Universal Design Handbook

Building Accessible and Inclusive Environments

Advisory Committee on Accessibility (ACA)
Access Design Subcommittee

THE CITY OF
CALGARY

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Executive summary

"In the past, design professionals may not have realized that when a disability meets a barrier, it creates a handicap." – *George Covington*

Each human being is different. We come in all different sizes, have different abilities, develop different preferences and continue to change throughout our lives. Considering the diversity of individuals and their needs, why is the environment in which we live standardized to meet the needs of the elusive "average person?"

Built environments take on a whole new meaning.

In the past, built environments referred to physical spaces only.

A paradigm shift has occurred for those professionals involved in creating spaces where people live, work and play.

Now universal design principles can be applied to virtual environments as well.

Good design has the ability to adapt to all users and enable them to function successfully with – or within – it. And that's why, every time they initiate a new project, universal design practitioners ask, "Why make a special device or space for one group alone? Why not make it better for everyone?"

Indeed, why not?

This handbook introduces the concept of universal design, as well as the impacts that standard and traditional design projects have on people with disabilities and older adults.* It outlines what access-for-everyone entails, provides policy that supports universal design and puts the future of universal design, into perspective.

One objective of this handbook is to encourage design professionals – be they designers, architects, developers or planners – and the public to participate in universal design. By providing recommendations and examples of design that can be implemented in public and private spaces, this handbook seeks to demonstrate the advantages of going beyond minimum building code requirements and providing equal access, social inclusion and a level playing field for all.

*Throughout this handbook, the term "older adults" refers to persons aged 65 or older, or those approaching this age range.

Universal design is the best practice for designing new environments today because it embodies two simple – yet critically relevant – tenets: it's sustainable and cost-effective.

Making a building accessible from the beginning is easier and more cost-effective than retrofitting an existing building. Universally designed projects are built with everyone in mind and can benefit the greatest number of people. Regardless of ability, these environments can be accessible, functional and aesthetically pleasing.

1   Backgrounder

1.1   MUNICIPAL COMMITTEES SUPPORTING UNIVERSAL DESIGN

In May 1999, Calgary City Council approved the establishment of the Advisory Committee on Accessibility (ACA) as part of the Transportation Services for People with Disabilities Review.

The primary purpose of the ACA is to focus on broad policy issues and advise Calgary City Council on the accessibility of municipal properties, information and services. ACA is composed of appointed representatives from the community and City administrative staff. There are two subcommittees of the ACA: Access Design and Accessible Transportation (The City of Calgary, 2005).

1.1.1 Access Design Subcommittee

The Access Design Subcommittee reviews and makes recommendations on plans and/or issues relating to accessibility for people with disabilities. This includes, but is not limited to, the review of major public and private projects (e.g., properties, buildings, walkways, pathways and parks) to ensure the greatest level of accessibility for people with physical, sensory and cognitive disabilities (The City of Calgary, 2005).

> **Mission statement of the ACA**
> To provide access, recommendations and advice to Calgary City Council on the rights and service needs of Calgarians with disabilities (The City of Calgary, 2005).

1.1.2 Accessible Transportation Subcommittee

The Accessible Transportation Subcommittee reviews and makes recommendations on transportation services for people with disabilities. This committee liases closely with Calgary Transit (Transportation Infrastructure) and Access Calgary and Livery Transport Services (The City of Calgary, 2005).

2 Universal design

2.1 UNIVERSAL DESIGN CONCEPT

Jack Smart, volunteer chairperson of The City of Calgary's Advisory Committee on Accessibility (2009), has lived with a spinal cord injury for 20 years. He considers disability to be part of the human condition. "We will all be disabled at some point in our lives," he says, "Whether through a temporary event such as a broken leg, a permanent event such as a tragic accident, or simply aging – it's just a question of when."

To be frank, most able-bodied people don't think about disabilities at all. At best, when confronted with a person with a disability, they often don't believe it could happen to them. In reality, the number of people with disabilities in Canada (4.4 million) outnumbers the entire population of Alberta (3.3 million), and incidences of disability are growing ever more rapidly as our population ages (Statistics Canada, 2006).

This is why the practice of universal design is so important in this day and age. The Centre for Universal Design (2007) defines the concept as "…products and environments created to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design."

Universal design: products and environments created to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

Throughout this handbook, the term universal design is distinguished from "accessible design." The reasons for this are best stated by architect Edward Steinfeld, founding Director of the Center for Inclusive Design and Environmental Access (IDEA Center) at the State University of New York in Buffalo. He notes a growing interest in universal design as an alternative to "accessible design."

