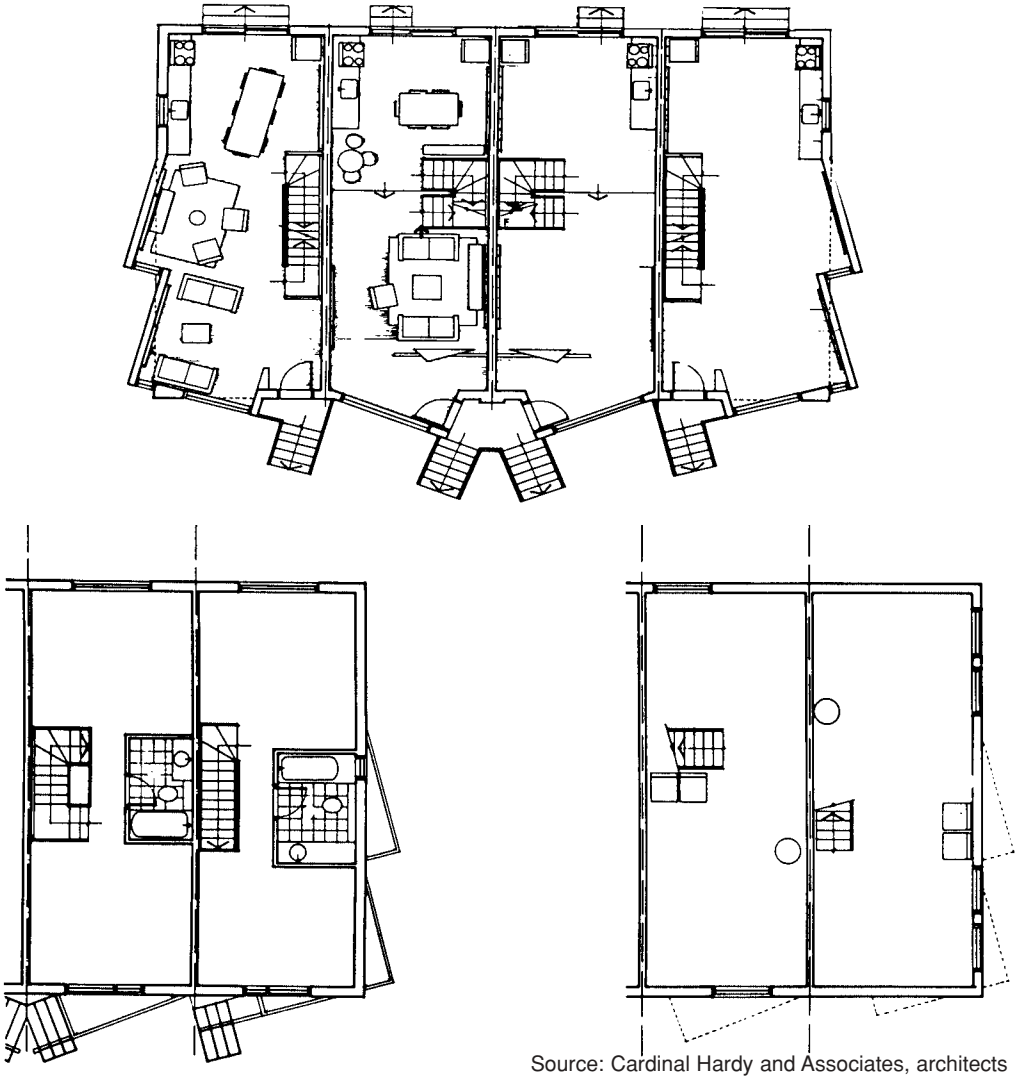
## Fonteneau Homes, Montréal

Developed for Operation Habiter Montréal, the Fonteneau project demonstrates new housing concepts to arouse young people's interest in living in Montréal.

The general layout of the Fonteneau project was inspired by the garden-city concept and by sustainable development objectives. The homes were designed for the needs and desires of young householders, enabling them to express their identities, become owners and take advantage of a natural outdoor setting. Located near Sherbrooke and Honoré-Beauregard streets in east-end Montréal, the project consists of 113 housing units, with 77 attached houses on common lots in the centre of the site and 36 semi-detached single-family dwellings on individual lots on the perimeter. The first group was offered as condominiums, the latter listed for private ownership.

Of the condominium homes, Model A (see Figure 2.10) provides a minimum-cost housing alternative. This upgradeable house consists of a two-storey row house with a basement and is designed for young households, with or without children, who in the future want to invest time and money adapting the home to their changing needs. The model features an open-concept floor plan, which may be partitioned in future. Only the sink and counter are provided in the kitchen, enabling residents to install appliances and storage space according to their personal needs or existing furniture, or in anticipation of future purchases. Model B (not illustrated) is a finished version of Model A, including habitable attic space.

**Figure 2.10: Plans for main floor, upper floor and basement of upgradeable home**



Source: Cardinal Hardy and Associates, architects

**Upgradeable features**

This open-concept design is inspired by the style of a traditional home (see Figure 2.11). It is actually a vertical loft, described by the architects as an expression of necessity. Abandoning plasterboard,[8] the traditional covering material, the interior architecture suggests visual expression through constituent materials: joists support the floor, concrete blocks provide soundproofing and fire protection as well as supporting the joists, a metal staircase links the three floors, solid wooden beams support the roof.

The architects did not intend to push the boundaries of research for low-cost housing but rather to achieve an aesthetically acceptable expression of minimalist architecture. They were looking for a minimal house to offer the maximum without appearing poorly built or unfinished.

To achieve this, they paid particular attention to finishing work. For example, concrete walls were treated with greater care than if they were to be hidden, wiring and plumbing were concentrated in certain areas and hidden by stained, finished birch plywood panelling, the frame was built with pine (superior quality material to spruce) and floors

**Figure 2.11: Architectural style of Fonteneau Homes**

Photo: Cardinal Hardy and Associates, architects.

were covered with hardwood. (See Figure 2.12 for a photo of the Model A main floor showing a concrete block wall, the plywood panel hiding wiring and plumbing installations, visible pine joists and hardwood flooring.)

*General considerations regarding affordability*
The sale price for an open-concept home is only slightly lower than that of a finished house. This is due to the features employed to avoid giving the open-concept home a poorly built or unfinished look. The small price discrepancy, together with the fact that some people do not feel capable of finishing their own homes, means that many buyers choose finished homes over upgradeable homes. Even so, upgradeable homes have generated some interest in housing which the occupant can personalize according to changing needs, without having to alter basic spaces or structure.

The architects felt it necessary to point out that building an extremely narrow home (Model A is four metres wide) does not mean substantial savings in construction costs. In fact, they believe the most influential factors in building a four or five metre-wide home are load-bearing walls,

**Figure 2.12: Model A main floor**

Photo: Cardinal Hardy and Associates, architects

electrical and mechanical installations, the main entrance, vestibule, kitchen and bathroom. On the other hand, they reported that building narrow houses may be justified where land is scarce or lot development costs are high (contaminated soils, for example), since land development-related costs for these homes can be distributed among a greater number of purchasers.

**Data sheet**

| | |
|---|---|
| Project: | Fonteneau Homes/Model A |
| Developer: | Le Groupe Capital de Montréal Inc. |
| Architects: | Cardinal Hardy and Associates |
| Builder: | Le Groupe Capital de Montréal Inc. |
| Project address: | Joseph A. Rodier Street, Montréal, QC |
| Housing type: | Single-family row housing |
| Number of units: | 12 |
| Number of floors: | 2 + basement |
| Unit size: | 143.0 m$^2$ |
| Main floor: | 61.6 m$^2$ |
| 2nd floor: | 40.7 m$^2$ |
| Basement: | 40.7 m$^2$ |
| Key dimensions of each unit | |
| Width: | 4 m |
| Depth: | 10.2 m |

Sale price for each unit, in 1991: $100,000 to $110,000[9] (before tax)

| | |
|---|---|
| Use: | Condominium |
| Target clientele: | Young households |
| Construction year: | 1991 to 1993 |

Type of adaptability:

( • ) Upgradeable
( ) Expandable
( ) Divisible
( ) Versatile
( ) Flexible

## Sprout: The Versatile, Dynamic House, Montréal

The design of this house, built near downtown Montréal, was inspired by a CMHC External Research Program study prepared by architect Sevag Pogharian in 1995. It is a row house that can accommodate up to three housing units (see Figure 2.13). The main house has four levels: the living room and kitchen are located on the main floor, with two bedrooms and a bathroom on the upper floor. An attic and a basement can become separate apartments. There is space to add a garage with a small, superimposed, two-storey apartment at the rear of the house (see Figure 2.14).

**Figure 2.13: Sprout: the Versatile, Dynamic House**

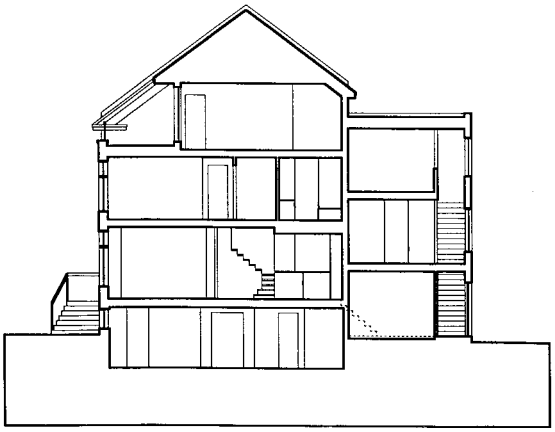
2.13a: Entrances to the two apartments located in the main house (top photo)
2.13b: Addition (bottom photo)

Photos: CMHC

**Upgradeable features**

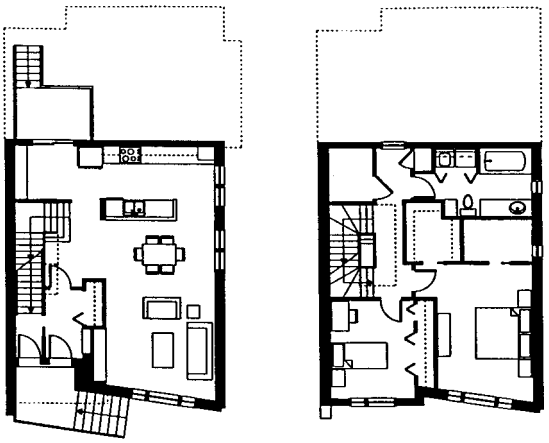
The basement and attic of the main house were designed to enable efficient finishing at a later date (figures 2.15 to 2.18). From the outset, floors were pre-wired for electricity and plumbing. The basement has been finished as a separate apartment with private entrance, while the attic is still unfinished. This area could become a playroom, work space or master bedroom, depending on the family's requirements.

