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RENOVATING DISTINCTIVE HOMES

The Century Home

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RENOVATING DISTINCTIVE HOMES: THE CENTURY HOME

Renovating Distinctive Homes: The Century Home

Prepared by

Canada Mortgage and Housing Corporation

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INTRODUCTION

In Canada each year more money is spent on renovation than on new home construction.

Many renovation projects are on century-old two-storey houses. These houses dot the landscape from Newfoundland to British Columbia. They were built between 1880 and 1930. Tens of thousands of these homes can be found in our rural areas and inner cities today.

Different types of houses pose different renovation challenges and problems. With the century-old two storey house, the layout, the construction methods and systems of the period, and the usable attic all pose particular renovation opportunities.

This is a new kind of renovation book. It focuses specifically on century-old two storey house. It combines space planning and design tips as well as technical information. All examples are based on house style.

This book is designed to provide you, the homeowner, with the basic information you need to plan and carry out successful renovation. It provides information on technical requirements, it give you insight on what to ask your contractor, information on specific renovation problems you are likely to encounter with this type of house and information on new trends in housing —Healthy Housing and Flex Housing— features you may want to incorporate into your plans.

Turn to Chapter 1 for background information on why your house is built the way it is and to Chapter 2 for typical problems century-old houses face and what needs attention as part of any renovation. For an overview of what a renovation project involves, see Chapter 3. For tools to help you plan and carry out your renovation, Chapter 4 provides worksheets, checklists and a sample renovation contract. For renovation ideas and tips on proper construction details, see the descriptions of typical renovation projects in Chapters 5 and 6. Finally, if you would like more detailed information on any aspect of renovation, turn to Chapter 7 for a directory of further information sources.

CHAPTER 1: THE HOUSE DESIGN

Introduction

The arrival of the 20th century heralded an age of prosperity in North America. The land and resources were unlimited and the new middle class needed housing—lots of it. In urban and rural areas, buildings were sprouting up almost over night.

These new houses were unique in many ways. They had basements and were built using dimension lumber. Some were balloon-frame and some were solid brick. Many were constructed from kits produced in factories in the United States and Canada and shipped by train to the building site. Most had central heating systems and plumbing and some even had electricity. By the mid–1920s, thousands of these homes had been built across Canada. They were the first widespread house construction types in North America and many examples are still around today.

Styles and finishing details vary between regions of the country—partly as a reflection of the diversity of the population and partly because of available building materials and fire code requirements.

Two basic design layouts exist: the square with a centre or side hall plan and the rectangular side hall plan. The square house maximizes usable floor space and minimizes building materials. Often identified as a "foursquare" especially on the Prairies, it is compact, easy to heat and relatively easy to erect.

The rectangular home suits the narrow lots in urban areas and is easily built as a duplex or part of a row. It is also compact, easy to heat and relatively easy to erect.

Illustration of a Foursquare House from the 1919 Aladdin Plans Catalogue
Gowans

Illustration of an early 1900s rectangular sidehall plan house from the Chicago Wrecking Co
Gowans

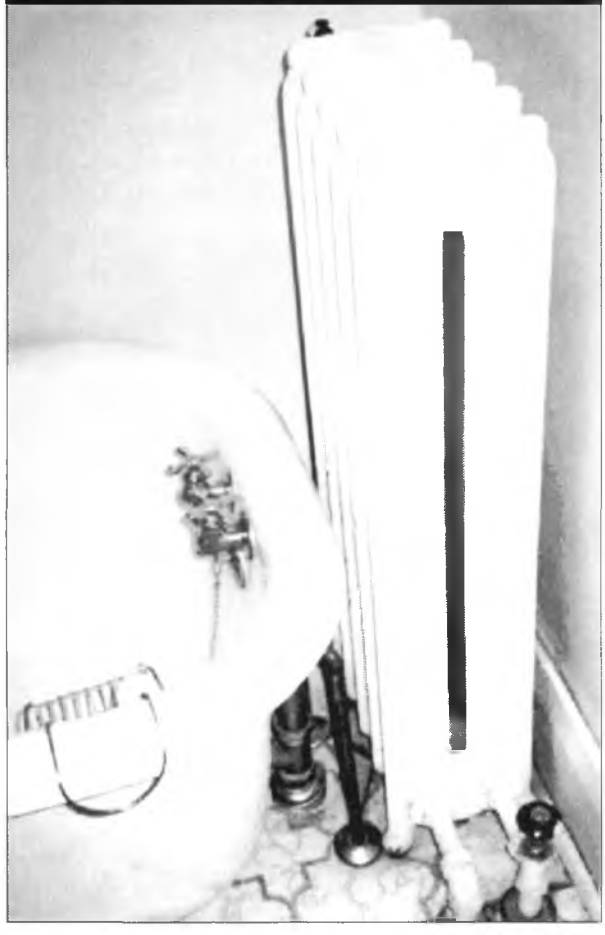
These houses had wide appeal. Farmers built them from kits shipped from the West Coast or the East by train. Builders and carpenters built them across North America. Architects,

lumber companies, mail order companies and designers developed generic plans and published them; making them available to builders at a relatively low cost.

One author called this generation of homes "The Comfortable House." They were built during a time of abundance and quality. In its first catalogue in 1906, the Aladdin Company boasted: "We'll pay $1 for every knot you can find in our wood." Aladdin continued to make the promise until the 1920s.

The builders of the period took pride in creating efficient houses that met their clients' needs. Comfort and sanitation were emphasized. In addition to central heating systems, other technological developments of the last part of the 19th century included the invention of the enamelled bathtub, the flush toilet and the electric light. By the end of the period, the luxuries of indoor plumbing and electricity were standard features for everyone.

By the 1920s most houses had central heating and indoor plumbing.
Buchan, Lawton, Parent Ltd



The simple floor plans of the 1900 house permitted flexibility in the design and use of the rooms. Additions, such as a summer kitchen, were anticipated in the original designs and sometimes included in the original construction. In rural areas, the rectangular house often grew to accommodate a second rectangle at right angles to the rear.

The heyday of two-storey balloon-frame and solid brick houses in Canada was from the 1880s to 1920s. By the late '20s and early '30s, platform construction was becoming the standard of construction and house types evolved.

The two-storey home of 1900 is popular today. Their classic styles and large size make them desirable. They are often located close to the downtown core of cities. Many are well finished inside, with hardwood floors, solid wood details and classic tile work.

Today, we see a trend towards new homes built with many of the same details as these century-old homes. The high-pitched roofs and dormer windows of many modern homes emulate the style of these older homes. As well, there is a trend to use the attic, especially in the larger cities of Toronto, Ottawa, Vancouver and Montréal.

Roots

Residential form is determined partly by the environment and available materials and partly by social and cultural traditions.

The two-storey, 1900 house is an excellent example of both factors playing an equal role. On the Prairies, for instance, the two-storey house was often the third house built by a farmer. It was a symbol of achievement. When settling the land, a Prairie farmer started by building a sod dwelling—in response to the harsh environment and the available materials.

As farmers prospered, they built a simple one-storey wood frame house—still a rudimentary shelter but a sign of permanence. As they prospered more, they looked to mail-order catalogues and bought dimensioned lumber to build a complete larger home, such as the "Eastbourne" from the Eaton's Catalogue of 1919.

The two-storey house of 1900 was comfortable housing for the working class and middle class. It was affordable and tasteful. Evolving from the American and British cottages and villas of the mid-1800s and the small Gothic cottage of Ontario, it was plainer than its predecessors. It had less ornamentation than the Victorian style and emphasized functionality more.

These comfortable homes offered space for families and convenience with all their modern features. Health was a major concern at the end of the 19th century and these homes were promoted as being good for your health. The two storeys provided good separation between the living areas on the first storey and sleeping areas on the second storey. The second-storey bedrooms were believed to have good ventilation. Indoor plumbing and basements with central heating also contributed to a healthier indoor environment.

From the T. Eaton Co. catalogue, 1919
Kalman, p. 617

Today we think of these homes as being "downtown" but when they were built they were suburban. They were located on less expensive land to meet the demand for inexpensive single-family dwellings. Beginning with the advent of the train and, even more so, with the development of the trolley car and eventually the automobile, urban workers could escape the city and live in the suburbs and commute to work.

For the first time, home ownership was a realistic dream for many working class and middle class families. These houses offered roots to the past, especially to colonial England, while at the same time being a distinctly North American house type. The Americans saw this as a major step in the American Dream and Canadians followed suit.These homes also reflected the qualities of virtue and security. They symbolized the stability of the family, independence and security against the world.

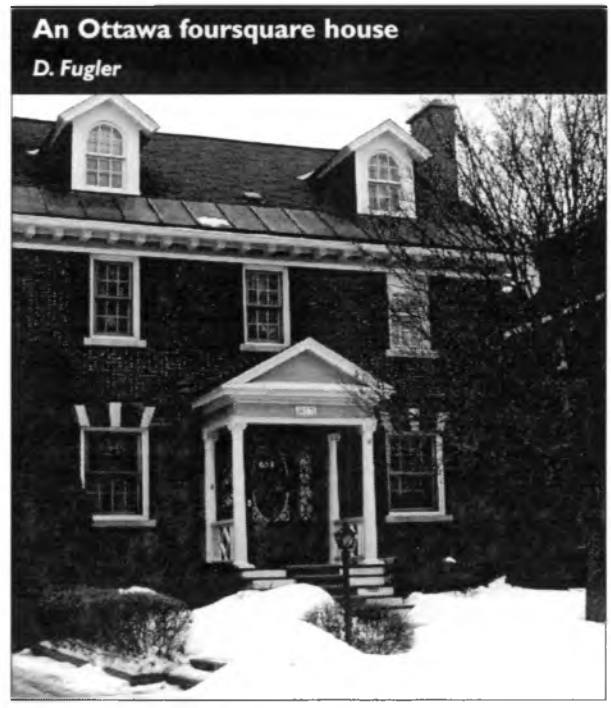
The foursquare

The classic foursquare is a two-storey house with a large attic. Although basically square in shape, the term foursquare refers to the four square rooms on the main floor. Typically, the house has a large entry hall leading to a living room, dining room and kitchen on the main floor. The entry hall acts as a room, receiving guests and separating the outside world from the inner sanctum of the house.

The house sits on a raised basement, often with a poured concrete floor. The basement ceiling is raised to accommodate the central furnace and to provide room for ductwork or heating pipes. Although these basements may not seem high and dry today, they were a major improvement over the damp, dirt-floor basements of earlier house types.

The house has a front veranda running the full width of the first storey. The roof is pyramidal or hipped and usually has a dormer facing the street. The chimney runs up the centre of the house or on an outside wall, depending on the location of the fireplace in the living room.

Many variations of the classic foursquare exist. Some examples have gable roofs and some have verandas around two or three sides.



An Ottawa foursquare house
D. Fugler

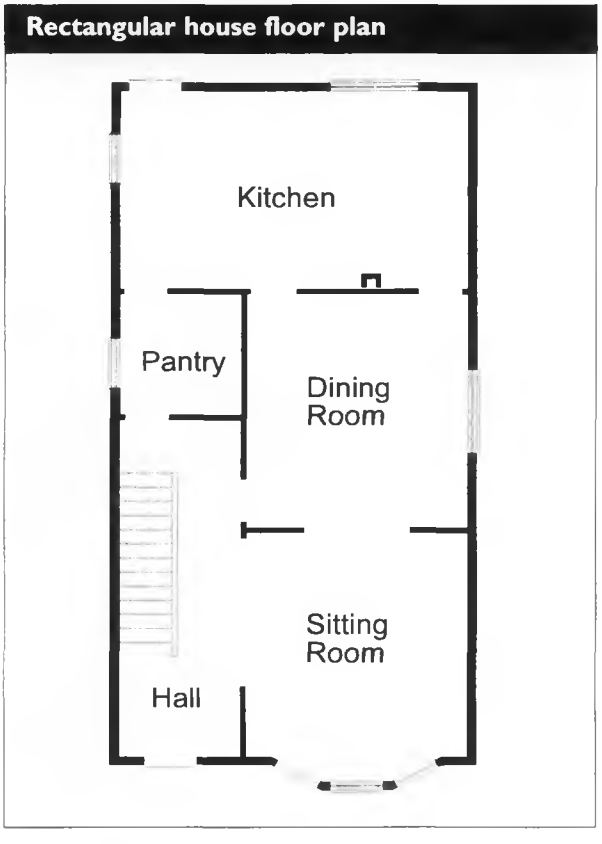
Others are large and more ornately finished with turrets—tying in the Victorian look with the modern house. Larger versions often incorporate a centre hall plan with a study or den on the main floor.

The homestead or rectangular city house

In the Canadian West, these homes were referred to as homestead homes and in the United States they were called Homestead-Temple houses. Rectangular and placed length-wise on a narrow lot, they were popular in urban areas where land values were higher. In working class neighbourhoods they were built as doubles or row houses, often with flat roofs.

Many of the features of the foursquare appear in the rectangular city or homestead house as well. They have higher basements with concrete floors, verandas in some parts of the country and spacious attics for storage.

A rectangular house in Charlottetown
M. Lodge



Rectangular house floor plan

Inside, the layout is linear. Entered from the front at one side, the living space is down one side of the house. The living room is at the front with a dining room in the centre and a kitchen at the back. A shed-summer kitchen is often added on the rear. The stairs directly access the second floor from the entrance hall.

The second floor is similar, with three bedrooms in line from front to back and the bathroom at the rear at the top of the stairs. The bathroom sits above the plumbing in the kitchen to keep the plumbing in one area and reduce costs.

Roof styles range from flat to gables with dormers to cottage and hip roofs. Many of the attics in the urban versions of these homes are inaccessible. In rural areas they may be accessed for storage space.

Anatomy of the house

This section highlights the features of the century-old house. These homes were built by small firms and individuals who used a wide range of construction techniques and products. Some features may be the same as your house and others may be quite different.

Foundation

The foundation allows the house to rest solidly on the ground without shifting or cracking. It must resist the effects of water, frost and lateral soil pressures.

Foundations were typically made of rubblestone by stonemasons. Foundation materials differed according to local availability of materials. In Alberta, for example, sandstone was commonly used. Towards the '20s and '30s, poured concrete foundations were used in some areas.

Rubblestone foundation
F. Szadkowski

Rubblestone foundations were thick, usually 700 mm (24 in.) and did not incorporate a footing. These basement walls were intended to support the house. They did not necessarily keep out the water. Because the basement was not intended as living space, it was not insulated.

Structure

The structure supports the roof and provides a framework to enclose the space. It must be strong enough to bear the weight of the roof, the house itself, the occupants, their furniture and the force of wind pressures and snow loads.

Two types of structures were used for the walls of the century-old house: balloon-frame and solid brick. Balloon-frame incorporates a frame structure of wood, usually 2x4 dimension lumber, to support the structure. Solid brick uses two or three thicknesses of brick to support the structure.

Balloon-frame construction was common across Canada. At the time, it was the most popular method of construction and was the procedure described in the mail order kits. In balloon framing, the walls are built in one unit from the foundation to the top of the second floor. The framing forms a balloon or uninterrupted frame around the whole building.

A balloon-frame addition to a homestead house in Alberta prior to 1915.
Wetherell, p. 142

In solid brick homes, the solid brick walls surround the whole building and provide the cladding, support and structure in one component. The brick walls are not well insulated. Usually a lath and plaster finish is applied over strapping and building paper on the inside wall.

For both types of structures, the supporting framework for the first floor (the floor joists) are laid vertically on top of the foundation wall and may be integrated in the wall structure. The floor of the second floor is hung from the walls.

In situations where the width of the house is wider than the length of a floor joist, interior support is required to support the floors. In some parts of Canada, interior brick walls in

the basement support the joists while timber and wood provide support in other regions. Similar support is required for the joists of the second floor. This requires some load-bearing interior walls on the main floor.

Subflooring nailed to the floor joists completes the structural part of the floor. In most homes, wide boards laid perpendicular or on a diagonal to the joists form the subfloor. Interior walls are built with 2x4 dimension lumber.

The roof is typically framed with 2x4 or 2x6-in. rafters fastened to the top of the walls and meeting a ridge pole at the peak of the roof. These rafters are covered (sheathed) with 1x8-in. boards. Near the peak of the roof, 1x4-in boards (collar ties) connect and reinforce each pair of opposing rafters.

Exterior finishes

The exterior finish encloses the space and protects the structure from damage. It must resist the entry of water, snow, wind and vermin.

Examples of all balloon-frame siding types are found in every region of Canada. Wood siding is more prevalent in Atlantic Canada and on the West Coast, brick in central Canada and wood and stucco in the Prairies. Some designs combine two siding materials.

For example, on brick veneer homes, stucco is often used on the second floor and dormers. Most roofs are protected with wood or asphalt shingles laid over the roofing boards.

Interior finishes

Interior finishes protect the structure on the inside of the home. They provide attractive, durable surfaces and protect the structure from damage.

On the east coast, trim is painted and made from softer woods
M. Lodge

In 1900, interior walls were finished in lath and plaster. Baseboards and trim were cut to size on-site from specially milled dimension lumber. Closet and room doors were panelled and made of solid wood.

The flooring of choice in the main floor living areas was hardwood. Tongue-and-groove strips of hardwood were nailed to the subflooring, then sanded and finished on-site. Kitchen and bathroom floors were generally sheet linoleum. For the sleeping areas, softwood flooring, such as pine, was often laid first and then covered with carpeting in high-traffic areas.

Kitchen cabinets were built on-site using lumber and finished with enamel-based paints. Countertops were wood, tile, or metal.

Bathroom floors were finished either in ceramic tile or linoleum. Tub and shower enclosures were usually finished in ceramic tile.

Thermal protection

Thermal protection is added to the foundation, walls and roof to protect the structure from extreme variations in temperature and to provide greater comfort for the occupants. It must form an even blanket around the building, without gaps or paths where heat can escape. There are three components in the thermal protection of a house:

1. Insulation to keep the heat in.
2. A continuous air barrier to prevent both heat and moisture from being carried out of the house through gaps and cracks in the building envelope and to prevent moisture condensing inside the walls and causing water damage to the structure.
3. A vapour retarder to prevent water vapour in the house from penetrating through the building envelope.

Thermal protection in the 1900 house was minimal. Originally, the walls and attic were not insulated. Today, insulation has been added to the attics of many of these homes and, in some cases, the walls.

The 1900 home did not have an air barrier or vapour retarder. Doors were usually equipped with weatherstripping to prevent drafts. Common weatherstripping materials included felt and brass.

The standard windows were single pane with wooden sashes and wooden framed removable storms. The most common window styles were single-and double-hung vertical sash. The windows were typically quite large and incorporated weight systems hidden within the walls to help raise and lower the lower window.

Mechanical systems

Mechanical systems provide the occupants with heat, electric power, light and ventilation and with water and waste water services.

Heating systems varied according to the type of fuel used and how the heat was distributed throughout the house.

Radiant hot water and gravity-convection were the most common heating systems in 1900. Coal-fired stoves were common at the beginning of the time frame but, by the end, most homes had central systems. Coal, wood and natural gas were all used as fuel sources. Natural gas was available in southern Alberta by 1905 but was not available in the rest of Canada until many years later because there was a limited distribution system and coal was cheaper.

Initially the hot water and air systems were distributed passively by gravity. However, by the 1960s most of these had been converted to forced systems using pumps or fans.

The earlier homes of the period may not have originally had electricity but by the 1920s most urban homes had electricity and were installing electrical services. The electrical service in most homes was 40 or 60 amps with knob-and-tube wiring. Plumbing was all metal, with cast iron used for waste and vent lines and galvanized steel or copper for water supply piping.

There was no separate ventilation system. The house depended on open windows and air leakage to exchange fresh air for stale air.

Conclusion

Over the years, the century-old houses have maintained their status as comfortable and very desirable place. Their reputation as safe, well-built homes has stood the test of time and allowed them to adapt to the many different needs of today's homeowner.

Introduction

Renovation is an excellent opportunity to create a living space to meet your individual needs. It is also a perfect opportunity to make your home a healthier and safer place to live.

Why do people renovate? The simple answer is to make the house a better place to live. Families change and this affects the amount and kind of space they need in a home. Styles and standards change and this prompts the desire to upgrade and modernize. This chapter explores changing expectations about housing and their impact on the century-old home.

People renovate to satisfy their wants and needs but, after almost a century, the house requires some attention for its own sake. This chapter also examines the problems found in older houses.

In the past few decades, research and experience have broadened our understanding of many aspects of housing. This chapter introduces new considerations, such as the House as a System, FlexHousing™ and Healthy Housing™.

Consider the issues raised in this chapter as part of any renovation plan.

Changing expectations about housing

Century-old homes were primarily built to serve established families. Today, the uses for these homes are more diverse. They may contain a large family but could equally include three or more generations of one family or three separate apartments.

Families with an elderly parent or an adult child are becoming more common. As well, increasing numbers of households have one member working from home. These changes affect the design and use of space in the home.

In the late 1890s and early 1900s, Canadians' desires for housing were quite different. Homes did not have family rooms or large open areas. Some had two kitchens. The laundry was done in a room off the kitchen and the only bathroom was on the second floor. Today, more amenities and a higher level of comfort and convenience are expected—even in older homes.

Space considerations

The typical modest century-old home had a square or rectangular footprint with a parlour, dining room and kitchen on the first floor, three or four bedrooms and a small bathroom on the second floor and, possibly, a half-storey attic. The two storeys provided 110 to 185 m^2 (1,200 to 2,000 sq. ft.) of living space. The house generally had an unfinished basement containing the wood or coal-fired heating system for the house. Storage was limited on the living levels, bedroom closets were small and the attic was used to store old furniture and out-of-season clothes.

Today's homeowners have very different expectations for their homes. They live very differently and require space for television viewing and other leisure activities, a home office with a computer, more bathrooms and more storage. The plumbing, heating and electrical systems will likely require upgrading to meet these needs.

Upgrading and modernizing the home

Services

In 1900, many Canadian homes used wells, springs or rivers for their source of water and had outdoor privies. Indoor waste water was drained or dumped in a cesspool in the rear yard. In larger urban areas, typhoid and cholera outbreaks had prompted the creation of sewer and water systems but these were still under construction and did not service every home.

Plumbing and waste drainage systems in new homes were rudimentary and usually based around a single stack with the bathroom above the kitchen. The single stack was a major improvement, however, and continues to be used in homes today.

By 1900, lead plumbing was not considered safe to carry potable water and cast-iron pipes with lead solder and caulking were used in water systems. Fresh water was a precious commodity; in many homes it had to be hand carried or pumped to a reservoir in the attic and it was often difficult to obtain. On the Prairies, melted snow provided the only water in winter.

In 1900, electricity was new to Canada and not widely available. By the 1920s, however, most middle class homes had electric lights connected with knob-and-tube wiring. These early systems varied across the country but one common type was a 30-amp, 110-volt, single-phase electrical service. By the 1930s, the standard was a 60-amp, 220-volt, two-phase service. Knob-and-tube wiring continued to be used until after the Second World War.

Today, none of the single-phase services exist but many 60-amp services are still in use and

Knob-and-tube wiring
Buchan, Lawton, Parent Ltd

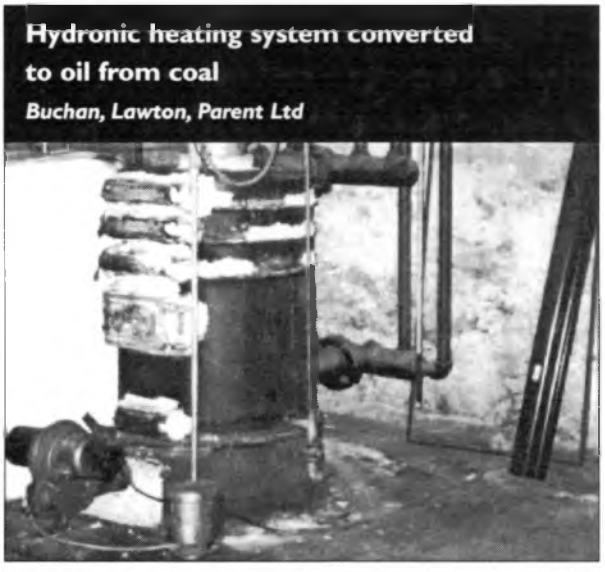
many century-old homes still have circuits with knob-and-tube wiring.

Knob-and-tube wiring consists of two single wires, a black, or hot, wire and a white, or neutral, wire. These two wires create a circuit and do not include an earth or ground wire. The two single wires are held in place throughout the house with ceramic knobs and tubes.

When upgrading an older home to provide all the conveniences requested by today's homeowners, a 100-amp electrical service is the minimum suggested size (a 200-amp service is recommended with air conditioning or electric heat). In older houses, most rooms —especially bedrooms and dining rooms— have only one ungrounded outlet. In new homes, outlets are required a minimum of every 3.6 m (12 ft.) of wall space. Even that may not meet the needs of homeowners with many electrical conveniences.

Since knob-and-tube wiring does not provide secondary grounding, there is more danger of receiving a shock from touching a shorted metal case or wire.

Deteriorated insulation covering the wires and deteriorated tape at wire splices can also present risks. While knob-and-tube wiring itself is not hazardous, avoid incorporating it with any new circuits added to the system. Homeowners often prefer to replace old wiring when doing major renovations. As well, insurance companies may require upgrades.



Hydronic heating system converted to oil from coal
Buchan, Lawton, Parent Ltd

Today, the century-old house is usually heated by a forced-air or hydronic (hot water) system. Hydronic heating systems are slow to respond to changes in outdoor temperature and may not be the right size to meet the current needs of the house. This leads to over- or under-heated houses, especially in spring and fall when the weather is variable. While the heating systems in some century-old houses have been completely replaced, many have only had parts upgraded as they fail. The "octopus" furnace still exists in many basements.

Modern furnaces are more fuel-efficient and forced-air or pumped hot water distribution make the systems more responsive. As well, automatic setback thermostats offer better control—allowing the temperature to be set back at night and during the day when the house is unoccupied.

Convenience

Houses require regular maintenance. For the 1900s house, exterior wood trim, siding and window frames require regular painting—as often as every three to four years. And, although brick and stucco demand less maintenance, caulking, cleaning and repointing are still an ongoing chore. Annual tasks involve changing storm windows and screens.

Homeowners have welcomed the new maintenance-free materials that result in less ladder time and more leisure time. These include vinyl, prefinished wood and aluminum siding, soffit and fascia and double- and triple-glazed window systems with maintenance-free vinyl, fibreglass and aluminum frames.

Comfort and air quality

Older frame houses were built with little or no insulation and no air barrier to keep out drafts. In winter, basements were often cold and rooms on the first and second floor were drafty and had cold spots near the windows and outside walls.

Century-old homes are typically five times leakier than the average new home. Today's houses are well insulated and sealed to prevent air leakage. Windows are more energy efficient. New houses are easier to heat and more comfortable. Drafts or cold spots are minimal —even when sitting near windows. Basements are insulated and can be comfortably used as living space. Homeowners of century-old homes often strive to make their old homes like new.

Houses built in the early 1900s depended on air leakage and open windows for ventilation.

This natural ventilation was not necessarily adequate to dispel cooking odours or excess humidity from laundry or showers. Options now exist to provide controlled ventilation and improve air quality.

Challenges to upgrading the two-storey house

Any renovator will tell you that one of the biggest challenges to renovating an older house is previous renovations. Many of the problems identified below are aggravated by previous "improvements."

Basement and foundation

Foundations must be placed below the line of frost penetration to provide a stable base for a house. In Canada the depth varies across the country but in most areas—except the West Coast—an excavation of at least 1.5 to 2.5 m (five to eight ft.) deep is enough. In the house of 1900, the excavated space provided the best location for the new hot-air and hydronic gravity furnaces and the space was dedicated to that purpose.

With its rubblestone foundation and low headroom, the basement of the century-old house was never intended as living space and should not be used for that purpose. The basement is generally leaky with air and moisture seeping through the walls and moisture wicking up through the floor. The foundation walls are not waterproofed or insulated and modifications to improve their thermal performance may affect the stability of the foundation.

First floor

When opening up the space, the balloon-frame construction of the house may limit the removal of walls on the first floor. Walls supporting the second floor will require structural reinforcement if they are to be moved or removed.

Many foursquare houses have a central chimney with a fireplace in the corner of the dining or living room, and this may also restrict the reconfiguration of walls. For homes with pantries, the space can often be remodelled into a powder room. For houses without pantries, however, there is limited scope for creating a main floor bathroom without limiting useful space in other rooms.

Firestopping is another concern in balloon-frame construction. Because the exterior wall cavity extends the full height of the two storeys, fire can travel up through the wall from the basement to the roof without being detected. When opening up exterior walls, insert fire blocking between the first and second floors as a safety precaution.

Second floor

As with the first floor, structural concerns present a challenge to removing or modifying walls on the second floor. As well, the bathrooms are often small and, because of the building's age, the plumbing often requires complete replacement when carrying out renovations.

Third floor—attic

Upgrading the attic can often be the least expensive way to increase the living space of an early 20th century home. The space is easy to get to and disruption to the living area of the house is minimal during the renovation. Often, there is already a rough floor and gable windows provide light and ventilation. Special attention must be taken when insulating and air sealing the walls and ceiling. Special attention must also be given to the ceiling joist size and spacing—they must be adequate to support the use of the space.

Storage

Storage space is limited in the early 20th century two-storey house. Since the bedrooms are already small, it is difficult to expand the closet space without cutting into valuable living area. If the basement is subject to dampness, avoid storing items, such as furniture, books, papers or clothing there, as they could be affected by mold and moisture damage. Attic space has traditionally been used for storage and you may want to keep some storage space in the attic even if it is being turned into living space.

The attic of this house contains two large bedrooms and a bathroom
Buchan, Lawton, Parent Ltd

When houses age

Century-old houses are now 80 to 120 years old. In addition to the continuing maintenance required on any house, older houses have unique problems. These problems may not be evident at first but they can result in serious damage to the house over time.

It is especially important to approach renovation from a practical point of view with older houses. Deal with underlying problems before tackling other renovation work and incorporate preventive maintenance as a part of any renovation project.

This section describes some of the common conditions that occur as houses age.

Components reach the end of their service life

Some building components are not designed to last the lifetime of the house. Asphalt shingles are rated for 15 to 30 years and begin to curl and crack as they wear out. Furnaces have a service life of 18 to 25 years and should be replaced to meet new standards and energy efficiency requirements. Electrical panels can become outdated or rust. Even plaster walls are not expected to last forever. After 100 years, bulges may appear in walls or ceilings where the plaster has pulled away from the supporting lath.

Some components wear out

Some components, particularly finishes like exterior paint, putty and caulking, simply dry out and harden in a short time. If they are not renewed regularly, there can be more serious deterioration to the underlying material.

This century-old house needs exterior repairs
Buchan, Lawton, Parent Ltd

For example, eavestroughing can become rusted and corroded, allowing rainwater to soak the exterior wall of the house and direct rainwater close to the foundation.

Interior components such as tile, sheet flooring or carpeting, can wear out in less than 10 years, depending on the material and traffic volume. Even durable hardwood flooring eventually shows signs of wear and needs to be refinished or replaced.

Other interior finishes, such as paint and wallpaper, need refreshing every few years. Panelling and cabinetry also need attention, although less frequently.

Less obvious components, such as water supply pipes, also wear out. Corrosion can restrict the water flow in older, galvanized steel pipes and cause low water pressure in the house.

Some components are damaged by exposure

Sunlight and exposure to the elements rapidly degrades many materials—paint, for example,

can deteriorate in just a few years. Exposure and air pollution dries and shrinks caulking. Over a longer period, weather and air pollution also damage the mortar in brickwork. After 100 years, most houses require extensive repointing of the mortar. Even on wood or stucco houses, the brick chimney probably requires repointing and possible rebuilding or replacement.

Foundation and structural problems

In the first few months after construction, houses settle slightly and minor cracks can appear in the foundation and finish materials. This is not a concern. Real problems can arise, however, if the structure is later weakened by moisture or water damage, by damage from insects (termites or carpenter ants) or by alterations to the building.

A weakened structure can lead to structural problems, such as twisted or rotted beams and posts, sagging floor joists and moldy or rotting timbers. Over time, these problems in the underlying structure can cause plaster to crack, doors and windows to stick and floors to sag or heave. Cracks and sticking windows or doors are often clues to structural changes. Investigate and fix serious structural problems to make sure there isn't further deterioration.

Ill-conceived past renovations are a major cause of structural problems in century-old houses. Careful detective work will help avoid problems when renovating previously renovated houses.

If a structural problem is investigated and is only minor or has stabilized, it may not need to be dealt with. It might make sense to choose to live with the sticking window or make repairs to it, for example, rather than replace it with something that does not match the rest of the windows in the house.

Efflorescence and evidence of water leaks around boarded-up window in basement
Buchan, Lawton, Parent Ltd

Moisture damage of some sort has likely occurred

Moisture is a major cause of damage to buildings. Over time, unwanted moisture can weaken the foundation, damage the structure and ruin interior and exterior finish materials. In older houses, the foundation walls are often made of rubblestone or poured concrete with large stone pieces. These foundations are often not waterproofed and tend to be porous, permitting ground water to seep through the walls. If there are perimeter drainage tiles, there are very few. Eventually the water, especially in a freeze-thaw situation, will cause the mortar or concrete to crumble.

Dampness in the basement creates ideal conditions for wood rot and mold to develop in structural members such as joists. Signs of moisture damage in basements include water stains, damp spots on foundation walls or floor, cracked and crumbling mortar or a white powdery deposit—called efflorescence—on walls and rot and mold. Wet and damp areas also encourage the influx of ants and termites.

Moisture in the wall has caused plaster to crack and break away.
Buchan, Lawton, Parent Ltd

Peeling paint on the upper floor of this house is an indication of a moisture problem.
Buchan, Lawton, Parent Ltd

Above-grade, moisture damage occurs when exterior building elements are not sufficiently protected from the weather. For example, dried and shrivelled caulking around penetrations through a wall or a rotting window frame can permit rain to soak the wall cavity. Paint failure, decay and buckling of wood siding can all occur when edges of the siding are unprotected or when materials have open joints or gaps. A missing or damaged roof shingle or piece of flashing can allow water to penetrate the roof, causing damage to the attic and to the ceiling below.

Moisture damage from ice damming is visible as stains on exterior siding and on the interior in the attic or the finished wall and ceiling below the leak.

Another common moisture problem is the buildup of condensation in attics. Air leakage from the house into the attic carries a lot of moisture. Before adding insulation to the attic, make sure air leakage from the house is stopped. Lack of adequate ventilation can also contribute to the buildup of moisture in an attic.

In balloon-frame houses, water can penetrate through the roof at the wall cavity, travel down the inside of the wall and emerge in the basement. Water can also enter the wall cavity from the exterior or the interior of the building. Water from a leaky faucet or pipe behind a toilet or bathtub can show up in the basement. In balloon-frame homes, careful detective work is often necessary to determine the source or sources of a leak.

Moisture damage can also occur when the building envelope is not protected from moist indoor air leaking into the walls or attic, condensing and causing wetting and damage to the building structure. Signs of excess humidity and potential problems include wet insulation or sheathing in the attic, stains on the ceiling, visible condensation on windows, water stains, blistering peeling paint and soft or rotten plaster or drywall.

As well, localized water damage can occur to countertops, flooring, tub enclosures and cabinets when fixtures, such as sinks, tubs and toilets, are not properly sealed.

In the century-old home, another, more serious, moisture contaminant may exist. The original drainpipes from the toilet, bathroom and kitchen fixtures were probably made of cast iron. After 100 years, this cast iron can be quite brittle and easily break and split. Small splits in a pipe can allow waste water to accumulate in hidden cavities of the wall and floor. Even when the pipes appear to be in good condition, renovation around the pipes can cause catastrophic failure. Use caution when working with old drainage pipes.

New considerations in housing

New, improved products and systems

Housing technology has evolved rapidly in the second half of the 20th century. New and improved products and systems are available to replace or upgrade existing components in the century-old house. Furnaces, lighting and appliances are far more efficient. The materials and installation of electrical systems are safer, many building products are maintenance-free and some materials are more durable. Siding and cladding systems, for example, are more durable and almost maintenance free; direct vent furnaces and fireplaces are energy efficient and much safer; and windows contribute to energy efficiency rather than letting heat escape from the house.

House as a system

The house-as-a-system approach recognizes that all the components of the house—the building shell, the heating and ventilation systems—interact as part of one system.

Understanding how the house acts as a system is especially important in renovation work since changes to one component can bring unexpected results. Upgrading the building envelope, for example, can lead to higher indoor humidity and condensation on windows unless the ventilation system is upgraded at the same time.

House-as-a-system best practices are incorporated in the construction details for each sample renovation project.