Accessible design is described as design that promotes accessibility for individuals with disabilities. Universal design, in contrast, is expected to benefit both users with and without disabilities (Steinfeld, 1994).

2.2 UNIVERSAL DESIGN AND ITS INNOVATOR

Although the term universal design was first coined in 1985 by architect Ron Mace, the design practice has yet to be globally integrated into mainstream projects. Sometimes designers get lucky and their projects result in functional and attractive spaces that benefit a wider audience, and sometimes they don't.

Ron Mace, an American Institute of Architecture fellow, was an architect who used a wheelchair and personally experienced the stigma associated with a disability. He acknowledged that time is needed to change attitudes, but that a day would come when universal design practices would be standardized. A few years later, an academic institute incorporated universal design as part of their curriculum.

2.3   CENTER FOR UNIVERSAL DESIGN

The Center for Universal Design was established in 1989 at Raleigh's North Carolina State University. The Center is a national research, information and technical assistance center that evaluates, develops and promotes accessible and universal design in housing, buildings, outdoor and urban environments and related products (Center for Universal Design, 2007).

The Center's mission is to improve the built environment and related products for all users by impacting change in policies and procedures through research, information, training and design assistance. The Center developed a successful program of assembling and disseminating existing information and creates new, landmark materials on accessible housing.

2.4   UNIVERSAL DESIGN PRINCIPLES CHECKLIST

Universal design principles, as outlined below, provide the best possible framework for design professionals to envision design possibilities that all users – people with disabilities or otherwise – benefit from.

Principles		Details	✓
Principle 1: Equitable use		**The design is useful and marketable to people with diverse abilities.**	
	1a	Provide the same means of use for all users: identical whenever possible; equivalent when not.	
	1b	Avoid segregating or stigmatizing any users.	
	1c	Provisions for privacy, security and safety should be equally available to all users.	
	1d	Make the design appealing to all users.	
Principle 2: Flexibility in use		**The design accommodates a wide range of individual preferences and abilities.**	
	2a	Provide choice in methods of use.	
	2b	Accommodate right- or left-handed access and use.	
	2c	Facilitate the user's accuracy and precision.	
	2d	Provide adaptability to the user's pace.	
Principle 3: Simple and intuitive use		**Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills or current concentration level.**	
	3a	Eliminate unnecessary complexity.	
	3b	Be consistent with user expectations and intuition.	
	3c	Accommodate a wide range of literacy and language skills.	
	3d	Prioritize based on importance.	
	3e	Provide effective prompting and feedback during and after task completion.	

Principles		Details	✓
Principle 4: **Perceptible** **information**		**The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.**	
	4a	Use different modes of communication (pictorial, verbal, tactile) to present essential information.	
	4b	Provide adequate contrast between essential information and its surroundings.	
	4c	Maximize legibility of essential information.	
	4d	Differentiate elements in ways that can be described (i.e. make it easy to give instructions or directions).	
	4e	Provide compatibility with a variety of techniques or devices used by people with sensory limitations.	
Principle 5: **Tolerance for error**		**The design minimizes hazards and the adverse consequences of accidental or unintended actions.**	
	5a	Arrange elements to minimize hazards and errors: most used elements, most accessible, hazardous elements eliminated, isolated or shielded.	
	5b	Provide warnings of hazards and errors.	
	5c	Provide fail-safe features.	
	5d	Discourage unconscious action in tasks that require vigilance.	
Principle 6: **Low physical effort**		**The design can be used efficiently, comfortably and with a minimum of fatigue.**	
	6a	Allow user to maintain a neutral body position.	
	6b	Use reasonable operating forces.	
	6c	Minimize repetitive actions.	
	6d	Minimize sustained physical effort.	

Principles	Details	✓
Principle 7: **Size and space for** **approach and use**	**Appropriate size and space is provided for approach, reach, manipulation and use, regardless of user's body size, posture or mobility.**	
7a	Provide a clear line of sight to important elements for any seated or standing user.	
7b	Make the reach to all components comfortable for any seated or standing user.	
7c	Accommodate variations in hand and grip size.	
7d	Provide adequate space for the use of assistive devices or personal assistance.	

2.5 HOW DESIGN PROFESSIONALS CAN BENEFIT FROM UNIVERSAL DESIGN

Universal design is becoming ever more popular as mainstream projects are headed by well-known practitioners, and prominent design companies increasingly apply its principles. This section dispels the myth that universal design is an unmarketable, idealistic design approach. It seeks to show designers, architects, developers, planners and other professionals the benefits of adopting universal design into their process – and demonstrates how the practice is sustainable over the long term.