**Figure 2.14: Cross-section of main house and addition**



Source: Sevag Pogharian, architect

**Figure 2.15: Initial phase**

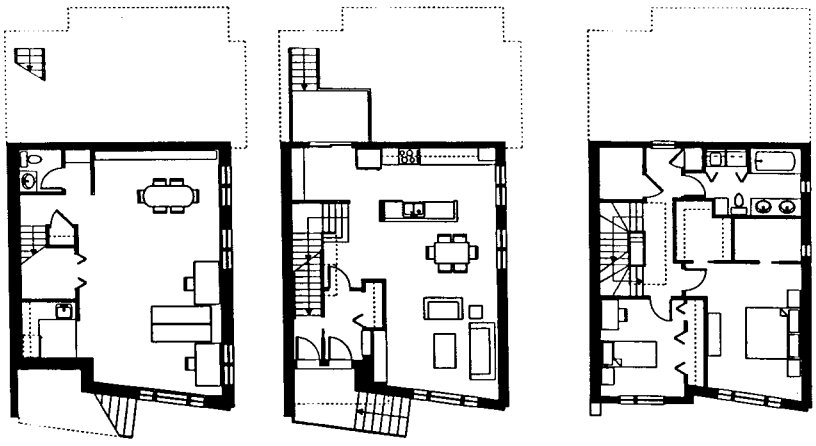


Main Floor 2nd floor

Initial phase: minimum interior development on the two floors. The apartment has two bedrooms with habitable surface area of only 130 m$^2$. The dotted line shows the planned location for the addition.

Source: Sevag Pogharian, architect

**Figure 2.16: Intermediate phase 1**

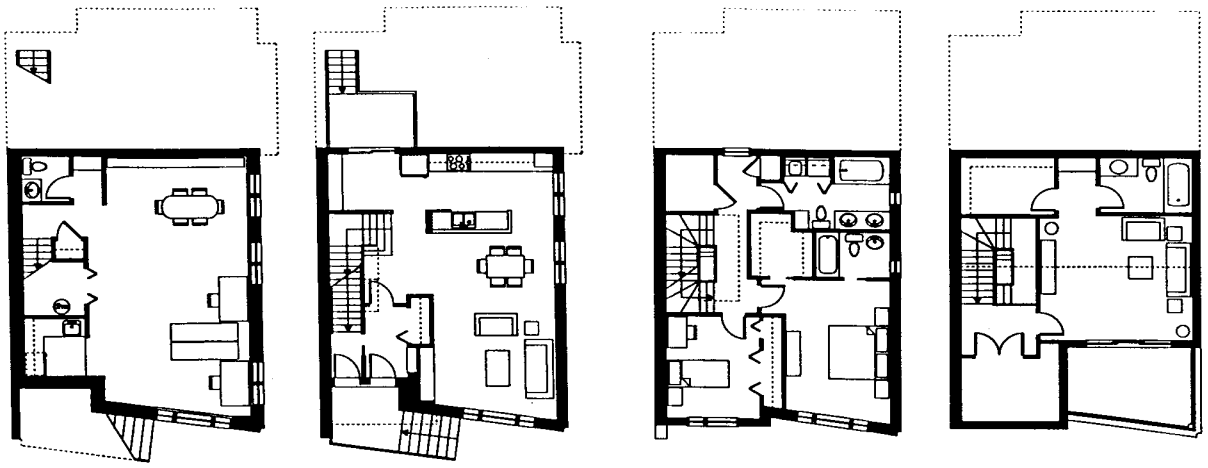


Basement Main floor 2nd floor

Intermediate phase 1: basement was converted into a professional office, and habitable surface area increased from 130 to 200 m$^2$. The dotted line shows the planned location for the addition.

Source: Sevag Pogharian, architect

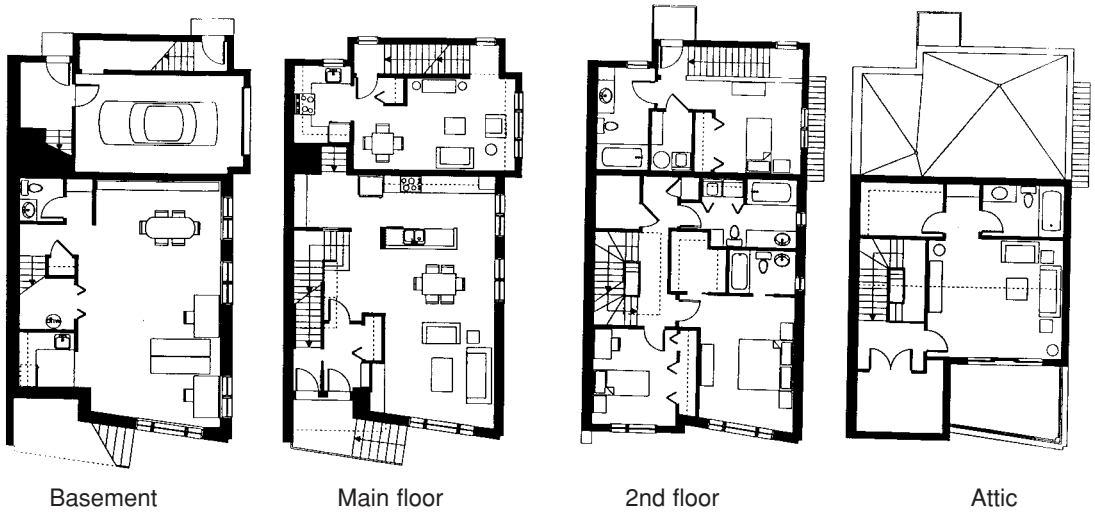
**Figure 2.17: Intermediate phase 2**




Intermediate phase 2: attic was converted into a family room, and habitable space increased from 200 to approximately 260 m$^2$. The dotted line shows the planned location for the addition.

Source: Sevag Pogharian, architect

**Figure 2.18: Last phase**




Last phase: garage and two-storey apartment were added at the rear of the main house and habitable living space increased from 260 m$^2$ to approximately 330 m$^2$.

Source: Sevag Pogharian, architect

**Expandable features**
The initial addition planned for the rear of the main house has been completed (see Figure 2.18). This addition enables the homeowner's mother to live near her family and yet maintain her privacy. Locating grandparents, parents and grandchildren in close proximity nurtures social life as well as making it easier to exchange services (caring for grandchildren, doing errands for seniors, driving parents to appointments, etc.).

**Divisible features**
In this house, the possibility of a private entrance to the basement is included in the design. The space can easily be converted into an extra apartment or remain part of the main house.

**Versatility**
The versatility of this home comes from its unfinished spaces, i.e. the basement and attic, which can be used for various functions.

**Data sheet**

| | |
|---|---|
| Project: | Sprout: the Versatile, Dynamic House |
| Developer, architect, builder: | Sevag Pogharian |
| Project address: | 3701 Saint Ambroise, Montréal, QC |
| Housing type: | Single-family row housing |
| Number of units: | 2 to 3 |
| Number of floors: | 2 + basement + attic |
| Unit size: | |
| • Main house: | 256.8 m$^2$ |
| • Main floor: | 62.4 m$^2$ |
| • 2nd floor: | 67.6 m$^2$ |
| • Attic: | 57.1 m$^2$ |
| • Basement: | 69.7 m$^2$ |
| Addition: | 109.9 m$^2$ |
| • Main floor: | 37.4 m$^2$ |
| • 2nd floor: | 35.1 m$^2$ |
| • Basement: | 37.4 m$^2$ |

Key dimensions of each unit
Main house:

| | |
|---|---|
| • Width: | 7.6 m |
| • Depth: | 9.7 m |
| Addition: | |
| 1.Width: | 4.9 m |
| 2.Depth: | 7.6 m |

Key dimensions of lot

| | |
|---|---|
| • Width: | 8.8 m |
| • Depth: | 28.4 m |
| Lot surface: | 249.9 m$^2$ |

Market cost[10] of each unit, including lot, in 1997:

- Main house, including two apartments: $163,000[11] (before tax)
- Addition: $39,500 (before tax)

Use: Private property and/or rental apartments
Target clientele: Varied
Construction year: 1997
Type of adaptability:

( • ) Upgradeable
( • ) Expandable
( • ) Divisible
( • ) Versatile
( ) Flexible

## Riverforks, London

This project (see Figure 2.19) was entered in the Flex Housing Design competition, sponsored by CMHC in 1996 to encourage new residential building ideas. Through this competition, CMHC hoped to encourage housing designs that could be easily adapted to the inhabitants' current and future needs, and to increase the awareness of consumers and the housing industry of the advantages of this type of housing.

**Figure 2.19: Three-dimensional drawing of the Riverforks home**

Source: Nicholas Varias, architect.

The Riverforks project won first prize in the individual or group apartment category, including semi-detached, "plex" and row housing. The Riverforks home was a three-storey semi-detached house (see Figure 2.20) to be built in London. A variation of it was built in Ottawa.

**Figure 2.20: Main facade of the Riverforks home**

Source: Nicholas Varias, architect

This home may take the form of a duplex or single-family dwelling and has two floors and an attic. The main floor may be used as an independent, two-bedroom apartment. These two bedrooms may also be used as an office when the main floor and second floor are combined to create a single-family dwelling (see Figure 2.21).

The single-family home (figures 2.21 and 2.22) has two bedrooms and can be enlarged. The same is true of the second floor apartment and attic (see Figure 2.23).

This house was also designed to meet Healthy Housing criteria and barrier free access regulations.

**Figure 2.21: Alternate main floor plans**

Alternate main floor plans showing possible layouts for this space as an independent apartment (drawing on left) or as part of a single-family dwelling (drawing on right)

1. Kitchen and dining area
2. Family room
3. Bathroom and laundry
4. Bedroom
5. Foyer
6. Space for future elevator
7. Office
8. Waiting room

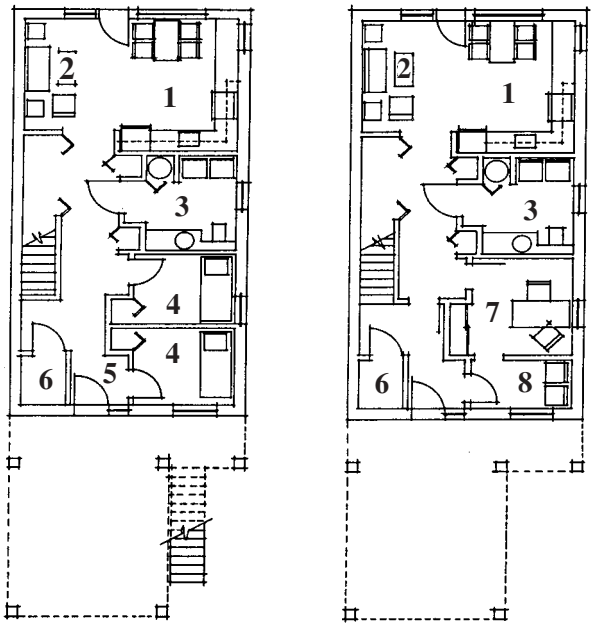



**Figure 2.22: Alternate plans for second floor**

Alternate plans for the 2nd floor showing potential layouts as an independent apartment (drawing on left) or as part of a single-family dwelling (drawing on right)

1. Bedroom
2. Bathroom
3. Kitchen and dining area
4. Living room
5. Entrance hall
6. Space for future
7. Elevator
8. Terrace
9. Reading area
10. Solarium