Adaptability

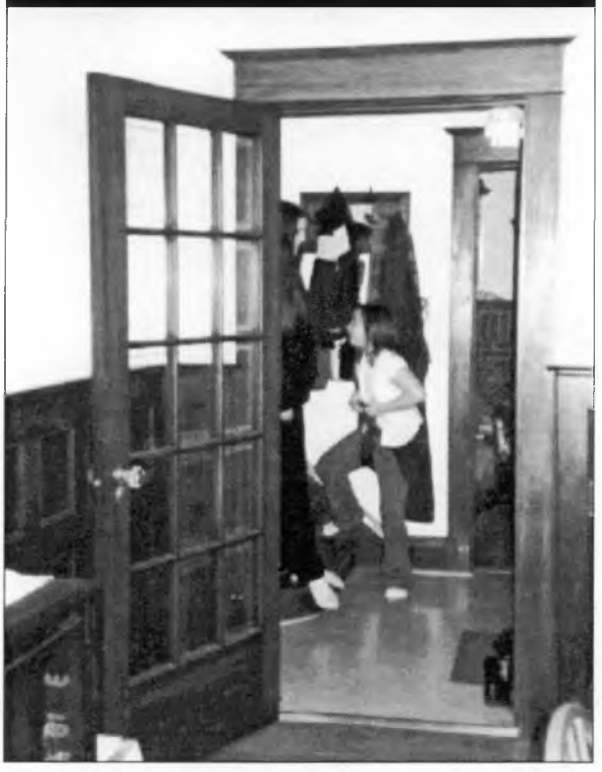
Housing is a durable commodity. In Canada, houses built more than 200 years ago are still occupied and in Europe many homes are much older.

In the 20th century, family needs, population and communities changed rapidly. It only makes sense that housing should adapt to our changing requirements.

For example, by planning ahead to include the required wiring for electrical and computer systems, a nursery can be used as a home office in the future. Similarly, an open plan may be nice when children are small, but the addition of french or pocket doors allows more flexible use of space when the house is full of teenagers. In bathroom renovations, the simple addition of grab bars and easy access door and faucet handles make the house more usable for an elderly or disabled person.

This approach to home building and renovation is called FlexHousing™. Tips on how to incorporate FlexHousing™ principles are included in the detailed coverage of each sample renovation project.

Solid wood floors and hardwood floors are easily cleaned to remove molds and contaminants and have long-term appeal and durability
Buchan, Lawton, Parent Ltd



Health and environmental considerations

Healthy Housing™ is a new approach to building and renovating houses. It recognizes that the houses we live in can affect our health and also have a major impact on the environment around us. Consider these facts.

Occupant health—air quality

Canadians spend 90 per cent of their time indoors. The indoor environment can be three to four times more polluted than outdoor air. One-third of households report someone with allergies or breathing problems. Healthy Housing™ supports occupant health by choosing materials, products and systems that maintain good indoor air quality.

Natural resources—water and materials

In Canada, demand for water is increasing much faster than the population, straining water infrastructure and, in some communities, limiting water resources. On average, Canadians consume twice as much water per day in their homes as Europeans. In the summer, communities large and small have experienced water shortages. Healthy Housing™ uses low-flow showerheads and toilets to reduce water use by up to 70 per cent.

This approach carries through to the efficient use of all natural resources. Small dimension lumber, such as 2x4s and 2x6s, are used instead of large-dimension lumber from slow-growth forests. Engineered wood products, such as pre-manufactured trusses and composite wood products including medium density fibreboard, are manufactured from small dimension lumber and wood by-products. These products use our natural resources more effectively. The efficient use of natural resources includes choosing materials with low embodied energy, functionality, long-term appeal and durability.

Environmental responsibility—waste water

In 1991, 75 per cent of Canadians were served by a sewage collection system. A large portion of the existing treatment systems, however, require upgrading to meet today's environmental standards. Healthy Housing™ uses equipment and materials aimed at reducing the pollution of water, air and land.

Energy efficiency

Canada is one of the highest per capita energy consuming nations in the world—partly as a consequence of climate, geography and industrial base. Housing accounts for 20 per cent of national energy use. More than one-third of Canada's houses were built before 1960, when houses were poorly insulated. The energy efficiency of existing housing must be improved if Canada is to meet commitments to greenhouse gas reductions. Healthy Housing™ achieves significant energy savings through improvements to the building envelope, heating system and lighting and through using renewable energy sources, such as wood heating or solar energy.

Natural Resources Canada offers individualized, professional advice to homeowners on energy efficiency through the EnerGuide for Houses Program. Expanding on the well-known EnerGuide Labelling Program for home appliances, EnerGuide for Houses provides homeowners with the facts they need to make informed decisions about energy efficiency. There is a nominal fee for the service.

Affordability

Healthy Housing™ is for everyone. A healthy environment is beneficial to people of all ages. As well, many of the healthy improvements save renovation costs and substantially reduce a home's operating costs. Refer to the descriptions of renovation projects for tips on how to incorporate Healthy Housing™ principles into your renovation.

Conclusion

The early 20th century two-storey house exists in many forms across North America. It is the oldest style still found frequently in most Canadian cities and across the rural landscape.

For their time, the homes were well designed and well built—their continued existence is a testimony to that fact. Still, after a century of occupancy, there are many reasons why these homes require more than just maintenance. Families and society have changed and these changes are reflected in the way our homes are used. As well, standards for building components and services have risen over the years.

New knowledge has shown houses can be more efficient and have less impact on the environment and on the pocketbook. Over the years, problems may have developed through simple wear and tear or through failure of building components.

Changing expectations, new considerations and any problems—address these as part of any renovation plan.

CHAPTER 3: THE RENOVATION PROCESS

Introduction

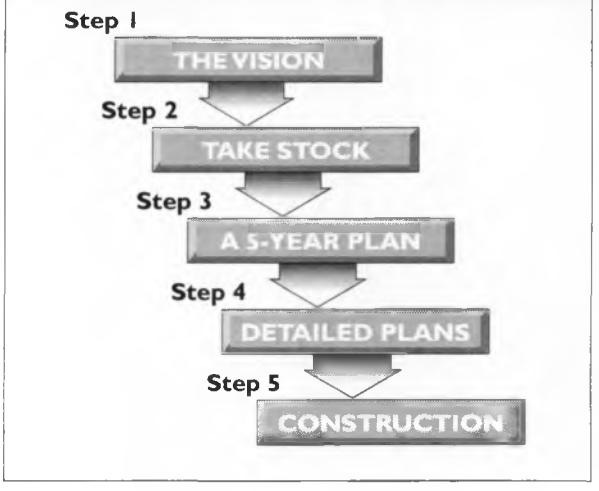
The renovation process

Most homeowners maintain their houses on an ongoing basis and carry out a large job every few years—a new roof this year and painting the exterior three or four years later. Many undertake some of the jobs themselves, for example, repainting or building a deck. Once in a while, a major project, such as redoing the kitchen or adding an addition, requires work from a general contractor and specialty trades. Despite the constant attention, effort and expense—the upgraded results may be less than satisfactory.

- The quality of the finished work does not measure up to expectations.
- The renovation doesn't achieve the desired look or feel of the space.
- The project costs far more than anticipated.
- The job dragged on far too long.
- Some existing problems were ignored and had to be dealt with later at greater expense.
- The renovation changed the house in unexpected ways.
- Unexpected problems were discovered—requiring more work and expense.
- The work had to be ripped out three or four years later to accommodate a subsequent renovation.

Avoid many of these common pitfalls with a better understanding of the renovation process and proper attention to planning and preparation. This chapter provides an overview of renovation as it proceeds from vision to construction. It offers a step-by-step description of what is involved and what tasks you, the homeowner, need to accomplish for a successful renovation.

Figure 3-1 The Renovation Process



The renovation process

Why do people renovate?—To make the house into a better place to live. Renovation starts with your vision of your goals for your house and moves through several steps to the completion of individual projects.

Along the way you need to take stock—develop a solid understanding of the house—what needs attention, its good features and its limitations, problems and opportunities.

With a vision in mind and a thorough knowledge of what you have to work with, you develop the big picture—a rough plan of what you aim to accomplish over the next three to five years or longer.

Then you get down to the pleasant task of making your dream a reality by tackling individual projects. Depending on the circumstances, your plan may spread projects over several years or group them into one major renovation effort. Whether the project is big or small, you need to develop detailed plans and preparations and arrange the actual construction work.

Step 1. The vision

If you don't know where you're going, how will you know when you get there?

You may already have some very specific ideas about your house—improvements you want to make or problems you need to fix.

Step back for a moment and look at the house as a whole. What kind of house do you see having in three to five years, or even in 10 years?

How do you and other family members picture your ideal home . . . with a large family room and a glowing fire . . . with a fully equipped hobby room or a state-of-the-art kitchen? Has your family changed or do you anticipate changes? Do you need more space or would you like to use the space for different activities?

Dreaming doesn't cost anything and it can help to identify the features that will give you the most satisfaction. Besides, drawing a vision of your future home helps you to get a picture of how the various ideas and projects you have in mind fit together.

Use the Checklist in Chapter 4 to help develop the vision of your ideal home.

Step 2. Take stock

Even if you do not plan to do any of the work yourself, you need to understand enough about your house to be able to understand the renovation process.

To begin with, find out what it will take to bring the house up to building codes and current construction standards. Although you may not be required to bring your house up to current standards, identify any deficiencies and understand how these deficiencies may affect the renovation. Upgrades to a kitchen, for example, might require the installing a new electrical service to provide enough electrical outlets.

Besides helping to identify hidden problems, getting to know your house better helps you to identify opportunities for combining jobs efficiently. For example, you could run conduit and ventilation ducts or install a plumbing-wiring chase to the second floor at the same time as you replace a deteriorated waste pipe for the bathroom.

The separate parts of a house form one complete system. Understanding how the parts interact can help you to anticipate how a planned renovation to one component may affect others. For example, an addition may put too great a load on the existing heating system and you may need a new furnace. Similarly, removing an interior wall may require additional structural reinforcement or rerouting of the plumbing and wiring enclosed in the wall cavity.

Finally, a thorough understanding of the house and the renovation possibilities helps you to stage the improvements in a logical order and avoid unnecessary work and expense.

The best way to gain an understanding of your house is to carry out a thorough inspection. Renovators, experienced home inspectors or other professionals, such as an engineer or architect, can do inspections. If you are already knowledgeable about house construction, you can do the inspection yourself.

The inspection should answer these questions

- How is the house built? What is it is made of and how is it assembled?
- Is it safe? Are there any hazards requiring immediate attention, for example, an unsafe heating system, broken handrails or stair treads?
- Do the components of the house meet current standards?
- What components require immediate attention, such as caulking, windows, condensation in attic and water leaks? Are there other components in need of repair or replacement? If so, how soon?
- What components should and can be upgraded while renovating?
- Do less obvious problems exist that could become serious later, especially if a renovation is carried out?
- What are the opportunities for making the house more energy efficient?
- What are the opportunities for improving indoor air quality

The inspection is similar to a general physical check-up for your house. Cover all aspects of the house—basement, mechanical systems, the exterior and the main floors and attic—not just the areas you are considering renovating or the areas where you know there are problems.

Take stock. Look at the plumbing, electrical and heating systems. Get out a flashlight and look in the far corners of the basement and the attic. While some things, such as the need for a paint job, are obvious, other potential problems are only noticeable when you look in out of the way places.

A sample Inspection Checklist is included in Chapter 4.

As part of taking stock, prepare a site plan of the house and the property. A plan may already be available in the information package you obtained when you bought or mortgaged the house. If not, create your own sketch of the property and house by measuring the lot and including the house and any outbuildings. Measure and note all setbacks to the property lines. Information on setbacks is available from your local municipality.

Step 3. A Five-year plan

This is where you begin to put your dreams on paper. When complete, your plan will identify what you want to accomplish over the next three to five years, roughly how much each project will cost and when it will be done. Even if your renovation work is limited to one major job every year or so, an overall plan guides the process and helps to:

- Clarify the direction you are taking with the house
- Ensure the essential jobs are given top priority and the components of the house are renewed before they break down—preventing unpleasant surprises
- Ensure the projects are carried out in a logical sequence—saving you time and money
- Allow you to space out major jobs and avoid having to complete them all in the same year
- Allow you to realistically plan and budget for home maintenance and renovation.

List the projects

To begin developing your plan, list the projects and tasks required to achieve your vision and to address any problems identified in the inspection. Place them in order of priority. The Planning Worksheet in Chapter 4 is a useful aid for this step.

Describe the work

You may be in hurry to get the work started but, before starting any renovation job, have a clear idea of what you want to accomplish and your budget. Otherwise, you may get more (or less) than you bargained for.

Develop a simple description for each job. Include a preliminary estimate of the costs and identify when it should be done. For smaller jobs, such as replacing the furnace, a few notes are adequate. You can often obtain typical price ranges from the trades involved.

At this stage in larger projects, try to visualize how your finished project is going to look. Start a clipping file to collect ideas and design illustrations you like. If you are rearranging space or adding new space, draw a floor plan to scale and try out different furniture arrangements and traffic patterns. Templates of typical furniture and recommended space allowances are included in Chapter 4.

Keep an open mind at first. A problem can usually be solved in more than one way and the best solution may not be the most obvious. Mentally walk through the space and imagine traffic flows and the views from room to room. Do a sketch of any addition to help you to visualize how it will look from the outside.

Don't ignore the essentials. Finishings can be easily upgraded or added later but it's very costly to redo structural work, add more space or upgrade services after the work is complete.

At this point you may have more questions than answers. What's involved in removing this wall? How much will it add to the cost of the renovation? Are there other possible ways to add more space?

Get advice from a professional contractor, engineer or architect or a qualified home inspector. For a consultation fee, they walk through your home with you and answer questions about your proposed plans. They may even provide a concept sketch. For large projects, this is money well spent. The fee is often paid back through money saved and mistakes avoided during the renovation.

Contractors, magazine articles and friends are all good sources for cost ranges for various types of projects.

Remember the costs for renovation work can vary significantly depending on:

- The quality of workmanship.
- The quality of materials, especially finish materials used.
- Unforeseen problems discovered during the course of the work, for example, rotten floor joists or deteriorated plumbing and
- Prevalent rates in various parts of the country.

Reality check

Once you have your dreams on paper, it's time for a reality check. Ask yourself if your plans are:

- Permitted under current zoning by-laws
- Practical
- Financially feasible.

Permits

Check to see whether your dream addition conforms to local zoning by-laws. If not, you may need to apply for a variance. A variance is usually not difficult to obtain for a minor

change in setback or lot coverage, especially if your renovation is in keeping with the other houses on the street. However, it is best to obtain permission before committing to the work.

Contact your municipal building department to confirm setback requirements and other relevant regulations. Ensure you clearly understand all requirements.

Before demolishing an existing structure or addition, make sure it can be replaced. In some cases, if the existing structure is demolished, it may not be possible to obtain a permit to build a new structure or addition. The setback requirements may have changed since the construction of the building or addition or it may have originally been constructed without proper approval or before approvals were required. As well, in the case of renovation and new construction, different sections of the building code can apply.

The definition of renovation and new construction can have a significant impact on the project. A renovation may not require the various systems in the building to meet the current building code, unlike new construction, which must meet code. Once a percentage of the building being renovated reaches a certain amount, a municipality may require the whole building to meet the current code.

Many older homes are built closer to the road and the lotline than is now permitted. These same homes may also be at the height limit for their zoning. You may not be permitted to add a gable and turn attic space into living space without obtaining a zoning variance.

Before proceeding to the detailed planning stage, speak to your municipal building department and find out what limitations and requirements the municipality sets out for renovating your house. Get a list of all required approvals (including approvals from other authorities, such as a regional or conservation authority) and a time frame for obtaining approvals.

Practicality and lifestyle decisions
For improvements beyond preventive maintenance, consider these questions:

- How long do you plan to stay in the house?
- How much of the renovation cost can you likely recover on resale?
- Are you concerned about resale value?
- Does your planned renovation put your house's selling price out of line with other houses in the neighbourhood?
- Will the renovation increase or decrease costs for heat, hydro and water?
- How will it affect the assessed value of your home?
- Will your property taxes and home insurance go up as a result?
- If the planned improvements are based on lifestyle decisions, how will they affect future lifestyle changes?

Financial feasibility
Finally, is the project financially feasible? Can you carry the additional costs of the renovation work and any increase in operating costs?

How will you finance the work? For major projects, a personal loan is one possibility. Increasing the amount of your mortgage allows you to pay for the work over a longer period of time. Keep in mind that lenders prefer to see a minimum of 15 per cent equity in the home and the costs for principal, interest and taxes at no more than 30 per cent of income. Before proceeding further on a major project, find out if you qualify for any needed financing.

Finalize your five-year plan

After the reality check, you may need to revisit your priorities or scale back your plans. As you finalize your five-year plan, organize your projects into a logical sequence. When complete, your plan should:

- Give priority to essential maintenance and repair work
- Take advantage of opportunities to save money by combining jobs
- Schedule projects to suit your financial resources.

Step 4. Detailed plans

Your completed plan may consist of a series of individual projects spread over several years or you may decide to carry out all the work in a few months as one major renovation. Whatever you decide to do, this section reviews the tasks required before construction starts, from preparing detailed plans to last-minute preparations of the work site.

Detailed plan

On major projects, detailed plans are required for building permit approvals. Even small jobs go more smoothly with a proper set of plans and specifications. A detailed plan:

- Clearly presents the scope of the project and what the work requires
- Provides the information needed to obtain quotes from contractors
- Specifies the finished appearance of the job.

For smaller jobs, such as re-roofing, a short description of the work is required. Include the following items:

- Scope of the work: what is included and what is not. For example, on a roofing job, is the sunroom roof to be included as well?
- Specifications for the quality of materials and workmanship: For example, will the shingles be 20-, 25-, or 30-year type? Does the job include installing an ice and water shield membrane and metal flashing along the eaves to prevent water entry in the winter? Are the flashings to be replaced?
- A sketch of any unusual detail: for example, how the new flashing is to be installed at the chimney.
- Types of guarantees.
- Who is responsible for debris removal and daily clean up?
- Payment terms.

For small projects, you can prepare the detailed specifications yourself. However, you may want to seek professional advice. Professionals are often aware of a wider choice of materials beyond those available through local building supply stores. They also ensure the details are worked out, such as appropriate flashing material for the roof.

Large projects, such as an addition, require more information, including a site plan, floor plans, elevations and drawings of construction details and written specifications.

There are several different ways to obtain detailed plans for larger projects.

- Hire an architect, architectural technologist or an engineer. Typically the fee for design services is 10 per cent of the value of the work.
- Hire a contractor to do the design and renovating. Most contractors are prepared to develop detailed drawings and will include this cost in their quote for the work, if requested. However, it is not appropriate to take the drawings of one contractor and use them to obtain quotes from others.

- If you are skilled in this area and have some time, prepare the drawings yourself.

Who will do the work?

Should you act as your own general contractor?

Ask yourself these questions:

- Do you have the time to spend organizing and supervising the work?
- Do you have a great deal of patience?
- Are you a competent handyman?
- Do you understand construction practices thoroughly?
- Can you find the right subtrades and get competitive bids?
- Are you assertive enough to provide the supervision and scheduling?
- Do you work well under stress?
- Does your insurance include liability coverage?
- Do you have the support and agreement of your family?

Use the size and complexity of the job as your guide to deciding who will actually do the work. Hire a neighbourhood handyman for some small jobs, such as painting or installing a fence or deck, or do it yourself. Hire skilled and professional tradesmen for other tasks, such as roofing, wiring or plumbing.

When hiring anyone to work on your house, be aware of liability and workplace safety issues. If you hire a handyman who does not have adequate insurance, you can be held responsible for injuries to the handyman and others. Ask for copies of workers' compensation, general liability, and all risks property and equipment insurance certificates from anyone you hire.

Larger jobs usually involve several trades. For example, a kitchen renovation can involve a cabinetmaker, carpenter, electrician, plumber, drywall installer, flooring installer and painter. For larger jobs, use the services of a general contractor to carry out the project.

There are other, easier ways to save money on your renovation than acting as your own general contractor. You (and a few friends) can handle some of the demolition. You can negotiate with the contractor to provide site clean up or do some of the finishing work yourself, such as painting.

Hiring a contractor

Whether the job is a single task, such as building a deck, or a full addition involving several trades, the process of hiring a contractor is the same.

If you know a reputable contractor or builder, negotiate with them directly. Most contractors depend on service and good will to stay in business and they will work hard to make your renovation a success.

If you do not know a reputable contractor or builder, contact a minimum of three candidates to ask for quotes. Ask your designer, friends and neighbours or your local Home Builders' Association for referrals. Provide all the candidates with the same information: your detailed plans and specifications. Request a list of three references from previous clients and follow up by checking these references. If possible, visit sites of previous work and work in progress and ask the owners about the contractor's performance.

When evaluating the bids, use the Contractor Checklist in Chapter 4 and keep these points in mind:

- Suitable experience: Does the contractor have experience with the scale of job you have in mind?
- References: How do previous customers view the contractor's performance?
- Working relationship: Will you be able to form a good working relationship?
- Licences and insurance: Does the contractor carry the appropriate licences and insurance to cover public liability and property damage?
- Price: The lowest bid is not necessarily the best. If it is much lower than the others are, the contractor may have misunderstood the scope of the work, made a mistake or be trying to get a foot in the door and counting on charging for extras later.

The Contract

Whether your project is large or small, a contract is essential. It records the agreement and understanding between you and your contractor. The contract can vary from a simple letter to a document of many pages but the essential features are the same. Include the following:

- Address of the property where the work will be done.
- The client's name and address.
- The contractor's name, address and phone number and the name of the person who will be in charge on-site,
- Detailed description of the work to be performed under the contract; (for larger projects attach the drawings and specifications as part of the contract).
- Agreement on who is responsible for obtaining any necessary permits, licences and certificates.
- A statement of the contractor's public liability and property damage insurance coverage,
- Dates for starting and completing the work.
- An itemized price for the contracted work and the terms of payment.
- A statement of any warrantees or guarantees on the work and
- Signature of both parties, with each retaining an original signed copy of the contract.

Follow these rules

- Always get it in writing.
- Don't sign anything until you've had a chance to take time and review it and compare it to your other options.
- Compare any contracts against what's needed, as outlined in this section. Don't be shy about making changes or additions to any contract presented by the contractor

For larger projects or additions, contracts also include:

- Agreement on who is responsible for removing all construction debris.
- A statement on who is responsible for increased fire and theft coverage for the new work under construction (usually the homeowner).
- A statement from the contractor indicating he/she is responsible for any applicable workers' compensation coverage (request copy of certificate) and
- A statement naming the person (usually the homeowner) who is responsible for providing the contractor and his sub-trades with access to the property, electrical power, water, washrooms and any other necessities.

Remember, anyone you hire to work at your house should have appropriate insurance, including personal and public liability, property damage and worker's compensation.

If a worker without insurance is injured or causes damage to your property or anyone else's while working for you, then you, as the homeowner, may be held responsible.

In the case of large jobs with a number of subcontractors and suppliers, the stipulated price contract provided by the Canadian Construction Documents Centre (CCDC) provides the resources to create a comprehensive contract.

Refer to Chapter 4 for a sample contract.

Getting permits

While the contractor or trades person may arrange to get the required permits, the homeowner is ultimately responsible to ensure they are in place. If you are not sure you need a permit, call your municipal building department. It's always less costly in the end to spend time on permits and inspections up front than to have to redo or remove work later.

Planning approvals
Planning approvals are only required when the renovation plans do not conform to the local by-laws regarding set backs from the property line, coverage of the lot by the building or the intended use. In these circumstances, you must apply to the municipality for an exception or variance to the by-law. Renovations or changes to older homes may require minor variances.

Building permits
Building permits are required to ensure the work is inspected and verified in accordance with the building code. A building permit is generally not required if the project is simply replacing a worn building component, such as roofing. Permits are required for any structural changes or additions to a building, to excavate or build a foundation and to install new plumbing, wiring, heating or air conditioning.

Plumbing, heating and electrical permits
Permits may be required for changes to these systems. Generally, the respective trade person arranges for the permit.

Demolition permit
Some municipalities require a permit to remove all or part of a building, for example, to remove a back porch and replace it with a deck.

Last-minute preparation

As the homeowner, you are responsible for providing space, access and the utilities used by the workers. Whether the job is big or small, you need to make the following arrangements.

- Remove or protect anything that may be damaged by construction activity. Outdoors, this could include brickwork, prized shrubs and plants. Indoors, protect carpets, cabinetry and panelling, furniture and artwork.
- Provide an area for workers to store materials, tools and refuse. If a dumpster is required, choose a location that will minimize damage to your lawn.
- Provide access for the workers to water, washrooms and a telephone.
- Seal off areas of major interior work to protect the rest of the house from dust and disruption, OR, if this is not possible, arrange to move out for a while. Some construction processes and finishes are toxic during installation and it may be necessary to move out until the work is completed to avoid health problems.
- Talk to the contractor to get an idea of the sequence of the work. Make appropriate plans for periods of greatest noise or disruption, including times when water and hydro may be turned off.

Step 5. Construction

Once the work is underway, stay involved. Make sure the project is going according to plan and address any problems before they get out of hand. During construction you are responsible for:

- Informing the renovator about deficiencies or mistakes as soon as possible.
- Paying for the job.
- Deciding whether the job has been done to meet your satisfaction.

Communicate

Difficulties are bound to arise in the course of any job but, with a good working relationship, the homeowner and contractor can quickly sort things out. The key is communication.

- Keep in touch. Don't hesitate to call the contractor if you have a question or if there is some change on the job site or with the work you weren't expecting. If you have a concern, deal with it immediately.

For larger jobs, set up a regular meeting time, once or twice a week, with the contractor and your designer if you have one. This arrangement saves time for both you and the contractor. It provides a relaxed forum to review the work to date, resolve any questions about materials or methods and deal with change orders and any concerns you may have.

- Keep lines of communication clear. You may ask questions of the workers on-site but always deal directly with the contractor to settle any issues.
- Hear the other side. When difficulties do arise, try to see it from the contractor's point of view, as well and clarify the issue amicably, before positions harden.

Inspections

For renovation projects involving a permit, the work must be inspected—in some cases several times. Major additions are generally inspected three or four times:

- After the footings and foundation wall are constructed and before the foundation is backfilled.
- When any new framing is complete.
- After the insulation is installed.
- When the job is complete.

Plumbing inspections are generally carried out at least once, after the pipes are installed, but before the fixtures are in. Some mechanical and electrical systems are inspected twice. Although it is the responsibility of the contractor to arrange the inspections, it's a good practice to be on hand when the inspector is there. With their wealth of experience, inspectors are a good source of information and suggestions.

Mid-course changes

Very few renovation jobs go completely as planned. Partway through the project, you may decide to add more features or upgrade a component, prompting a cut back in other areas.

In some cases, problems are discovered in the course of the work. For example, opening a wall reveals rotten structural members requiring replacement before the work can go forward.

At times like these, the time spent building a good working relationship with the contractor pays off. You need to jointly agree on an approach to be taken and record it as a written change order, signed by both parties.

Payments

Some contractors may request a down payment before beginning the job. Although this is not uncommon, money should only change hands after the work is agreed upon and a contract drawn up and signed by both parties.

Typically, payments are made on a regular basis, at milestones in the work, on a set payment schedule or on completion of parts of the work. Milestone payments are occur as certain tasks are finished, such as the laying of the foundation for an addition. The contractor documents the work on an invoice with the labour and materials clearly outlined. A small percentage, usually 10 per cent of the total job amount, is normally held back from the payment of the job until it is substantially complete.

Construction lien legislation requires that you hold back a certain percentage of every payment you make (usually around 10 per cent), for a certain length of time. This legislation is designed to protect you, the homeowner, in case the contractor does not pay the subtrades and suppliers involved in your project. If not paid, these people have the right to place a lien against your property within a specified length of time (typically 45 to 60 days). Lien legislation is provincial law and the specific requirements vary from province to province. You can contact the authorities in your province for more information.

Final inspection

When the job is complete, conduct a final inspection of the work with the contractor. At this point identify any deficient or incomplete work and come to an agreement with the contractor on how the deficiencies will be resolved. Ensure the corrections have been made and the contract requirements have been met before releasing the final payment.

Introduction

This chapter is your toolkit for planning and managing successful renovation in your home. These tools cover the steps in the renovation process, from developing a vision of your ideal home to preparing a contract for the work. They include the following:

The vision

- A Vision Worksheet to note your ideas and to identify just what you want to accomplish in your home

Taking stock

- A sample House Inspection Checklist

The big picture

- A Renovation Planning Worksheet to help preparing your five-year plan

Detailed plans and preparation

- A set of scaled templates for planning room layouts
- A checklist to use when hiring a contractor
- A sample contract

Vision Worksheet

1. We need to correct an obvious problem:

Fuel bills are too high.	The electrical system is overloaded/not enough outlets.
The house is hard to heat and/or is uncomfortable.	The roof leaks.
Components of the house have reached their lifespan.	The basement leaks.
The house affects family members who have allergies, asthma or other health sensitivities.	The house is too damp and moldy.
Other	

Our vision includes: _____

_____

_____

2. We basically like the house as it is but would like to make some improvements:

To make the layout more convenient.	To make the house more appealing/attractive.
To cut down on maintenance.	To make it more comfortable.
To modernize the wiring and plumbing.	To update the kitchen.
To modernize the bathroom.	To open up the floor plan.
Other	

Our vision includes: _____

_____

_____

3. Our interests and/or family have changed. We need to change the space to accommodate:

More children.	A nanny.
Growing children or teenagers.	A parent coming to stay.
A rental suite.	Grown children returning.
A home office.	An entertainment centre.
A home daycare.	A growing hobby or craft interest.
Other home business.	Other

Our vision includes: _____

_____

_____

House Inspection Checklist

This checklist is designed to assist you in making a quick but broad examination of your home. It should point out areas that need attention or further investigation. It will also help familiarize you with your home, in preparation for discussions with contractors.

• Number of Occupants	Daytime: _____ Nightime: _____
• Usual Indoor Temperature	Daytime: _____ Nightime: _____
• Humidity Levels	acceptable ___ high ___ low ___
• Humidity Sources	_____
• Odours	acceptable ___ complaints: _____
• Drafts	acceptable ___ complaints: _____
• Thermal Comfort	acceptable ___ complaints: _____
• Special Uses	_____

Basement/Crawlspace

Foundation Walls	
• Construction	rubblestone___ poured concrete___ concrete block___
	preserved wood___ concealed___ other_____
• Cracks, movement	concealed___ none___ minor___ notes_____
• Signs of moisture	water leakage: none___ location and notes_____
	moisture pass-through: none___ effluorescence___ dampness___
	condensation: none___ location and notes_____
• Insulation	none___ interior___ exterior___ fibre___ foam___
	thickess___ R___ condition_____
• Vapour barrier	concealed___ none___ good___ poor___
• Moisture barrier	concealed___ none___ exterior___ interior___ good___ poor___
Floor	
• Construction	poured concrete___ dirt___ raised___ finished___
• Cracks, movement	concealed___ none___ minor___ other_____
• Signs of moisture	water leaks: none___ location and notes_____
	moisture pass-through: effluorescence___ spalling___ dampness___
• Floor drainage	none___ drain___ sump pump and location_____
Floor Support	
• Header	concealed___ signs of moisture/rot___ good___
• Joists	concealed___ size___ spacing_____ span_____
	signs of moisture/rot___ good___ cut outs___ notching___
• Posts	concealed___ none___ adequate___ poor___
• Beams	concealed___ none___ wood___ steel___ good___ poor___
NOTES	

Mechanical Systems

Heating System	
• Fuel	oil___ gas___ electric___ wood___ other_____
• Type	forced air___ hydronic___ electric baseboard___ gravity___
• Capacity	_____ kW or BTU/hr
• Condition	good___ questionable___ poor___
• Accessory operation	humidifier___ air cleaner___ air conditioner___ heat pump___
• Furnace air filter	good___ needs replacement___
Fireplace:	
• Type	none___ open face___ doors___ recirculating___ stove___
• Chimney condition	clean___ dirty___
• Evidence of spillage	none___ stains___
Hot Water System	
• Fuel	oil___ gas___ electric___ wood___ solar___ combination___
• Type	central hot water tank___ instantaneous___
• Ownership	rental___ owned___
Plumbing System	
Supply:	
• Type	copper___ iron___ plastic___ mixed___ galvanized___
• Shut-off valve	location_____ concealed___ operational___ not operational___
• Condition, leaks	good___ questionable___ poor___ notes:_____
• Potential for freezing	safe___ possible___
• Flow rates	good___ low pressure___ restricted flow___
Drainage:	
• Type	cast iron___ plastic___ copper___
• Stack location	_____
Electrical System	
Service:	
• Capacity	60 amps___ 100 amps___ 200 amps___ other___
• Distribution	fuse___ breaker___ spare circuits___
Wiring:	
• Type	copper___ aluminun___ grounded (three prong)___ ungrounded (two prong)___
• Age/condition	good___ old___ unsafe___
• Outlets	distribution: good___ need additional plug outlets_____
• Fans	none___ kitchens___ bathrooms___
• Ground fault breaker	bathrooms____ outdoors___ garage___ whirlpool bath___

NOTES

Main Floors

Exterior Walls	
• Construction	single stud: 2 x 4___, 2 x 6___ insulated sheathing (R_____)
• Insulation	none___ cellulose___ fibre___ foam___ R_____
• Finish	drywall___ plaster___ panelling___
• Cracks	none___ minor___ noteable_____
• Signs of moisture	none___ stains___ mold___ dampness___ peeling paint___
	soft plaster/drywall___, location_____
Interior Walls	
• Finish	drywall___ plaster___ panelling___
• Cracks	none___ minor___ noteable_____
• Signs of moisture	none___ stains___ mold___ dampness___ peeling paint___
	soft plaster/drywall___, location_____
Ceilings	
• Finish	drywall___ plaster___ panelling___
• Cracks	none___ minor___ noteable_____
• Signs of moisture	none___ stains___ mold___ dampness___ peeling paint___
	soft plaster/drywall___, location_____
Floors	pre-finished tile or sheet material___
• Finish	carpet___ tile___ linoleum___ hardwood___ ceramic___ other___
• Level	good___ foundation movement___ interior support___ sag___
• Squeak	none___ acceptable___ requires correcting___

Windows and Doors

Windows	
• Type	single hung___ double hung___ fixed___ awning___ casement___ sliders___
• Glazing	single___ single and storm___ double___ triple___ other_____
• Frame	wood___ moisture damage___ rot___
	aluminum___ vinyl___ other___
• Condition	good___ poor___ notes:_____
• Seal/weatherstripping	good___ poor___ notes:_____
• Sill condition	good___ moisture damage___ rot___
Doors	
• Type	wood___ metal___ insulated___
• Storm	none___ aluminum___ wood___
• Weatherstripping	none___ good___ loose fitting___
NOTES	

Attic Ceiling Space

• Type	flat roof___ cathedral ceiling___ peaked___ other_____
• Structure and Condition	concealed___ joist___ rafter___ truss___ concealed___ good___ damaged___ rot___
• Sheathing and Condition	plank___ plywood___ composite___ other_____ concealed___ good___ damaged___ rot___
• Insulation	none___ blown___ batts__ mica___ cellulose___ fibreglass___ other_____ R value_____
• Vapour barrier	none___ poly___ other_____
• Air barrier	none___ well sealed___ evidence of air leakage___
• Evidence of roof leakage	none___ description/location_____
• Evidence of condensation	none___ general staining___ condensation on sheathing___ wet or packed insulation___
• Evidence of air leakage	attic hatch___ plumbing stack___
• Ventilation	soffits___ peak___ gable___ mushroom___ adequate___ inadequate___