Driving factors behind an increased interest in universal design are the potential purchasing power of people with disabilities, a growing number of survivors with a disability, and increasing life spans (Steinfeld, 1994).

The result for the design professional? Enhanced creativity, increased earning potential, better built buildings (the three Bs), lower costs – all without losing focus on aesthetics.

2.5.1 Enhanced creativity

Universal design provides an excellent opportunity to exercise creativity in a field that will see increased demand in coming years. Although designing for broader use may be a more challenging task than designing for a small group, universal design enhances the opportunity for creative elements. Designers have the ability to express their talent by identifying how a project can benefit everyone.

The market for universal design is unlimited because the focus is on better designs for everyone, not just an accessible design for people with disabilities. (The distinction between accessible design and universal design is detailed in Section 2.1.) Universal design is a concept primed for growth and optimal creativity.

2.5.2 Increased earning potential

One way a designer can increase their earning potential is to widen their target audience. Many designers, developers, architects and planners have a specific group in mind for whom they are designing. With universal design, all people are considered. Therefore, no particular group is the focus. By designing projects around social inclusion, the quality, value and longevity of a project increases along with the scope of work.

Globalization has links to this increased earning potential and the concept of universal design. As we move towards a more integrated society by including people, technology, businesses and ideas on a global level, it becomes apparent that the universal design concept is ahead of its time.

2.5.3 Building better buildings (the three Bs)

Longevity is one area of focus in every design project. Once money is invested, the assumption is that the project is built to function for years and will leave a lasting impression.

The assumption of longevity means these may be the same buildings the designers, architects, developers and planners will use in the future. Consider the irony of an architect who designs a state-of-the-art museum with beautiful high ceilings, glass doors and slate stairs leading up to the main entrance. Thirty years later, this same architect develops a medical condition for which a cane is needed. When visiting the museum, she/he struggles to climb the stairs because no universally designed ramp was included in the blueprints.

2.5.4 Lowered costs

Generally, it's more cost effective to build new homes and buildings that are accessible to a wide range of people than it is to build homes and buildings that don't include some foresight, or are inappropriate to our changing needs. Fortunately, universally designed projects foresee our changing environments and are more suitable to the needs of future populations.

Universally designed projects are more marketable because they address the needs of a more diverse population.

2.5.5 Aesthetics

There is some stigma attached to the concept of universal design. People often believe that to be fully accessible, a design must sacrifice aesthetics in favour of an institutional look and feel. This does not have to be the case. Aesthetics are an important part of any design. By starting with a universal design approach, designers and architects can create the look they want without having to make changes or modifications to accommodate a greater number of users. By applying universal design principles at the front-end of a project, these issues are already addressed. Therefore, the integrity of the project can be maintained, as well as its marketability.

Universal design in practice

Living in a time where individuals are more conscious about hygiene, germs and passing "something" on to others, the provision of touchless, sensor-operated faucets in washrooms or kitchens assists people who have difficulty grasping knobs and provides others with a hygienic alternative.

2.6   USERS OF UNIVERSAL DESIGN

Often, it's not a person's disability that causes exclusion, but the way in which built environments are designed (Greater London Authority, 2004). For example, disability includes people with permanent loss of function – as well as people who have temporary injuries. Universal design is also useful for parents with strollers, people who use walkers or workers making deliveries, to provide a few examples.

2.6.1 People with disabilities

People with disabilities are the most obvious beneficiaries of universal design. The greatest advantage of these principles for people with disabilities is equitable use: they can access an environment just like an able-bodied person. There is no stigma, no special treatment and no focus on their disability. Universal design helps integrate people with disabilities into mainstream society. They are no longer identified by their disability. For additional discussion on the specifics of disability, see Section 3.

2.6.2 People without disabilities

Most people experience some level of disability in their lifetime. Whether it's an injured arm, a migraine headache, laser eye surgery or the flu, at some point all of us rely on the built environment to compensate for our abilities.

A significant feature of universal design is the everyday benefits for everyone. Designers who currently use the concept ask, "Why make a special device for one group? Why not make a better device for everyone?"

Universal design raises the standard of design. Regardless of ability, universal design improves the quality of life for everyone. Consider these situations and how universal design would affect each:

- Person entering a building carrying a large box.

- Person using a shower with a slippery floor.