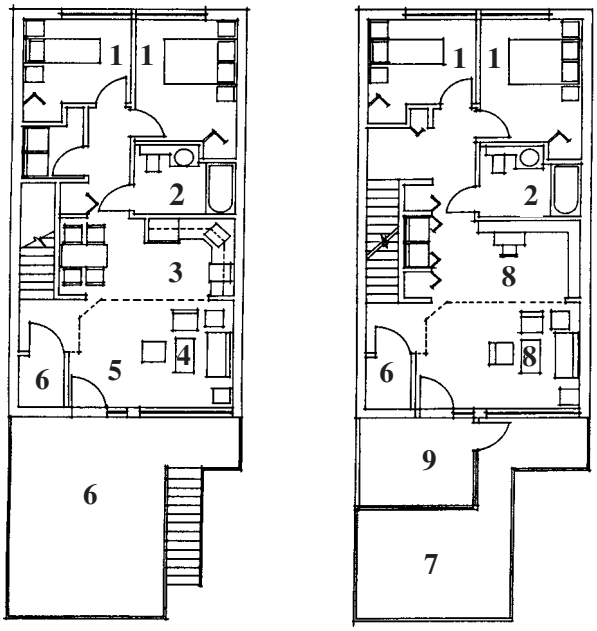
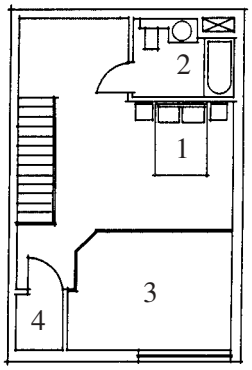


**Figure 2.23: Plan of attic**




Plan of attic, which may be connected to the second floor ("plex" version) or to the single-family dwelling. This space may serve a number of purposes: master bedroom, family room or work area.

I. Master bedroom
2. Bathroom
3. Opening to 2nd floor
4. Space for future elevator

Source: Nicholas Varias, architect

**Upgradeable features**
The upgradeable features of this house focus on the potential to finish the main floor and attic at a later date. Alterations would be simple, since these spaces have been pre-wired for electricity and plumbing during initial construction.

**Divisible features**
The divisible features of this house follow from the fact that it may be converted into a duplex or single-family dwelling without major construction (see figures 2.21 and 2.22).

**Versatility features**
The designer's occupation scenario, below, demonstrates the enormous versatility of this home.

Year 1: A young professional, Nicole, purchases the home with an unfinished attic space; she lives on the second floor and rents out the main floor to a young articling law student, Steven (Figure 2.24, Option A).

Year 2: Nicole and Steven become friends. They share the garden and have many activities in common; they fall in love and decide to marry. They open up the staircase between the main and upper floors (Figure 2.24, Option B).

Year 3: Since the couple no longer needs two vehicles, Steven sells his car and uses this money to convert part of the main floor into an office. Steven considers having his office at ground level an asset, since some of his clients use wheel chairs (Figure 2.24, Option B).

Year 4: A daughter, Elizabeth, is born. Nicole's mother moves in with the couple and cares for her grandchild while the parents are at work. Nicole and Steven finish the attic as their master bedroom (Figure 2.24, Option C).

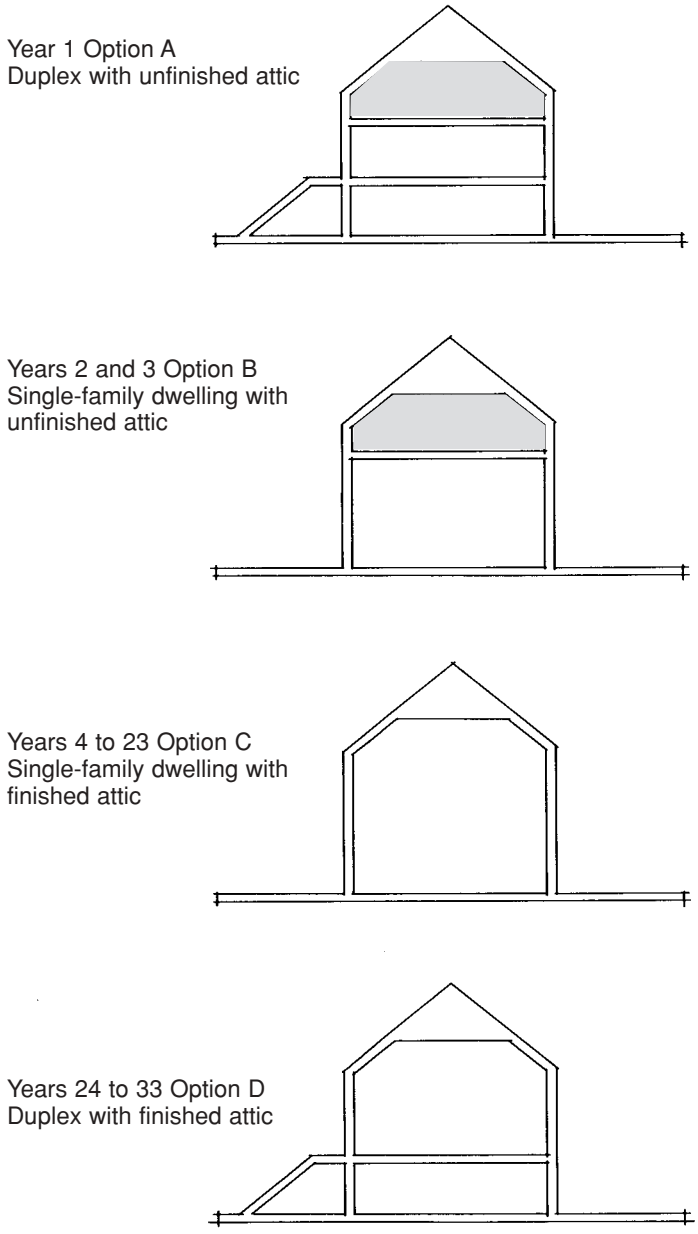
Year 24: Elizabeth is now 20 years old, her grandmother has passed away, and Steven has moved his office downtown. Her parents offer to let Elizabeth live on the main floor, which would give both her and her parents more privacy (Figure 2.24, Option D).

Year 26: Elizabeth leaves home to study in the United States. Nicole and Steven rent out the main floor to strangers and use the extra income to cover their daughter's tuition (Figure 2.24, option D).

Year 30: Elizabeth marries Peter and returns to her hometown. Nicole and Steven decide to help the young couple by offering them the main floor (Figure 2.24, Option D).

Year 33: Elizabeth and Peter become the parents of a little boy, Frank. Nicole and Steven offer the upstairs apartment to the couple, since it is now too large for the grandparents' needs. The new grandparents are happy to move closer to the garden and still continue to share the home with their daughter, her husband and their beloved grandson (Figure 2.24, Option D).

**Figure 2.24: Schematic of various uses of home over 33 years**




**Flexible features**

The flexibility of this home comes mainly from its use of open-web floor joists and suspended ceilings. This type of construction facilitates installation of mechanical and electrical systems and the use of non-load-bearing partitions. These construction elements allow alteration of the floor plans without affecting structural integrity. Flexibility was also built in to enable the addition of new, technologically advanced systems related to health, safety, efficiency, comfort or working in the home. In this regard, note the space reserved for the addition of an elevator in the main facade of the building (see figures 2.21 to 2.23).

**Data sheet**

| | |
|---|---|
| Project: | Riverforks |
| Developer: | New Development Corporation |
| Architect: | Nicholas Varias |
| Builder: | not built |
| Project address: | London, ON |
| Housing type: | Semi-detached[12] |
| Number of units: | 2 |
| Number of floors: | 2 + attic |
| Unit size: | 247.4 m$^2$ |
| Main floor: | 69.4 m$^2$ |
| 2nd floor: | 69.4 m$^2$ |
| Basement: | 69.4 m$^2$ |
| Attic: | 39.2 m$^2$ |
| Key dimensions of each unit | |
| Width: | 5.8 m |
| Depth: | 11.7 m |
| Key dimensions of lot[13] (one house) | |
| Width: | 53.1 m |
| Depth: | 7.1 m |
| Lot surface: | 377 m$^2$ |

Anticipated sale price for single-family units,[14] including lot: $139,760 (before tax)

Use: Plex type private property and/or rental apartments
Target clientele: Varied
Construction year: 1996 (not built)
Type of adaptability:

( • ) Upgradeable
( ) Expandable
( • ) Divisible
( • ) Versatile
( ) Flexible

## Adaptable House, Montréal

The concept of the adaptable house (Figure 2.25) is based on authors Jocelyn Duff and Terrence Dawes' 1992 study of wartime houses. The authors feel that the lessons learned from the study (growth through side and rear additions, basement and attic space) can be applied to the property ownership problems experienced by young households today. Fifty years later, this adaptable house project is also an attempt to rationalize the use of space, materials and resources.

**Figure 2.25: Potential for side addition**

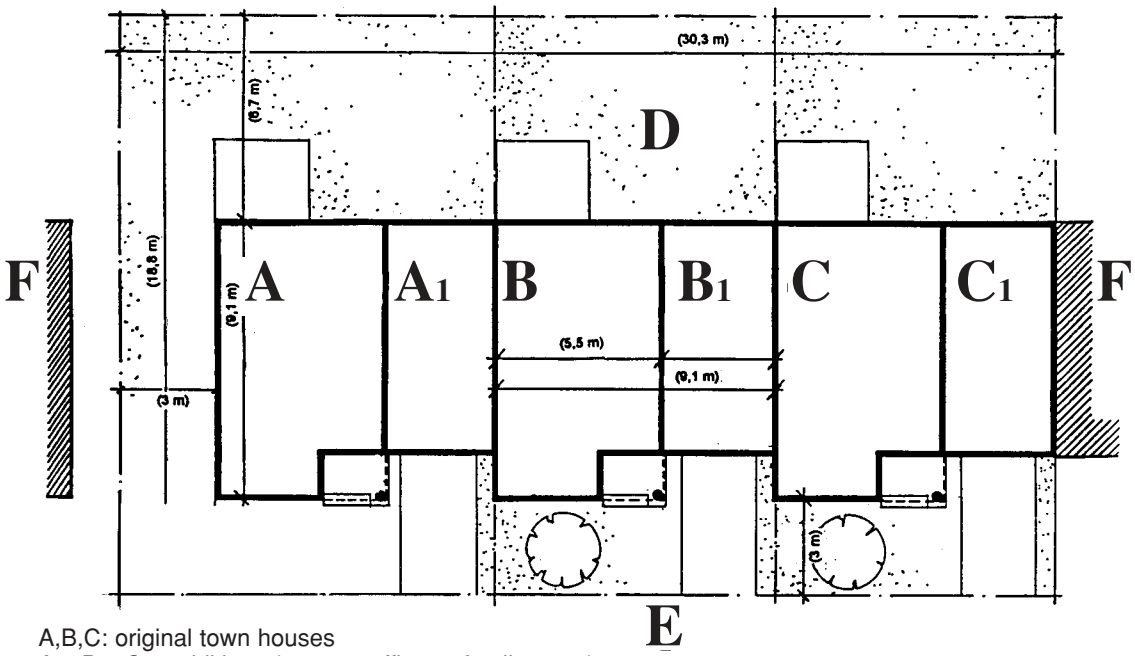
The distinctive feature of the adaptable house is its potential for a side addition. As shown, this feature allows the house to preserve its individual appearance when built as a row house.