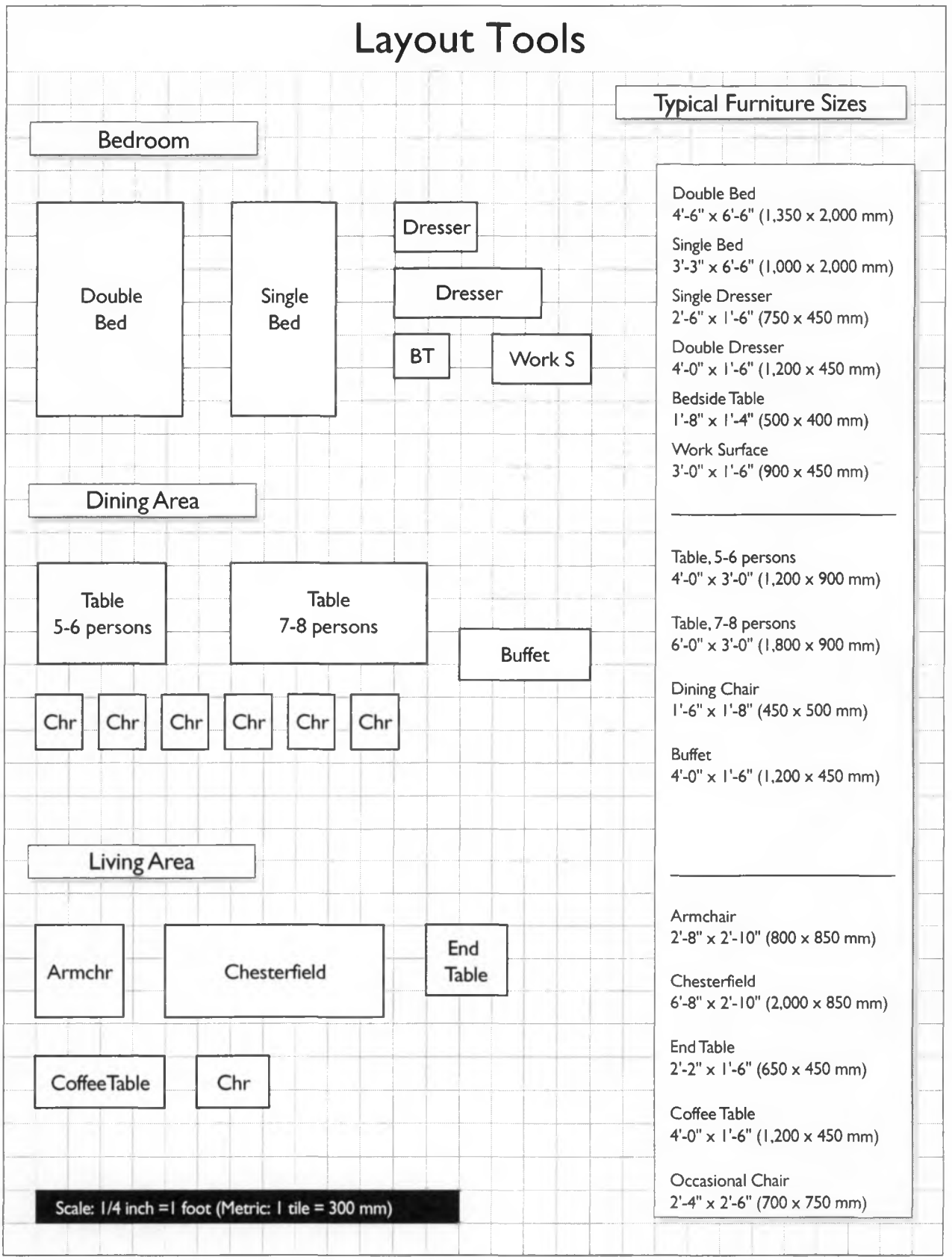
House Exterior

Foundation	
• Signs of moisture	none___ exterior source___ interior source_____
• General condition	good___ poor___ description_____
• Cracks	none___ minor___ noteable_____
• Grading	positive slope away from house___ slope toward house at___
Chimney	
• Condition	good___ repoint___ rebuild___
Exterior Walls	
• Finish	brick___ stucco___ wood___ aluminum___ vinyl___ stone___ other_____ good condition___ needs attention___
• Cracks, bows, sags	none___ minor___ notable_____
• Signs of moisture	none___ exterior source___ interior source___
Windows	
• Type	fixed___ awning___ sliders___ casement___ boarded up___
• Signs of moisture	none___ stains___ rust___ rot___
• Cracks, bows, sags	none___ notable_____
• Flashing and caulking	good___ needs repair___ replacement___
Roofing	
• Remaining life	1-3 yrs___ 5 yrs___ 10 yrs___ longer___
• Type	asphalt shingle___ slate shingle___ wood shake/shingle___ tar/gravel___ other___
• Condition	good___ minor repair___ major repair/replacement___
• Heat loss	okay___ winter snow melt___ winter icicles___
• Eavestrough/downspout	good___ needs repair___ no eavestrough___
• Drainage	good___ pooling___

Renovation Planning Worksheet

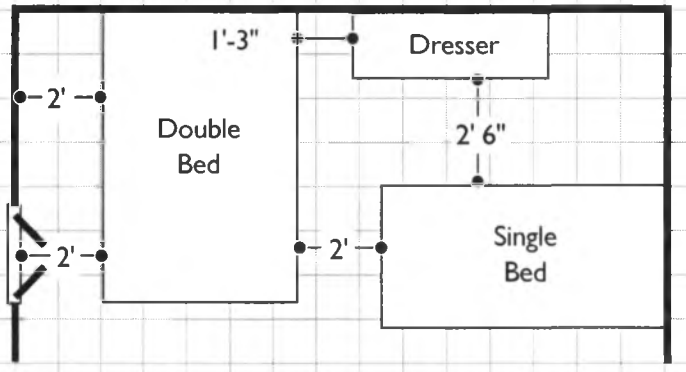
PROJECTS AND TASKS	Priority	Trade Required OR Do-it-Yourself	Ballpark Cost
The Essentials . . . addressing immediate problems and preventative maintenance			
Reroof			
Basement waterproofing			
Correct moisture problem			
Repaint exterior siding/trim			
Recaulk siding			
Correct electrical problems			
Correct plumbing problems/tub enclosures			
Service HVAC equipment			
Correct indoor air quality problems			
Home Improvements . . . improving the existing space			
Upgrade wiring			
Upgrade plumbing			
Upgrade HVAC system			
Modernize kitchen			
Modernize bathroom			
Change interior room layout/move walls			
Replace/upgrade flooring			
Replace interior finishes/stairs and railings			
Re-siding			
New windows			
Upgrade insulation and air sealing			
Space Related . . . adding new rooms			
Finishing the basement			
Second-storey expansion			
Ground floor addition			

Layout Tools

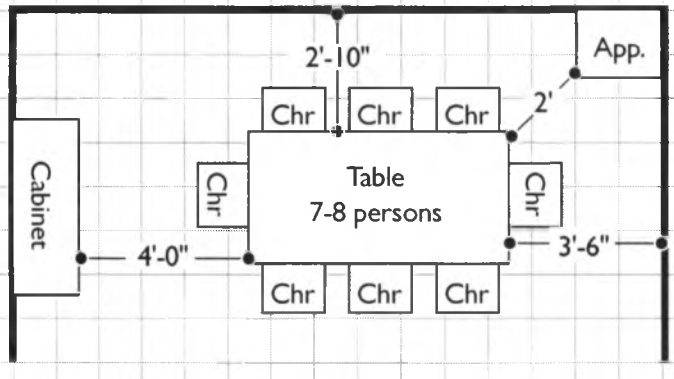


Layout Tools cont'd

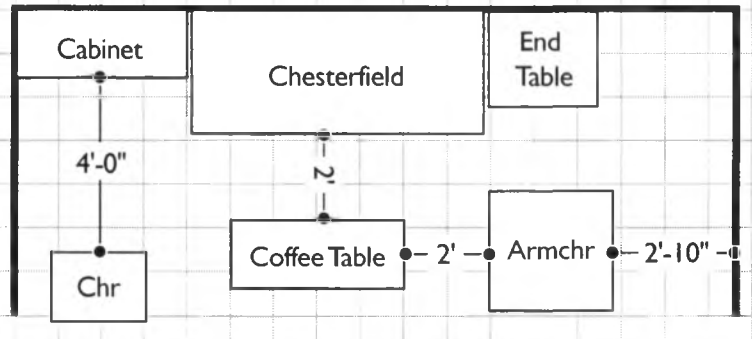
Bedroom



Dining Area



Living Area



Scale: 1/4 inch =1 foot (Metric: 1 tile = 300 mm)

Recommended Clearances

Access between a bed and furniture
2'-6" (750 mm)

Access between a bed and closet
2'-0" (600 mm)

Bed-making space
1'-3" (400 mm)

Access between a bed and wall
2'-0" (600 mm)

Space between beds
2'-0" (600 mm)

General access
2'-10" (850 mm)

Access between a table
and opening cabinet
4'-0" (1,200 mm)

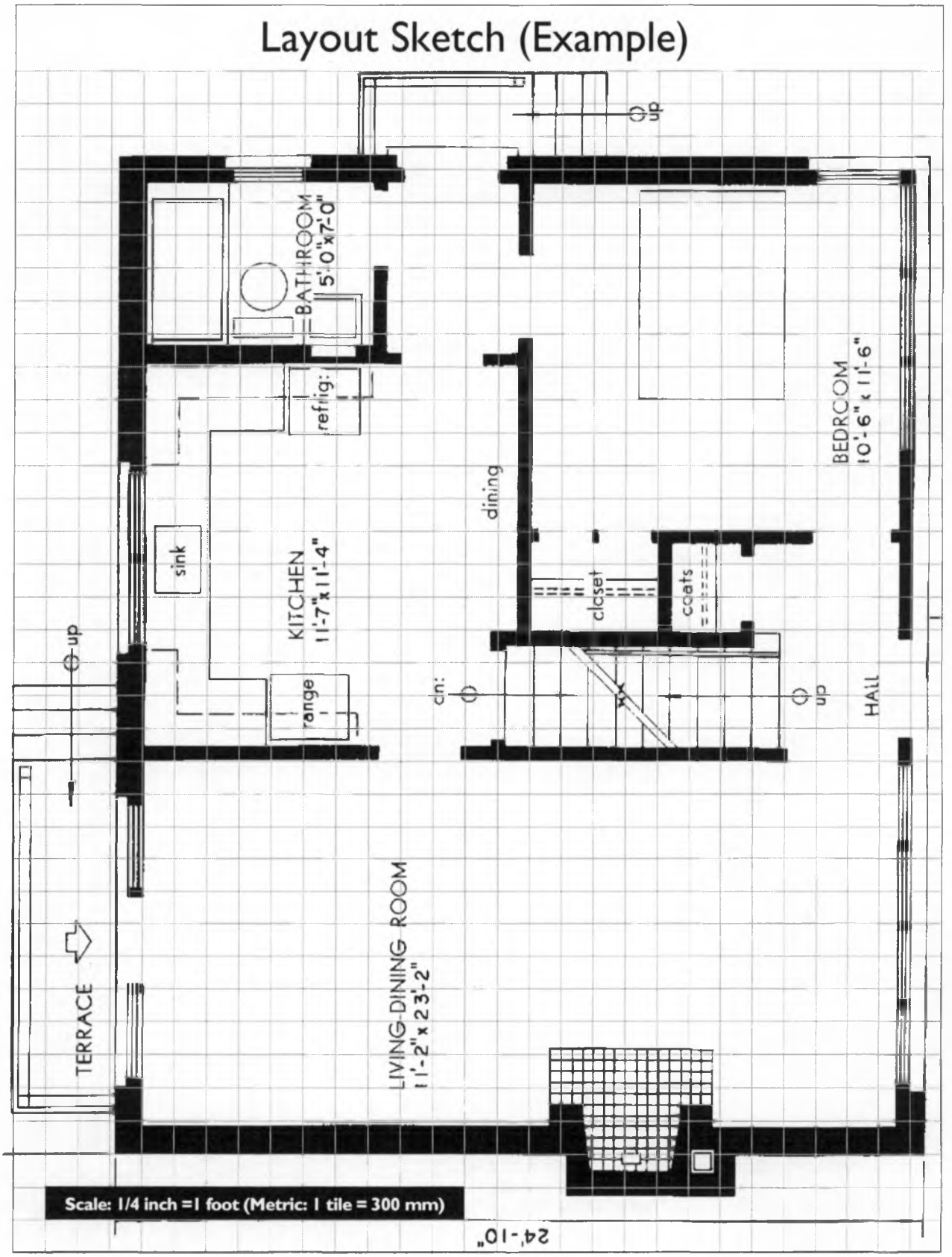
General access behind a chair
3'-6" (1,000 mm)

Access between a table
and other furniture
2'-0" (600 mm)

Limited access behind a chair
and between a table and a wall
2'-10" (850 mm)

Access between a table and seating
4'-0" (1,200 mm)

Access between a table and
cabinets or appliances
4'-0" (1,200 mm)


Layout Sketch (Example)
up
BATHROOM
5'-0"x7'-0"
refrig.
BEDROOM
10'-6" x 11'-6"
dining
sink
KITCHEN
11'-7"x11'-4"
closet
coats
range
dn:
up
HALL
up
TERRACE
LIVING-DINING ROOM
11'-2"x 23'-2"
Scale: 1/4 inch =1 foot (Metric: 1 tile = 300 mm)
24'-10"

Contractor Checklist

CONTRACTOR 1

1. Suitable experience for the job at hand

2. References

3. Working Relationship

4. Licenses, Insurances, Prof. Affiliations

5. Price

CONTRACTOR 2

1. Suitable experience for the job at hand

2. References

3. Working Relationship

4. Licenses, Insurances, Prof. Affiliations

5. Price

CONTRACTOR 3

1. Suitable experience for the job at hand

2. References

3. Working Relationship

4. Licenses, Insurances, Prof. Affiliations

5. Price

Sample Contract

Between the Owner: _____
And the Contractor: _____
Subject Property: _____

Contract Documents:

1) This agreement
2) Attached drawings and specifications signed by both parties
3) Additional documents and contract amendments (extras and deletions) signed by both parties during the course of this agreement.

The Contractor Shall:

1) Furnish all labour, materials, supervision and services to carry out the work detailed in the attached plans and specifications (to be initialled by the contractor and the owner) at the above address.
2) Be licensed and maintain full public-liability and property-damage insurance covering the above work.
3) Maintain workers' compensation coverage on all employees as required by provincial law and ensure that all subcontractors maintain such coverage on their employees. Maintain site safety at all times.
4) Acknowledge the right of the owner to retain a mechanic's lien holdback as specified by provincial law.
5) Do all work to the requirements of the applicable building codes
6) Be responsible for the work carried out under this contract by any subcontractors the contractor may employ.
7) Agree to start the work within 10 days of the signing of this contract and to complete it not later than _____ days after the work has started.
8) Remove all construction debris from the property upon completion of the work and, if damage occurs, restore the property to its original condition.
9) Warrant the work and materials for a period of one year from the date of completion and, during this time, repair any defects immediately upon receiving written notice from the owner. This warranty does not replace the following manufacturers' warranties on materials and equipment (details to be included or attached).

Permits:

1) The responsibility for obtaining any necessary permits is as designated below:

	Owner	Contractor
a) Building permit	_____	_____
b) Heating permit	_____	_____
c) Hydro permit	_____	_____
d) Plumbing permit	_____	_____
e) Site-works/Demolition permit	_____	_____
f) Other: _____	_____	_____

The Owner Shall:

1) Be responsible for assuring that the property meets municipal zoning by-laws and, if necessary, that special permission has been obtained from the appropriate authorities for the work covered in this contract.
2) Provide the space and freedom of movement on the property for the contractor's workers to do their jobs.
3) Pay the sum of $ ..... (including all applicable taxes) to the contractor as follows:

_____ upon _____, _____ upon _____ and _____ upon _____ .

Signed: _____ _____
Owner Contractor

Date _____:

Overview of design considerations

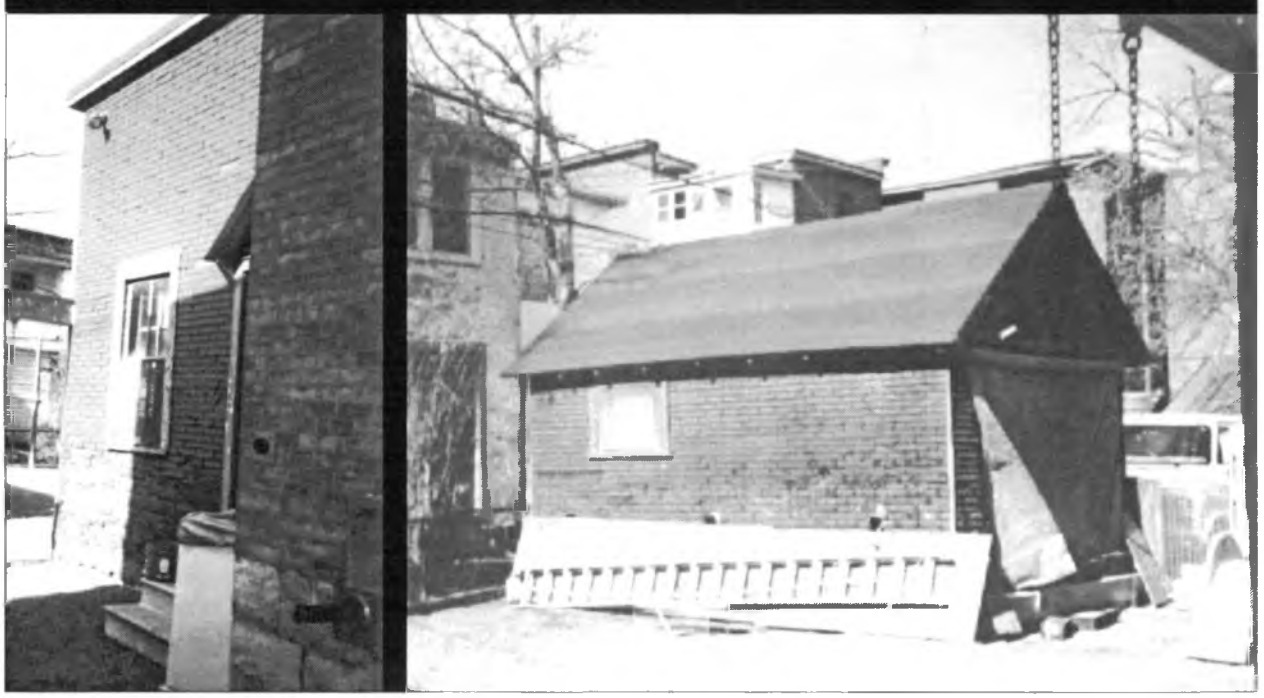
Chapter 3 outlines the process for carrying out any type of renovation—large or small. The planning process is common for any type of addition and, for a renovation to be successful, it should come before the actual work begins. This chapter looks at some options for making major changes to the living space, either through an addition or the extensive rearrangement of existing space. It includes:

- A family room/kitchen single floor addition.
- An attic conversion to sleeping loft with bathroom or a home office.
- The opening up of the ground floor.
- Reconfiguring the second floor.
- Converting to a duplex.

Chapter 6 examines a variety of upgrades to the century-old house. The sections on upgrading the kitchen, the bathroom, the heating system, re-roofing, re-siding, new windows and accessibility retrofits contain additional information relevant to the projects addressed in this chapter.

Before starting detailed planning, address the following preliminary considerations. Review the first section of this chapter as part of any major renovation carried out on this type of house.

If a garage or rear addition does not conform to current zoning bylaws, you may not be permitted to replace it with a new structure.
F. Szadkowski



Can we get there from here? Existing houses may not meet current bylaws for setbacks and height. Before demolishing a garage or summer kitchen to replace it with a modern structure, contact your municipal building department to determine if these structures conform to the zoning. In some jurisdictions, a non-conforming garage or porch cannot be torn down and replaced with a new structure; however, the existing structure can be repaired and maintained. Attic renovations may also encounter permit problems, if new windows or gables rise beyond permitted heights.

New wood kitchen cabinets integrate with old wood in hallway and off-gas less chemicals.
Buchan, Lawton, Parent Ltd

Access to inner-city lots is often restricted. It may not be possible to move excavation equipment and vehicles carrying materials into the rear yard of these houses. Moving construction materials and debris by hand is very labour intensive and expensive.

Making it better for everyone involved: New building materials off-gas contaminants and pollutants into the home environment. Consider choosing healthy building materials and finishes where possible, especially when occupants of the house suffer from asthma or other respiratory conditions.

In planning an addition or major renovation to an existing house, it is important to answer some questions about how the space will be used and how it will affect the rest of the house and the occupants.

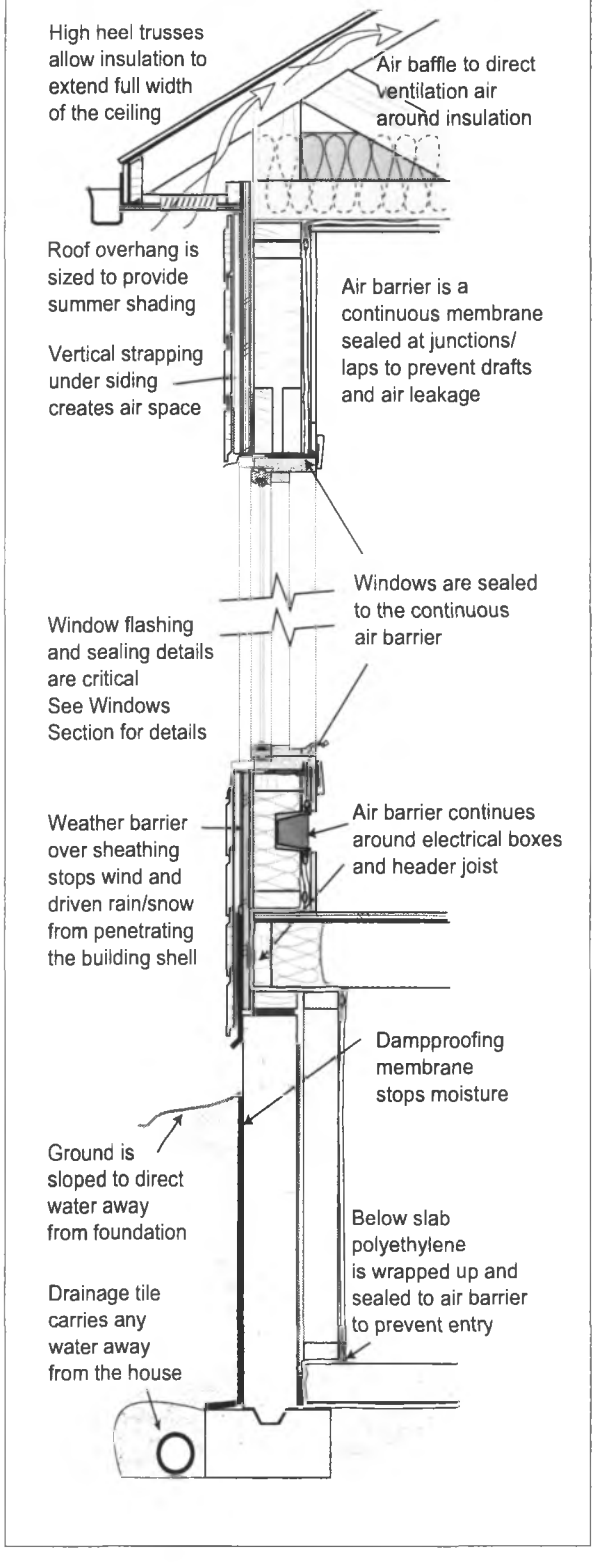
- How will the new space affect present use of the house? Will the kitchen, for example, be moved into the addition or renovated space?
- Will access to the new space affect traffic patterns through the house? Will modifications to other parts of the house be required to improve traffic flows? The exterior walls of the house and some interior walls are structural. Enlarging doorways and windows must take this into consideration.
- Will the floor level be maintained or will a "sunken" space work better?
- Will the space be usable throughout the year—comfortable in both summer and winter?
- How will an addition or renovation affect daylighting to existing rooms? Will they need new or enlarged windows?
- Can plumbing and electrical services be easily integrated?

- How will the space be heated—by extending the current house heating system or by installing new equipment? Is there potential for passive solar heating?
- If the addition requires the construction of a new foundation, will additional basement space be useful or would a crawl space or slab-on-grade foundation prove adequate?
- How will a new basement affect the drainage around the existing house?
- How will the roofline of the addition meet the existing house? Will it affect windows, skylights, chimneys or other penetrations?
- What type of ceiling will work best in the proposed addition or renovated area—raised or cathedral ceilings, or a more typical flat ceiling?
- What type of windows, cladding and other exterior elements will best complement the existing house?
- How will the addition link the house to the garden? For example, an extension across part of the house could create an L-shaped backdrop for a new patio.
- How will the renovation or addition fit in with the existing house? Any addition, including a dormer, should be in proportion with the rest of the house. Window size, style and height, as well as siding and trim should all be compatible. Make the house look as if the addition or renovated space was part of the original plan.

Construction

Each provincial building code governs design and construction practices. However, many aspects of working with existing structures are not dealt with in building codes. Several key construction considerations must be addressed to ensure the long-term durability and energy efficiency of the addition.

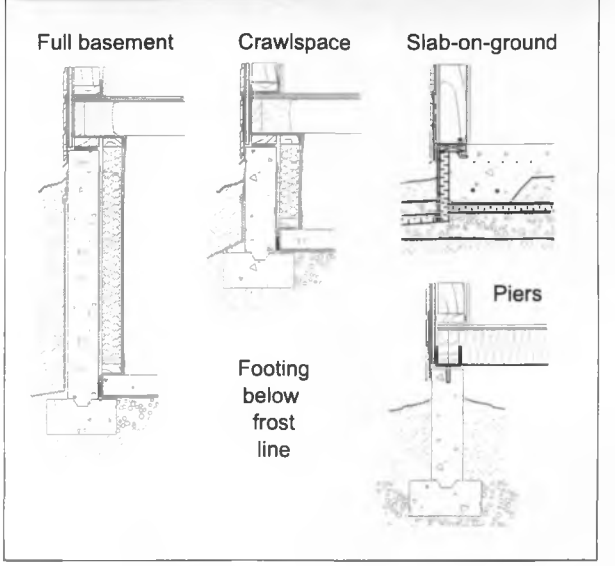
Construction details—new addition



Foundations

- The excavation and construction of an addition must not affect the structural integrity of the existing house. If the house sits on a rubble foundation or on a foundation without a sound footing, underpinning may be required.
- Termites are a concern in Toronto, Vancouver and surrounding localities. Confirm there is no structural damage and avoid untreated wood in contact with soil. Carpenter ants are also a problem.
- Many options exist to support a structure including columns/piers on pad footings and a full foundation with exterior walls. Regardless of the type of support, the foundation must be installed on a footing below the frost line to avoid heaving and possible damage to the building.
- If piers are used to support the structure, the base of the floor is exposed to the exterior. This requires insulation and the installation of an air-vapour barrier. Proper detailing is required to ensure the floor is kept warm and to avoid condensation occurring in this space. A further concern with this type of system is the difficulty in making the required mechanical connections such as ductwork, plumbing and wiring.
- A full foundation with a crawl space or full basement has many long-term benefits. The floor above a heated space is much warmer. Also, it is simpler to make mechanical connections or make future alterations with the components exposed.
- A full basement or crawl space must be accessible from the existing house for heating and ventilation purposes. Some structural alterations may be required unless there is a window or door in the existing foundation to use as an access point. Ensure the opening is large enough to accommodate ductwork, plumbing and electrical connections, as well as access for future servicing.

Foundation options



- Connect heated crawl spaces to the house ventilation system. Ventilate unheated crawl spaces with outdoor air.
- Direct surface and soil moisture away from the foundation walls. To direct surface moisture away from the house, slope the ground away from the house. To direct soil moisture away from the house and to relieve hydrostatic pressure, use a free draining material next to the wall with a good quality water proofing material to seal the wall from the exterior. A variety of water proofing materials is available including mopped or brushed on foundation tar, spray-on membrane applied by professionals, plastic drain gap membrane and bituminous peel and stick membrane.

- In addition to water proofing the exterior wall of the foundation, install perimeter drainage next to the footing. Connect this drainage system to a sump pump or to the drainage system around the existing house.
- The more you plan to use the basement or crawl space, the greater the need to ensure moisture stays outside the building.

Framing

- Permanently tie the floor system into the existing house structure, using either threaded rods or lag bolts. Make floor systems in the addition or renovated area level, even where the floor of the house is not level.
- When expanding the size of window or door openings in the existing house walls, additional structural support may be required. Ensure structural support is carried through to foundation.

Careful detailing is required when joining the new structure to the existing house
Buchan, Lawton, Parent Ltd

Wall systems

- Structurally tie the new walls to the existing walls of the main building.
- Ensure the joint between the cladding and trim of the existing house and the addition is sealed to prevent rain and snow entry. Where possible, make the joints continuous and avoid butt joints. Place the weatherproofing on the exterior.
- Provide an effective air seal at the junction of the addition and existing house to eliminate air leakage. The air-vapour barrier detail needs to be examined to ensure there is continuity at this transition.
- To prevent condensation in the wall space and heat loss due to air leakage, a continuous air barrier and a vapour retarder is required. This is commonly achieved by stapling polyethylene on the interior face of the studs. Overlap and seal all joints.
- Seal all penetrations through the building envelope of the house (the walls, roof and foundation). The spaces between window and door frames are often sealed with spray-in foam insulation. Flash and caulk these openings on the exterior.
- Consider using the rainscreen principle for the exterior wall system, especially when using wood or stucco finishes.

Roofing

- Construct the structure of the roof to meet the load requirements for the area. If you are converting an existing porch, the original roof may not be structurally adequate and it may require reinforcement or replacement.
- Take special care at junctions between the new roof and the existing structure. Seek professional design and installation assistance to avoid water and moisture penetration into the cavities and to tie the two structures together. Install appropriate flashing and seal all joints.

- A number of techniques exist to create energy-efficient and durable cathedral ceilings and gable walls. Scissor trusses and techniques where the sloped roof surface is treated as a wall can be used.
- Install a proper air-vapour barrier at the ceiling level. If polyethylene is used, overlap and seal all joints, and seal the lower portion to the polyethylene on the walls. Sealed electrical boxes are also recommended. (They are required by Code in new construction.)
- Use high heel trusses or other types of trusses designed to accommodate a full depth of insulation over the exterior wall. Heat loss at this point is common and can result in ice formation and ice back up (damming) beneath the shingles.
- To prevent snow build-up and ice damming at the eaves, allow for good ventilation of the attic/roof space and install required eave protection.

Other considerations

- The renovation of older homes often requires upgraded services. It may be possible to modify or extend existing services into the modified space, however, if the heating, electrical or plumbing systems are more than 30 years old, assess and upgrade these systems where necessary to meet increased demands.
- Avoid placing plumbing in exterior walls. With Canada's cold winter climate, it is good practice to keep all plumbing in the interior heated walls.
- Keep the number of penetrations in exterior walls to a minimum. Use non-metal boxes with air and vapour sealing for electrical outlets in exterior walls and ceilings. Ensure the insulation goes behind the box.
- Construction-sites are messy. Resist the temptation to open the addition to the rest of the house until the addition is weather-tight and the dusty work is complete. This reduces the amount of construction dirt and airborne particles entering the house.
- Clean ductwork and change furnace filters when renovation work complete.
- Ensure finished grades slope away from the house to divert water away from the foundation.

FlexHousing™

Certain spaces within a house have more flexibility than others. A ground floor addition, for example, is the most flexible —it can become a family room, a granny flat, a home office, a kitchen or a bedroom. An attic is less flexible. The two flights of stairs limit accessibility for less mobile occupants; however, it can still become a home office, extra bedrooms or a playroom.

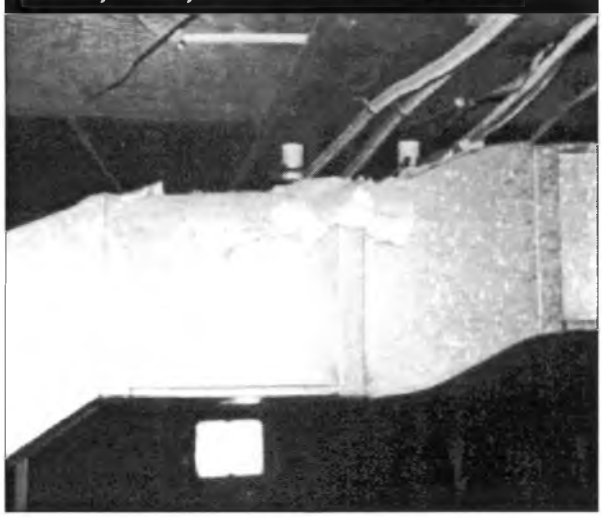
It is good practice is to keep as many options open as possible when renovating. Where feasible, include rough-ins for plumbing, electrical, telephone and cable outlets, even if they're not going to be used immediately. To provide even greater flexibility for future uses, install PVC conduit with open boxes and chaseways for access to utilities between floors.

Flexibility ties in with accessibility. In bathrooms, for example, install reinforcing for the future addition of grab bars and other safety features. In bedrooms, bathrooms and common rooms, use extra-wide doorways to accommodate wheelchairs. Install light switches and outlets at levels accessible to children and wheelchair-bound occupants. Avoid transitions in floor levels—steps up or down can limit accessibility and create a hazard.

A ground floor addition can be one of the most adaptable and useful spaces in the home, provided it has all the necessary features. These need to be finished immediately, but future disruption will be minimized if they are "roughed in" when the addition is built.

For example, a home office may require additional wiring for equipment and more overhead lighting. At the initial building stage, this involves ensuring sufficient wiring circuits and telephone lines are allocated to the addition. Similarly, a ground floor addition is the ideal location for a nanny or granny suite, if permitted by the zoning. Minimally this requires a two-piece bathroom, but a full bath and even a kitchenette may be desired. Plumbing and electrical services could be roughed-in for these functions when the addition is built and the fixtures added later, as needed.

Asbestos was used to protect the wood structure from the heat in ductwork
Buchan, Lawton, Parent Ltd



Accessibility to the space is an important consideration. Make sure connecting doorways are sufficiently wide and any changes in floor level can be traversed with ease between the main part of the house and the new space.

A separate outdoor entrance, for example, could be included with a wheelchair ramp.

Healthy Housing™ options

The goal of Healthy Housing™ is to create a safe, healthy living environment during and after construction. Healthy sustainable construction and renovation involves making the house:

- ***Healthier*** for occupants by reducing levels of contaminants in the house.
- ***More energy efficient*** by incorporating energy-efficient materials and techniques in the renovation plan.
- ***More resource efficient*** by using resources wisely and reducing, reusing and recycling wherever feasible.
- ***Healthier*** for the global environment in the long term by reducing greenhouse gas emissions and reducing water consumption.
- ***More affordable*** to create, operate and maintain by looking at all costs, not just up-front costs.

CMHC promotes improvements in design techniques, technologies, products and materials for renovating housing to meet these goals. CMHC is an excellent resource for information on Healthy Housing™ when planning a renovation.

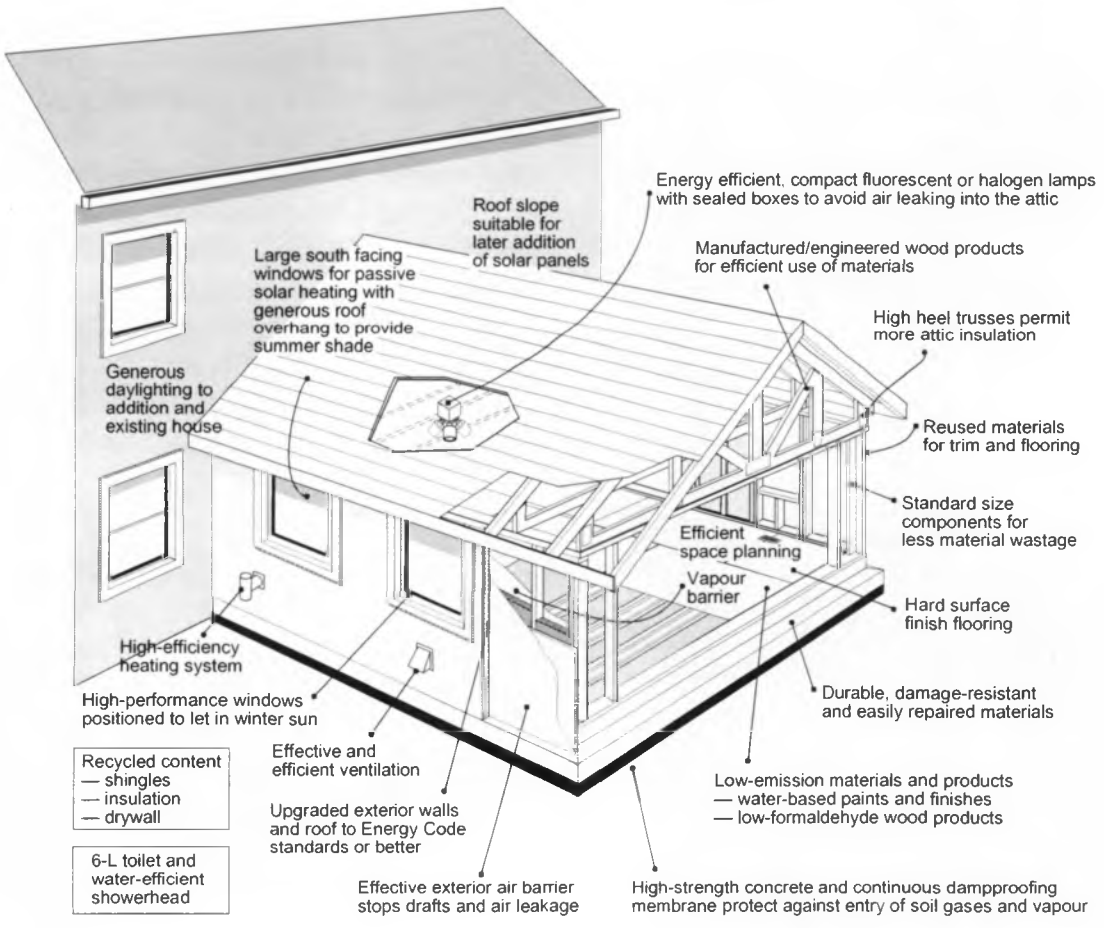
Before, during and after renovating, consider Healthy Housing™ issues including:

- ***Unhealthy environments***, such as moldy basements, lead paint, lead pipes and asbestos-containing materials including wrap on heating system pipes, wallboard, flooring and flooring paper. Renovating can release contaminants to the indoor air.