Source: Jocelyn Duff, architect.

The original house (Figure 2.26) was 5.5 m wide, the minimum width permitted for a privately owned home in Montréal. The house was built on a lateral edge of the 9.1 m-wide lot, leaving 3.6 m of free space on one side for a future addition. The house was designed for one of the shallow lots in the Tétraultville neighbourhood, bordering downtown Montréal.

The walls and roof were constructed of self-bracing waferboard panels infused with isocyanurate insulation. This method enables elimination of on-site frame construction and wall insulation. Panels fit together at the sides and are light enough to be handled by two people. This system has a number of interesting possibilities for young do-it-yourselfers who want to reduce housing costs.

**Figure 2.26: Layout options for three units**




A,B,C: original town houses
A1, B1, C1: additions (garage, office or family room)
D: Yard
E: Street
F: Existing neighbouring homes

Source: Jocelyn Duff, architect

As proof, this house was erected for a home show without specialized equipment or labour. The exterior walls and roof went up in four hours with no residual construction waste on the site.

**Upgradeable features**

The owner can finish the basement and attic at a later date, according to needs and finances. The attic (Figure 2.27), reached initially by a pull-down ladder, can be converted into a mezzanine, a medium-sized separate room or a large room (see Figure 2.28). The self-bracing roof panels and laminated wooden ridgeboard are used to keep this space completely uncluttered (Figure 2.29).

**Expandable features**

The original house has two floors with a surface area of 92 square metres. A garage or new habitable room may be added to the side on the vacant portion of the lot (see Figure 2.26). The loss of yard space is compensated for by construction of a private rooftop terrace on the addition.

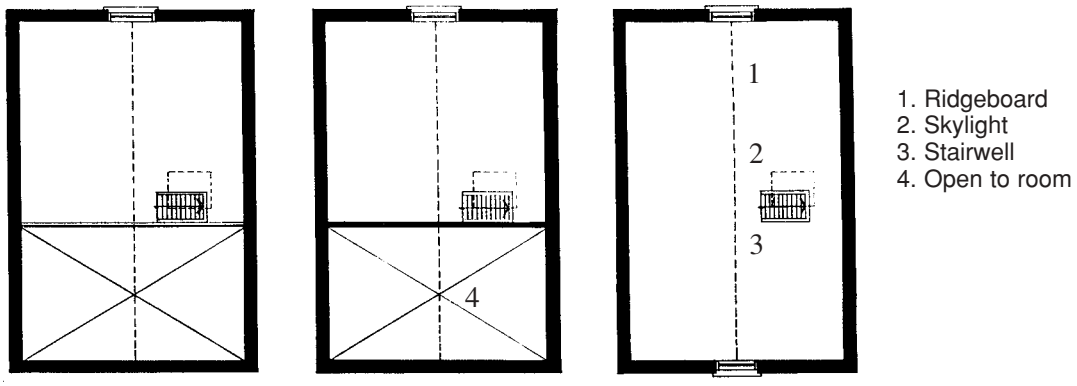
**Versatility features**

The attic (Figure 2.28) and main floor (Figure 2.30) of this house may be interpreted in a number of ways. For example, an insulated garage door with a window enables easy conversion of the garage into habitable space (Figure 2.31).

**Figure 2.27: Pull-down ladder to attic**

Source: Jocelyn Duff, architect.

**Figure 2.28: Attic options**

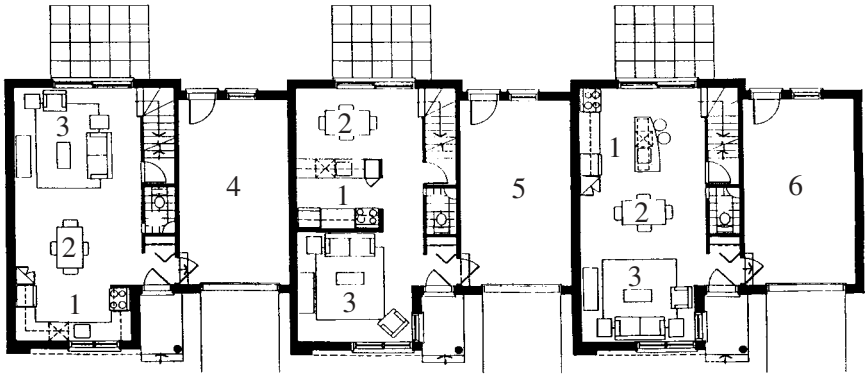



Source: Jocelyn Duff, architect

**Figure 2.29: Self-bracing roof panels and laminated wooden ridgeboard open attic space**

Source: Jocelyn Duff, architect.

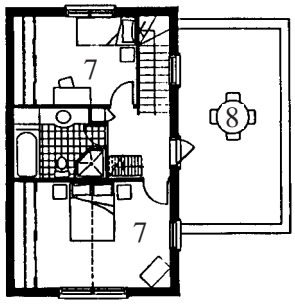
**Figure 2.30: Main floor plan**




Option
Living room
Dining room
Kitchen

Option
Dining room
Kitchen
Living room

Option
Kitchen
Dining room
Living room




The open-concept main floor plan allows buyers to adapt living spaces to their tastes and requirements; standard upper floor plan.

1. Kitchen
2. Dining room
3. Living room
4. Office/Workshop
5. Family room
6. Garage
7. Upstairs bedroom
8. Rooftop terrace

Source: Jocelyn Duff, architect

**Figure 2.31: Potential for growth**

Photo: Jocelyn Duff, architect.

Potential for sideways growth gives the addition another advantage because of its nearness to the sidewalk and street. A windowed, insulated garage door allows this area to be converted into living space, office or garage in very little time.

**Figure 2.32: View of kitchen**

Photo: Jocelyn Duff, architect.

View of the kitchen, which owners have chosen to locate in the front.

### Flexibility features

Single-span open-web floor joists allow full overhead clearance in the main floor living area. These joists facilitate installation of wiring and ducting. The open-concept layout in the original plan allows purchasers to adapt living areas to their lifestyles and tastes (Figure 2.32).

**Data sheet**

| | |
|---|---|
| Project: | Adaptable House |
| Developer: | Hébert and Tremblay |
| Architect: | Jocelyn Duff |
| Builder: | not built |
| Project address: | Duscheneau Street, Montréal, QC |
| Housing type : | Zero setback/Row housing |
| Number of units: | 3 |
| Number of floors: | 2 + basement + attic |
| Unit size: | 163.7 m$^2$ |
| Main floor: | 44.3 m$^2$ |
| 2nd floor: | 47.7 m$^2$ |
| Attic | 44.3 m$^2$ |
| Addition: | 27.4 m$^2$ |

Key dimensions of each unit

| | |
|---|---|
| Width: | 5.5 m to 9.1 m |
| Depth: | 9.1 m |

Key dimensions of lot

| | |
|---|---|
| Width: | 9.1 m |
| Depth: | 18.8 m |
| Lot surface: | 171.1 m$^2$ |

Anticipated sale price[15] for units, including lot: $105,000 (before tax)

Use: Private property

Target clientele: Young households

Construction year: 1996 (not built)

Type of adaptability:

( • ) Upgradeable
( • ) Expandable
( ) Divisible
( • ) Versatile
( • ) Flexible

## The Wickman - Habitat for Humanity Flex House, Edmonton

Like the Riverforks project, Edmonton's The Wickman - Habitat for Humanity Flex House was designed for the Flex Housing Design competition, sponsored by CMHC in 1996.

The Wickman - Habitat for Humanity Flex House project won first prize in the individual homes category. The design was for a single house which could be enlarged in various phases by adding one or more extras in the space between the original house and the garage (Figure 2.33). The original house featured two levels and a basement. The open-concept main floor (Figure 2.34) had a kitchen, dining room and living room. On the upper floor (Figure 2.35) were three bedrooms and two bathrooms. The breezeway connecting the house to the garage could be used as an office or studio. This space also had a bathroom and rooftop terrace.

The house is entirely barrier-free and meets Healthy Housing criteria.

This house was designed to be built in Balwin, an affordable district of downtown Edmonton.

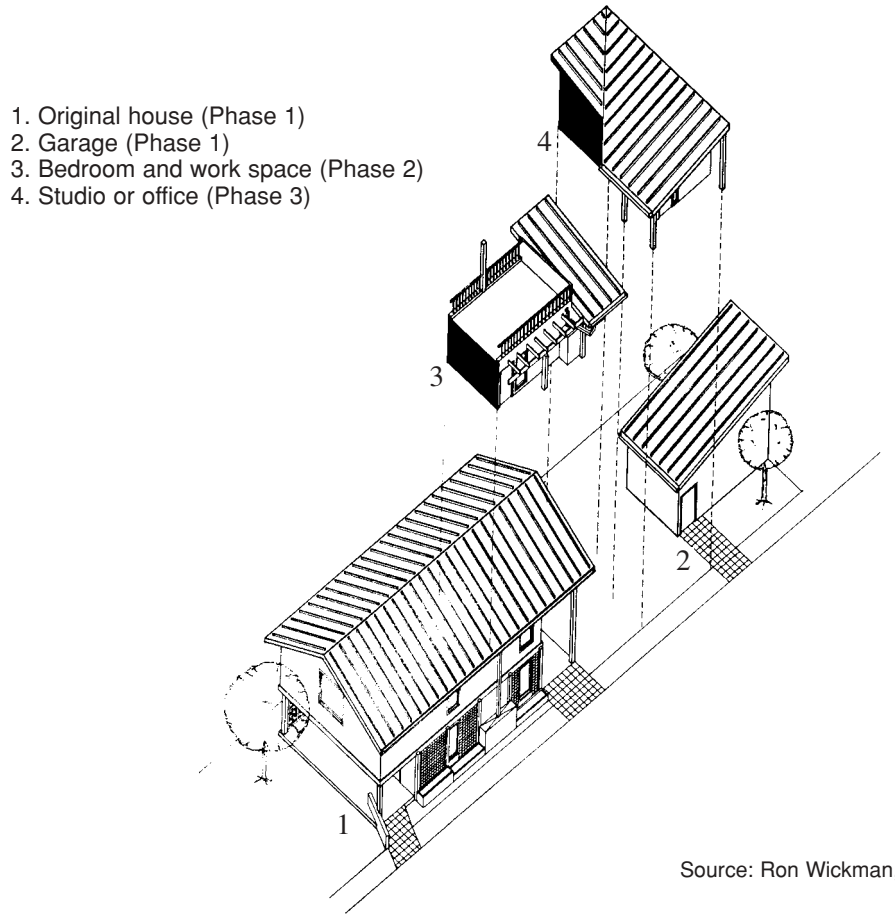
**Expandable features**

The expandable features of this house provide potential for enlargement in various phases, according to the needs and finances of the family (figures 2.34 to 2.37).