Deal with unhealthy environments before proceeding with other renovations.

- ***Adequate ventilation*** air to house With new, well-sealed windows, a 1900 house may no longer have an adequate air exchange rate—hydronic heating systems and gas-fired appliances can make the situation worse. One recommended solution is to install a balanced ventilation system in the house incorporating a heat recovery ventilator.
- ***Radon and soil gas*** Radon or soil gases may be a problem at your site, especially in the basement. If so, deal with them accordingly. (Refer to CMHC for information.)
- ***Materials*** with low embodied energy and high durability, such as hardwood floors, wool carpets, ceramic tile
- ***Avoiding unhealthy building components***, such as urea formaldehyde-based particleboard (choose construction-grade plywood incorporating more stable phenol formaldehyde glues). Kitchen cabinets can off-gas chemicals. Cabinet makers can use products made of low-emission particleboard or medium density fibreboard (MDF). To reduce chemical off gassing, ensure all edges of particleboard products are sealed with a water-based sealer. If possible, allow materials to off-gas before bringing them into the house.

Healthy House options—new construction



- ***Avoiding chemical off gassing*** from finishing materials, such as carpets, wood, plastics, paints.
- ***Improving energy efficiency*** and reduce the effect on the environment, such as planting drought-tolerant landscaping, installing a high-efficiency furnace, using low-flow toilets and showerheads.
- ***Construction-site safety.*** Watch out for open holes, ladders, tools, cleaning products, debris, bird droppings and other hazards.
- ***Reduce, reuse and recycle*** waste materials. Use engineered wood products in place of lumber from old-growth trees, use up "leftover" lumber for blocking, etc.
- ***Reducing dust***, especially for people with asthma and lung problems.

Plan how you are going to live through the renovation. Many renovators recommend homeowners move out during major renovations to avoid conflicting demands on space and to avoid health concerns.

Consider upgrading the insulation levels in the walls and roof of all areas being renovated. This creates a more comfortable space in both summer and winter. Make use of passive cooling strategies to minimize or avoid air conditioning. Overhangs on south facing windows shade the house from the midday summer sun. Deciduous trees on the east, south and west sides of the house provide shade in summer and lose their leaves in winter to let the winter sun heat the house. A light or medium tone roof colour helps to avoid heat buildup during the summer.

Inside the house, insulate the plumbing and ventilation ducts to keep the heat in and to reduce the potential for condensation. Insulate all hot water pipes (plumbing and heating system) to prevent heat loss. As well, insulate the fresh air ducts supplying cold winter air to the furnace or ventilation system and the cold water pipes of the plumbing system to prevent condensation. It's generally good practice to insulate all "hot" and "cold" pipes. Most hardware and home improvement stores sell foam pipe insulation.

Financial implications

Construction costs depend on local labour rates and the design, materials and finishes chosen. The integration of a new kitchen or bathroom as part of the renovation or additional features, such as a wood or gas-burning fireplace or a wet bar, also affect the overall cost of the project.

In terms of ongoing operating expenses for items such as heating and air-conditioning, an addition built to energy-efficient standards should have only a minimal impact on the house-heating bill. If the main house is upgraded at the same time, the overall heating bill, including the addition, can be less than the bill for the original house alone.

FAMILY ROOM-KITCHEN SINGLE FLOOR ADDITION

Overview

The lack of a family room and the age of the kitchen are two drawbacks often associated with a century-old house. Both can be rectified with a single floor addition and kitchen renovation. An addition can also be used for a senior's suite or a home office with a few minor changes. Many layouts are possible for the one-storey addition.

Before sitting down at the drawing table with the following ideas, refer to the front section of this chapter. It outlines many important considerations to address before beginning the actual planning of the addition.

Foundation

In most areas of the country, a crawl space or basement is typically installed under larger additions. Since the basement of a century-old home is not good living space, an addition provides an opportunity to create a recreation room or extra living space at the basement level. When designing the connection to an existing foundation, seek professional help (engineering or architectural) to ensure the excavation and connection do not undermine the existing foundation.

Where the basement of an addition is to be used as living space, especially if it is below a family room or extended kitchen, consider installing new stairs to create a direct access to the new space.

Rebuild the Summer Kitchen or Replace

Many century-old homes have a rear porch or summer kitchen. One option is to convert an existing three-season room into a four-season space. At the outset, converting an existing structure may seem to be logical and less costly than replacing with new. This may not be the case. Consider a number of variables to ensure that renovating the old structure is worthwhile and the most logical approach.

The first step is to assess the existing structure. Determine the construction methods used. How is it framed and supported? What are the sizes of the framing members including the walls, floor and roof structure? Is there a full foundation beneath the structure or do beams and columns/piers support it? Is the structure part of the existing building or has it been added at a later date? Are there any notable signs of structural failure? Are there any signs of water entry or damage? Inspect the interfaces between the new and old structure, such as flashing details.

Inspect the electrical, plumbing and mechanical systems as part of the assessment. Note all existing systems, their condition and age. Does the wiring appear to be the same as in the main house? Is the space currently heated and/or cooled? If so, how are these requirements met? Are there any obvious problems? Is it possible to connect the existing heating system to this area or will it require a detached system, such as electric heaters.

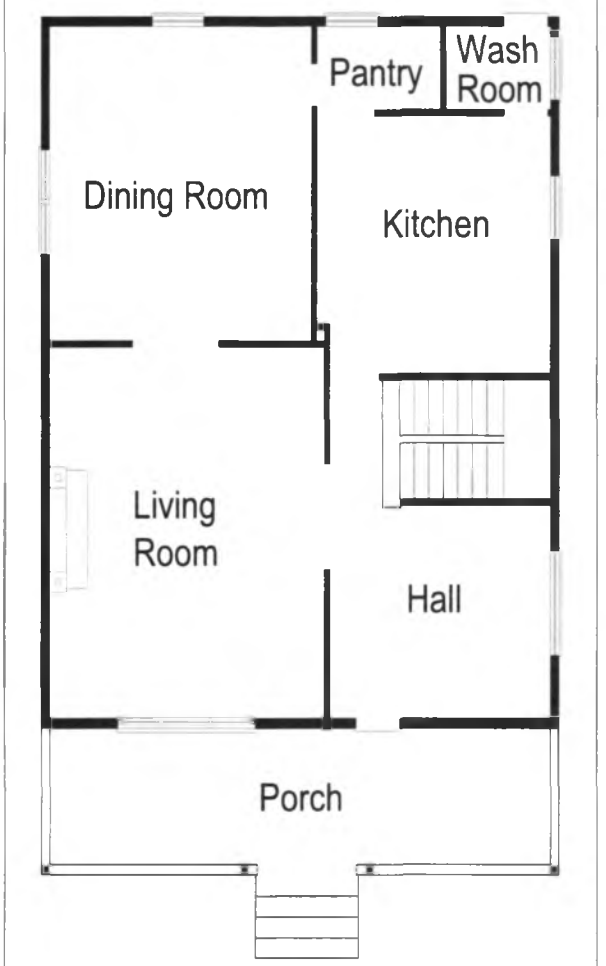
The cost implications of using the existing structure versus removing the old and adding a new addition need to be assessed. Obtain pricing for both options ensuring that the objectives and code requirements are met for each option. Once the pricing is obtained, compare the prices along with the advantages and disadvantages of both options.

Unless the zoning does not permit the removal and construction of a new structure, it is usually better to remove an old summer kitchen or porch and replace it with new construction. Renovating a poorly built structure could prove to be an inadvisable or costly long-term investment.

FLOOR PLANS FOR ONE-STOREY ADDITION

Typical layout: foursquare house

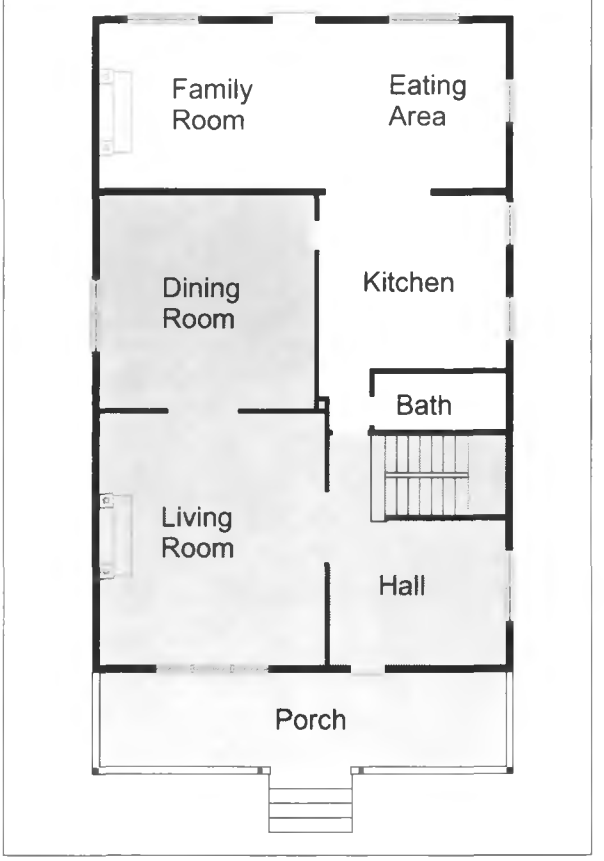
Foursquare house original floor plan



a) Rear addition

- Provides increased kitchen area and family room on main floor
- Removes pantry and old washing area and opens up living area of house to rear yard
- With French doors or a sliding door opening onto a rear deck, the rear yard can extend the living space of the house
- Provides space in original kitchen area to install powder room
- Another option is to remove the original stairs to the basement and install a powder room under the stairs (accessed from the hall or kitchen). Provide new access to the basement at the rear of the house from the family room
- Install French doors between the dining room and family room to provide privacy and still have access to rear yard

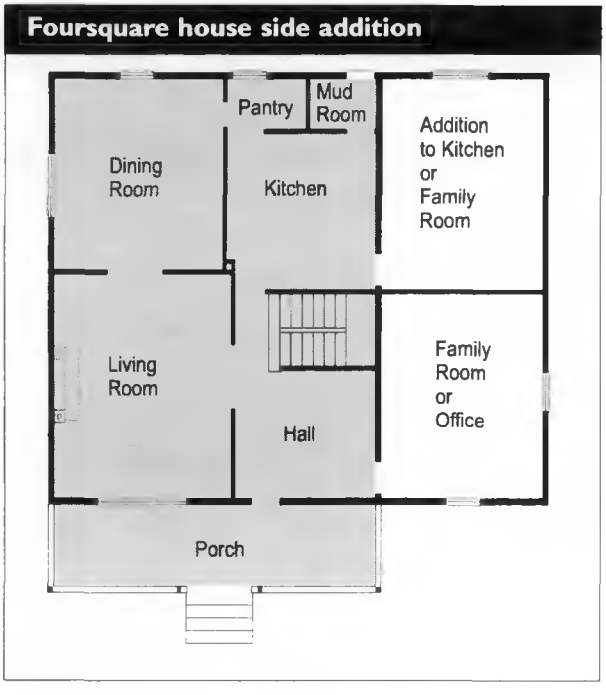
Foursquare house rear addition



b) Side addition

- If the lot size permits, a side addition provides increased kitchen area and family room on main floor.
- Provides good separation from family and formal functions of the house
- As an alternative, the family room could become a home office with its own separate front entry. Depending on the size of the office, a combined kitchen/family room could be created behind the office.
- With its street exposure, the side addition could be used to create a senior's suite.

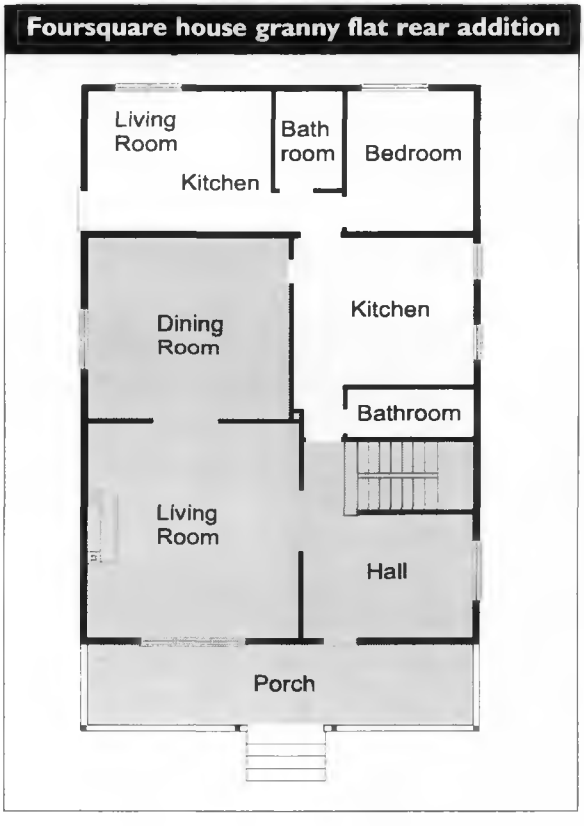
Foursquare house side addition



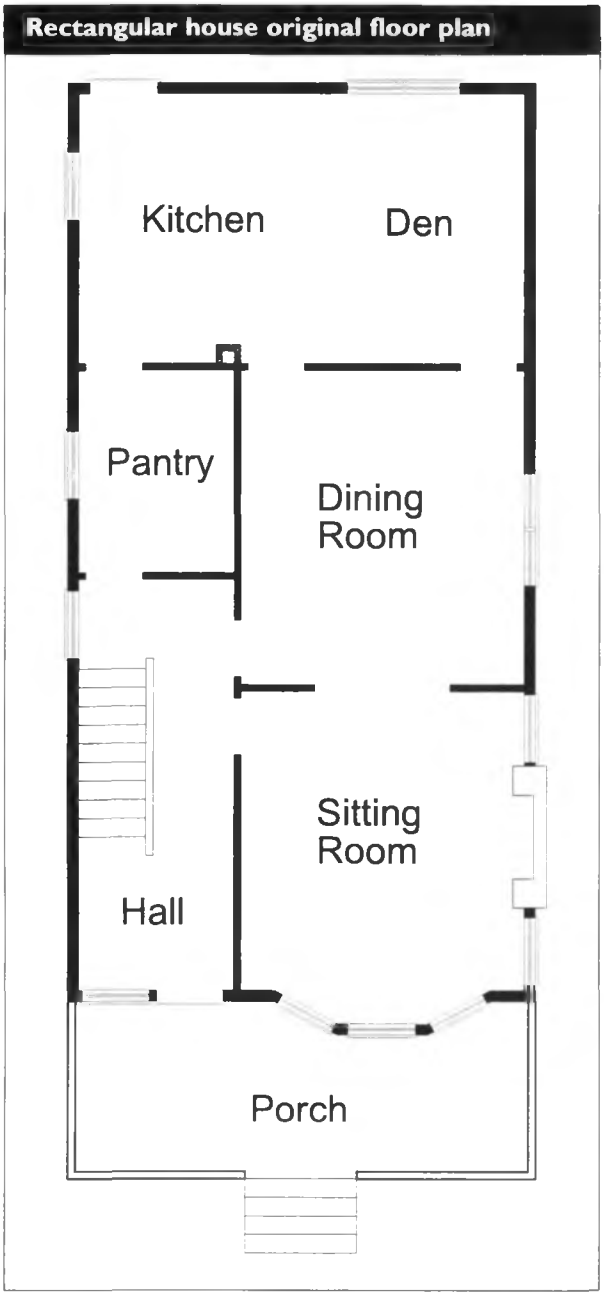
c) Granny flat rear addition

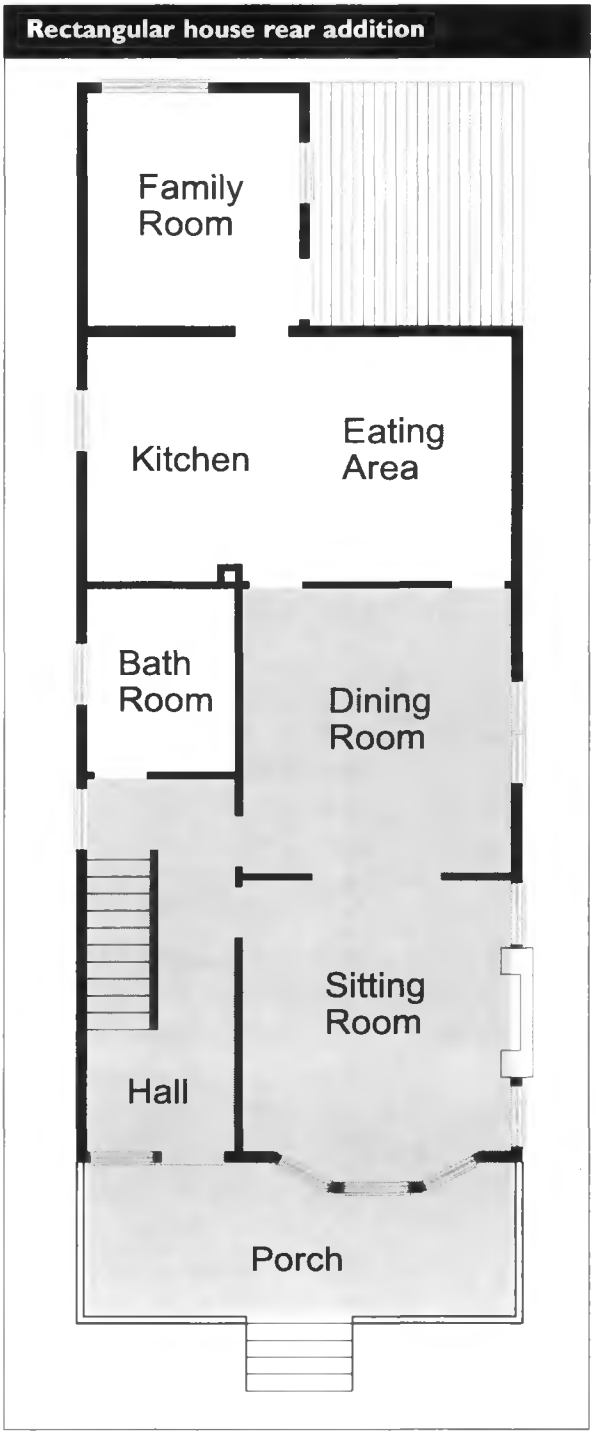
- Provides senior's suite (granny flat) for live-in family members. At minimum, it creates a sitting area, bedroom and ensuite separate from the main area of the house. Could be increased to include a small kitchen and a full bathroom in the new addition, as well as a sitting area and bedroom. The suite should have a separate entrance for guests.
- Pantry could be removed to create access to suite. Old washing area could become main floor bathroom or new bathroom could be created near stairs in kitchen.
- Reduce available space for kitchen area by removing pantry.

Foursquare house granny flat rear addition



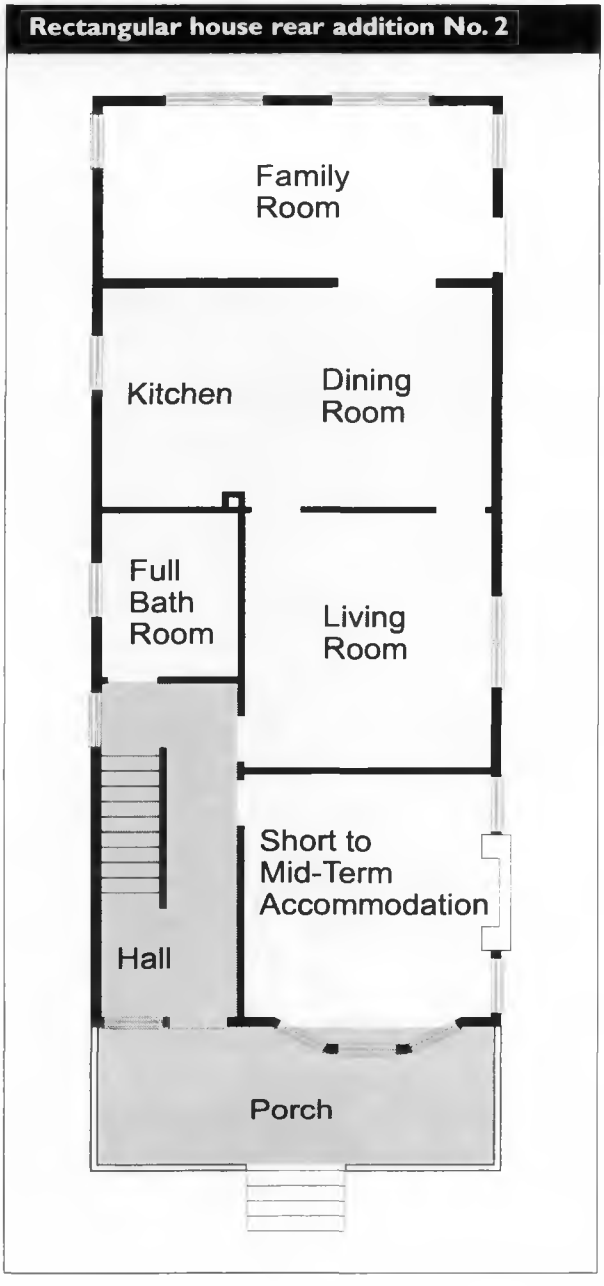
Typical layout: century-old rectangular (city) house





a) Rear addition

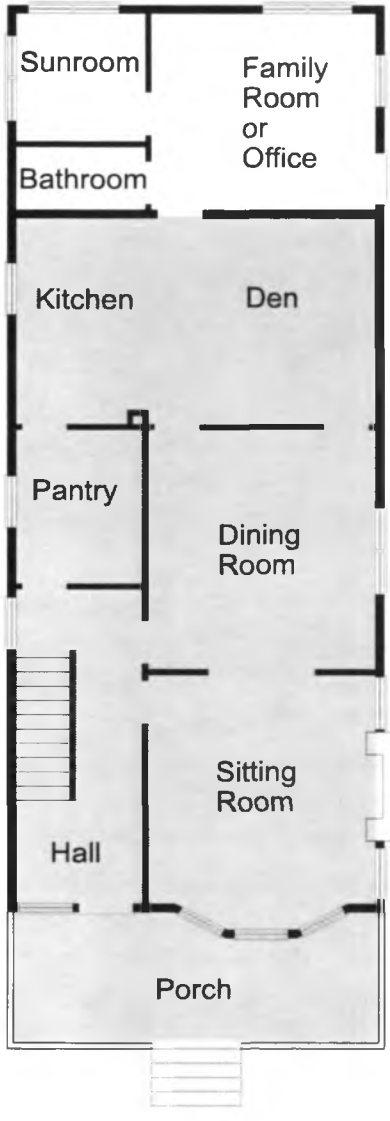
- Provides family room on main floor
- Works well with kitchen in the centre of the house to separate formal from family activities
- Opens up rear of house to rear yard
- Creates sheltered area for a deck.
- Old pantry could be converted into a powder room or full-piece bath.



b) Rear addition No. 2

- Provides large family room on main floor
- Works well with kitchen in the centre of the house to separate formal from family activities.
- Opens up rear of house to rear yard
- Old pantry is converted into a full-piece bath and closed off from kitchen
- With large family room at rear and full bath on main floor, the sitting room at front of house could be converted into bed-sitting area for short to mid-term accommodation for an invalid or a senior family member.
- As a second alternative, the family room could be converted into a senior's suite.
- For houses with small bedrooms on the second floor, it may be desirable to include a second floor in the addition to create a large master bedroom and ensuite bathroom.

Rectangular house rear addition No. 3



c) Rear addition No. 3

- Provides room for family room or home office on main floor
- Provides space for two-piece washroom
- Provides space for sunroom
- Opens up rear of house to rear yard.
- Requires little intrusion into existing house while renovation is under way.
- Part of the existing pantry could be converted into a hall closet.

CONVERSION OF ATTIC TO LIVING SPACE

Overview

The attic of the century-old house is often an ideal candidate for conversion to a sleeping loft or home office. In the past, these attics were used to store out-of-season clothes and other treasures, and may already have access stairs and a subfloor. With a minimal amount of work and materials, the attic can become prime living space. However, pay careful attention to insulating, detailing the air barrier and vapour retarder, and ensuring proper ventilation and air circulation to avoid future moisture problems. Also, ensure the size and span of the floor joists can handle additional loads safely.

Before sitting down at the drawing table with the following ideas, refer to the front section of this chapter. It outlines many important points to consider before the actual planning of the renovation can begin.

Square cottage style roof on duplexes
Buchan, Lawton, Parent Ltd

Gable and cottage roofs on rectangular houses

Foursquare house with mansard roof and rectangular house with hip roof

Rectangular houses with flat roofs

Design considerations

Roof configurations

The roofs of century-old homes come in many shapes, from a square cottage style to a straight gable-ended or a flat roof. Often the roof is a combination of a number of styles. In all but the homes with flat roofs, houses generally have a good-size attic without trusses, collar ties or other obstructions to complicate its use as living space.

A dormer opens up more of the roof area and creates a larger space with adequate headroom. Dormers usually have gable, shed or hip roofs. They can add significantly to the cost of renovating. Structural considerations must be addressed, as well as the detailing and finishing complications.

When making a decision about dormers, consider the street appearance of the renovation. Follow the original style of the house for roof style, siding and window choices. Also consider the proximity of the dormer to the chimney and the plumbing stack. Avoid complicated details that are difficult to seal and to provide required fire protection.

This foursquare house has a new dormer to open up the attic space
Buchan, Lawton, Parent Ltd

Transitions between the different faces of the attic space complicate the insulation and air-vapour barrier details. To keep costs down and to simplify sealing the space, try to limit the number of interior transitions.

Construction

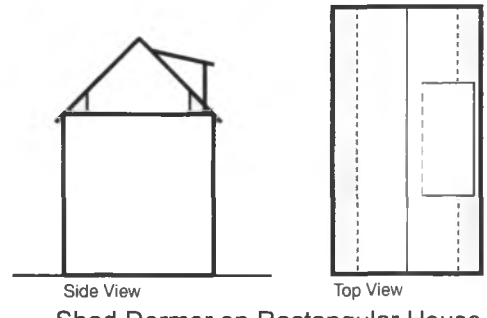
Structure

Where dormers are added or expanded in the roof, take care with the framing at the intersecting roof joints. The size of the dormer opening will dictate the structural work required. For a simple dormer, structural members in the existing roof must be reinforced to support the wider opening. For larger openings, a new central roof ridge beam is required to support the entire roof. The ridge beam must have adequate bearing, either through structural support at either end of the roof or on a central partition wall. When making major modifications to the roof structure, most municipalities require stamped engineering drawings and a letter of undertaking from a structural engineer.

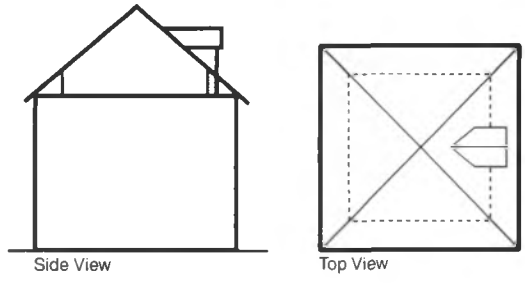
Roof details

Weatherproofing the house while the roof is open is a key construction issue. The larger the roof opening, the greater the chance of water entry during construction. Provide adequate tarping and weatherproofing to protect the house and contents from rain damage.

Dormer types



Shed Dormer on Rectangular House



Gable Dormer on Foursquare House

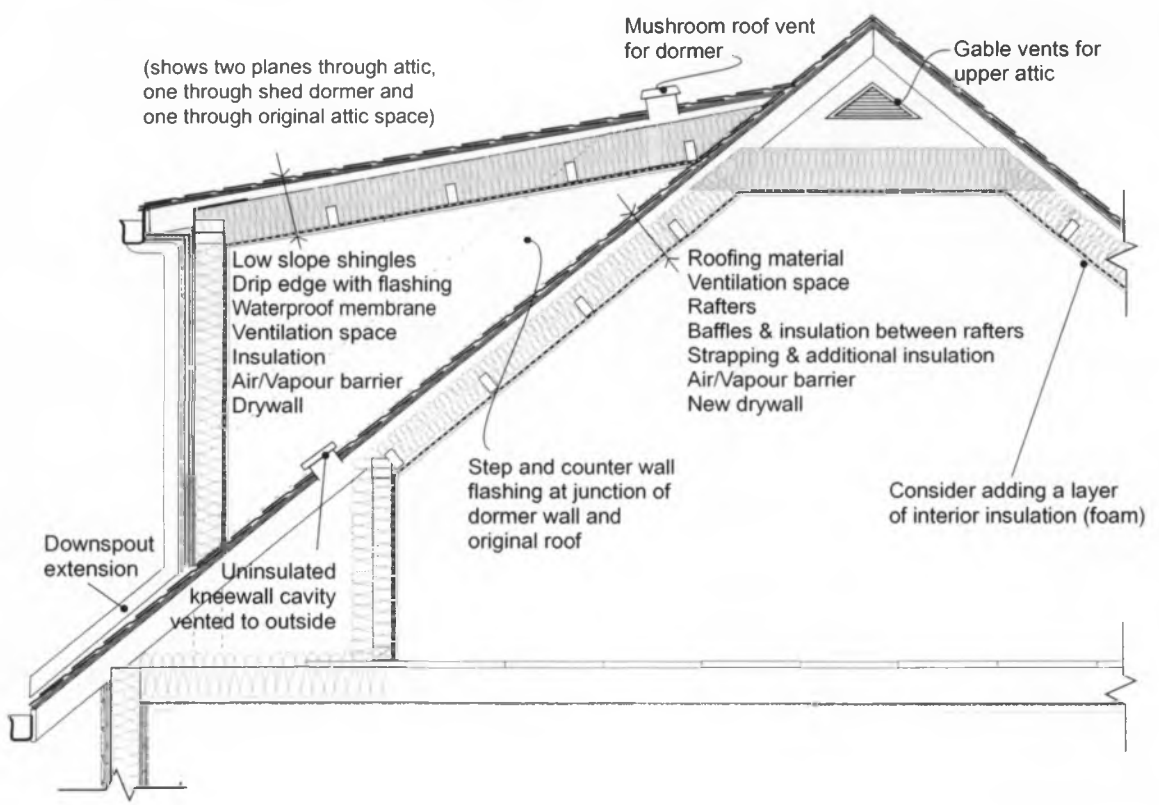
Several roof construction details require special attention for waterproofing and roof drainage. Extend valley flashings at least one metre under the roofing. Metal flashings or torch-on systems are recommended. The roofs of many shed and hip dormers have a very shallow pitch. Low-sloped roofs require extra care to prevent ice damming. Consider special roofing materials (low-slope shingles) and ice and watershield membranes for these locations. Although gable dormer roofs are steeper, the corners formed where the dormer meets the main roof create pockets to trap snow and ice. Use a waterproof membrane behind flashings and at all transition points. Extend the membrane out at least one metre beyond transition points.

Insulation and attic ventilation

In sloped roof situations, three distinct areas require insulation: the kneewall, the sloped wall/ceiling and the upper attic. The figure: "Construction Details Shed Dormer in Attic" illustrate these areas.

Take care to ensure uniform levels of insulation throughout the roof and the air barrier and vapour retarder are in the appropriate locations. Failure to adequately insulate and detail the air-vapour barrier can result in moisture problems, heat buildup in the summer and drafts in winter.

Construction details shed dormer in attic



Ventilation is also important in the unheated spaces of the attic. Soffit and eave vents, ridge vents, gable end vents and mushroom vents can all be used to achieve adequate ventilation. The National Building Code specifies the minimum ventilation area required for the roof space. Where possible, avoid placing vents in areas where snow builds up during the winter.

Heat loss through the roof can lead to icicles and ice damming.
F. Szadkowski

The sloped portion of the roof is a challenge to insulate, ventilate and incorporate an air barrier and vapour retarder. To permit the movement of air on the cold side of the insulation, set the insulation on the sloped portion of the roof away from the exterior sheathing with strapping or baffles.

Another option is to treat the sloped section of the ceiling as an exterior wall. This effectively breaks the attic into smaller uninsulated areas comprising the kneewalls and the upper attic with an insulated wall between. This option can present major difficulties in placing the air barrier and vapour retarder in the correct location and ensuring they are continuous.

Insulate slope in knee wall

Some homeowners use the cavity behind the kneewall for storage. If you plan to use this space, place the insulation in the sloped wall of the roof and not in the kneewall. Make the storage area part of the heated space of the attic. Undercut the kneewall doors or install louvers to promote air exchange between the kneewall cavity and the attic living space.

In older homes, heat loss at the point where the upper wall meets the base of the roof is common. This can result in ice forming and backing up beneath the shingles. To avoid this heat loss, ensure the area above the wall is well insulated and the air-vapour barrier is continuous. Install eave protection in the event ice damming does occur.

Plumbing

Although there may not be any plans to include a bathroom in the attic space, consider the plumbing stack when planning the use of the space. The stack is the vent for the plumbing fixtures in the house. There is at least one and maybe more stacks passing through the attic. These cannot be moved or removed without major ramifications and remodelling below. The stacks can be boxed in and it may be possible to vent a new bathroom into the stack in the future.

Heating

Most century-old attics are unheated except by the heat leaking up from the lower floors. Some homes have hydronic heating (radiators) in the attic but it is unlikely that forced-air ducts were installed when the home was built. Bringing heat up to the attic from the existing furnace involves creating a chase for the ducts or piping through the lower floors and may require a larger furnace. Other heating options include installing gas or electric baseboards or a fuel-fired stove, such as propane, natural gas, pellet or wood, where permitted.

Bathroom ventilation

Bathrooms require effective ventilation to control moisture. Today, many households have two or more people showering each day and opening a window does not provide adequate ventilation.

Choose an exhaust fan with two or three operating speeds and a low-noise rating. As a minimum, a fan should have a capacity rating of 25 L/s (50 cu. ft. per minute) and a low noise factor (one sone rating or less). A fan with a higher capacity may be required, if the bathroom is large or your municipality has additional ventilation requirements. Manual timers can provide more effective ventilation of bathrooms by allowing the fan to remain on for some time after leaving the room.

Vent the fan to the outside using a minimum of ductwork. The ideal route is through the bathroom wall. If the duct runs through the attic space, ensure the opening into the attic is well sealed and the duct run is short, direct and well insulated. Use solid metal ductwork to vent the fans. Flexible ductwork may be easier to install but it increases the resistance to airflow and makes the fan less effective. Flexible ductwork is also much easier to damage and could result in moist air escaping into the attic or wall cavity.

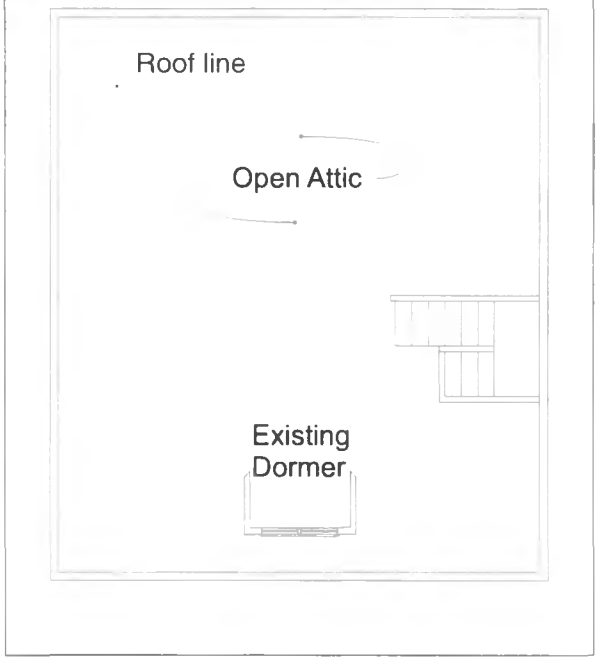
In old houses where natural ventilation is still relied on to provide ventilation air, exhaust fans can create an imbalance in air pressure in the house. If the house is very leaky, this may not be a problem but, as leakage paths are stopped (to keep the winter heat in), problems can arise. Depressurizing the house can cause conditions where the furnace and fireplace chimneys backdraft and moist air is drawn into the building envelope. When installing exhaust fans, have the air pressures in the house tested and install an air supply to the house, if necessary. For more information on ventilation, refer to the Heating, Ventilating and Cooling section in Chapter 6.

FlexHousing™

When designing the layout of the space, consider potential future uses as well as your current needs. For example, the immediate plan may be to create a large open space for a home office. Could it be used later as a children's playroom, a studio or a master bedroom suite? What features should be included to ensure the space can be used differently in the future? A bathroom may be beyond the current budget but it might be feasible to rough-in the plumbing for a future bathroom above the existing one on the second floor.

The stairway to the attic of the century-old home is often steep and narrow. Moving renovation materials and furniture into the space can be a challenge and it may become more of an issue in the future. Consider widening the stairs to improve the access.

Foursquare house original attic plan



Healthy Housing™

When cleaning up attics or any area where rodents, birds and other animals may have nested or taken roost, take special care to ensure you don't inhale the dust. The feces of some birds, bats and animals can cause serious health problems or death.