**Divisible features**

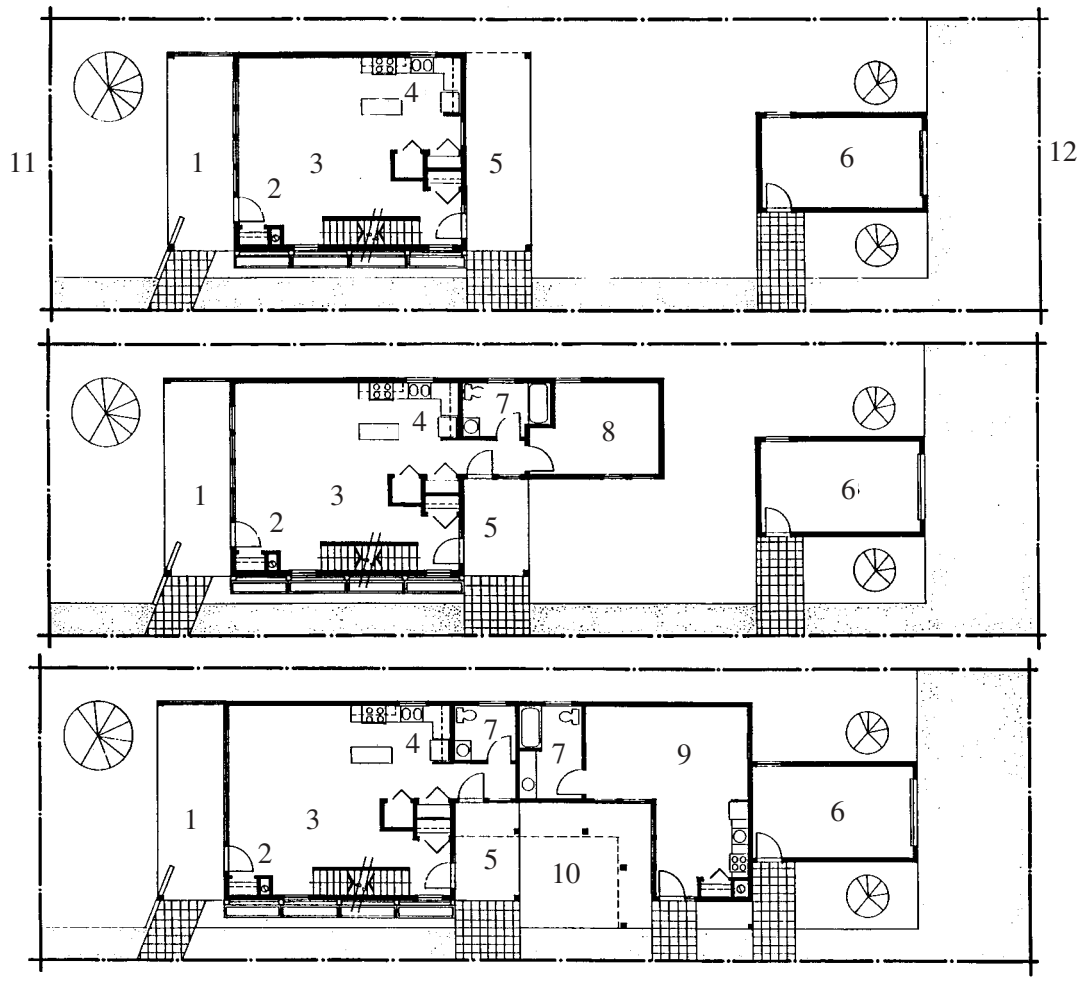
The divisible features of this home allow it to be converted into living quarters with office or two separate apartments, without involving major work.

**Figure 2.33: Axonometric diagram with possible additions to original house**




Source: Ron Wickman, architect

**Figure 2.34: Main floor plans**




Main floor plans showing how the project can be completed in three successive phases.

1. Porch
2. Entrance hall
3. Living/dining room
4. Kitchen
5. Patio
6. Garage
7. Bathroom
8. Bedroom or work space
9. Office or studio
10. Yard
11. Street
12. Alley

Source: Ron Wickman, architect

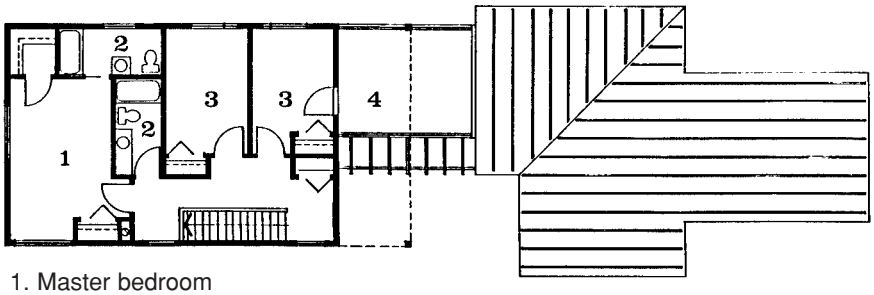
**Versatility features**

The versatility of this home is mainly due to the open-concept main floor of the original house, which allows users to arrange furniture within this space in various ways. The addition and basement are also extremely flexible, since they can be used for a wide range of purposes.

**Data sheet**

| | |
|---|---|
| Project: | Cœur de la ville |
| Developer: | Finalta Designs Inc. |
| Architect: | Ron Wickman |
| Builder: | not built |
| Project address: | Balwin district, Edmonton, AB |
| Housing type: | Detached home |
| Number of units: | 1 or 2 |
| Number of floors: | 2 + basement |
| Unit size: | |
| Original house: | 194.6 m |
| Main floor: | 5.8 $m^2$ |
| 2nd floor: | 77 $m^2$ or 93.8 $m^2$ |
| Basement: | 58.8 $m^2$ |
| • Addition: | 122.3 m |
| Main floor: | 51.1 $m^2$ |
| Basement: | 51.1 $m^2$ |
| Garage: | 20.1 $m^2$ |

**Figure 2.35: Upper floor plan, phase 3**



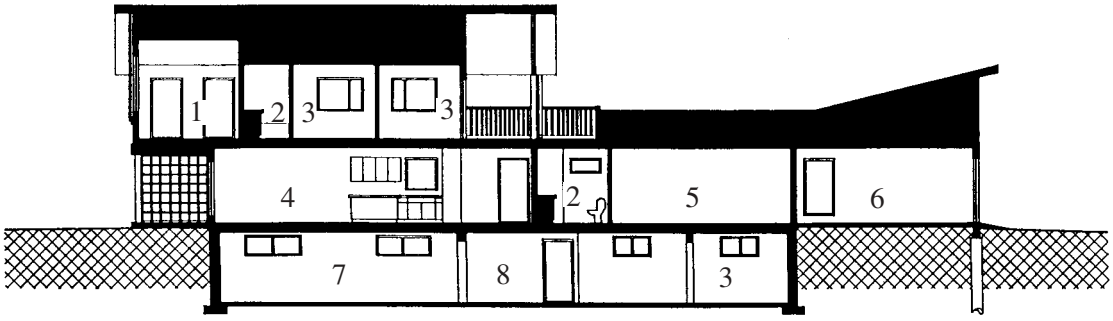

1. Master bedroom
2. Bathroom
3. Bedroom
4. Rooftop terrace

Source: Ron Wickman, architect (scale 1:250).

**Figure 2.36: Perspective showing the interior courtyard of the finished home**

Source: Ron Wickman, architect

**Figure 2.37: Longitudinal cross-section of the house, once Phase 3 is finished**




1. Master bedroom
2. Bathroom
3. Bedroom
4. Living/dining room
5. Office or studio
6. Garage
7. Family room
8. Storage space

Source: Ron Wickman, architect

Key dimensions of each unit
3.Original house
Width: 7.0 m
Depth: 8.4 m
4.Addition
Width: 3.5 to 7 m (variable)
Depth: 11.1 m
Key dimensions of lot
Width: 10.7 m
Depth: 36.6 m
Lot surface: 391.6 $m^2$

Anticipated sale price for single-family units,[16] including garage and lot: $122,500 (before tax)
Anticipated sale price, after Phase 2: $152,500 (before tax)
Anticipated sale price, after Phase 3: $182,500 (before tax)
Use: Private ownership
Target clientele: All types of families
Construction year: 1996 (not built)
Type of adaptability:
( ) Upgradeable
( • ) Expandable
( • ) Divisible
( • ) Versatile
( ) Flexible

## Europa Town Homes, Phase 1, Outremont

This group consists of eight townhouses built in a former industrial zone on Querbes Street in Outremont. The houses are relatively narrow (4.6 m), three-storey buildings. The forward portion of the main floor may be used for a variety of purposes, as may the rear garage.

The second floor contains the living room, dining room, kitchen and large patio above the garage entrance. The third floor may be converted into two or three bedrooms. Figure 2.38 shows various angles of the facades of the eight Europa Town Home units. Figure 2.39 displays the second floor terraces at the rear of the eight homes. Access to the backyard is via a gateway entrance and the garage doors are located beneath the terraces.

**Figure 2.38: Facades of the eight Europa Town Home units**

Photo: Boutros + Pratte, architects.

**Figure 2.39: Second floor terraces at the rear of the eight houses.**

Photo: Pierre Teasdale, architect.

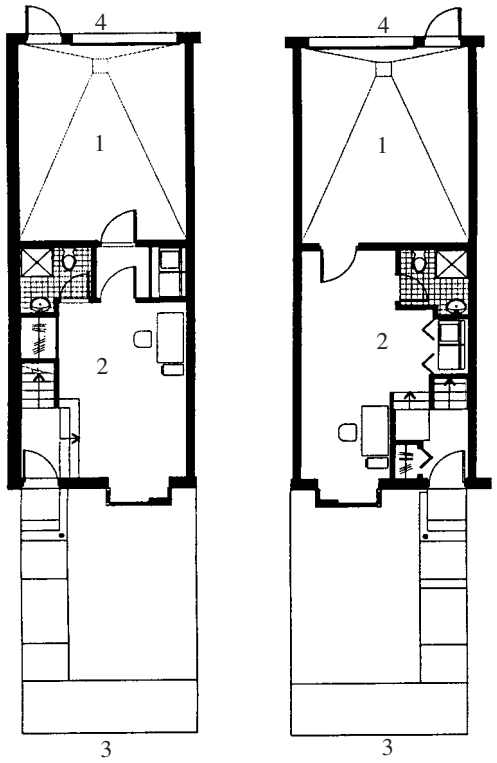
**Upgradeable feature**
The main floor of the home (Figure 2.40) may be finished, since it can be isolated from the rest of the house and since the main living areas are on the second and third floors.

**Versatility features**
This house is extremely versatile on all levels, especially on the main floor. This level may serve a number of purposes (see Figure 2.40), for example:

- family room in the front and garage at the rear;
- office in the front and garage in the rear;
- office filling entire main floor; or
- studio filling entire main floor.