For family members with asthma, allergies or respiratory ailments, a "clean air" bedroom provides an oasis where the body may rest and recover. Avoid wall-to-wall carpeting in bedrooms and pay special attention to the choice of materials and finishes. Keep in mind the Healthy Housing™ concerns identified at the beginning of this chapter and refer to CMHC's *"Clean Air Guide"* for further Healthy Housing™ tips.

Floor plans for attic renovation

Typical layout: foursquare house

Many foursquare homes have dormer windows providing light and ventilation to the attic.

a) One room—bedroom or office

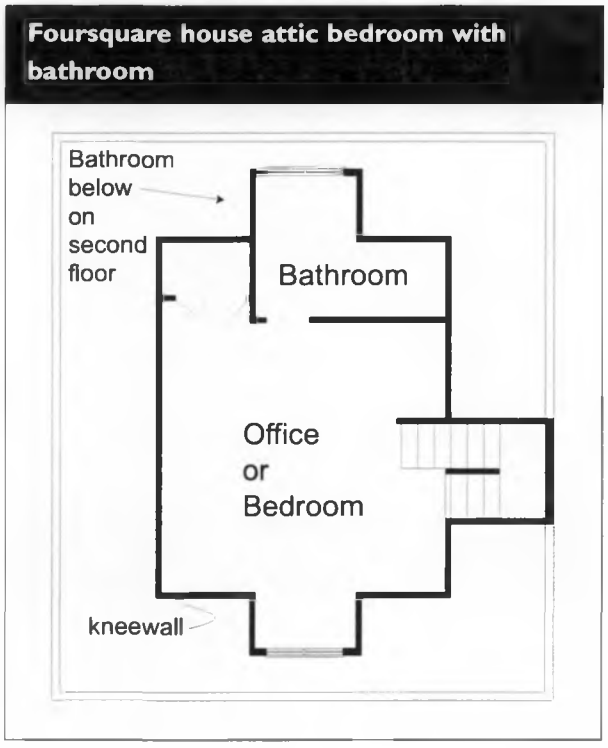
- Inexpensive and permits flexible use of space
- Takes advantage of the existing windows and does not involve any modifications to the roof
- Does not affect the appearance of the house from the exterior
- With windows on only one face of the house, ventilation may be a problem in the summer
- Additional natural light can be achieved with a skylight. Note: hire a professional to install skylights using proper flashing details on the roof and integrating the air-vapour barrier detail on the inside.
- Install rough-ins for plumbing of a bathroom at a later date to increase the flexibility of the space.

Foursquare house one room—bedroom or office

b) Bedroom with bathroom

- Single room with bathroom permits flexible use of space.
- New dormer at rear provides headroom to create new bathroom over existing bathroom below. Depending on the size of the pipe and the requirements of the municipality, you can usually have two or three bathrooms on a single stack.
- A rear dormer does not affect the appearance of the house from the road.

Foursquare house attic bedroom with bathroom

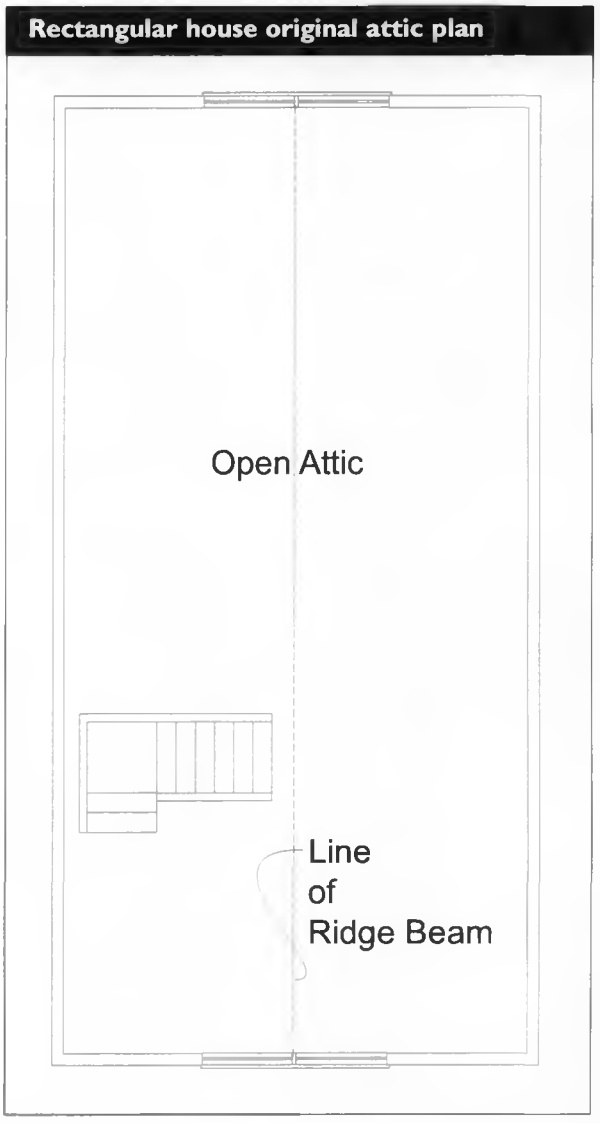


- Installing operable windows in bathroom permits cross ventilation of the attic.
- Ventilation can be a problem, especially if electric baseboard heat is used. Natural ventilation is effective in open areas but a good bathroom fan makes it all work much better. The fan should be a good quality and capable of running continuously.
- Skylights can add natural light.

Typical layout: rectangular city house with gable roof

Dormer windows in each end of the gable provide light and ventilation in the attic.

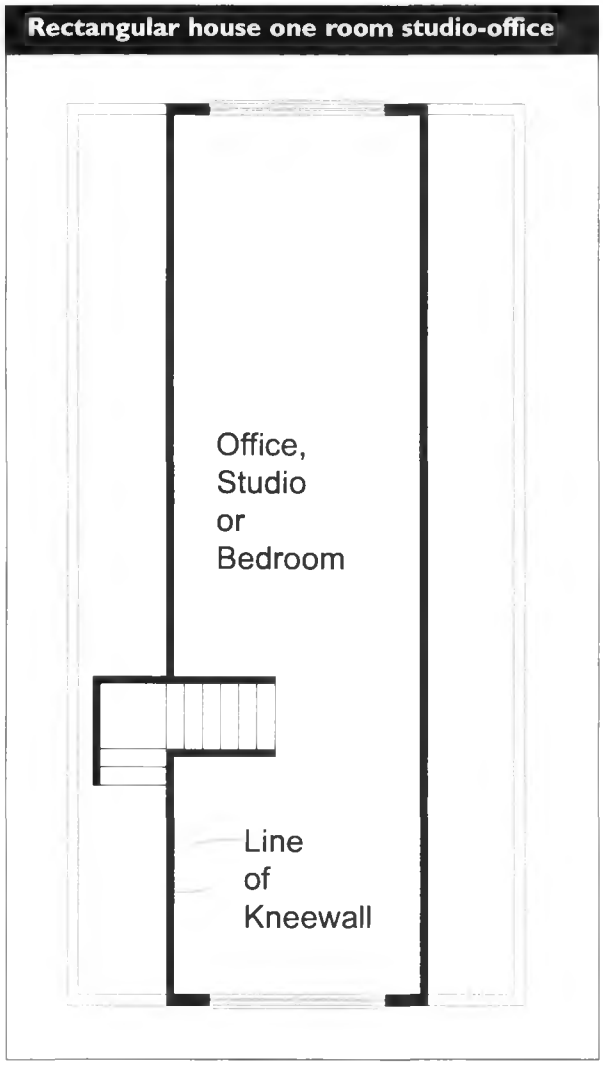
Rectangular house original attic plan



a) One room studio space

- Inexpensive and permits flexible use of space
- Takes advantage of existing windows and does not involve any modifications to the roof. If windows are too small or non-existent, windows can usually be easily installed in the gable end walls. New windows may be required to meet the egress requirements of the Code for bedrooms.
- Does not significantly affect the appearance of the house from the exterior

Rectangular house one room studio-office



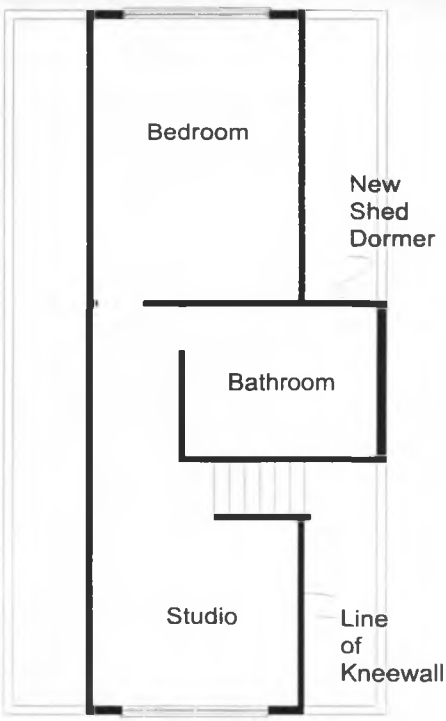
- Ventilation is less of a problem with windows at both ends of the house and an open concept space.
- Access to the attic can be a problem. Stair access to the second floor is often along one of the long outside walls. With a rectangular gable roof, the attic space above the stair is limited. One option is to turn the stairs part way up and follow the slope of roof (see illustration). However, this may interfere with the hallway of the second floor and require an alternate solution, such as taking space from a bedroom or bumping up the roof space above the stairwell.
- Install rough-ins for plumbing of a bathroom at a later date to increase the flexibility of the space.
- Consider insulation and ventilation challenges mentioned earlier.

b) Bedroom with bathroom

- Single room with bathroom permits flexible use of space.
- New dormer in side of attic space provides headroom to create new bathroom over existing bathroom below. Depending on the size of the pipe and the requirements of the municipality, two or three bathrooms can usually be on a single stack.
- A gable or shed dormer can usually be integrated into the appearance of the house.
- Installing operable windows in the attic permits cross ventilation.
- Additional natural light can be achieved with a skylight.

Rectangular house attic bedroom with bathroom

Rectangular house attic bedroom with bathroom



c) Bedroom, bathroom and studio

- Bathroom in centre of attic with a bedroom at one end and a studio at the other; the studio could become a second bedroom with the addition of another wall.
- Ventilation can be a problem, especially if electric baseboard heat is used. The more open the space is, the more effective the natural ventilation will be. A good bathroom fan is preferable.
- New dormer in side of attic space provides headroom to create new bathroom over existing bathroom below.

A shed gable on the side of this rectangular coast house lets in lots of light and creates a spacious leisure area in the attic.
M. Lodge

Attic interior and stairs in the same house

OPENING UP THE GROUND FLOOR AND SECOND FLOOR

Overview

Many century-old homes have enough floor space but, unfortunately, the space is not organized to meet the lifestyles of today's family. Pantries, eating nooks and rear entry vestibules surround the kitchen, reducing the flexibility of the space and creating a cramped feeling of too many walls and chopped up spaces. A large separate dining room could be more useful as a family room attached to the kitchen. A den-study could be converted to a bedroom or family room. The floor plan often cuts off the rear yard from the living space.

Removing walls requires careful planning. A bump-out in the wall conceals a support post and heating system ductwork and the floor inlay fills in the floor where the wall previously stood.
Buchan, Lawton, Parent Ltd

On the second floor, small bedrooms with limited closet space and only one bathroom can be renovated into fewer larger bedrooms with more bathrooms and large closets.

Before sitting down at the drawing table with the following ideas, refer to the front section of this chapter. It outlines many important points to consider before beginning the actual planning of the renovation.

If removing or relocating walls is part of the planning, consider hiring an engineer to provide structural advice. Some of the first floor walls support the second floor and cannot be removed without ensuring the floors continue to be adequately supported. Posts and beams or lintels can replace a wall but hire a professional to calculate the size required and their placement.

One clue to determining whether a wall is structural is in the basement. Interior brick walls or posts and beams centred in the basement are there to support the main floor. The walls above these brick walls are usually load bearing or structural, as well.

Design considerations

Structure

The exterior walls of the solid brick and balloon-frame house form the structure of the building. Changes to window or door size or location must take into consideration the structural nature of the wall. Inserting a wide picture window or a patio door, for example, requires careful assessment and reinforcement of the wall structure to avoid damaging the building. In a balloon-frame wall, several tall

narrow windows are easier to integrate rather than one wide window. Making structural changes to the exterior walls of a century-old home is often costly, especially if it is a solid brick wall.

The interior walls, particularly those dividing the house in half and those adjacent to a stairwell or above a brick wall in the basement are usually structural and can only be removed if replaced by a supporting post and beam. Interior walls, such as around pantries and vestibules, may not be structural, however, it is wise to consult a professional for advice before removing any walls.

Insulation and air-vapour sealing

Originally the walls of the century-old home had no insulation and, in many cases, continue to be uninsulated. In solid brick homes, the plaster was applied directly to the brick leaving no space for insulation. In balloon-frame homes, an air space was left between the exterior sheathing and the interior lath and plaster. A century ago, this dead air space was believed to be effective insulation and, to some degree, it was.

Adding insulation to these walls can be a challenge and, in some cases, may not be a good idea. The wall cavity of the balloon-frame home can be filled with blown-in insulation, such as cellulose, or sprayed-in foam. It requires making small holes in either the interior or exterior of each cavity but it can be an effective way to reduce energy costs.

For the solid brick house, the safer way to add insulation is on the exterior of the building. Insulation placed on the interior of the wall changes the dynamics of the wall. Without insulation, the wall is kept warmer and drier during the winter by heat escaping from the house. When the heat is held in by interior insulation, the wall may be subject to more of the freeze-thaw cycles of a Canadian winter. If the brick or mortar has absorbed water, the freeze-thaw cycle may cause the brick to spall and break apart.

Applying insulation on the exterior of the building keeps the brick warm and keeps the heat in. Unfortunately, the beautiful old brick is one of the most desirable features of the century-old home. Many homeowners have chosen to live with higher heating bills rather than cover the brick.

CMHC is conducting studies of buildings where insulation has been installed on the inside face of a solid brick wall. In some Canadian climates, such as the cold dry winter of the Prairies, it may be possible to successfully insulate the inside face of these walls without jeopardizing the brick walls.

In all old houses, heat loss can be significantly reduced by installing new, more efficient windows and maintaining a continuous air barrier. In old homes where the original exterior walls are intact, the many layers of oil-based paint may provide a very effective air-vapour barrier on the wall. By making sure the air barrier is continuous around the windows and other penetrations, heat loss can be reduced. One possible path of air leakage is at the wall/floor interface. This cavity can be filled with spray foam insulation by removing the baseboard and quarter round.

Another area of heat loss is in the wall cavity on either side of the window. These spaces originally contained the weight system used to help open and close the window. If the weight system is no longer used, insulate and seal these cavities to reduce heat loss.

To summarize, the suggested sequence of energy conservation measures for these older homes is:

- Install an energy efficient heating system.
- Seal the house (hire a professional weatherization contractor).
- Install additional insulation in the attic, if accessible.
- Add wall insulation, if required.

Wall cavity partly exposed in right window frame
F. Szadkowski

Ventilation

Old leaky houses rely on natural processes to ventilate the house. As improvements are made to keep the heat in the house, the natural exchange of stale air with fresh air is reduced.

For more information on ventilation in a century-old home refer to the section in Chapter 6 on upgrading the heating, ventilation and cooling systems.

FlexHousing™

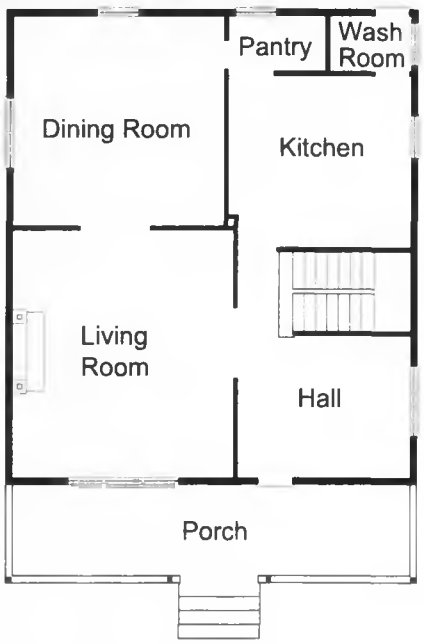
When renovating the first floor, consider what future changes may be made to the second floor or attic. Would more bathrooms be desirable? Is the existing plumbing in good shape? Is the heating system going to need changes? What about the electrical wiring? Create an access chase or cupboard to provide a path through the first floor for future use. As well, install conduit for future use to supply cable, telephone and security system wiring to the second and third floors.

It may not be possible to create a living space on the main floor of a century-old home for a handicapped occupant or senior with limited mobility. Incorporating space when renovating for an elevator will permit greater flexibility for the future.

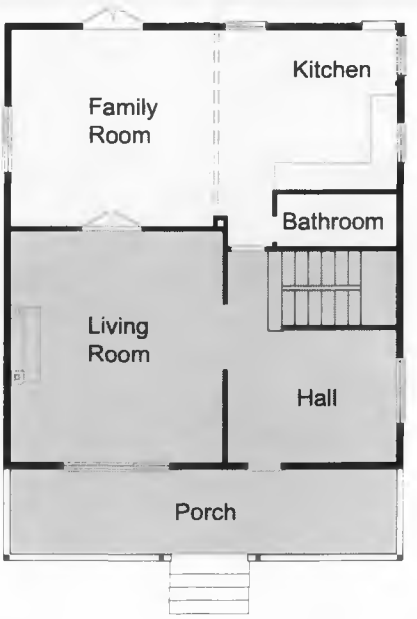
FLOOR PLANS FOR GROUND FLOOR RENOVATION

Typical layout: foursquare house

Foursquare house original floor plan



Foursquare house kitchen-family room conversion



a) Dining room and kitchen conversion to kitchen-family room

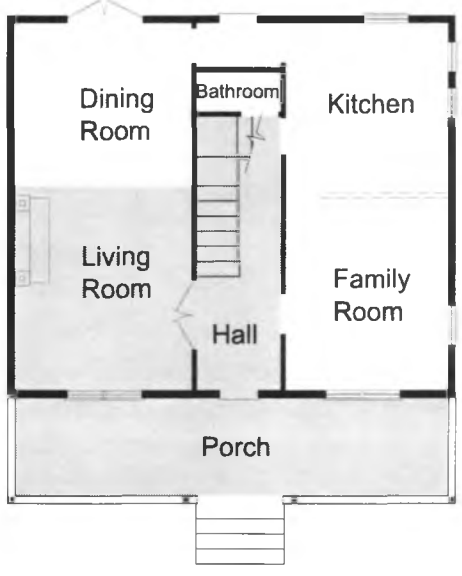
- Many of today's families do not use a formal dining room. It can be an ideal space to convert to a new family room or "great room," especially if it is separate from the living room.
- Place bathrooms in close proximity to reduce plumbing costs. In this case, the new kitchen/bathroom orientation will probably require a new stack.
- Removal of rear vestibule and pantry and installation of larger window and French doors opens up rear of house to rear yard.

b) Dining room and kitchen conversion to kitchen-family room

Foursquare centre hall original floor plan

- Long narrow configuration of original living room converts to living/dining room combination and provides option of combined family room/kitchen.
- Good separation between formal and family areas of the house
- Location of powder room may require new access to basement from under side of stairs.
- Powder room location may require new stack, depending on location of second floor bathroom.

Foursquare centre hall plan family room from dining room

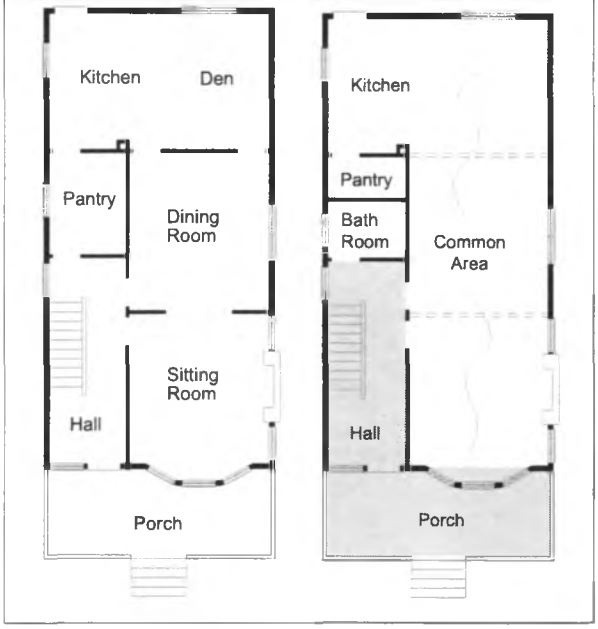


c) Great room common area

- The removal of the walls separating, the kitchen, den, dining room and living room allow the creation of one L-shaped common room. Lintels or posts and beams are required where structural walls are removed.
- The pantry converts to a powder room.
- The large open area permits activities to expand or contract into the space as needed.
- Keeping the kitchen in the back corner of the house places it out of sight of other activities but does not divorce it completely. It also makes it accessible to rear yard.

Rectangular house original floor plan

Rectangular house main floor conversion

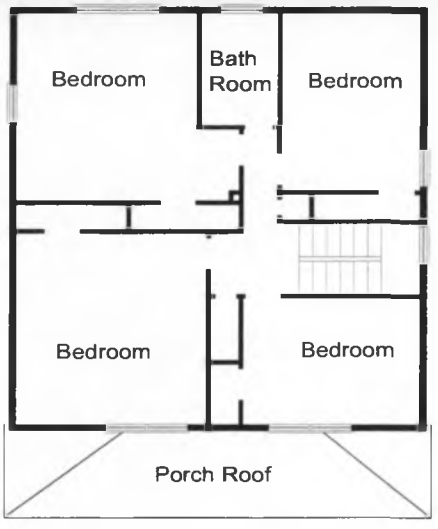


The original living room, dining room and den have been opened in one great room in this renovated Ottawa house.
Buchan, Lawton, Parent Ltd

FLOOR PLANS FOR SECOND FLOOR RENOVATION

Typical layout: foursquare house

Foursquare House Original Second Floor Plan



Foursquare House Master Bedroom Conversion

a) Master bedroom conversion

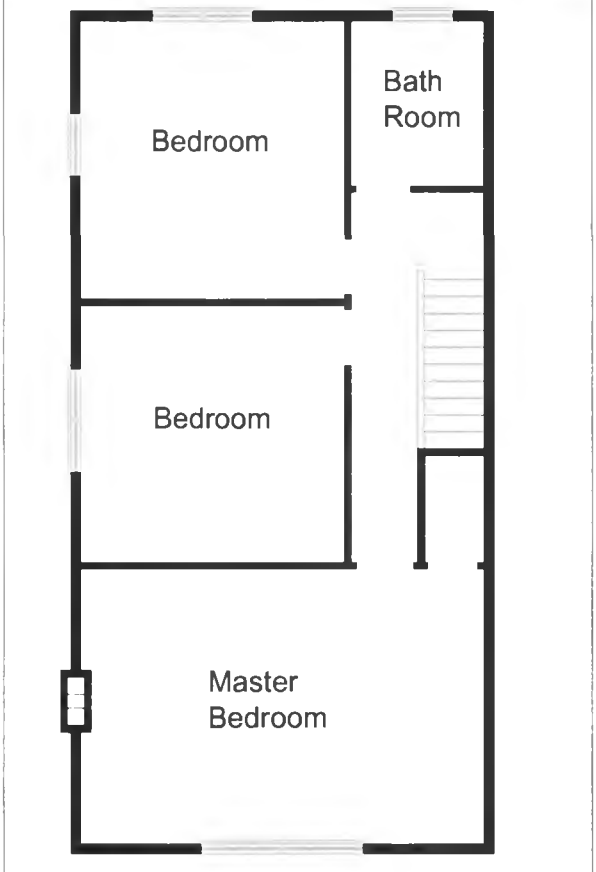
- Remove existing bathroom including two interior walls. Install two new bathrooms in old bedroom creating a master bedroom with ensuite and new main bathroom.
- The new bathrooms are not large but more than adequate for a four-piece bath (3 m x 2.5 m).
- Placing bathrooms together saves on plumbing and integrates well with proposed kitchen and powder room on ground floor. However, it does require all new plumbing and a new stack.

Typical layout: rectangular city house

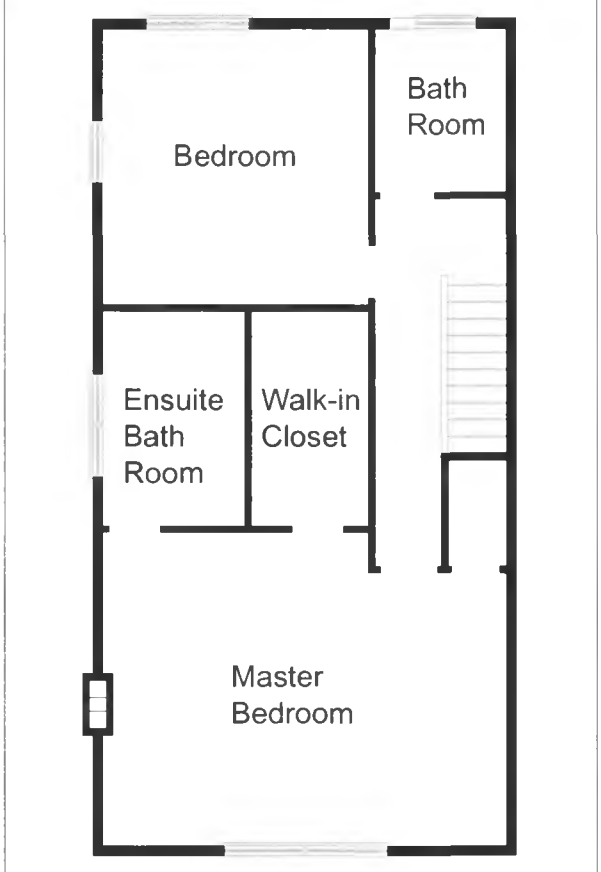
a) Master bedroom conversion

- Renovate two smaller bedrooms to create a master bedroom and ensuite.
- Leaves the existing bathroom intact. Involves minimal disruption to rest of second floor.
- Probably requires the installation of a new stack and new plumbing. (Could be tied in with first floor powder room.)
- Two bedrooms could limit resale of house.

Rectangular House Original Second Floor Plan



Rectangular House Master Bedroom Conversion



b) Master bedroom conversion with access to attic

- Creates access to attic for more bedrooms while still providing large master bedroom suite on second floor.
- Leaves the existing bathroom and rear bedroom intact.
- Probably requires the installation of a new stack and new plumbing. (Could be tied in with first floor powder room.)
- Extra bedrooms on third floor will help resale value of house.

Take the location of ductwork and grilles into consideration when planning renovation
S. Marshall

Duplexes and multi-family homes

Over the years, many large inner-city homes have been converted into duplexes or triplexes, probably as a response to a demand for that type of housing and as mechanism for covering the costs of maintaining the houses—especially when the owner had more room than needed. In the '70s and '80s, this type of conversion was discouraged by many cities in an effort to "clean up" and re-establish healthy communities in the downtown cores. Lately, however, cities, such as Vancouver, have removed some of the barriers to creating duplexes from single family homes after realizing they can be an important part of the revitalization.

Creating a duplex—some of the issues

An extensive renovation is usually required to turn a single-family home into a multi-family building. Municipal approval is required first—zoning approval will likely be necessary and your neighbours are usually given the opportunity to object. Safety of the occupants is also a major concern. The plumbing, heating and electrical systems must be safe and will probably require upgrading to the current code. The fire code, fire separations and sound separations must be taken into consideration, along with providing separate routes into and out of the apartments. Parking can also be a problem with the closely spaced houses of the urban core.

After determining if it is permissible, determine whether it is feasible. Can you recover the costs of the renovation through rent? How does it compare to other rents for similar space in the area? What about your future investment—by converting to a duplex are you devaluing the property or increasing its value?

Many large older homes have been successfully converted into duplexes and triplexes in large urban areas and smaller communities across Canada. Urban Quebec, for example, is one area where duplexes are more common. Each case is unique. Is it technically feasible? Does the layout of the house lend itself to conversion? Does the municipality permit conversion to multi-family units? These questions must be answered before the detailed planning can begin.

Century-old homes in Winnipeg, top, Ottawa and Toronto. Lack of parking can be a major obstacle to converting to a duplex or triplex.

Changing a duplex back to a single-family home

A number of the issues and considerations raised with converting to a duplex should also be considered when changing the house back to a single-family home. Renovations usually require building permits and, in some municipalities, renovations valued at greater than 50 per cent of the value of the building may require upgrades to the whole house to meet the current building code.

Again, each case is unique. What is the trend with the surrounding homes, are they mainly single-family dwellings or mixed? Is it technically feasible? Does the municipality restrict conversion back to a single-family home? What is the long-term potential for the neighbourhood? If the neighbourhood houses are rooming homes and run-down apartments, it may be difficult to obtain financing for major work.

Also consider your long-term goals for the house. It may be desirable to convert back to a rental duplex in the future. If so, changes should be made with this possibility in mind.

The owner of this duplex is converting both second floors to be part of the one unit and plans to use the second main floor space as a rental unit.
F. Sandkowski

Another trend in older urban areas is to convert two duplexes, built as duplexes, to one single-family home. This is usually done with smaller flat-roofed homes in old working class neighbourhoods of larger cities. The surrounding gardens are small and parking is limited. By purchasing two duplexes, a family can obtain more living and sleeping space without enlarging the footprint of the house. These units are usually configured to permit the reconversion to two duplexes in the future.

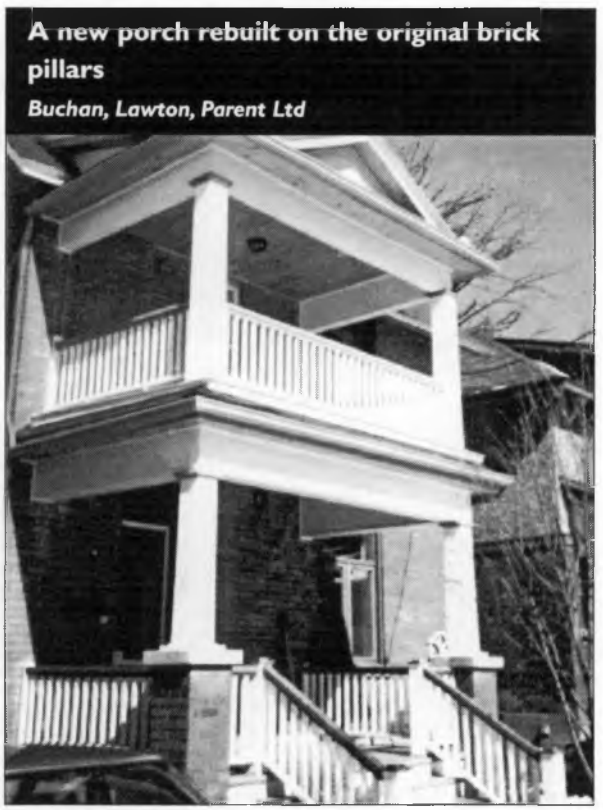
Pros and cons of duplexing

Pros	Cons
Revenue can help defray cost of house purchase.	Required to upgrade utilities, heating systems, and sound and fire separations to meet current code
Revenue can be used to upgrade house and carry out repairs.	May be required to separate utilities and heating by apartment.
Environmentally appropriate (reusing existing housing, permitting higher densities)	Less space and privacy
Can accommodate lifestyle changes and allow families to reside longer in one house	May not "fit in" with neighbourhood
	May not be able to charge enough rent to cover costs

Introduction

Chapter 3 outlines the process for carrying out any type of renovation—large or small. The planning process is common for all types of renovation and, to be successful, should come before the actual work begins. This chapter looks at some options for making minor modifications to the house, either through an improvement to the exterior of the house (porch rebuild, foundation repair, re-roofing or re-siding) or through interior changes, such as a kitchen or bathroom upgrade or an accessibility retrofit.

The "Overview of Design Considerations" in the front section of Chapter 5 includes a discussion of the preliminary considerations you may wish to review before beginning even a minor renovation project.



A new porch rebuilt on the original brick pillars
Buchan, Lawton, Parent Ltd

REBUILDING OR RE-INSTATING THE FRONT PORCH

Overview

A new porch built on the original brick pillars—The front porch of the century-old home is one of its most endearing features. It is a strong visual element and an integral part of the home's esthetics. Not only does it shield the visitor from the elements, it provides a cool spot to sit on a hot summer evening and it shields the front window from the hot summer sun.

Some porches support a second floor sunroom or are enclosed to create a three-season living space. After a century of use, the porch is often the feature most in need of structural repair on these old homes.

Before demolishing a porch to replace it with a new structure, contact your municipal building department to determine whether it falls within the current setbacks from the street. If it does not meet current setbacks, the porch may be considered a non-conforming use. In some jurisdictions, a non-conforming porch cannot be torn down and replaced with a new structure; however, the existing structure can be repaired and maintained.

Rebuilding a porch requires professional skills. From creating a deck with an appropriate slope to designing and building safe railings, incorporating the correct detailing for joining, flashing and caulking and making it look right, it is not a weekend do-it-yourself project.

Design considerations

Appearance is important—it is a matter of harmony. Include elements of the style of the original porch when rebuilding. If the porch has been substantially modified over the years, look for ideas in communities with similar houses.

Follow good renovation and restoration practices when building a porch. Start at the foundation. Piers are commonly used to support the porch but a full foundation connected to the heated basement is also used. Pressure treated wood and other water-resistant materials are available for structural and floor finish materials. Ensure the detailing of the joint between the house and the porch is adequate to avoid moisture problems.

Construction

Foundation

- Assorted types of foundations support porches including columns or piers on pad footings and full foundations with exterior walls. Regardless of the type of support, install the foundation or piers on a footing placed below the frost line to avoid heaving and possible damage to the porch or house.
- A century ago, a common design strategy involved placing a full foundation under the porch and creating a cold storage room accessed from the basement. Generally speaking, cold storage rooms do not work; condensation and mold are potential problems, especially if the space is unheated and unventilated. Piers or a full heated foundation are better options.
- Where a full foundation is used, integrate the space with the basement, provide heat and ventilation and ensure the porch floor is sloped for good drainage and well sealed to avoid leaks.
- To direct surface moisture away from the house, slope the ground away from the foundation. If excavating around the foundation, use a good quality waterproofing material to seal the wall from the exterior and a free draining material next to the wall to relieve hydrostatic pressure. Various waterproofing materials are available, including mopped or brushed-on foundation tar, spray-on membrane applied by professionals, plastic drain gap membrane and bituminous peel and stick membrane. Durability and effectiveness vary between the different types of materials. Tar is the traditional method but the other membranes are usually more effective over the long run.
- In addition to directing water away from the foundation wall, provide drainage to remove water that reaches the footing. Install perimeter drainage next to the footings and connect it to a sump or to the drainage system around the existing house. Refer to the following section on foundation-drainage repair for further information on sump pumps and connections to municipal storm systems.

Framing

- Permanently tie the floor system into the existing house structure, using either threaded rods or lag bolts. Construct the floor of the porch level across its width with a slight downward slope to the outside front edge of the porch to create positive drainage away from the house.

- Use pressure treated wood for the structure of the porch, especially vertical support members, floor joists and headers exposed to a moist environment. Keep in mind, pressure treated wood loses up to one-third of its strength during treatment and contains toxic chemicals released when wood is cut or burnt.

Wall systems

- Structurally tie the structure (roof and supports) of the porch to the walls of the main building.
- Seal the joint between the cladding and trim of the existing house and the porch to prevent rain and snow entry. Place the weatherproofing on the exterior.

Finishes

- Use cedar, pressure treated wood, plastic composites, vinyl, fibreglass and metals to recreate or simulate the original details and finishes of the porches. A tremendous range of materials is available. Many have durable finishes designed to last a long time and to reduce maintenance.

Roofing

- Construct the structure of the roof to meet the load requirements for the area. When rebuilding an existing porch, the original roof may not be structurally adequate and may require reinforcement or replacement.
- Take special care at the junctions between the new roof and the existing structure. Seek professional design and installation assistance to avoid water and moisture penetration into the wall cavity and to tie the two structures together. Install appropriate flashing and seal all joints.
- Ensure the roof drainage (eavestrough and downspouts) direct water away from the house. One option is to extend downspouts at least 1.2 m (4 ft.) away from the foundation and use plastic or concrete deflectors to further move the water away from the house. In regions where this is not permitted, such as British Columbia, another option is to direct the rainwater to the perimeter drainage system or a sump.

FlexHousing™

Most porches are four or five steps up above the sidewalk. For families with strollers and carriages or persons with limited mobility, it may be possible to integrate an access ramp into the front or side of the porch. Take care in the design of the porch roof to avoid ice and snow buildup on the ramp.

Healthy Housing™

Old porches may have concealed spots where rodents, birds and other animals have nested or taken roost. When demolishing these areas, take special care to ensure you do not inhale the dust from their debris. Particles from the feces of some birds, bats and animals can cause serious health-related problems, if inhaled. Information on dealing with the safe removal of animal feces is available from your local municipality.