Much of the versatility of these units comes from the architects' decision to move the space generally reserved for the basement (the multipurpose area) to ground level (Figure 2.41) This makes the space more accessible and more habitable (due to ample window space) than it would be if half-buried. Furthermore, placing the garage at ground level eliminates the need for vehicle ramps and maximizes useable horizontal exterior surfaces at the back of the house.

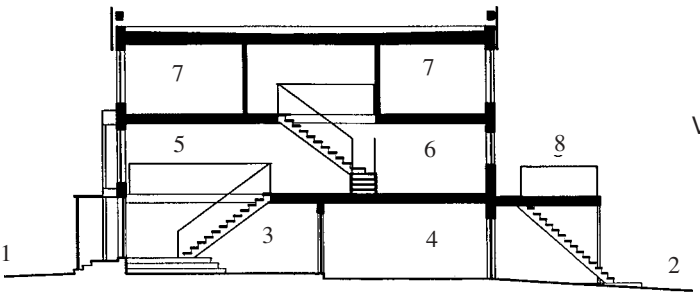
**Figure 2.40: Plans of various main floor options**




1. Garage
2. Family room or office
3. Sidewalk
4. Backyard

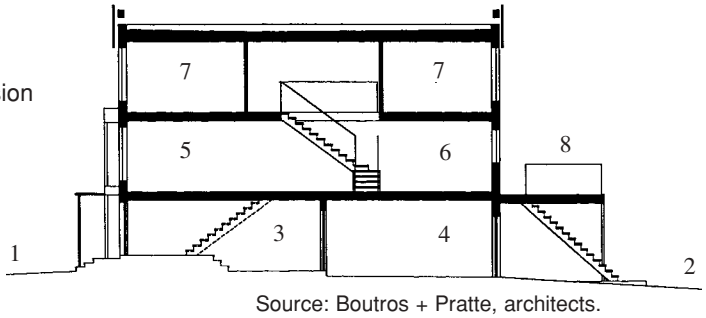
Source: Boutros + Pratte, architects

**Figure 2.41: Longitudinal cross-section of the house**




Version with mezzanine living room

Version with full size living room

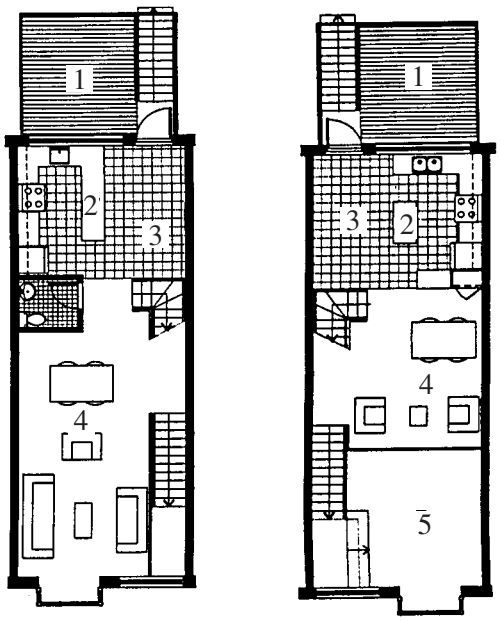



1. Street
2. Backyard
3. Family room or office
4. Garage, workshop or office extension
5. Living/dining room
6. Kitchen
7. Bedroom
8. Terrace

Source: Boutros + Pratte, architects.

The second floor layout (see Figure 2.42) varies from one residence to the next: some use all available floor space while others use this floor as a mezzanine to create a two-storey vertical space rising from the main floor at the front of the house. There are also some variations in kitchen and dining room layouts on the second floor.

**Figure 2.42: Second floor layouts with or without mezzanine**




1. Terrace
2. Kitchen
3. Breakfast nook
4. Living/dining room
5. Open to main floor

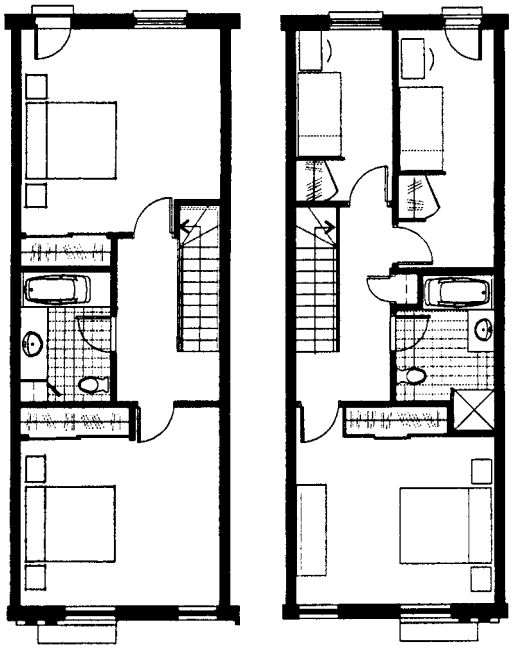
Source: Boutros + Pratte, architects

The third floor layout (see Figure 2.43) varies with respect to the number of bedrooms. Some residents have chosen to build three bedrooms, while others opt for only two.

### Flexibility features

Single-span open-web floor joists disengage the entire main-floor living space. These joists permit easy installation of wiring and ducting. The open-concept plan enables homebuyers to arrange living spaces according to their lifestyles and tastes (see figures 2.40, 2.42 and 2.43).

**Figure 2.43: Two arrangements for the third floor**



Source: Boutros + Pratte, architects

This flexibility also facilitates the installation of new, technologically advanced systems related to health, safety, efficiency, comfort and working in the home.

### General affordability

Building eight, 4.6 m-wide homes rather than seven 5.26 m-wide homes on this 36.8-m lot enables distribution of land-related expenses to a greater number of purchasers and reduces the cost of each house by several thousand dollars.

Building three floors above ground instead of the usual two and a half adds value to each home despite the additional expense of extra exterior finishing and larger windows.

**Data sheet**

| | |
|---|---|
| Project: | Europa Town Homes, Phase 1 |
| Developer: | Jean-Pierre Houle |
| Architect: | Boutros + Pratte |
| Builder: | Jean-Pierre Houle |
| Project address: | 900-914 Querbes, Outremont, QC |
| Housing type: | Row housing |
| Number of units: | 8 |
| Number of floors: | 3 |
| Unit size: | 168.0 $m^2$ |
| Main floor: | 56.0 $m^2$ |
| 2nd floor: | 56.0 $m^2$ |
| 3rd floor: | 56.0 $m^2$ |

Key dimensions of each unit

| | |
|---|---|
| Width: | 4.6 m |
| Depth: | 13.0 m |

Key dimensions of lot

| | |
|---|---|
| Width: | 4.6 m |
| Depth: | 24.5 m |
| Lot surface: | 112.7 $m^2$ |

Unit sale price[17] in 1997: $150,000[18] (before tax)
Use: Private ownership with right of way for parking lot access
Target clientele: Varied
Construction year: 1997
Type of adaptability:

( • ) Upgradeable
( ) Expandable
( ) Divisible
( • ) Versatile
( • ) Flexible

## Adaptable Townhouses, Montréal

Like the Petites Maisons Delanaudière, these two, narrow urban in-fill homes are built on a standard 7.6-m lot. For many years, the designers have been searching for the most imaginative way to use limited urban space. They also intended to create interior spaces which were adaptable to changing and varied needs of urban dwellers.

Two model homes were built for the 1995 Montréal Home Show. These were later disassembled and relocated on Saint Denis Street, near downtown Montréal (see Figure 2.44). This operation was made easier by the structural sandwich-board construction of the houses. The panels were composed of concrete poured into a permanent polystyrene frame, reinforced by steel rods. Concrete floor slabs were laid over open-web steel joists. The acoustical and fire protection properties of this method of construction are advantageous for in-fill construction in high-density urban settings. Each house has three floors (see Figure 2.45). The main floor houses the kitchen, dining room, living room and a small bathroom. The second floor consists of a mezzanine at the front of the house. The mezzanine has two rooms that may be separated or combined using a sliding door. The third floor contains the master bedroom, a large bathroom and laundry room.

### Versatility features

This house would suit a wide range of consumers (young families, childless couples, singles). Many of its spaces are multipurpose (bedroom, office, workshop, etc.). This versatility is especially evident on the main floor and mezzanine, as shown in the Figure 2.45 scenarios. If we look at the plans, it is also easy to envision construction of an extra bedroom on the third floor by reducing the size of the bathroom and moving it to the centre of the house.

### Flexibility features

The flexibility of this home is apparent mainly on the mezzanine level (figures 2.46 and 2.47) where sliding doors enable the two spaces to be separated or combined, as required. This is an extremely simple mechanism that significantly increases the home's adaptability. Use of open-web steel joists also facilitates the horizontal installation of electrical and mechanical systems. However, prefabricated concrete block construction (with slabs and panels) is more expensive than wood frame construction and offers less vertical flexibility.

**Figure 2.44: View of main facade**

Main facade of the semi-detached houses from Saint Denis Street.

Source: Jocelyn Duff, architect.

**Figure 2.45: Plans for each level of the house**


Plans for each level of the house and a description of possible uses for some of the rooms.

Main floor

Living room or workshop
Dining room
Breakfast nook
Bathroom

2nd floor

Office or family room
Bedroom or office
Laundry

3rd floor

Bedroom
Bathroom[19]

Source: Jocelyn Duff, architect

**Data sheet**

| | |
|---|---|
| Project: | Adaptable townhouses |
| Developer: | Government-private sector partnership (City of Montréal, Polycrete and Vincent Guyon) |
| Architect: | Jocelyn Duff |
| Builder: | Vincent Guyon |
| Project address: | 5572 and 5574 Saint Denis, Montréal, QC |
| Housing type: | Row housing |
| Number of units: | 2 |
| Number of floors: | 3 |
| Unit size: | 97.6 m$^2$ |
| Main floor: | 36.6 m$^2$ |
| 2nd floor: | 24.4 m$^2$ (mezzanine) |
| 3rd floor: | 36.6 m$^2$ |

Key dimensions of each unit

| | |
|---|---|
| Width: | 3.8 m |
| Depth: | 11.6 m |

Key dimensions of lot

| | |
|---|---|
| Width: | 3.8 m |
| Depth: | 21.3 m |
| Lot surface: | 80.9 m$^2$ |

Unit sale price in 1995: $109,000[20] (before tax)
Use: Condominium
Target clientele:Varied
Construction year: 1995
Type of adaptability:

( ) Upgradeable
( ) Expandable
( ) Divisible
( • ) Versatile
( • ) Flexible

**Figure 2.46: Mezzanine as combination child's bedroom and playroom**

Photo: Jocelyn Duff, architect.

**Figure 2.47: Mezzanine used as a combined office and reading room**

Photo: Jocelyn Duff, architect.