FOUNDATION-DRAINAGE REPAIR

Overview

The foundation of the century-old home supports the house. The basements can be relatively dry and moisture free but they are

not intended to be turned into insulated and finished living space. The stability of the foundation wall depends, to some extent, on being heated throughout the winter months. If the foundation wall is not kept above freezing, it is very susceptible to freeze-thaw conditions.

Low headroom and rubblestone walls restrict the use of basements on century-old homes
F. Szadkowski

Although it is possible to insulate the foundation wall on the outside, it is usually costly—especially if the foundation is rubblestone. Interior insulation and finishing is not recommended in basements where there are chronic moisture problems. When these constraints are considered along with the limited headroom and the narrow and steep access stairway, it becomes clear that the basement of the century-old home is usually not a good candidate for conversion to living space. It can be good space to house the furnace, laundry area, a workshop and, possibly, storage.

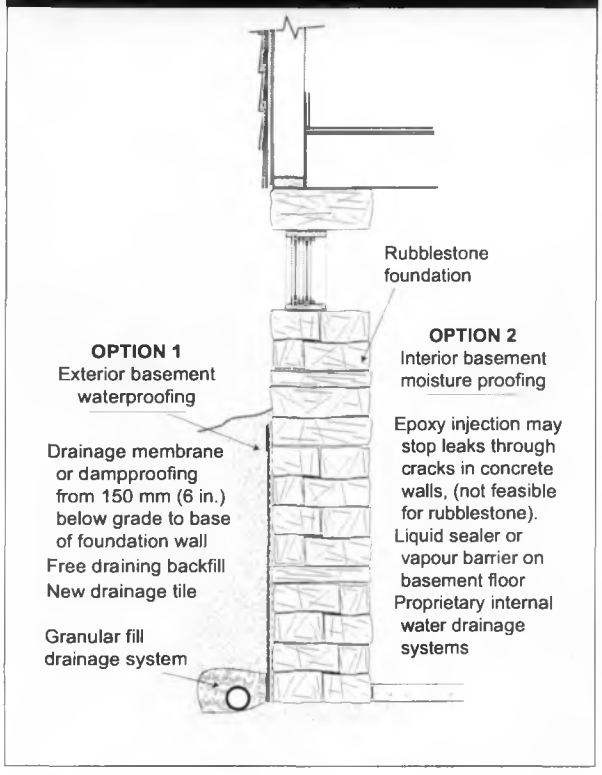
Design considerations

Moisture can be a problem in the basements of these old homes. It can seep through the foundation walls, be drawn up through the floor or come from above. Minor amounts of water may not cause a problem, especially if you are not using the basement. If, however, there are signs of mold, rot, or standing water, deal with the problem. Even though the basement may not be part of the living space, it is part of the house environment. Mold and rot can attack structural members and basement air contaminated with mold spores will find its way up to the living space.

Extended drainspout and good slope direct surface moisture away from foundation
Buchan, Lawton, Parent Ltd

In terms of the mechanical systems in the house, the basement is the nerve centre. Space is required for utilities, such as the furnace, water heater and electrical panel. Access is required to plumbing shut-off valves, electrical and phone cable junctions and cleanouts at the base of vertical plumbing stacks. As well, many of the services for the upstairs run through the basement ceiling. Any basement modifications must take these requirements into consideration. Keep access doorways to and within the basement large enough to accommodate a furnace, hot water tank or other mechanical equipment that may require replacement.

Construction detail basement waterproofing upgrades



Construction

Achieving a dry basement

It is preferable to stop excess moisture at its source—outside the basement. A careful inspection of the basement can help to determine the source or sources. Is the moisture coming through the walls? Does the moisture appear to be related to periods of rain or snowfall? Is there a high water table? Does the garden slope away from the house or direct water towards the foundation?

Is moisture coming up through the floor? Where homes are well above the water table and the land is sloped away from the house, moisture may be wicking up through the floor. Do items stored on the floor, such as cardboard boxes, become damp and moldy, if left for a while?

Is the water coming from above? Water may be entering through the roof or walls of the house and draining into the basement. See CMHC's Investigating, Diagnosing and Treating Your Damp Basement for further details.

Exterior waterproofing involves installing a drainage membrane or dampproofing on the outside and adding free-draining backfill material and new drainage. Refer to "Construction Details Basement Waterproofing Upgrades" diagram, Option 1. Connect the perimeter drainage to the municipal storm sewer system or to a sump pit inside the basement.

Old wood-frame windows are often the easiest locations to bring cable and telephone connections into the house. These windows are another source of air leakage.

Buchan, Lawton, Parent Ltd

Connecting to the municipal storm sewer is expensive, especially if you have to cover the cost of road and sidewalk repair. Furthermore, it may not be possible to connect—even in some urban areas sewers do not pass by every house or they may be part of a combined system. Combined systems carry sewage as well as storm runoff and many municipalities will not permit connections from individual drainage systems.

A second, less expensive, solution is to install a sump and, where needed, a pump. Sump pumps, however, require homeowner maintenance, must have an appropriate place to pump the water and can breakdown and fail. If a sump pump fails or there is a power outage, the basement is more susceptible to flooding since the drainage system drains the water into the sump pit in the basement. Outside sump pits and pumps may reduce the possibility of basement flooding in the case of a power failure—depending on their elevation in relation to the basement floor.

There are methods to treat basement moisture from the inside (See "Construction Details Basement Waterproofing Upgrades" diagram, Option 2.). Inject epoxy from the inside to reduce leakage through cracks and holes in concrete foundation walls. Arrest the movement of soil moisture through the floor by using a liquid sealer or by installing a plastic sheet material (vapour barrier) over the floor. If a vapour barrier is used, protect it from damage by a subfloor. Other proprietary internal water drainage systems are available.

Interior treatments may be less expensive and less disruptive but they are also less effective. If water keeps moving through an old wall to an interior collection system, the wall may be damaged by the water flow. Exterior treatments provide a more permanent and effective solution.

If you plan to place moisture barriers on the inside of the wall or floor, take care to avoid creating an environment where molds can grow. To survive, molds need a food source, such as cardboard, drywall or other organic materials, an appropriate temperature (20 to 30°C) and sufficient moisture. Since the temperature and moisture levels will be ideal, ensure there is no organic matter for a food source on the cold side of the vapour barrier. Clean the surfaces thoroughly before installation and check periodically, if possible.

For basements with severely deteriorated foundations, it is possible to build a new foundation for the house. This is a very costly procedure and requires the expertise of a professional house raiser. The procedure involves lifting the house, supporting it on temporary foundation cribbing, forming and pouring new footings and new foundation walls. After the concrete has cured for a minimum of seven days (longer for a large, heavy house),the house is lowered onto the new foundation and bolted into place.

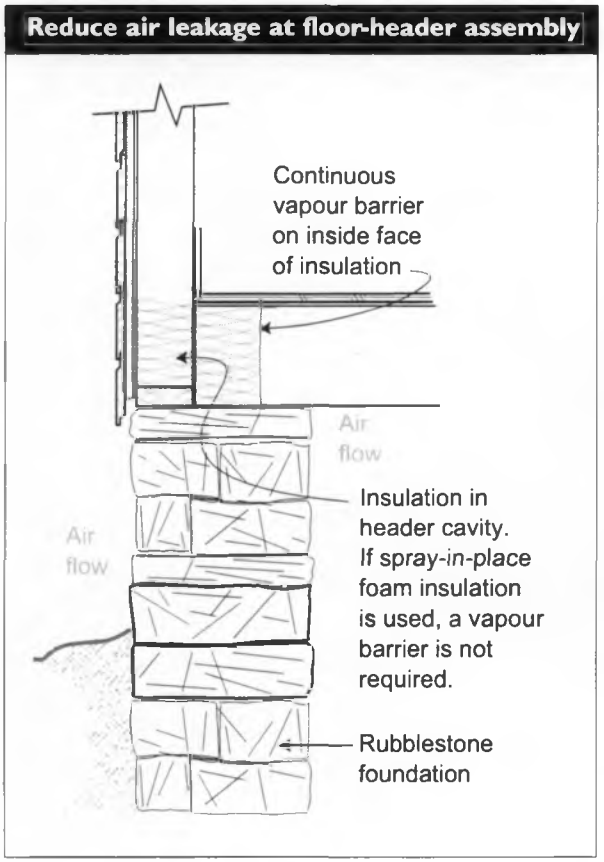
Where the basement has experienced moisture problems, any structural damage to walls, floor or supporting timbers must be repaired and any mold removed before proceeding with the work. Chimneys, fireplaces and heavy and bulky components of the house require extra considerations.

The creation of a new foundation presents a few of opportunities. Increased headroom is possible (subject to municipal height restrictions) and waterproofing can be installed on the exterior of the foundation. Where appropriate, window wells and larger windows can provide more light to the basement.

Reducing air leakage

One major area of air leakage in the basement of a century-old house is at the point where the floor joists of the first floor meet the exterior foundation wall. Referred to as the floor-header assembly, it often has only the exterior cladding between the inside and outside of the house or possibly a row of rubblestone. To reduce air leakage at this location, insulate and seal the space between the joists. It is important to install a continuous vapour barrier on the warm face-interior face when insulating the header area. Avoid the situation where moisture migrates into the insulation and becomes trapped against the header and joists and eventually causing them to rot. The header area can also be insulated and air sealed with expanding spray foam installed by professionals.

Reduce air leakage at floor-header assembly



Healthy Housing™

Ventilation

Reducing air leakage in the basement helps to keep the heat in (and reduce heating costs) but it may have negative impacts, as well. It can increase the level of moisture in the air and reduce the amount of air available for the combustion appliances in the basement, such as the furnace and hot water heater although this level of air tightness is rare in older homes. To avoid the possibility of backdrafting combustion appliances including fireplaces, ensure house fans, furnace fans or leaky drafts do not excessively depressurize the appliances. For more information on ventilation, refer to the Heating, Ventilating and Cooling section later in this chapter.

Many houses require summer use of a dehumidifier to keep basement relative humidity adequately low (less than 60 per cent RH).

Leaded paints, asbestos in insulation, plaster and other materials and molds are all Healthy Housing™ concerns to be aware of when renovating basement areas.

Leaded paints, asbestos and mold can all be found in old basements

KITCHEN RENOVATIONS

Overview

At the turn of the 20th century, the kitchen was in a state of evolution. Modern conveniences were being introduced and there was a trend away from the large multi-purpose rooms where the homemaker spent most of her day and toward more compact and efficient kitchens. In the earlier homes of the timeframe, kitchens tended to be large but, by the end of the period, kitchens were relatively small and designed more for utility.

New cupboards, wiring, plumbing and a refinished hardwood floor upgraded this kitchen
Buchan, Lawton, Parent Ltd

Kitchens have continued to evolve, becoming even smaller in the post-war house and then growing to become part of a larger family-oriented space towards the end of the twentieth century. The farmhouse style kitchen and great room concept are two expressions of this trend. As the kitchen has returned to its position as the focal point of family life, style and appearance have become more important.

A kitchen renovation project can range from a simple facelift with cabinet resurfacing, new paint and flooring, to a complete renovation, involving a new room layout, new cabinets, services and appliances.

Design considerations

Scope

Kitchens are one of the most costly areas in the house to remodel. The cabinetry, fixtures, appliances, plumbing, wiring and finishes are all expensive components. Careful planning and preparations are necessary to avoid costly mistakes.

A major renovation also presents the opportunity to add or change windows and to insulate and seal exterior walls. However, before deciding on a complete renovation, consider how long you plan to be in the house and, if cost is a factor, whether the cost of the renovation can be recouped when you sell the house. If the room layout is acceptable, a facelift and, perhaps, some minor upgrades may suffice.

Consider the state of the utilities in the kitchen. Assess the plumbing and electrical wiring to ensure it meets the needs of a modern kitchen. Blowing fuses or circuit breakers is frustrating and indicates a potentially dangerous situation.

As you plan your new kitchen, try to discover what has happened over the past century in the space. How was the space used originally? Did the kitchen have a pantry or eating nook? Was the stove originally-wood burning and connected to the chimney? The more you know about the space, the less chance of unpleasant surprises.

What works best for you

A kitchen is first and foremost a workshop for cooking. In designing the layout, think about the extent and type of cooking carried out in your home. Also consider future cooking needs. Even though you do not use a convection oven now, you may want one later. Read books, clip pictures and visit showrooms to gather ideas.

In addition to cooking, kitchens must serve many other activities. The kitchen is often the nerve centre of the household. Make a list of the activities you expect to carry out in the kitchen and identify all appliances and features you eventually want your renovated kitchen to contain.

Draw a plan of the space locating existing walls, windows, plumbing and electrical outlets. See Chapter 4 for renovation planning worksheets and templates. Lay out the space to include areas for kitchen activities, appliances and other desired features, such as a computer, television or sitting area. If possible, keep the plumbing in the existing locations to reduce costs. Consider working with a professional renovation contractor or a kitchen company. They are experienced in kitchen layout and familiar with the extensive range of kitchen products available.

Size

Most kitchens in century-old homes have the flexibility to meet the needs of today's modern homemaker. If space is limited, consider using space savers, such as pull out counters, roll-away work carts, overhead pot racks, a walk-in pantry cupboard and small-scale appliances. Find space for the social side of the kitchen by opening it up to an adjoining room. Turn a wall into a bar counter or remove a portion of the wall. (Bear in mind, some walls are structural and cannot be removed without replacing the support.)

Style

Include features from the period of the house in your renovation details. A new kitchen looks like it belongs when baseboards, trim and other finishing details are similar to those used in the rest of the house. As well, avoid the extremes of current trends. Your new kitchen will age more gracefully and not look out of date in a few years. Similar considerations apply to the exterior. If your kitchen renovation involves moving or enlarging a window opening, use a window style appropriate to the age of the house.

Construction

Cabinets and finishes

The floors and walls of century-old homes are often out of plumb. When installing cabinets, ensure the floors are level. It pays off in the longevity and appearance of the final product. Where floors cannot be easily levelled, use shims to ensure the lower cabinets are level. Fasten upper cabinets securely to solid blocking in the walls.

Consider the composition and materials used for cabinets. Low emission products, natural materials and sealed surfaces all create a healthier environment. As well, these materials are often more durable and last longer. Paints and other finishes are available in low-odour (low VOC)

and easy clean-up formulations that are better for the environment and for indoor air quality.

Fire safety and thermal comfort

With the old cabinets removed and the exterior walls exposed, it's an ideal time to make the room safer and more comfortable by installing firestopping and upgrading the insulation of a balloon-framed house. Place firestopping in the exterior wall cavity at the first and second floor levels. This keeps fires from spreading up through the open cavity of the balloon-framed wall.

If the original plaster is in good condition, blow insulation into the walls through small holes and then repair the holes. If the plaster needs replacing, remove the plaster, insulate the cavity and finish the wall with new drywall. Whichever approach is used, ensure the wall has a vapour retarder and a continuous air barrier to avoid future moisture problems. It is very difficult to create continuous air barriers and vapour retarders in an older house especially a balloon-frame building. Regardless, avoid a situation where moisture can be trapped against wood when insulating and including a firestop in a wall.

A common method of providing an air barrier and vapour retarder uses polyethylene sheet material for both functions. The "poly" must be UV-rated and at least 0.15 mm (referred to as 6 mil) thick, fastened to keep it from moving as the air pressures change and sealed at all joints and edges. To avoid condensation on the warm side of the vapour retarder, the accepted rule of thumb is to place at least two-thirds of the insulation on the cold side of the vapour retarder. Typically this is achieved by placing the poly on the inside face of the insulation before installing the drywall.

In a balloon-frame house, problems arise when trying to seal the air barrier at the floor and ceiling of one level of insulated wall. The wall cavity is open to the basement through the header area and to the second floor wall cavity. There is no structure to support the air barrier at the floor level. One way to deal with this problem is to insulate and incorporate air-vapour barriers on all floors of the wall cavity at the same time. At a minimum, insulate and seal the header space in the basement at the same time as insulating the kitchen wall.

Closed-cell spray-in foam insulation is a second option to providing insulation, an air barrier and a vapour retarder all in one. Properly installed, it fills the wall cavity completely and adheres to the wood structure creating an airtight assembly. Most spray-in foam products must be applied professionally and are more expensive than using the batt insulation and poly option.

Even if it is not used in the whole wall assembly, closed-cell spray-in foam insulation is very effective in difficult-to-insulate areas, such as the header space below the kitchen wall, around window and door frames and at gaps around plumbing, wiring and HVAC components.

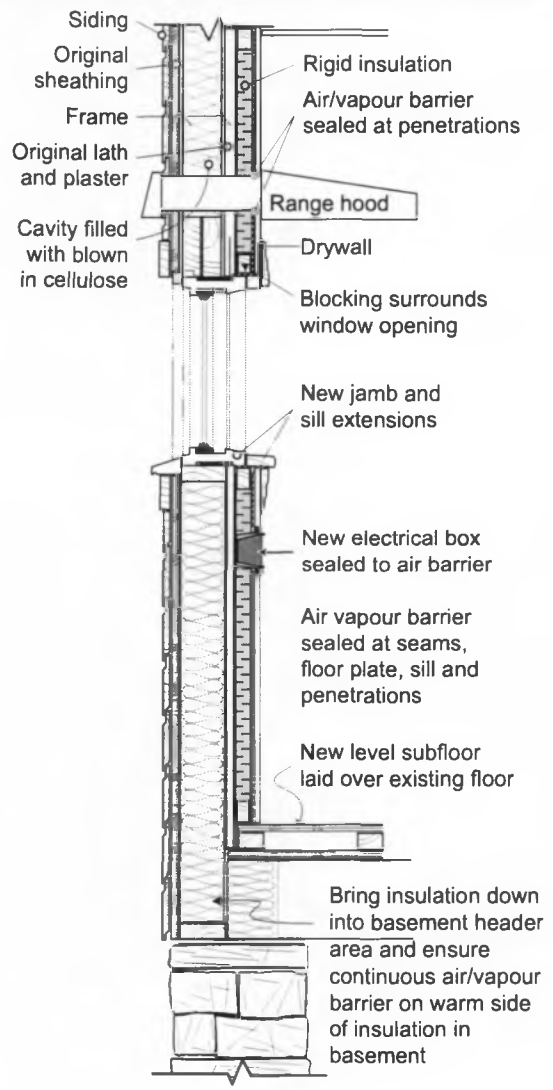
As part of the air-vapour sealing process, caulk or install gaskets on all penetrations in the outside wall, such as at vent openings and electrical outlets.

Other methods are available for creating an air barrier and vapour retarder, such as the airtight drywall approach. Consult a professional renovator, engineer or designer with a number of years of successful experience renovating century-old homes for advice on appropriate options for dealing with your specific house.

Ventilation

Pay attention to ventilation even for a minor kitchen remodel. Vent stovetops directly to the outside or use a recirculating range hood, depending on cooking style and other ventilation systems in the kitchen. In kitchens where the range hood is the only exhausting device, vent it to the outside. Where an HRV or a central exhaust fan is used, a recirculating range hood can be an effective solution.

Construction details exterior kitchen wall upgrade balloon-frame house



Choose an exhaust fan with two or three operating speeds and a low noise rating. A range hood extending towards the front of the stove and close to the cooking surface captures the most moisture and combustion products from a gas stove. Ease of cooking also plays a large part in the selection of an appropriate range hood. Install range hoods according to the manufacturer's recommendations.

Operating larger range hoods and exhaust fans can cause an imbalance in air pressure in the house. If the house is very leaky, this may not be a problem but as leakage paths are stopped, problems can develop. Depressurizing the house can create conditions where the furnace and fireplace chimneys backdraft contaminants into the house. When installing range hoods and exhaust fans, have the air pressures in the house tested and install a make-up air unit in the house, if necessary. For more information on ventilation, refer to the Heating, Ventilating and Cooling section later in this chapter.

In homes with a whole-house ventilation system, exhaust air from the kitchen to remove odours and to keep smells and humidity from moving into the rest of the house. A recirculating range hood provides adequate stovetop ventilation in these houses. Do not vent the stove directly to the exhaust air stream of the ventilation system.

Windows

Kitchens are areas of high humidity. Condensation can be a problem on kitchen windows. To create a warmer window surface and to minimize condensation, upgrade the windows to a higher insulating value with a good thermal separation at its edge. A kitchen renovation is an ideal time to upgrade windows.

It is equally important to seal the opening around the window frame. Heat is lost through the cavity and cracks between the window and the rough stud opening created for the window. In an older home on a cold windy day, feel the cold air blowing in around the window trim, especially if the trim is not well sealed to the wall and the window frame.

If you replace the window, insulate around the window frame and air seal the cavity. Non-expanding closed-cell spray-in foam insulation penetrates into the small cavities.

Note of caution: To maintain a new window warranty, install the window according to the manufacturer's installation instructions. Ensure any spray-in foam meets the manufacturer's specifications.

Use spray-foam insulation to insulate and air seal around existing windows and doors. When insulating existing windows, insulate and seal the cavities for the window weights, unless the weights are still used.

Plumbing

Relocating the sink or adding other water-consuming appliances involves plumbing changes. New drain and vent connections and water supply piping are required. Modifications to the kitchen plumbing may prompt the replacement of a significant portion of the plumbing in the house. Be prepared and knowledgeable so you can assess the situation rationally.

Heating

Heating is often forgotten in kitchen projects. Changes to the kitchen layout may require relocating the heating outlet or radiator. With the placement of cabinets along the walls of the kitchen, a heating outlet can be difficult to place. Consider the new, narrow-profile radiators for hydronic heating systems or a radiant floor system. Ensure heating requirements are included during renovation.

Electrical

An electrical code did not exist when the century-old houses were built. A minimum of eight dedicated circuits is recommended for counter outlets, appliances, general outlets, lighting and an exhaust fan in today's kitchens. If the main electrical panel is not large enough for the extra circuits, a sub-panel or new electrical service may be required. Include both central overhead fixtures and task lighting along the counters in the lighting plan.

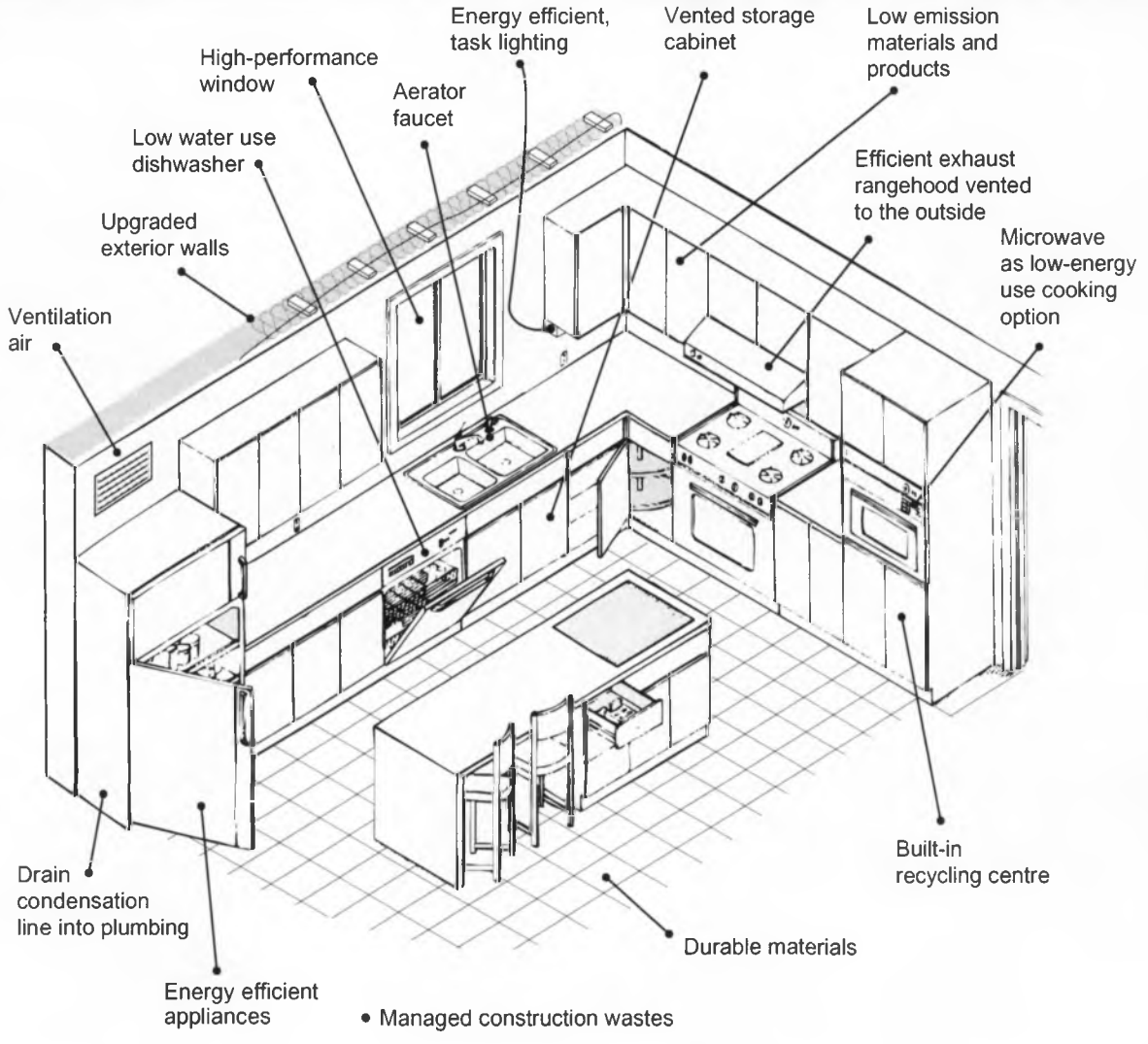
FlexHousing™

A kitchen renovation provides an excellent opportunity to include features to make the kitchen more accessible to a person with limited mobility. Features such as sufficient floor space to manoeuvre a wheelchair, the inclusion of pull-out work boards and electrical outlets at the front of some cabinets do not add significantly to costs, if they are built in from the beginning. Some features can be roughed in for possible use at a later date. For example, plumbing and counter tops can be installed to permit their relocation at table height, if required (see section on renovating for accessibility at the end of Chapter 6 for more details).

Healthy Housing™

Because so many activities occur in the kitchen—cooking, washing, food storage, eating—there are many opportunities to improve indoor air quality, upgrade energy and water efficiency and use new materials wisely.

Healthy House options in the kitchen



If choosing new appliances, use the EnerGuide rating to select the most energy efficient models. Compact fluorescent and halogen lighting offer warm light with low energy use. Aerator faucets use less water and are inexpensive and easy to install. Dishwashers with delay timers are cost efficient and easily used during the night when there is less demand for power generation and their noise has less impact.

Careful choice and management of materials results in less waste during renovation and a more durable end product. Using durable and repairable materials ensures the renovation is attractive for many years. Solid wood cabinets over particleboard or medium density fibreboard (MDF), for example, withstand the bumps and maintain their good looks. Ceramic tile, vinyl composite tile, laminate, wood and cork

flooring are durable and easy-to-clean choices for flooring in a kitchen. CMHC and other sources publish information on choosing low-emission products. Recycle used cabinets and fixtures through a local building re-use centre.

Note of caution: The paints used before 1950, especially the glossy enamel paints used in kitchens and bathrooms of old homes, generally contained high levels of lead. If these paints are disturbed, the lead is very hazardous. Avoid breathing in or ingesting the dust and take precautions to avoid spreading the dust. Do not prepare food in the same area as the dust.

If you suspect the old paint is still on the walls, have the paint tested for lead. Lead is particularly dangerous for children and pregnant women. Ingesting even small amounts can lead to neurological damage. CMHC and Heath Canada provide guidelines for safely dealing with lead paint. Information is available at Health Canada's Web site at www.hc-sc.gc.ca under lead paint.

Asbestos is a second hazard in old homes. The older sheet flooring and colourful square vinyl tiles used in kitchens and bathrooms often contain asbestos. The minute particles from the asbestos can lead to lung disease. Take precautions to avoid inhaling the asbestos dust.

Financial implications

Kitchen remodelling has a high rate of cost recovery for a renovation activity. On average, over two-thirds of the cost are recovered at resale.

BATHROOM RENOVATIONS

Overview

A century ago, the bathroom may have been just that—a room with a tub for taking a bath. Sir Thomas Crapper had only recently introduced his improvements to the flush toilet in England and many North American bathrooms were rudimentary.

Original plumbing, tub and tile work from the 1920s
Buchan, Lawton, Parent Ltd

The bathroom in the century-old homes has probably received a number of facelifts through the years. Some bathrooms may still contain the old cast-iron and porcelain fixtures while others may have been completely gutted and renovated several times in the last 40 or 50 years.

Unless a bathroom has suffered severe moisture damage, the main motivation for a bathroom renovation is comfort, convenience and appearance. Worn-out finishes and outdated fixtures call for a facelift. Where additional space can be found, it is possible to add amenities such as a whirlpool, bidet or sauna.

Design Considerations

Scope

As with kitchens, the scope of the project is the first consideration. Is it simply a matter of replacing older fixtures and giving a facelift to wall and floor finishes? Or is a complete renovation required, involving expanded space and additional fixtures? Has moisture or structural damage occurred?

If there is moisture damage, check the condition of structural members, particularly those next to the tub or shower enclosure, at the base of the toilet and in wall and floor cavities adjacent to plumbing. Determine the source of the moisture and repair or remove the problem in order to avoid the return of the moisture in the future. Make required repairs before the work begins.

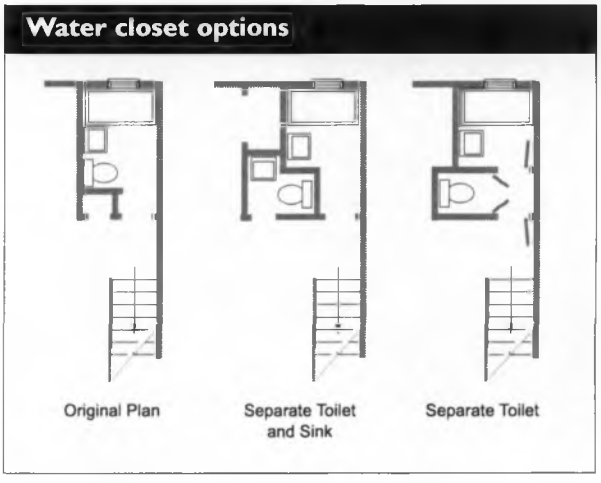
Changing the bathroom layout can involve moving walls and fixtures. When the associated plumbing changes are factored in, it may require modifications from the attic to the basement.

Layout

Leaving the floor plan alone requires less work and is always less expensive.

Increasing the size of a bathroom necessitates moving walls. One solution is to expand into an adjoining bedroom or hallway. Just a foot or two often makes a big difference in the placement of fixtures and convenience in the bathroom.

If a second bathroom is desired because of family size, but space is at a premium, one solution is to locate the toilet and a small sink in a separate space. Sometimes referred to as a water closet or WC, the small room separates the two main functions of the bathroom into two rooms. The main bathroom continues to contain the tub, shower and a vanity sink. Refer to Water Closet Options.

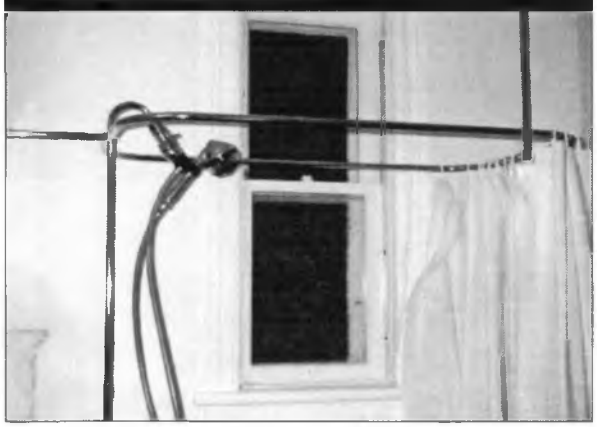


When contemplating changes in the layout of a bathroom, avoid placing plumbing in an outside wall. Plumbing penetrations in the exterior wall require holes through the air barrier-vapour retarder and plumbing in an exterior wall cavity is more vulnerable to the freezing temperatures of winter. As well, avoid placing tubs and showers on exterior walls where they tend to be colder in the winter.

In older homes, tubs are commonly installed under the bathroom window. While the tub alone may not present a moisture problem, a shower constantly beating against a window, especially an operable window, is a recipe for moisture problems. One option is to remove the window and replace it with glass blocks.

Another option, if space permits, is to install a separate shower stall and remove the shower from above the tub.

A shower curtain completely surrounds this tub to protect the window from spray
Buchan, Lawton, Parent Ltd



Style

Duplicating the quality of original materials may be difficult within today's budget. Before discarding worn fixtures or ripping out the ceramic tile wall or floor, check with a restoration specialist. Enamel resurfacing is an option for the fixtures and it may also be possible to bring tiles back to nearly new condition. Retaining some vintage features can provide a focal point for the redecorating scheme and reusing materials is a Healthy Housing™ concept.

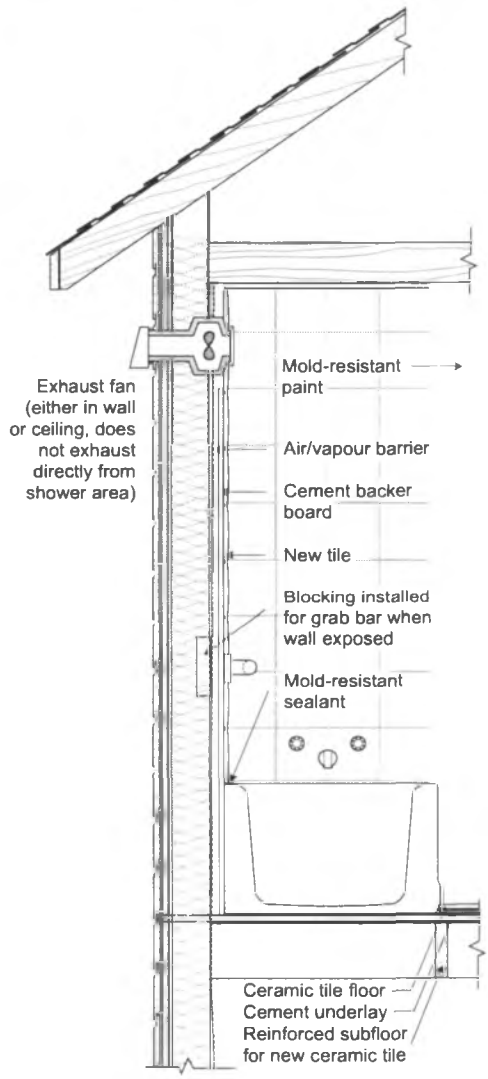
Construction

Many of the construction concerns discussed under the section on renovating the kitchen apply equally to bathroom renovations. Refer to the section on kitchen renovation when planning a bathroom renovation. Note also the concerns about lead paint and asbestos. Avoid breathing in or ingesting the dust that may contain lead or asbestos and take precautions to avoid spreading the dust throughout the house.

Moisture control

Bathrooms are particularly vulnerable to damage from water leaks and from water vapour. Moisture penetrating behind ceramic tile and shower enclosures is the most common and costly failure in bathrooms. Leaks around tub enclosures can damage finishes and weaken the building structure. If you are replacing the wall behind the shower or tub, install a continuous air barrier-vapour retarder and use a backer board designed for wet environments.

Construction details bathroom wall upgrade balloon-frame house



A one-piece shower-tub enclosure can also minimize water-related problems. Do not use drywall or water-resistant drywall in tub or shower areas; these products are not intended for wet environments.

Caulking is the first line of defence. Ensure the joints between the tub and tile or tub enclosure and in the shower stall are well sealed. Replace caulking at the first signs of deterioration. Use mildew resistant sealants and caulking.

Seal around openings to the outside (exhaust fans, windows) to prevent water vapour escaping into the wall cavity or attic where it can condense and cause damage. Caulk the joint between the floor and wall behind baseboards to prevent moisture entering the wall cavity. Seal around the base of plumbing fixtures. Seal and insulate ceiling-mounted fixtures in bathrooms below the attic to ensure moisture does not escape through the fixture to the attic. Use pot lights specifically designed for insulated ceilings. When using a series of pot lights, one option is to create a bulkhead below the finished ceiling and install the lights in the bulkhead, leaving the ceiling air barrier-vapour retarder intact.

Condensation on the interior surface of cool exterior walls can be a major problem in older homes. The best approach is to exhaust the moisture-laden air before it can condense on the walls. Install an adequately sized exhaust fan. Where possible, reduce condensation by insulating the exterior wall cavity. Insulating walls is discussed in the previous section on renovating kitchens.

Mold growth is one unhealthy result from excessive moisture. To survive, molds need a food source, such as an organic material, an appropriate temperature (20 to 30°C) and sufficient moisture. Increasing bathroom ventilation can help reduce moisture levels and mold growth. Removing any sources of food for mold is also a good strategy. To completely remedy a mold problem:

- Remove any mold-contaminated materials.
- Clean the bathroom.
- Modify the environment so the mold does not come back.

Cleaning hard surfaces with TSP or porous surfaces with a bleach and detergent solution and then rinsing with water destroys all molds. Launder all linens and throw out items that cannot be cleaned. When redecorating, use mold-resistant paints and sealants designed for bathrooms and high humidity areas.