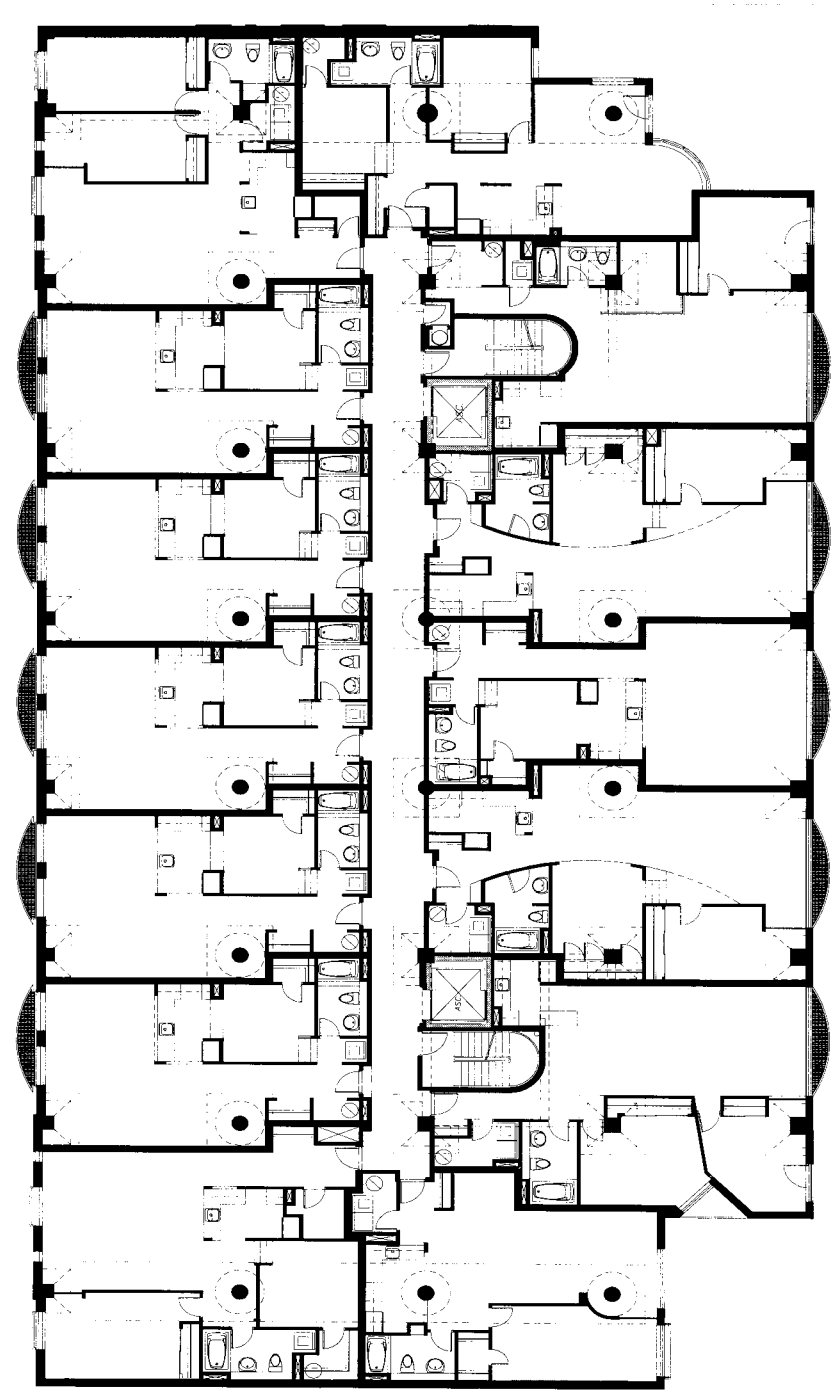
## Quai de la Commune, Montréal

This project is at the intersection of de la Commune and des Sœurs-Grises streets (Figure 2.48), in the Faubourg des Récollets district near Montréal's Old Port. It is a six-storey industrial building that has been recycled as an apartment building with 80 apartments lined up back-to-back along a hallway serviced by two elevators (Figure 2.49). This industrial building (Figure 2.50) differs from traditional apartment buildings because of the ceiling heights (3.7 m on the main floor and 3.3 m on the upper floors) and the "bulk" design of many of the apartments. The apartments are in fact hybrid lofts, or semi-finished apartments, halfway between traditional apartments (finished environment) and traditional lofts (rough environment). Apartment sizes vary from 76 to 113 square metres, and layouts are relatively open-concept style, with the exception of the bathroom. The floor of the area reserved for sleeping is usually raised by 800 mm to help differentiate this space and give it some privacy (figures 2.51 and 2.52).

**Figure 2.48: View of des Sœurs-Grises facade from de la Commune Street**

Photo: Cardinal Hardy and Associates, architects

**Figure 2.49: Typical floor plan**



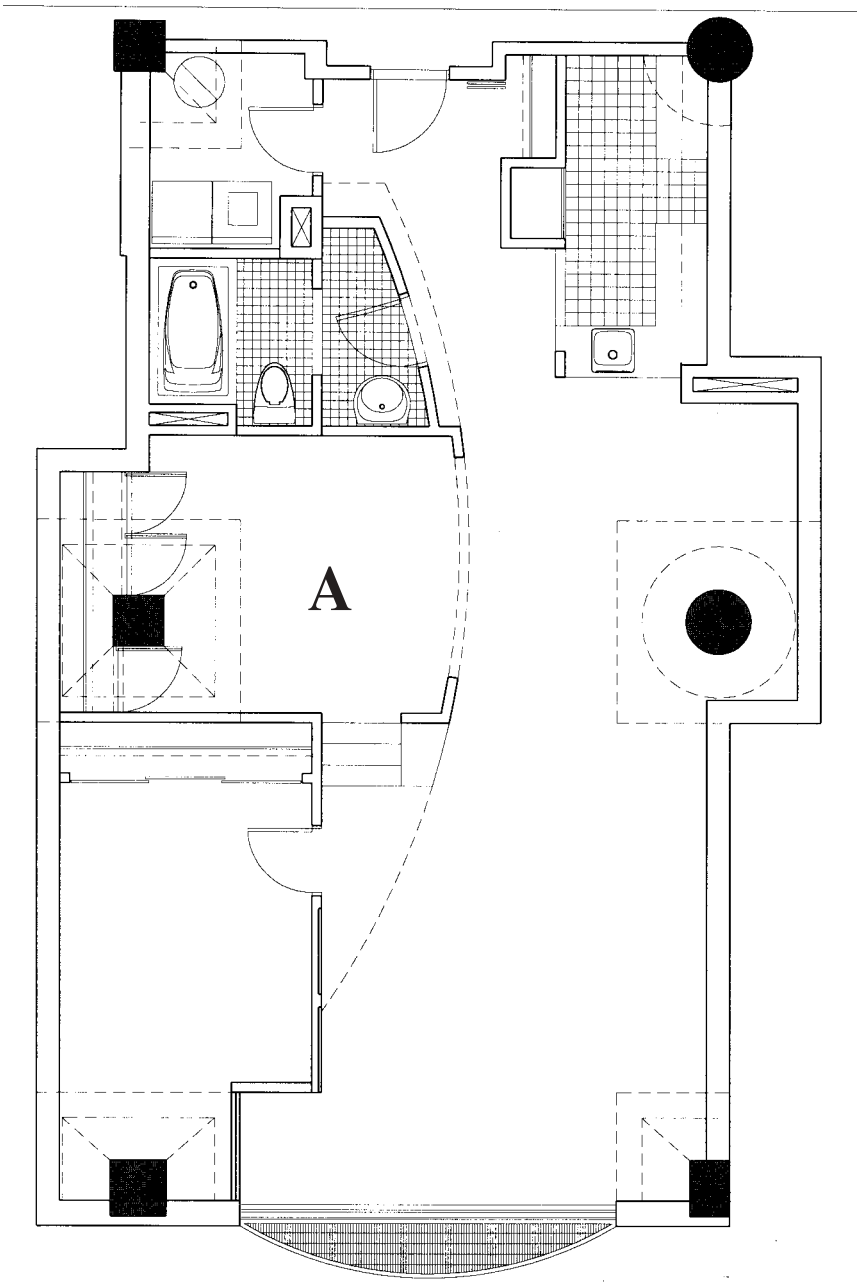
Source: Cardinal Hardy and Associates, architects

**Figure 2.50: Different from traditional apartment buildings**

This industrial building differs from traditional apartment buildings in the height of its ceilings and its structural strength.

Photo: Cardinal Hardy and Associates, architects.

**Figure 2.51: Raised sleeping area**




The area reserved for sleeping (A) is usually raised 800 mm and enclosed with a short wall, helping to differentiate this space and giving it some privacy.

Source: Cardinal Hardy and Associates, architects

**Figure 2.52: Sleeping platform with glass blocks**

In this instance, the sleeping platform is raised and surrounded by a glass block partition.

Photo: Yves Belley

**Figure 2.53: Combining two floors**

Floor opening enables two superimposed units to be combined via a spiral staircase.

Photo: Pierre Teasdale, architect.

**Expandable features**

Some residents, who needed more space for a single apartment, chose to combine two neighbouring units, sometimes on the same floor, sometimes using the floor above (see Figure 2.53). Obviously, expansion is easier to manage in the planning stages than after the work is complete. In fact, once the neighbouring units are occupied, this potential could completely disappear. Other than this restriction, such adaptability enables buyers to purchase more customized housing than that offered by traditional apartment buildings.

**Divisible features**

Given the existing mechanical and electrical infrastructure on each floor, any apartment resulting from the combination of two other apartments can be re-divided without major work.

**Versatility features**

The open-concept layout of these apartments offers greater versatility than any other type of housing, allowing room for the owner's creativity (Figure 2.54). This versatility seems to suit people who want a custom home but who do not want to live in the "habitable box" with low ceilings and narrow rooms that some feel is typical of apartment buildings. However, versatility increases or decreases with apartment size. In fact, without partitions, buffer zones have to be introduced into the open-concept plans to differentiate space. Here, given the relatively limited size of the apartments, the architects had the ingenious idea of using spatial height by

**Figure 2.54: Versatility of open concept**

The open-concept layout of these apartments, more than any other type of housing, offers the versatility to give free reign to an occupant's creativity.

Photo: Cardinal Hardy and Associates, architects.

raising certain portions of the floor, which also helps differentiate space (see Figure 2.51). The height of the ceiling also allows separation of space with screens that do not reach the ceiling, allowing natural light to penetrate throughout.

**Flexibility features**

Raising certain portions of the floor leaves space for the installation of electrical and mechanical systems within the raised platforms and makes the space even more flexible.