Ventilation

A century ago, an open window provided ventilation for the bathroom. In many households today, two or more people shower each day and an open window cannot provide adequate ventilation. Effective ventilation is essential to controlling moisture.

The current fans used in houses are often ineffective and noisy. As a minimum, install a fan with a capacity rating of 25 L/s (50 cu. ft. per minute) and a low noise factor (one sone rating or less). A fan with a higher capacity may be required, if the bathroom is large or the municipality has additional ventilation requirements.

Vent the fan to the outside. Install the fan with a minimum of ductwork and, ideally, through the bathroom wall. If the duct runs through the attic space, ensure the opening into the attic is well sealed, the duct run is as short and direct as possible and is well insulated. Use insulated solid metal ductwork for the fans. Flexible ductwork may be easier to install but

it increases the resistance to airflow and makes the fan less effective. Flexible ductwork is also much easier to damage leading to the possibility of releasing moist air into the attic or wall cavity.

Fans controlled by a dehumidistat or by a timer are more likely to be used. Provide manual controls as well, to be able to override the control for continuous ventilation, if needed. For more information on ventilation, refer to the Heating, Ventilating and Cooling section later in this chapter.

Plumbing

Wherever practical, replace galvanized supply piping with copper piping. Carefully inspect the older cast-iron waste pipes. After more than 80 years, the cast iron can become brittle and is easily damaged by renovation activity. Weakened cast-iron pipes can split and leak sewage inside your walls. Replace suspect cast iron with ABS waste pipe or new cast-iron waste pipe.

To avoid problems with water pressure in the bathroom, run feed lines directly from the basement, not off the kitchen lines. To avoid "knocking" in the pipes, install an expansion loop at the height of each plumbing run as well as pipe support brackets. In some urban centres, water pressure is a neighbourhood problem. Alleviate chronic problems by installing a separate pressure tank in the basement or installing a new connection to the city water mains.

Note: Do not mix different metals, such as steel pipe supports and copper pipe together. Electrolysis will result and eventually cause a leak.

This cast-iron plumbing stack is in good condition

Buchan, Lawton, Parent Ltd

This stack may be near the end of its useful life

Buchan, Lawton, Parent Ltd

Plumbing fixtures

When choosing new fixtures, ensure they fit the existing plumbing layout or be prepared for modifications. Some toilet models are designed to fit into tighter spaces than the standard clearance. Install a water-efficient toilet using six litres of water or less per flush. These are now required by code in some provinces or municipalities. To reduce problems with condensation or "sweating" on toilet tanks, purchase tanks lined with insulation on the inside.

Low-flow showerheads reduce water usage. Another water saving feature is a shut-off valve in the shower or a single-control, pressure-balanced shower faucet. These let you turn off the water in the shower while soaping and then turn it back on at the same temperature to rinse.

Electrical

The century-old bathroom often had no electrical outlet at all. Building codes now require an outlet near the sink with a ground fault interrupt or the circuit must be equipped with an interrupt at the main electrical panel. Locate light switches out of reach of the tub and use moisture-proof shower light fixtures. Use sealed and insulated ceiling-mounted fixtures in bathrooms below the attic. When redoing the lighting, consider energy-efficient, compact fluorescent or halogen lamps. A combination of overhead and vanity lighting is effective in the bathroom.

Flooring

To minimize headaches, install new flooring before reinstalling the fixtures. Rigid flooring, such as ceramic tile, may require additional support and cement underlay to prevent tile breakage.

FlexHousing™

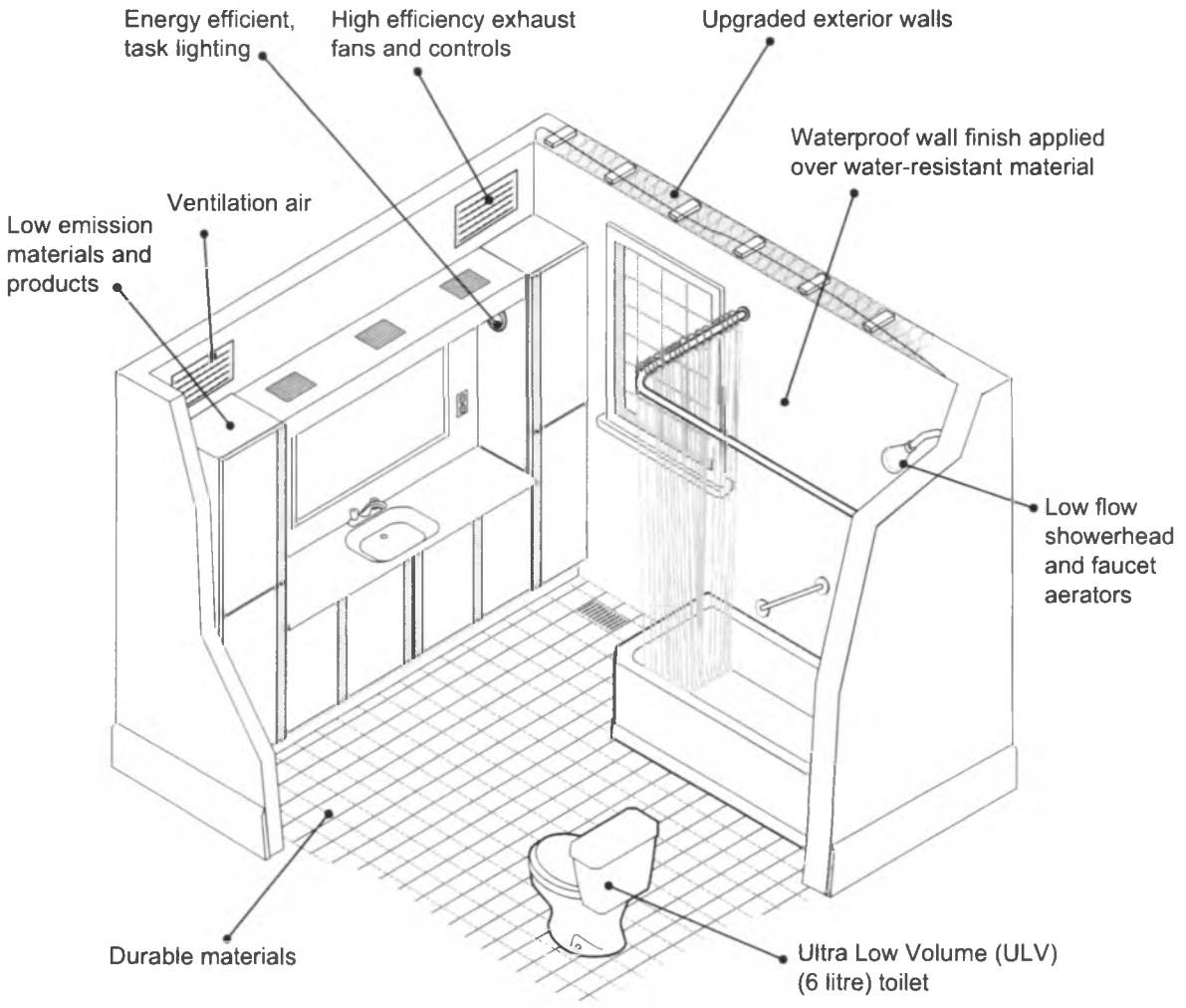
With some foresight, features can be incorporated in a bathroom renovation to adapt a bathroom to meet the needs of an elderly or incapacitated person at a later date. For example, when walls are exposed, install blocking at the tub to provide support for grab bars. Similarly, if the layout and entrance are changed, provide a wider doorway and more floor space to permit a person with a walker to manoeuvre in the space. All members of the household appreciate a non-slip surface on the floor and in the bathtub.

If wheelchair access is a possible future need, consider enlarging or adding a bathroom on the main floor.

Financial implications

Bathroom renovations are one of the most favourable renovation projects. On average, a bathroom renovation returns two-thirds to three-quarters of the cost outlay on resale.

Healthy House options in the bathroom



• Managed construction wastes

UPGRADING THE HEATING, VENTILATING AND COOLING SYSTEMS

Overview

Putting in a new furnace isn't usually at the top of a homeowner's wish list for home renovation. Upgrading the heating, ventilating or air conditioning (cooling) system is usually triggered by one of several factors: the system is old and needs replacing; the house is too hot in summer or too cold in winter; the homeowner wants to change the distribution system or fuel source; the heating system is very costly to run; additional space requires more capacity; or there is a concern about indoor air quality.

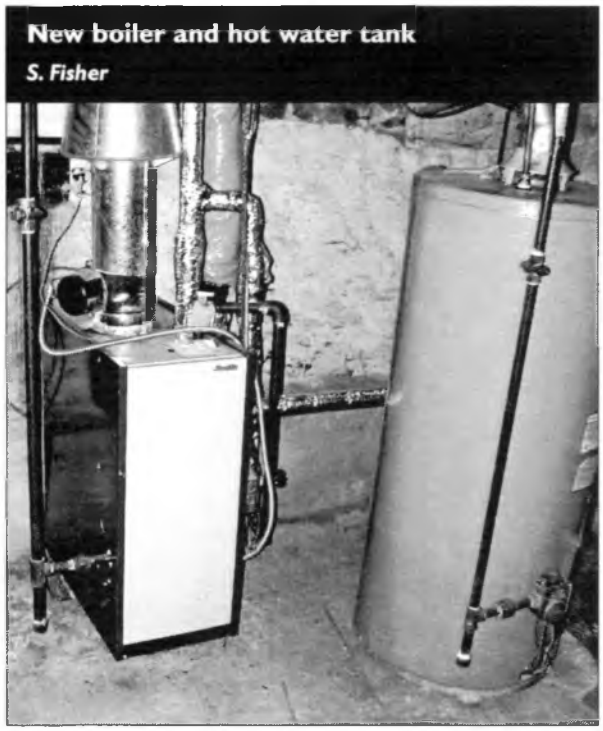
Whatever the reason for the retrofit, far more heating and cooling options are available today than 100 years ago. As well, there is a better understanding of the need for ventilation in the home and the factors that can lead to increased ventilation requirements. The challenge is to apply today's products and knowledge to an older home in an appropriate way.

Originally the house was heated by one or a combination of the three heating systems popular a century ago. Fireplaces and stoves, gravity air furnaces and hydronic central systems were available options. Across Canada, coal and wood fuels were available and Alberta also had natural gas.

Coal- or wood-burning fireplaces were common in the parlour or living room of the house along with a coal or wood-burning stove in the kitchen. In some homes, fireplaces and stoves provided all of the heat while in other homes they supplemented a central source of heat.

Originally, this P.E.I. home had a square grille open to the basement in the hallway beside the stair. Heat rose from the basement furnace through the grille to heat the house.
M. Lodge

The earlier houses from the period may have had a gravity furnace installed in the basement. In their simplest form, these furnaces had a chimney and a large square duct on the top. Above the duct on the first floor was a large hole covered by a grate. The heat rose up from the furnace through the hole and into the rest of the house by "gravity." With this type of system, the central core of the house tended to be warm but the rooms on the main floor and the areas against the outside wall were very cold in winter.



New boiler and hot water tank
S. Fisher

Installing ductwork to distribute the heat to the various rooms of the house was an early refinement to the system. The system still relied on gravity to distribute the heat from the furnace and the rooms furthest from the source were often cold. The ducts radiated out from the top of the furnace sloping out and upward towards the rooms above. The furnaces were large and black and were commonly referred to as "octopuses."

At the beginning of the 20th century, a second type of heating system was becoming popular. Hydronic systems used a coal-fired furnace to heat water and send it through ferrous (cast-iron or steel) pipes circulating throughout the house. Hot water or steam flowed into radiators in each room radiating heat. As the steam or water cooled, it fell back through return pipes to the boiler to be heated again.

These new systems were popular; they were cleaner, delivered heat to each room more efficiently and rooms could be closed off if they weren't needed. By the 1920s, hydronic systems were more popular than gravity furnaces in most parts of the country.

Over the years, a number of improvements were introduced. Gravity furnaces were retrofitted with fans and hydronic systems were provided with pumps to push the heated air and water or steam up to the living space. Furnaces were converted to use cleaner fuels, such as oil and natural gas and, later, electricity.

Although these heating systems have been upgraded over the last century, many of the components could still be 100 years old. The ductwork on the forced-air systems and the piping, radiators, valves, even the body of the furnace itself may still be in use on the hydronic systems.

Most century-old basements contain remnants of the early systems. Brick-walled coal rooms with heavy doors contained the coal dust and protected the coal from sparks.

Until recently, ventilation and summer cooling were not considered important. Even today, most of these old homes do not have whole-house ventilation or air conditioning systems. Typical ventilation and cooling upgrades include bathroom exhaust fans, kitchen range hoods and window air conditioners in the upper floor bedrooms.

Design considerations

Heating

Heating system upgrades range from a simple tune-up to replacing the furnace to changing the distribution system or energy source. A reputable heating contractor or a mechanical engineer can review the system and provide advice on appropriate options for your specific situation.

The first consideration is the overall state of the system. In some cases, at least some of the components are one hundred years old. An assessment should be done of all components.

For forced-air systems, this involves examining the ductwork, dampers and grilles, as well as, the furnace and its operating parts. Are there obstructions in the ductwork or parts removed? Is there good airflow to all rooms in the house? Try the garbage bag airflow test and check the airflows. Are the return air ducts drawing air back to the furnace? What is the remaining lifespan of the furnace?

For hydronic systems, examine piping, radiators, valves, pumps and the other operating parts of the furnace.

Is heat reaching each room? Are there physical blockages in the system or is trapped air a problem? Has the system received proper maintenance over the years? Is there evidence of rust in the system? Has the fluid in the system been analysed for impurities or are there indications of problems? Is there evidence of moisture or water in the area of radiators, below pipe runs, around the furnace? Are all valves in operating order? Are different types of metal in the system?

A typical oil-fired, forced-air furnace
Buchan, Lawton, Parent Ltd

Garbage bag airflow test

If you have a forced-air heating system, a garbage bag can be a simple tool to compare airflows at the supply registers or heating grilles in your house. Hold the open end of the garbage bag over the register and record the amount of time is takes to fill the bag. Similar-sized rooms at a similar distance from the furnace should take the same amount of time to fill. Use the garbage bag airflow test to compare airflows to various rooms or as a calibration tool. If you know the volume of the bag, the actual flow rate can be calculated. Refer to CMHC for further information.

With hydronic systems, one particular concern is the introduction of metals, such as copper or brass, into a ferrous pipe system. The two types of metals are incompatible and, unless the copper or brass is properly isolated with dielectric couplers, the incompatible metals cause the ferrous metal to corrode and eventually block the pipes.

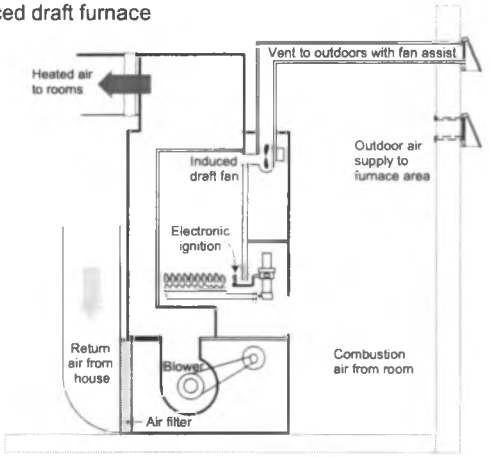
A second consideration is the size of system. The size of the house and the energy efficiency of its building envelope affect the ability of the heating system to heat the house. If a proposed addition is energy efficient and the furnace is in good working order, you may not need to upgrade the furnace to meet the additional load. If a house is uncomfortable, the best approach is to improve the energy efficiency of the house by draft proofing and insulating (where feasible) rather than increasing the capacity of the furnace.

Improve heating system performance by either tuning the existing system or replacing equipment. Upgrade older, still useful furnaces with a tune-up, burner replacement and the addition of a thermostat with setback controls. Add a fan or pump to distribute heat through the house more effectively, if the furnace still has a gravity-type distribution systems.

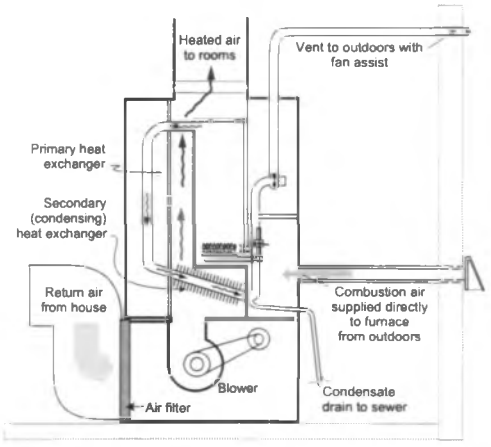
The second approach involves replacing equipment. New system types range from induced draft mid-efficiency furnaces to high-efficiency condensing units. Consider an integrated system for a house with an energy efficient building envelope or to supplement an existing heating system. An integrated system basically uses the burner in the hot water tank to heat the house as well as the domestic hot water. Whether you choose an integrated or separate system, consider efficiency improvements to the hot water supply when making improvements to the space heating system. See the diagram "Gas Heating Options—Central Systems." Oil-fired central systems have similar options.

Gas heating options—central systems

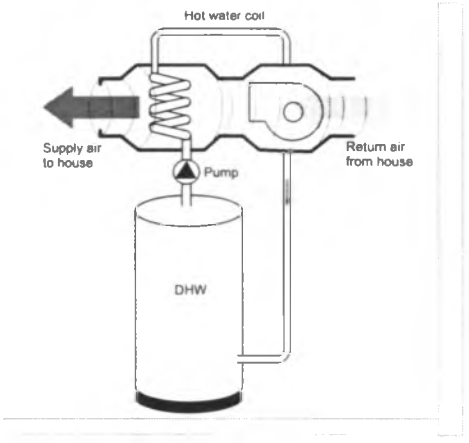
Mid-efficiency, induced draft furnace



High-efficiency, condensing furnace



Integrated space heat and hot water heating system



In addition to replacing the heating equipment, changing the type of fuel or the heating distribution system are other options. You may decide to change the fuel source because of operating costs or health considerations. Changes to the type of distribution system may be warranted because the existing system is seriously deteriorated or requires major modifications due to renovation changes.

It is costly to switch from a hydronic system to a forced-air system, as new ductwork will be required. However, the savings in fuel costs and the potential to install central air conditioning may justify the expense over the long term. Retrofitting a home with a hydronic distribution system requires the installation of new piping to each room. This will be less costly, if the walls have to be opened up as part of other renovation work.

Radiators are sized to provide adequate heat for each specific room. Modifications to the hydronic system can knock it out of balance and lead to major heating problems.
Buchan, Lawton, Parent Ltd

Sometimes the least expensive option is to provide supplementary heating to a hard-to-heat area of the house. Many options are available, including: wood- or gas-fuelled fireplaces or stoves, gas or electric baseboard heaters and portable electric radiant heaters. Direct vent fireplaces and stoves are a very popular form of supplemental heating. These units are very efficient and can be fuelled by natural gas (where available) or propane. Pellet stoves using waste products from the lumber industry are also popular.

Caution: Do not use unvented propane, natural gas or oil space heaters for supplementary heating. These units release dangerous carbon monoxide fumes into the home and can create life-threatening situations.

Radiant floor or ceiling systems are another option for supplementary heat in difficult-to-heat rooms, such as bathrooms or additions with slab-on-grade-floors. A wide variety of hot water or electric radiant heat systems are available. In hot water radiant systems, hot water is pumped through tubing in the floor or ceiling and heat is radiated to the room.

Ventilation

Ventilation options

All houses require ventilation to provide fresh air for occupants, combustion air for gas appliances, furnaces, wood stoves and fireplaces and to remove stale air, odours and excess moisture. A century ago, houses relied on windows to provide ventilation in summer. In winter, air leakage through the building shell introduced fresh air at the lower level and allowed stale air to leak out at the upper levels.

Any change to the house envelope, such as air sealing, siding or window replacement, affects air leakage and the ventilation system.

Similarly, any change to the heating system, such as a conversion to a forced-air system, or the addition of exhaust appliances, such as a central vacuum, clothes dryer or an indoor cooking grill with exhaust, affects house ventilation.

Mechanical ventilation is now required in all new houses. Strategies for upgrading ventilation in older houses range from installing individual Refer to the Ventilation Options diagram.

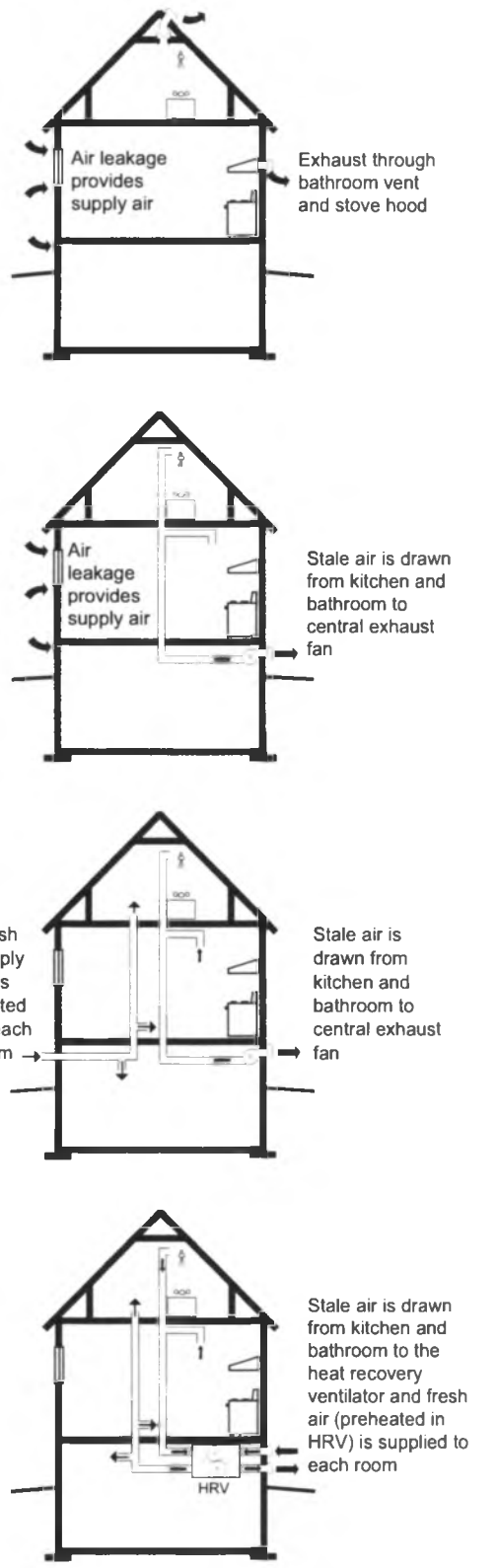
At a minimum, equip kitchens and bathrooms with energy-efficient, adequately sized exhaust fans to expel stale moist air to the outside. Using exhaust fans can cause problems with furnaces and fireplaces, however. If the air leakage into the house is not adequate or if powerful kitchen exhaust fans are installed, the house will become depressurized.

Depressurizing the house draws the outdoor air into the house through any available leakage path. In areas with radon gas or other contaminants in the soil, these contaminants are drawn into the house.

Depressurization can also cause combustion appliances to vent carbon monoxide and other contaminants back into the house. Called combustion spillage, the problem can be avoided by installing sealed combustion appliances. Houses with chimneys should not have large exhaust appliances installed.

Central ventilation systems are a second ventilation option. In their simplest form, central exhaust fans draw stale air from the major areas where contaminants are produced—kitchen, bathroom and utility room—and exhausts the air outside through a central duct. These central exhaust fans can be quiet and effective but may unbalance house pressures and cause backdrafting problems similar to individual exhaust fans.

Ventilation options



For houses with fuel-burning appliances, such as a furnace or fireplace, a balanced central ventilation system with an exhaust and a supply fan is a safer alternative. In these systems, fresh air is drawn into the house at the same time as the stale air is exhausted. These systems tend to be more expensive to install and operate (more ductwork and two fans) but they avoid the potential for backdrafting.

Over the past few decades, Canadian researchers have developed an improved balanced central ventilation system. At its heart is a heat recovery ventilator (HRV) or an energy recovery ventilator (ERV). The HRV recovers heat from the warm outgoing exhaust air and transfers it to the cold incoming supply air. The ERV transfers humidity as well. By warming the incoming fresh air as it enters the house, the HRV saves most of the cost of heating that air.

An HRV hangs in the basement of a century-old home. The HRV removes stale air from the bathrooms and kitchen and supplies fresh air to each floor.
Buchan, Lawton, Parent Ltd

HRVs and ERVs are sized to fit a particular house and provide adequate ventilation without over-ventilating. HRVs usually operate on a constant low-speed or intermittent basis with the option of increasing exhaust levels as required. HRVs are balanced systems: if the exhaust fan speed is increased, the supply fan speed is increased to maintain a balanced pressure in the house. HRVs avoid many of the problems related to exhaust-only systems and provide cost-effective ventilation.

For a healthy indoor environment, circulate fresh air throughout the house. Bedrooms often have inadequate air circulation. To improve air circulation in a room with no dedicated air return, the simplest solution is to undercut the access door to allow the free flow of air, even when the door is closed. Opening the window when the weather permits can also be beneficial.

Houses heated hydronically cannot rely on the heating system to move fresh air around the house. An HRV supplying air to each floor and exhausting stale air from high contaminant areas is an excellent solution to improving fresh air circulation.

Cooling

Cooling in its simplest form is achieved by opening the windows and doors of a house in the evening or at night. A central air conditioning system using the forced-air heating system ductwork is a more reliable approach to cooling the century-old home. Systems are sized to meet the specific size and airtightness of the house.

Older gravity-type duct systems are often not compatible with central cooling. For these houses and houses with hydronic heating

systems, cooling options include: individual room units, through-the-wall units and attic or roof-top units designed to cool the upper floor of the house. These systems are often very effective at cooling the whole house since the cool air from the upper floor pours down the stairwell and dissipates to the main floor rooms.

When landscaping or contemplating cutting down trees on your yard, keep in mind the cooling contribution of large deciduous trees. Large shade trees on the east, south and west faces of the house can significantly reduce the house's cooling load by providing shade from the summer sun.

Construction

When it comes to the actual construction phase, most homeowners hire a mechanical contractor to change the mechanical systems in their house. Few people have the expertise or qualifications to install furnaces or ductwork. A contractor provides a written warranty and installs the equipment in accordance with applicable regulations and the manufacturer's instructions.

If there is any uncertainty about the house requirements for ventilation and combustion air, consult a professional, such as a mechanical engineer or a reputable heating contractor with experience in modifying systems in your type of house. Professionals assess the existing system and provide advice on appropriate options for your specific situation.

A do-it-yourselfer can install a bathroom or kitchen exhaust fan. Avoid using the lowest price fans; they are often ineffective and noisy.

As a minimum, install a fan with a capacity rating of 25 L/s (50 cu. ft. per minute) and a low noise factor (one sone rating or less). You may require a fan with a higher capacity, if the kitchen or bathroom is large or the municipality has additional ventilation requirements. Higher quality, quieter fans are more likely to be used when needed and often consume less energy than lower priced fans.

Choose the appropriate size of exhaust fan to meet the ventilation requirements for the specific room or application. A larger room requires a larger fan and a long duct run requires a larger fan. To provide the design exhaust capacity (to exhaust the required amount of air), the fan must overcome the resistance caused by the various components within its system including the ductwork, grille and exterior hood.

Duct the fan outdoors via the shortest route to reduce the length of duct and, therefore, the resistance from the duct. Avoid using flexible (accordion-style) ductwork. Solid ductwork is smoother on the inside and creates significantly less resistance to the flow of air. Flexible ductwork is also more fragile and susceptible to punctures. Avoid elbows; they also slow down the airflow.

If the resistance to airflow is high, as it is in a long duct run of flexible pipe, a much larger fan is required to provide the needed exhaust capacity. A larger fan consumes more energy.

Do not exhaust house air into the attic and, if possible, avoid ductwork through the attic. Where ductwork passes through an exterior wall or the attic, seal it to prevent moist air from escaping into the wall cavity or attic and insulate it to prevent condensation. Carefully seal around all penetrations through ceilings (especially below attics) and in exterior walls.

Configure central exhaust systems and HRVs to meet the ventilation needs of the house and occupants. At a minimum, exhaust air from all bathrooms and the kitchen. Ventilation system choices range from simple point, or central exhaust systems to fully ducted systems with heat recovery.

The simplest central exhaust systems have a have a single speed motor (they are either on or off) and exhaust air from the bathrooms and kitchen. Ductwork is required from the bathrooms and kitchen to the fan and they depressurize the house.

HRV installations fall into three categories: simple, extended and fully ducted. Most HRVs have a two-speed fan motor permitting the system to run at low speed most of the time and at high speed when desired. Their heat recovery feature reduces heating costs and their system is balanced to avoid problems with depressurizing the house.

Simplified HRV installation

In a simplified system, exhaust air for the HRV is drawn from the furnace return-air plenum and fresh air is supplied to the furnace return-air plenum (downstream of where the air is exhausted). This system is the least-expensive and easiest to install in a retrofit situation. Its drawbacks include: year-round use of the furnace fan to circulate the ventilation air; not feasible in houses without forced-air heating systems; and possible need for exhaust fans in bathrooms and kitchen because it does not draw air directly from sources of high humidity or contamination. It is also the most costly system to operate unless your furnace has a very efficient circulation fan.

Extended

In an extended system, exhaust air is drawn from the kitchen and bathrooms and fresh air is supplied to the furnace return. This system exhausts high humidity and contaminants directly from their source through dedicated ducts and uses the furnace ductwork to supply fresh air to the living areas. The main drawback is year round use of the furnace fan to circulate the ventilation air.

Fully ducted

A fully ducted system is completely independent of any other air circulating device. It exhausts air from areas of high contamination and humidity (kitchens and bathrooms) and supplies air directly to the other habitable rooms in the house. This system can be used in any house with any type of heating system. Its drawbacks include cost—it is the most expensive to install—and difficulty with retrofitting into existing houses. In many areas of Canada, supplementary heat is needed to make the incoming air tolerable in winter.

Automated controllers improve the effectiveness and efficiency of central exhaust systems and HRVs. Humidity or occupancy sensors are used to trigger fan operation for systems with a single-speed motor. For two-speed systems, one option is to continuously operate the system at low speed and use a manually operated timer to switch to high-speed operation. A more effective option is to operate two-speed systems continuously at low speed and use humidity or occupancy sensors to trigger high-speed fan operation.

Consider performance and cost when making ventilation decisions. Installing a cheap system with performance problems or discomfort issues is false economy.

Healthy Housing™

Indoor air quality is an increasing source of concern to Canadians. The first line of defence against poor indoor air quality is to avoid materials and household products with high levels of chemical emissions. See CMHC's Building Materials for the Environmentally Hypersensitive for further information. Where these materials and products cannot be avoided, ventilation may be an effective second strategy. For individuals who are dust sensitive, high efficiency furnace filters are available to reduce particulate matter in the air.

Ventilation can be an effective strategy for dealing with the molds and elevated humidity levels encountered in century-old homes. Spot exhaust fans and HRVs are effective tools to reduce humidity and contaminant levels. Healthy Housing™ encourages improvements to the energy efficiency of mechanical systems.

Efficient fan motors and automatic controls reduce electrical demand and provide more effective ventilation of contaminants from the house. Balanced ventilation systems with heat recovery improve air quality in the home and recover heat from the outgoing exhaust air.

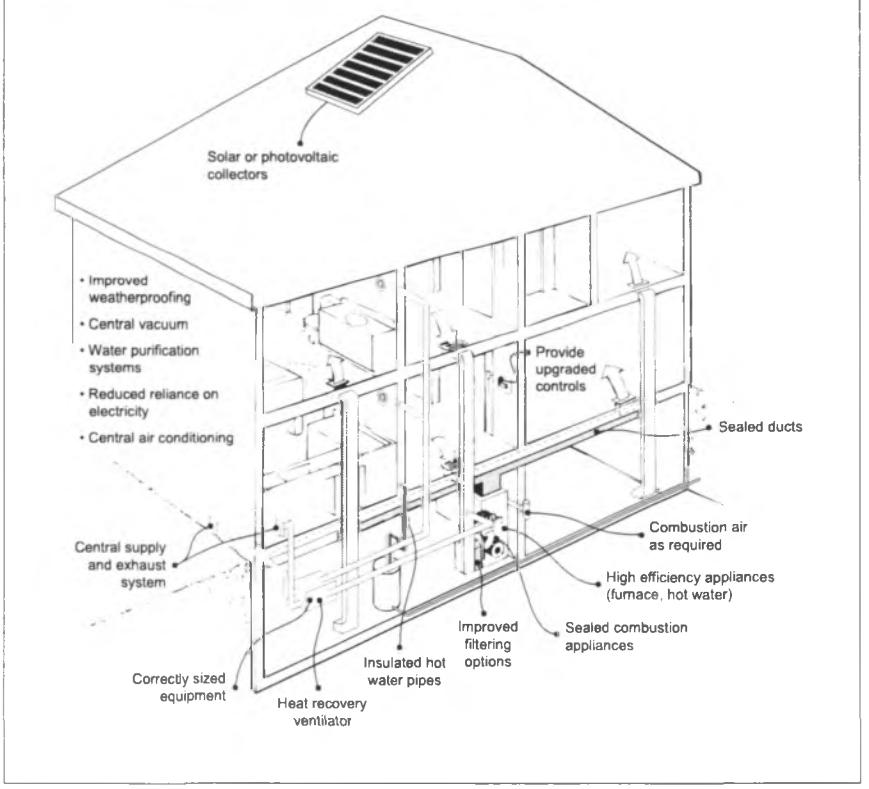
Consider renewable sources of energy for the home. Solar water heating systems significantly reduce purchased energy requirements for hot water and are designed to work in the Canadian climate.

South and west facing windows collect heat from the sun during the winter. Shade trees and awnings protect the house in the summer and reduce the need for cooling.

Financial implications

If you plan to own your house for five years or more, the greatest financial benefit of upgrading a heating system is the potential to reduce operating costs. Replacing an old low-efficiency oil forced-air furnace with a high-efficiency gas furnace can reduce operating costs to a half or one-third the original operating cost. The payback of the new furnace can be as little as five years. As a rule of thumb, approximately half the cost of an upgraded heating system can be recovered on resale.

Healthy House options mechanical systems



RE-ROOFING AND ICE DAMMING

Overview

A complex cottage roof with gables and chimney
Buchan, Lawton, Parent Ltd

Keeping the roof of your home in good repair is essential. The roof is the most exposed part of a building and it must resist precipitation, sunlight, heat, cold, winds and other stresses. The roof not only shelters you from the weather but it also protects the structure of the building from damage.

Century-old homes have sloped or flat roofs or a combination of both types. Refer to the section on attic conversions in Chapter 5 for photographs of some typical roof styles. Homes with sloped roofs often have gables and living space in the attic. Single floor sections or additions, such as a porch or rear kitchen, have shed, gable or flat roofs. Many of the sloped roofs are complex designs with valleys, ridges and flat or low-sloped sections.

Reshingle or re-roof asphalt shingle roofs every 15 to 25 years. To avoid problems—especially if you have a more complex roof—have professionals with experience roofing your specific type of roof do the work. Remember to check references and confirm adequate levels of insurance.

Flat roofs are protected from the elements of nature through the use of membranes, insulation and ballast in a number of different combinations. During the first half of the 20th century, flat roofs were protected with a conventional built-up roof. Layers of roofing felt were laid over the roof deck and bonded to one another by hot bitumen (a tar-like substance). A flood coat of hot bitumen was applied over the felt to make it waterproof and a top cover of gravel was used to protect the lower components against weather and mechanical damage. If the roof was insulated, the insulation was placed below the roof deck.

Re-roofing a flat roof requires a different type of expertise than a sloped roof. Hire professionals with expertise in that type of roofing. A well-designed and properly constructed flat roof is expected to last more than 20 years if it is properly maintained.

Re-roofing presents opportunities to change the appearance of the house, avoid leaks and problems with ice damming and to upgrade insulation. However, if the job is not done properly, it can result in premature failure of the system and damage to the building structure.

Design considerations

Choice of material—sloped roofs

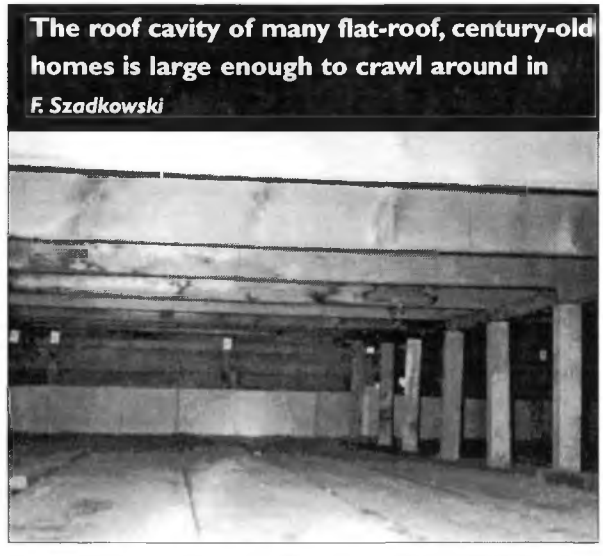
Lighter coloured roofs last longer and are cooler in summer
Buchan, Lawton, Parent Ltd

When deciding on a new roof, choose a material that is appropriate to the age and style of the house. Sloped roofs were originally shingled in wood, slate or, by the 1920s, asphalt shingles. On most of these homes, the roofs have been replaced least four or five times and are now roofed in asphalt shingles. Steel, wood and a number of composite materials are also available as roofing materials but asphalt shingles are generally accepted as the most suitable and cost-effective solution for the century-old house.

Consider the impact of colour when choosing a roofing material. Sunlight and summer heat cause hardening and premature deterioration of shingles. Lighter colours reflect the sunlight and prevent heat buildup in the summer months. A lighter coloured roof also leads to lower temperatures in the attic. This is especially important if the attic is occupied space.

To help avoid ice-damming problems on low slope roofs (slopes less than 4:12), completely cover the sheathing in a waterproof membrane. On steeper roofs, use a waterproof membrane on the edge of the roof and at all valleys and penetrations. Although a waterproof membrane is recommended on roofs, it is not necessary to cover the boards or sheathing in paper before installing the new shingles.

Choice of material—flat roofs



The roof cavity of many flat-roof, century-old homes is large enough to crawl around in
F. Szadkowski

Conventional flat roofs are still used today although an air barrier is now placed on the roof deck with a layer of insulation above and a waterproofing membrane laid on top of the insulation.

A conventional flat roof is any type of assembly where the waterproofing membrane is placed on top of the insulation. Some type of ballast, such as gravel, is often placed on top of the membrane for protection and to hold the roof in place. The main advantages of a conventional assembly are the ease of inspecting the membrane for deterioration and damage, the potential to create a lighter-weight assembly and the broader range of usable insulation types.

The major disadvantages are the exposure of the membrane to damage from weather and sunlight and the potential to trap moisture between the air-vapour barrier and the membrane.

Other systems and assemblies exist for flat roofs, including inverted or protected membrane systems in which the waterproofing membrane is placed below the insulating layer. In these systems, the membrane is protected from the sun, weather, mechanical damage and extremes in temperature. It is adhered directly to the roof deck where it acts as the air barrier and the vapour retarder. There is less choice in insulating materials for these systems and it is difficult to inspect the membrane for deterioration or damage. Ballast is usually required to hold the roof in place.

Each system has advantages and disadvantages and the appropriate choice often depends on the existing roof structure, the use of the roof, the availability of materials and the expertise of local roofing professionals. The structure of the roof is a major factor in determining the appropriate roofing solution. A heavier system cannot be used if the supporting structure is not capable of supporting the weight of the assembly along with the snow and wind loads.

Scope

There is more to re-roofing than simply replacing shingles or the roofing membrane. Ensure flashings and caulking around roof penetrations, such as plumbing stacks or chimneys, are in good condition. On a century-old home, inspect the roof sheathing, deck, joists and supporting timbers and repair or replace where necessary. Also, replace the flashings in valleys and by dormers. It is good practice to remove the old shingles rather than shingling over them.

If you are making modifications to the roof, such as installing a dormer or rebuilding a front porch, the original roof structure may not be adequate to support the changes. Depending on what is being done and the regulations in your municipality, you may be required to upgrade the roof to meet current building codes. Consult your building inspector or a reputable roofing contractor for further information.

In locations where a flat or sloped roof intersects with a wall, such as above a porch or a one-storey addition, take special care to ensure moisture doesn't penetrate the wall connection. Seek a reputable roofer to install the appropriate flashings and seal all joints.

Underlying problems

Where the roofing has failed, address any underlying problems as part of the re-roofing job. Four common problems are:

- Water penetration through the roof because of an improper roofing detail.
- Premature deterioration of roofing components from wind and weather.
- Water damage to roof structure and ceiling caused by ice damming.
- Premature rotting of sheathing due to excessive air leakage from the house or poor ventilation.

Construction

Re-roofing a century-old home is not a job for a handyman or a do-it-yourselfer. Reputable roofing contractors have the tools, equipment, knowledge and skills to carry out a roofing job safely and cost effectively.

Choose shingles and other components with longer lifespans and warranties since labour is a large part of the cost of a re-roofing job.

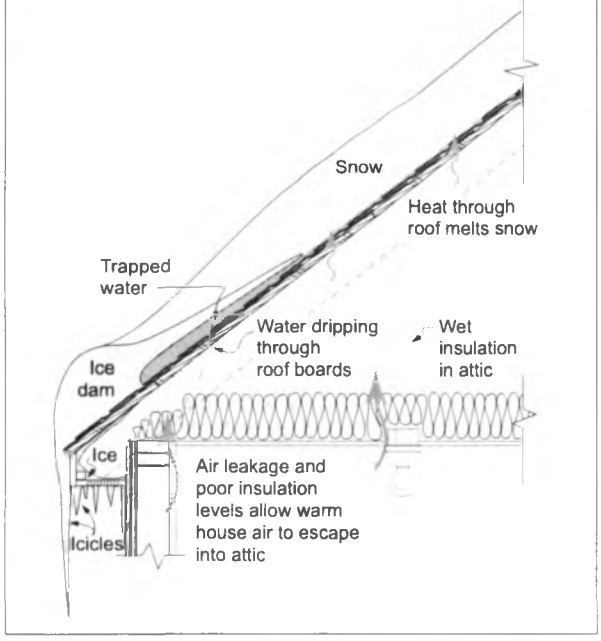
Choose components with similar lifespans and replace all worn components at the same time. There is little point to installing new 25-year shingles over flashings with only ten years of life left.

Ice damming

An ice dam is an accumulation of ice at the eave or in the valley of a sloped roof. Although the ice dam itself may not damage the roof, it prevents melting snow from freely draining off the roof. This trapped water sits on the roof surface and penetrates behind and below the shingles. If the water is able to penetrate through the roof, it can:

- Damage attic and wall insulation.
- Damage interior finishes.
- Reduce the effectiveness of insulation and walls because of wetness.
- Promote mold growth and wood rot if the wetness persists.
- Promote infestations of carpenter ants or other pests.

Ice damming



Ice dams form when heat escaping from the house melts the snow on the roof. The water drains down the roof and then freezes as it reaches the cold section of the roof over the eaves. As this action continues to occur over the winter, layers of ice build over the cold section of the roof and create a dam (see "Ice damming" illustration). The dam traps the melt water over the warmer section of the roof. The water works its way under the shingles, penetrates the roof sheathing and causes damage in the attic space and rooms below.

Four conditions are required for ice damming to occur:

- Significant snow accumulation.
- Sustained below freezing temperatures (includes most of Canada except for the lower coastal area of British Columbia.
- A warm roof over the attic space—caused by inadequate insulation or leakage of warm air from the house.
- Cold surface temperatures over the eaves.

Warm attics occur in century-old houses where the following details are not adequately insulated and sealed:

- The wall-roof junction.
- The sloped ceiling portion of a finished attic or cathedral ceiling.
- Around gable openings.
- The knee wall area.
- Unfinished attic spaces open to the heated living space of the house through unsealed doors and ceiling penetrations.

Mitigation

There are several ways to reduce the effects of ice damming and prevent water leaks into the building. On the exterior of the roof, use either a waterproof barrier over the vulnerable areas of the roof or melt the ice dam. On the

inside, provide adequate insulation and sealing to prevent air leakage.

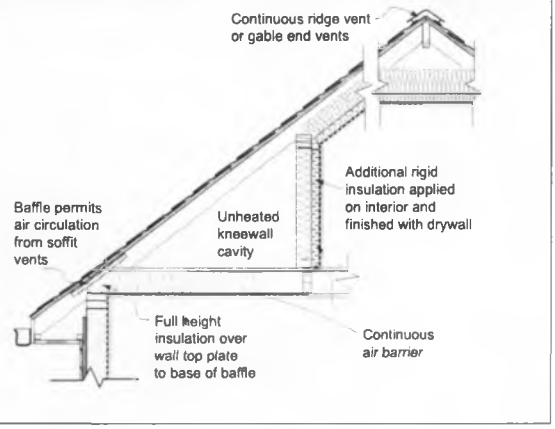
In new construction, eave protection is required by most building codes on regular-sloped shingle, tile or shake roofs where ice damming is a concern. Eave protection covers a minimum width of 900 mm (36 in.) up the slope of the roof and at least 300 mm (12 in.) over the inside face of the exterior wall. Eave protection does not prevent ice dams; it stops water from leaking through the roof sheathing at the eave. Waterproof membranes have been specifically developed to provide eave protection and minimize ice-damming problems.

Some homeowners install electric heating cables at the eaves to melt channels in the ice and allow the water to drain away. This adds to your electric bills and may detract from the appearance of the house. The best solution is to prevent ice dams from forming in the first place.

Prevention

The key to avoiding ice damming is to prevent heat escaping from the house and warming the roof. This requires sealing and insulating the roof or the attic floor (if the attic is unoccupied) to create a uniformly cold surface.

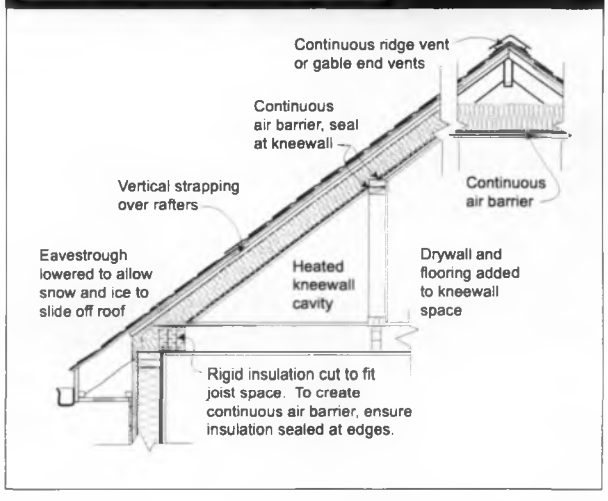
Interior insulation upgrade



Where the shingles are in good condition and re-roofing is not planned for some years, seal and upgrade the insulation from the inside (see "Interior insulation upgrade" diagram). The illustration shows an existing kneewall upgraded with additional rigid insulation and a continuous air barrier. The rigid insulation acts as a vapour retarder.

Attention to detail is required in the kneewall area of the finished attic. Upgrade the insulation over the wall top plate at the eaves and install a baffle to allow air circulation from the soffit vents. Air-seal the rafter space under the kneewall. One option is to use rigid-foam insulation sealed to the rafters and ceiling drywall with spray foam.

Exterior insulation upgrade



If you are already re-roofing, this provides an opportunity to upgrade the insulation and seal the roof from the exterior (see "Exterior insulation upgrade" diagram). This approach treats the whole roof as a cathedral ceiling. Adding exterior insulation allows more flexible use of the space under the kneewalls. The exterior approach involves removing the old shingles and the roof decking and working from the inside out.

Install drywall or other sheathing on the underside of the rafters in the kneewall and attic spaces. At the same time, install a continuous air barrier and vapour retarder for the attic space (see "Air barriers and vapour retarders"). Once the air barrier and vapour retarder is in place, the insulation is installed from the outside. Opening up the roof provides an opportunity to increase the depth of the rafters and adequately insulate the attic. Strapping installed on top of the rafters creates a ventilation space before the decking is replaced and the new shingles are laid.

Air barriers and vapour retarders

Incorporating a continuous air barrier and a vapour retarder is a challenge when you improve the insulation levels in a century-old attic. Drywall (minimum 12.7-mm (1/2-in.) gypsum board) can be used, if it is sealed to the building frame and other components using gaskets, caulking and tape. Polyethylene air-vapour barrier can also be used. Problems arise around the edges where the floor joists intersect with the top of the wall and the rafters. Careful detailing using plywood, rigid or closed-cell spray-foam insulation and strategically applied sealants and caulking can create an effective air barrier. If drywall is used as the air barrier, use a vapour retarder paint on the inside surface of the drywall.

When air sealing, pay special attention to:

- Plumbing stacks.
- Chimney penetrations through attic.
- Light fixtures in walls or ceilings.
- Electric wiring and outlet boxes.
- Ducting for fans or heating systems.
- Window and skylight openings
- Perimeter walls.
- Tops of partition walls.
- Junction of cathedral ceiling with open attic spaces.
- Junctions between new and old construction.
- Transitions at dormers and
- Balloon-frame walls.

A variation of the exterior insulation approach involves spraying foam insulation into the rafter spaces. This eliminates the need for separate air sealing. And, since the spray-on foam completely fills the rafter spaces, roof ventilation is not required. The decking is installed immediately on top of the rafters.

Regardless of the method used to prevent ice damming, when re-roofing a sloped roof, install waterproofing or eave protection along the eaves and valleys of the century-old house. It is very difficult to completely stop heat loss through an old roof and waterproofing is a good second line of defence. At a minimum, install one row of the waterproofing along the eave and valleys and, if the kneewall cavity is not insulated, bring the waterproofing up the slope of the roof to 900 mm (2.9 ft.) beyond the point where the kneewall meets to roof.

For flat roofs, a properly designed and installed conventional or inverted roof should prevent ice dams.

Healthy Housing™

Lighter- coloured shingles have a longer life expectancy. They absorb less heat than dark shingles.

If the house has a south-facing roof slope with good exposure, it may be a candidate for a solar domestic hot water heating system. Plan ahead to incorporate adequate reinforcing for the system and any required plumbing in the attic space. Solar panels are typically installed after any re-roofing work is complete.

RE-SIDING AND NEW WINDOWS

Overview

The exterior finishes and windows of the 1900 home, if they have been well maintained and are still intact, add to the desirability of the house. If these features have been allowed to deteriorate or have been replaced with inappropriate or out-of-place substitutes, they can significantly devalue an otherwise well-appointed home.

Leaded panes and well-maintained frames are one of the most appealing features of this house.
Buchan, Lawton, Parent Ltd

The appeal of new siding and windows can't be denied. Today's materials make exterior painting a thing of the past—less ladder time, more leisure time. And who would miss the semi-annual ritual of removing and replacing the storm windows?

Choosing new windows and siding, however, is a challenging job. Nothing changes the appearance of the house as much as re-siding and replacing windows. If the planning and work is done with care, a siding and window retrofit can significantly improve comfort and energy efficiency and not take away from the character of the house.

A century-ago, the original windows, especially the ones facing the street and in the "public" areas of the house, were finely detailed with leaded panes and stained glass. Many fine examples of these windows still exist today. Unfortunately these windows are single paned with heat-radiating lead joints. They do not meet the energy efficiency demands of today's windows. It is a challenge to upgrade the windows and not destroy their charm.

Design considerations

Appearance

The first step is to decide whether the goal of re-siding is to totally change the look of the house or to simply find a look-alike material requiring less maintenance.

If a new look is desired, many choices exist including wood, composite woods, vinyl, aluminum, stucco, brick or stone. Some options are more costly than others and some, such as brick, may require additional structural support.

If low maintenance is the issue, today's vinyl, composite wood, fibrous cement and aluminum sidings replicate the look of horizontal wood siding. Prestained and prefinished wood products are also available with similar low-maintenance requirements.

When installing new siding, you may be tempted to save on labour and material costs by reducing or eliminating exterior trim around doors, windows, soffit-wall junctions and other locations. This can dramatically change the look of the house and take away the charm of its century-old tradition. It may also make joints vulnerable to water penetration.

Similar design problems arise when upgrading windows. When choosing window sizes and styles, consider how the installed window will look from the exterior and whether the style of the window suits the age, style and proportions of the house.

When upgrading windows, you may wish to keep the lead-paned and stained-glass windows of the century-old home. One solution is to permanently install operable storm windows on the exterior of the window frame or to install a complete second window on the outside. Century-old homes typically had wood-frame storm windows and it should be possible to integrate a new window or storm on the outside without affecting the appearance of the house. If a new window is installed on the outside of an existing window, regularly inspect the window to ensure any moisture or condensation trapped between the old and new windows does not lead to rotting wood frames.

A less-expensive option is to install inoperable clear energy-saving panels on the interior of the original windows. These are typically used only during the heating season.

In general, beware of fads that detract from the appearance of the house and ultimately from its value. Avoid trying to make the house look like something it is not. The best design solutions focus on retaining and enhancing the integrity of the house (see CMHC's Sensible Rehabilitation of Older Houses).

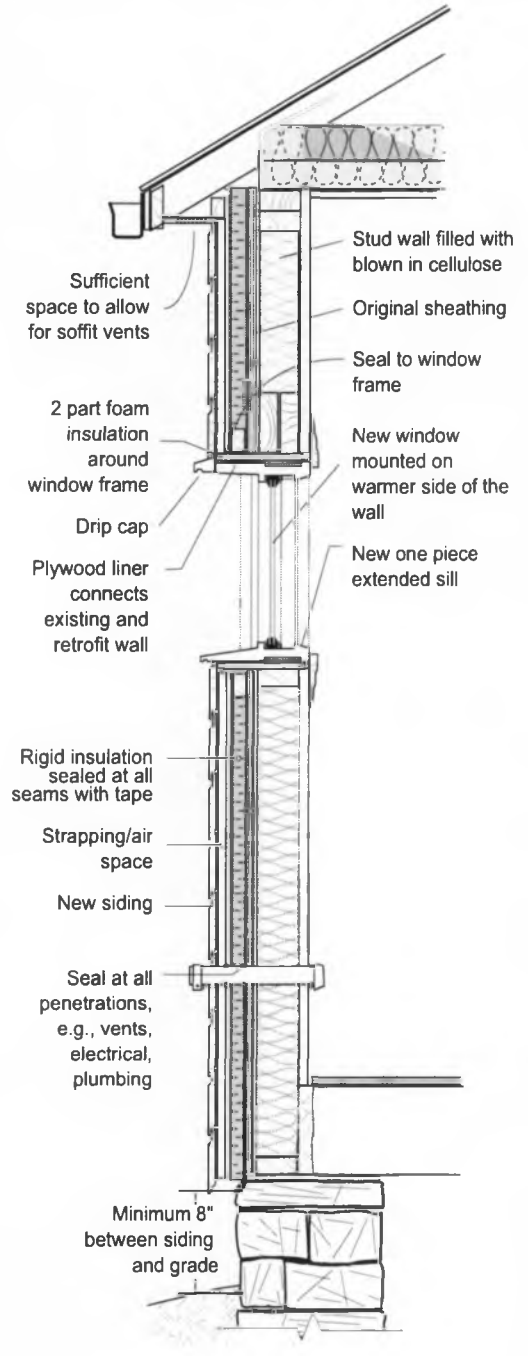
Underlying problems

If old siding has failed, understand why and correct the problem before concealing it with new siding. This is particularly important with moisture-related problems. Blistered or peeling paint, warped or cupped siding and wood decay all indicate moisture problems on old wood siding. On masonry siding, efflorescence or spalling are signs of moisture problems.

When repointing brick and replacing mortar on masonry buildings, modern mortar is a much higher strength than the mortars used a century ago. This new mortar can damage the older brick if applied incorrectly.

Maintenance is a critical factor in extending the longevity of the building cladding and windows. Replace caulking around windows, doors and other penetrations through the building envelope as they dry out. A rule of thumb is to replace caulking every five to ten years. The life of caulking, however, depends on a number of factors including type, quality, exposure to sun and weather and proper application.

Construction details for new siding and windows in a balloon-frame house



Thermal upgrade

Replacing siding and windows offers an excellent opportunity to make the house easier to heat and more comfortable. In many cases, the incremental cost of thermal upgrades to windows and siding is small compared to the overall cost of the job.

Insulated siding has a thin layer of insulation (often polyurethane foam) sprayed on the back of the siding. This offers only a slight improvement in the insulation level. Instead, consider installing insulation separately to gain higher insulation values.

On a solid brick house, add insulation on the exterior of the wall and cover with new siding. On balloon-frame homes, blow insulation into the wall cavity and add it to the exterior of the wall. Refer to the section in this chapter on kitchen remodelling for a discussion on wall systems and insulation, vapour retarders and air barriers.

Adding insulation on the exterior of the house may not be an option on some century-old homes. To assess whether your house is an appropriate candidate, examine the areas where the wall meets the roof.

Can the insulation be added to the wall and still be protected from the weather by the eave? It is not good building practice to create a situation where the wall is not adequately protected from rain and snow penetration. Some gable-ended homes have shallow overhangs, for example and these are not good candidates.

Installing new, permanent storm windows reduces the maintenance factor and improves the thermal performance of windows.

To further improve comfort and convenience, replace older single-pane windows with new double or triple-glazed units. Where the original window is sound, retrofit options include:

- Installing new weatherstripping and ensuring the space between the window frame and wall (the rough stud opening) is well sealed.
- Installing removable interior plastic storm windows in the winter.

When properly cared for, wooden windows last for many decades. Replacement may be in order, however, if window frames have deteriorated or the windows leak.

Windows range in price and features with a number of factors to consider. Window and glazing systems can be energy efficient and keep the heat in or be a source of heat loss. Operable styles include: casement, vertical and horizontal sliders, hoppers and awning windows. Frames are made of PVC (vinyl), wood, fibreglass, steel, aluminum and various combinations of these materials. Many wood frames are available with vinyl or aluminum on the exterior to reduce maintenance.

Quality and thermal value vary dramatically between frame type, style, glazing options and manufacturer. New, double-pane windows with low-emissivity coatings, insulated edge spacers and inert gas fillings, such as argon or krypton, represent a breakthrough in window technology and add to insulating values. Besides making the house easier to heat, energy efficient windows virtually expand usable space, taking away the drafts and cold areas near windows.

Most new windows types are rated by testing agencies and the National Building Code requires windows in new construction to meet minimum levels of performance. The Canadian Construction Materials Centre (National Research Council Canada) has information on the performance of many windows and the Canadian Window and Door Manufacturers Association also provides information to consumers.

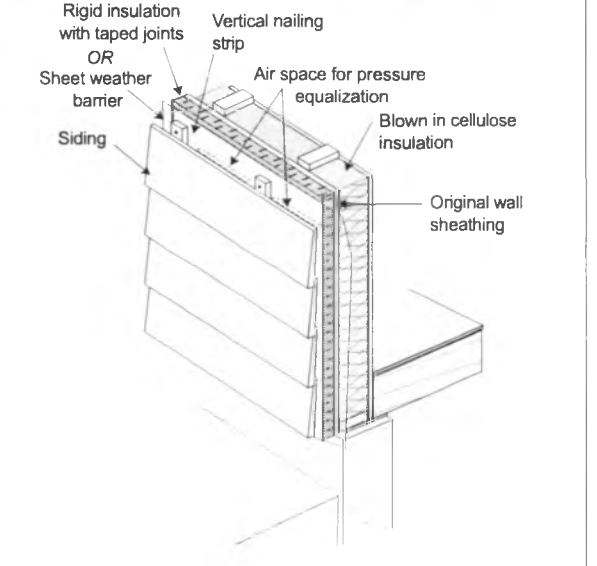
Construction

Siding

Moisture

Moisture can affect the structural integrity of the building and shorten the service life of the siding on the house. Moisture control in walls calls for a three part strategy:

Using the rainscreen principle



1. Prevent moisture leaking through the walls from inside the house. Where feasible, include a vapour retarder and a continuous air barrier inside the wall. For example, use a vapour retardant paint on the interior wall surfaces and wrap the house with a spun-bonded polyolefin air barrier on the exterior.
2. Protect the wall from water penetration from the outside. Provide eavestroughs, flashings, caulking and properly installed cladding. Ensure the cladding sheds water, especially at horizontal joints.
3. Provide a means of escape for any water penetrating into the wall. One method is to follow the rain screen principle and create an air space behind the cladding. This allows drainage and reduces heat buildup in the wall. (see "Using the rainscreen principle").

Installing exterior insulation

The simplest method to upgrade insulation on the exterior of the house is to fasten rigid insulation directly to the existing walls. Fasten furring strips over the insulation to provide a nailing surface for the new siding and the necessary air space behind the siding.

Place insulation over the original siding as long as the siding provides a solid surface to attach the new insulation and siding. Also, ensure there is no air space behind the original siding. An air space would allow cold air to circulate behind the new insulation and render it ineffective.

Windows

When installing new windows, consider the location of the window in the opening. For thermal performance, position the window pane closest to the warm side of the wall. Insulate and air seal the space between the window frame and the wall. One option is to use low expanding polyurethane foam. Also, connect the window frame to the new air barrier.

FlexHousing™

Changing window size and location affects the interior space as well as the exterior appearance of the house. Tall windows with a lower sill height let in more light and allow people to see out from a seated position.

Healthy Housing™

Adding more insulation and upgrading windows makes the house more comfortable and reduces demand on energy resources. Take advantage of passive solar heating. Position the largest window area on the south side of the house and keep blinds or curtains open on bright sunny winter days.

ACCESSIBILITY RETROFIT

Overview

Most accessibility retrofits benefit everyone who lives in the house. Adapting the home to improve accessibility depends on the individual family's needs and desires. These needs and desires change over time, however and you can make the house more adaptable by anticipating future needs. Incorporate features such as wider door openings and framing for bathroom grab bars or lowered sink and cooktop whenever a renovation is taking place.

When a specific situation arises, take an inventory of the house to determine what features need to be changed.

The extent of the renovation depends on the original design of the house, the nature of the person's infirmity and whether the person has a caregiver or will be living totally independent.

Design considerations

Mobility

The most significant changes are required to accommodate persons with limited mobility, such as a person who cannot climb stairs, requires a walker for support or uses a wheelchair.

Install a ramp with firm handrails to access the outdoors or alter a porch or deck to contain a motorized lift. For housebound persons, provide a deck or sheltered porch for sitting out, preferably where street activities can be seen.

In most century-old homes, the bedrooms and bathroom are on the second floor. It may be possible to modify a main floor den and incorporate a full bathroom in a pantry to create a suitable space for a person in a wheelchair. Alternately, provide a chair lift or elevator to the second floor.

Bathrooms in these old homes are often small. Enlarge the bathroom to accommodate wheelchair turning and space for a caregiver to assist with bathing.

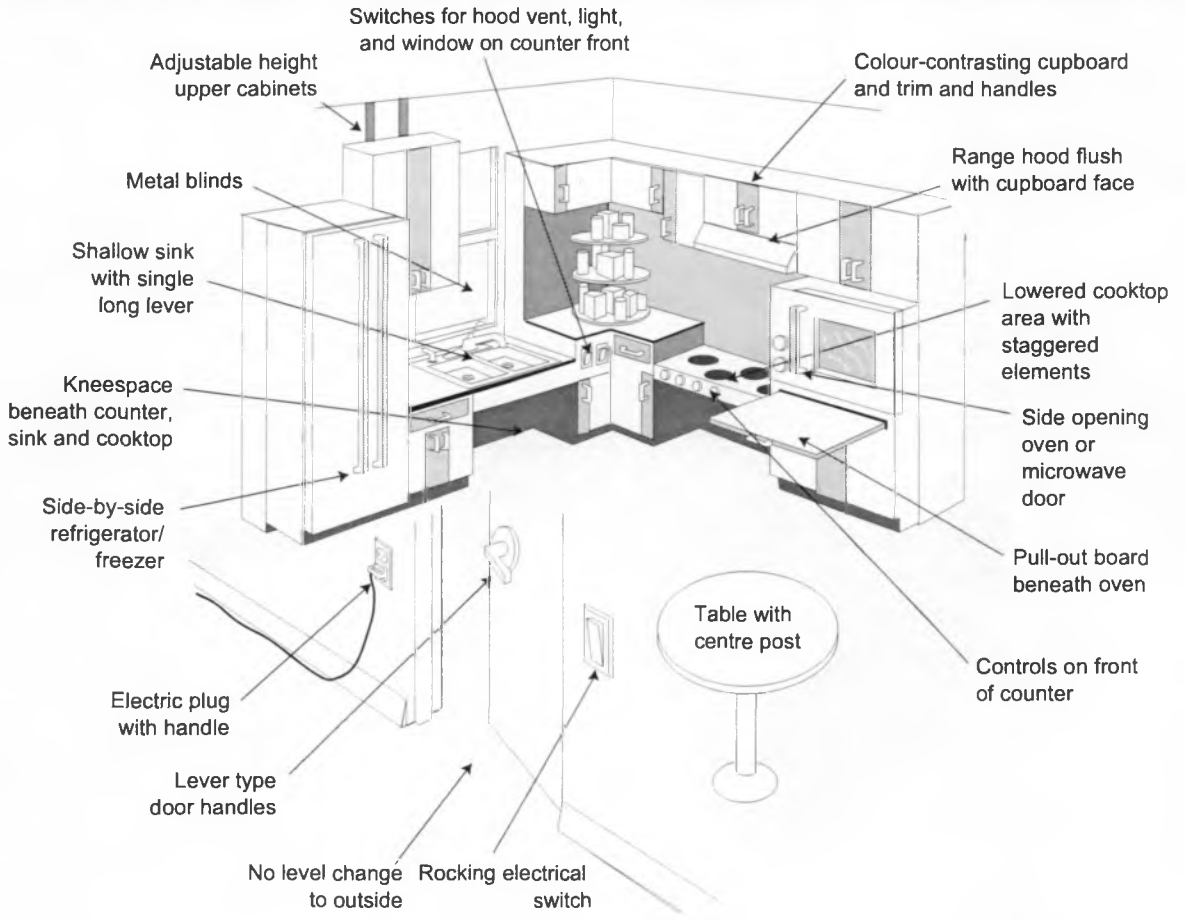
Kitchens require extensive renovation to accommodate a person who is wheelchair bound and living independently. Alterations include a lower cooktop and sink with knee space underneath. Pull out counters at table top height, pull down cabinets, a side opening wall oven and a side-by-side freezer-refrigerator make the kitchen more accessible. Storage carts stored under the counters are an alternative to lower cabinets.

To improve access, enlarge doorways in all living areas, install swing clear door hinges and equip doors with lever type handles. Many of the windows in century-old homes have lower sill heights. Maintain lower sill heights where possible to permit a person to see outdoors from a seated position.

Visibility

Changes to improve accessibility for people with visual impairment are less structural. The main consideration is to provide low glare surfaces and high colour contrast at surface edges. Use low gloss paints and floor finishes and provide even, diffuse lighting.

Details: Kitchen remodelling for accessibility



Reduce glare from windows by using adjustable blinds or screens. Use high colour contrast finishes and paints to define the edges of counters, cabinets, baseboards and doorways. Visual and tactile warning strips make stair treads safer and easier to negotiate.

Hearing

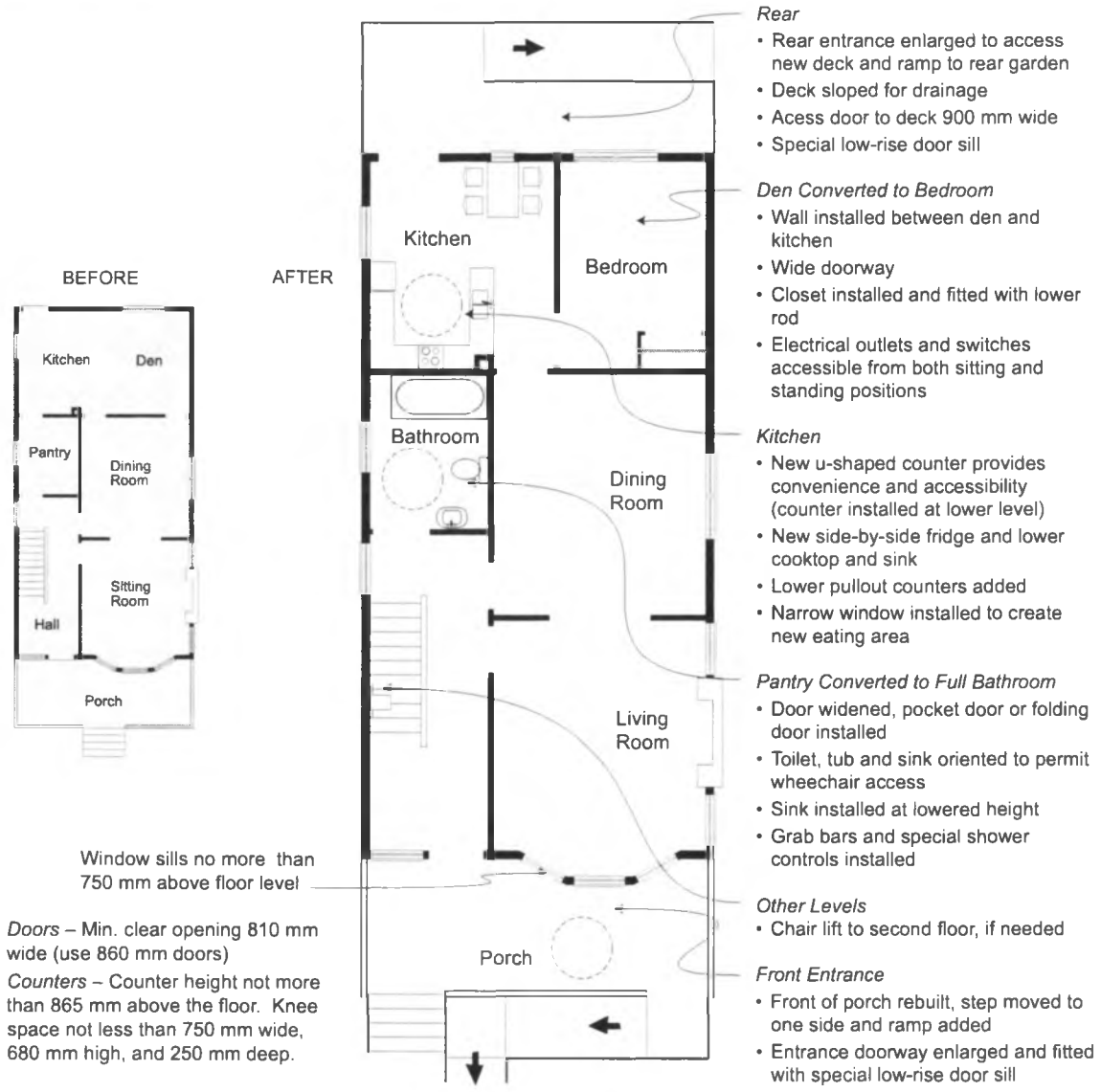
Adjust communication and warning devices to draw attention visually or by vibration for the hearing impaired. For example, equip smoke detectors with a large strobe light and telephones with a TDD device. Hook phones and doorbells to vibrating pagers. Install video monitors to oversee the front door or a child's room from living areas.

Construction

Ensure all alterations are firmly supported and attached to the building structure. Bathroom grab bars require extra reinforcing. Wider doorways require new framing and a wider lintels on load bearing partitions. Outside ramps must have a secure foundation.

Make doorways at least 860-mm (34-in.) wide with a clear opening of 810 mm (32 in.). Where space is at a premium, use 810-mm (32-in.) wide pocket doors. Pocket doors are easier for people in wheelchairs to use. Make door thresholds no higher than 13 mm (1/2 in.).

Details: Kitchen remodelling for accessibility



Replacing a stove with a separate cooktop and a wall oven requires a change in the wiring or gas lines. Where feasible, relocate switches and outlets to reachable heights. Place electrical switches at 1,050 mm (42 in.) above the floor and electrical outlets and telephone and cable jacks at 450 mm (18 in.) above the floor level.

Plumbing fixtures may also need to be changed to facilitate transfer. This would involve a higher tub and toilet and a lower vanity sink.

See CMHC's *Housing for Persons with Disabilities, Design Options for Barrier-Free* and *Adaptable Housing and FlexHousing™ Pocket Planner.*

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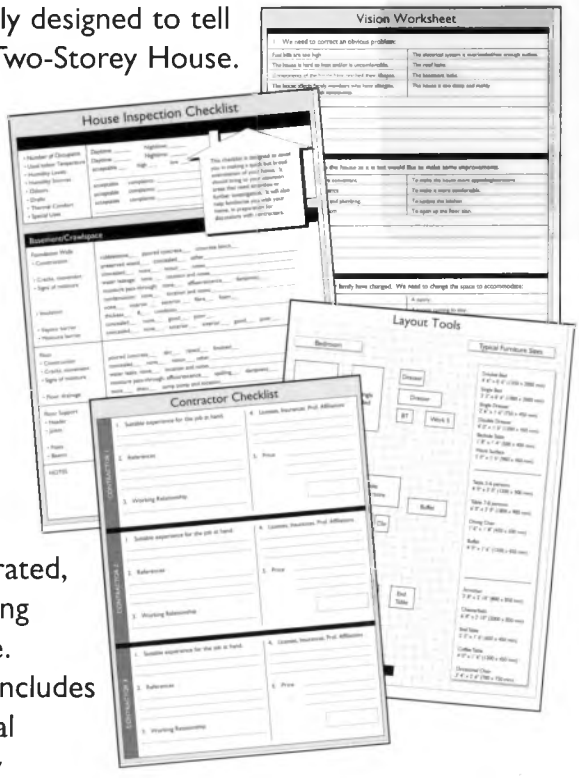

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