**Data sheet**

| | |
|---|---|
| Project: | Quai de la Commune |
| Developer: | Alliance Group |
| Architect: | Cardinal Hardy and Associates |
| Builder: | Alliance |
| Project address: | 20 des Soeurs-Grises, Montréal, QC |
| Housing type: | Loft style apartment building |
| Number of units: | 80 |
| Number of floors: | 6 |
| Unit size: | 76 $m^2$ to 113.0 $m^2$ |

Key dimensions of each unit

| | |
|---|---|
| Width: | Variable |
| Depth: | 11.6 m |

Unit sale price in 1997 (before tax):

- $81,260 (76 $m^2$ main floor apartment)
- $168,880 (113 $m^2$ apartment on the 6$^{th}$ floor)
- $1,175 (average price per $m^2$)

Use: Condominium

Target clientele: Varied

Construction year: 1997

Type of adaptability:

( ) Upgradeable
( • ) Expandable
( • ) Divisible
( • ) Versatile
( • ) Flexible

## Riverwind Towers, Edmonton

The Riverwind Towers complex (Figure 2.55), near downtown Edmonton, consists of two identical 20-storey apartment buildings connected at the base by a space housing recreational and service areas. Each tower contains 57 apartments, three per floor. The project differs from conventional apartment buildings in three ways. A mingle-style apartment is located in the centre of each floor (Figure 2.56) for unattached people who choose to room together. Exceptionally high-quality construction systems have been used for the building envelope (wall coverings, insulation and fenestration), providing better-than-average thermal performance. The ownership style, the Strata Title Housing Co-operative, combining certain features of condominiums with co-ownership, is the only one of its type.

**Figure 2.55: The Riverwind Towers, two identical apartment towers**

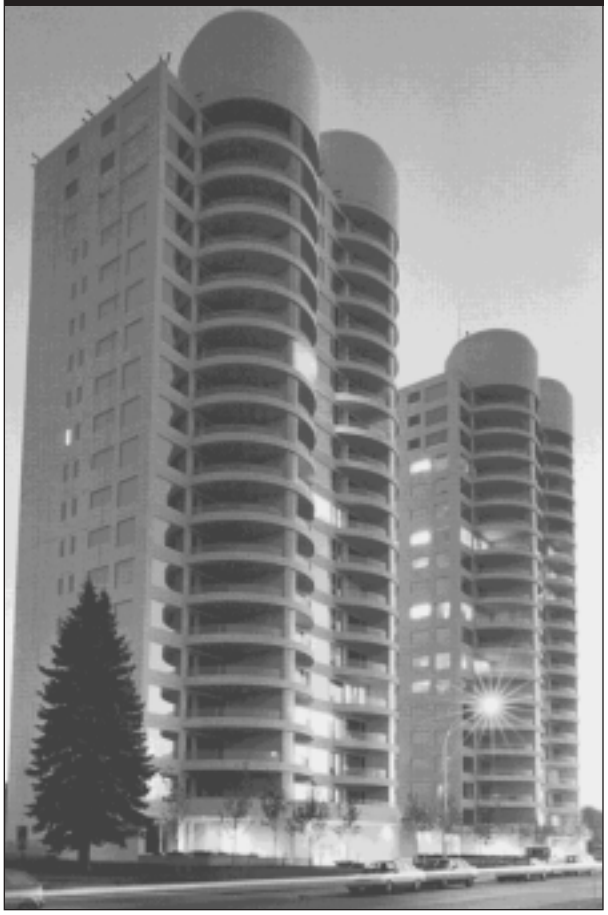


Photo: Visionwall.

### Versatility features

This project was selected because it includes 38 mingle-style, two-bedroom apartments that differ from conventional housing for the following reasons (see Figure 2.56).

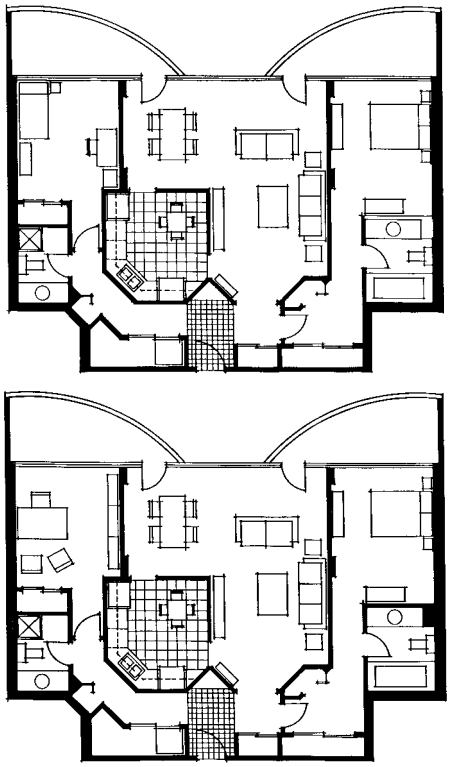
- Bedrooms are located on either side of the kitchen, dining room and living room for greater privacy.

- For the same reason, each bedroom has its own balcony and bathroom.

The versatility of this type of housing may also suit a variety of households, including:

- couples with different work and sleep patterns;
- a couple living with a young adult;

**Figure 2.56: Plans for mingle-style apartment arrangements**



Plans show two arrangements of a mingle-style apartment. In the first, the apartment is shared by a senior and caregiver. In the second, the apartment is used by a couple, one of whom has a home office.

Source: Dub Architects Ltd.

- a senior living with a caregiver; and
- two widows or widowers, or other individuals sharing an apartment.

This housing model is also suited to people who work and meet with clients at home, since the clients can enter the office area without going through the private living quarters.

Finally, this apartment may also vary depending on the placement of partitions.

**General affordability**

This project was selected for inclusion in this publication in spite of the high cost of these apartments, since the price is mainly due to the sizeable initial investment made by joint owners to minimize long-term operating costs. We were told, in fact, that the exterior walls had R-27 resistance, units were equipped with ceiling-mounted radiant heating systems with six thermostats per apartment and that the thermal efficiency of these apartments was so superior that they required only minimal additional heating and cooling during winter and summer. In light of these considerations, it is reasonable to assume the construction cost and sale price of these units would have been lower, had the building used more conventional systems.

**Data sheet**

| | |
|---|---|
| Project: | Riverwind Towers/mingle-style units |
| Developer: | Communitas |
| Architect: | Dub Architects Ltd. |
| Builder: | Forest Contract Management |
| Project address: | 10731 Saskatchewan Drive, Edmonton, AB |
| Housing type: | Apartment building |
| Number of units:[21] | 114 |
| Number of units:[22] | 38 |
| Number of floors: | 20 |
| y¡0 size: | 106 m$^2$ |

Key dimensions of each unit

| | |
|---|---|
| Width: | 12.5 m |
| Depth: | 8.8 m |

Approximate sale price[23] for mingle-style units in 1991: $200,000 (before tax)
Use: Strata Title Housing Co-operative
Target clientele: Varied
Construction year: 1991
Type of adaptability:

( ) Upgradeable
( ) Expandable
( ) Divisible
( • ) Versatile
( ) Flexible

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# *APPENDIX*

# *TYPICAL DESIGN PROJECTS AND STRATEGIES*

This appendix lists typical design projects and strategies which should be considered in choosing one of the housing and adaptability options discussed in this report.

## Upgradeable Housing

- Build an attic dormer to enable later finishing of this space as a family room, bedroom or work space.

- Provide and install mechanical and electrical wiring and ducting for later finishing of the:
  - attic, with or without bathroom;
  - basement, with or without bathroom; or
  - basement, with bathroom and kitchen.

- Finish the attic as a living space, with or without bathroom.

- Finish the basement as:
  - a family room or bedroom, with or without bathroom;
  - an office with bathroom and private outside entrance;
  - a studio with kitchenette and bathroom; or
  - a garage.

- Maximize floor spans to minimize the number of load-bearing walls.

- Build the roof with steep supports to enable habitable attic space.

- Add painted, plasterboard partitions.

- Cover a brick wall with plasterboard.

- Include a hinge-mounted door when building a partition.

## Expandable Housing

- Add to the main floor of a single-family dwelling:
  - a garage;
  - a family room;
  - an office; or
  - a studio.

- Add a second floor to a single-family dwelling to include a bedroom, bathroom and office.

- Build a bedroom and bathroom over the garage of a single-family home.

- Build a solarium on a floating concrete slab.

- Build a solarium on a rooftop or rooftop terrace.

- Convert a duplex into a single-family home.

- Plan to convert a duplex into a single-family home.

- Anticipate an eventual horizontal connection between a single-family dwelling and potential addition.

- Anticipate an eventual horizontal connection between two apartments in a multi-family dwelling located in a concrete building.

- Use a staircase to link two adjacent apartments in a wood frame or concrete building.

- Anticipate an eventual connection between two floors of a wood frame or concrete building (floor opening).

## Divisible Housing

- Convert a single-family home into a duplex.
- Anticipate conversion of a single-family home into a duplex.
- Soundproof floors (for impact or overhead noise) between two separate spaces belonging to separate apartments.
- Soundproof partitions (for overhead noise) between two separate spaces belonging to separate apartments.
- Install fireproofing in superimposed spaces or horizontally adjacent spaces belonging to separate apartments.

## Versatile Housing

- Maximize floor spans to minimize the number of load-bearing walls.
- Construct the roof structure with steep supports to allow habitable attic space.
- Exceed standard dimensions for each room and corridor to maximize potential uses for this space.
- Use double-sliding or hinge-mounted doors between rooms or between rooms and passages to enable combination or separation of these areas at will.

## Flexible Housing

- Build the roof structure with steep supports to allow habitable attic space.
- Build floors using open-web joists to avoid load-bearing walls and to open the layout, to make conversion easier and to add new, technologically advanced systems.
- Use double-sliding or hinge-mounted doors between rooms or between rooms and passages to enable combination or separation of these areas at will.

# ENDNOTES

1 Two-year mortgage of $97,850 at 6.25 per cent amortized over 25 years.

2 Based on four per cent per annum.

3 For homes of three or fewer stories.

4 Two-year mortgage of $35,000 at 6.25 per cent amortized over 25 years.

5 Based on four per cent per annum.

6 Savings $1,254 after two years divided by two.

7 We are unable to provide a sale price since owners built their own units.

8 Except for exterior walls, which must be insulated.

9 Price varies depending on location and basement finishing.

10 We are unable to provide a sale price since owners built their own units.

11 This amount could have been reduced to about $150,000 if the house had not been built to R-2000 specifications; it could also have been reduced to about $125,000 if local zoning regulations had allowed a reduction in the surface area of the house by 15 to 20 per cent.

12 This house can also be built as a detached or as a row house.

13 This lot can accommodate two semi-detached units.

14 Unfinished attic.

15 Finished garage with unfinished attic and basement.

16 Version with 77 square-metre second floor.

17 With unfinished basement.

18 Approximately 25 per cent of this amount applies to lot price.

19 An extra bedroom may be added on this floor by reducing the size of the bathroom and relocating it to the centre of the house.

20 The system used to build these houses is rare. They could have been built more economically using more conventional methods. Nevertheless, the unit sale price is comparable to market prices and to the cost of wood frame housing.

21 Units of all types in both towers.

22 Mingle-style apartments in both towers.

23 It was impossible to obtain precise pricing information from the developer.

24 This report and appendix discuss the results of a survey of some 200 magazine articles, books and research reports on the subject of affordable, adaptable housing. These documents also contain the results of various consultations with dozens of professors, researchers, architects, promoters, builders and provincial and municipal housing agencies across the country. The summary identifies innovative achievements in the field of affordable, adaptable housing. The work has enabled us to identify 175 projects worldwide, including 91 in Europe, 54 in Canada and 24 in the United States.

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