- Germ-conscious person turning taps in a public washroom.

- Shorter person reaching for an item in a kitchen cabinet.

- Taller person working at a standard height counter.

- Person entering a dark home late at night.

- Person wearing mittens, turning a round knob.

- Person using a mobility device visiting a friend or family's home (visitability is discussed in Section 4.3).

These examples are neither rare nor extraordinary. They do, however, point to the benefits of universal design. Although we can see the concept all around us, design professionals need to go a step further and practise it with intention.

Of course, accessibility is not only about supporting people with physical disabilities. Wheelchair ramps are far more commonly used by parents with strollers, students with bicycles and delivery people, than by people in wheelchairs. Good design is good design.

Take, for example, sidewalk curb cuts. These were originally intended for people using a mobility device. Now, city-wide sidewalk curb cuts benefit parents pushing strollers, in-line skaters, pedestrians using rolling luggage and shoppers bringing home their grocery pull-carts.

2.6.3 Older adults

The benefits of universal design for older adults are extensive. A universally designed environment adapts to the changing needs of its users, and thus helps minimize the impact of aging. This is particularly important given Calgary's aging population.

A universally designed setting gives older adults the option of continuing to live in their homes and communities despite changing abilities. This concept of "aging in place" enables older adults to live full and productive lives well into their senior years. They can remain in the community where they are most comfortable, rather than moving into institutional care, which might otherwise have been their only option. The adaptability of a universally designed environment can minimize feelings of frustration some may encounter as they age and experience changes in personal mobility.

2.7 CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN (CPTED)

The concept of "Crime Prevention through Environmental Design" (CPTED) was originally conceived by criminologist C. Ray Jeffrey. His famous book of the same name was published in 1971, and became the foundation for research on limiting crime by building safe environments.

Specifically, CPTED allows people to see and be seen continuously. Without blind spots such as dark corners or obstructed views, an individual is alerted to potential risks before they happen. Increased visibility is likely to deter perpetrators, because they are more easily identified and apprehended. There is also a greater chance that residents will be seen (and thus protected) by other members of their community. Consequently, their fears are reduced.

Furthermore, when an individual's sense of security in their community is increased, they are encouraged to take control of their environment and assume an ownership role. This, in turn, enables more interaction with one another and the increased likelihood of intervention if and when a crime occurs.

2.8 EASING CONCERNS ABOUT UNIVERSAL DESIGN CHALLENGES

Foresight and understanding are necessary prerequisites for universal design to be practised effectively and efficiently. Therefore, it's useful for design professionals to examine some of the assumptions associated with the practice of universal design – with an eye to finding solutions, rather than simply identifying obstacles.

It is important to note that as the principles of universal design are more readily applied in our environment over time, the challenges listed below will diminish accordingly. This is because new ideas often require more effort in the beginning, but less so as they become normalized and habitual in our thinking.

Challenge: profitability.
Solution: research into upcoming demographic changes.
Many design professionals are attracted to clients with extensive project proposals. In the past, designing for marginalized groups was rarely lucrative, but this has changed with the onset of an aging population and its corresponding increase in disability rates. (See Section 3.4 for more details.)

Challenge: resistance to change.
Solution: leadership.
Bureaucracies are notorious for placing constraints in the path of design professionals, and financial constraints most often stall proposed innovations. By communicating and educating clients about current population trends and the higher costs of retrofitting buildings, designers, developers and architects have the unique opportunity to provide leadership into new design possibilities – and create sustainable, win-win situations for all.

Challenge: polarization.
Solution: collaboration.
In order to achieve universality, collaboration is paramount. Although design professionals have a vested interest in promoting their profession, a synergy must develop between academic disciplines that look at trends, user needs, etc. (e.g. social scientists, population health researchers, market researchers, gerontologists and others), in order to successfully pursue universal design and avoid retrofit.

Challenge: lack of understanding.
Solution: education.
Armed with research about what consumers really want from their products – and with an openness to collaboration – today's design professionals are finding themselves at the forefront of an exciting, innovative and very lucrative market for universally designed environments.

3   Disability

So far, this handbook has presented universal design as the best practice for creating accessible environments for all users, regardless of their ability. With this in mind, learning more about disabilities in general – and fully comprehending the hurdles people with disabilities face – enables a design professional to transcend these barriers and create truly inclusive, functional and beautiful spaces.

When disability is wholly understood, true accessibility follows.

3.1   UNDERSTANDING DISABILITY

Many disabilities aren't easily classified. Each is unique in its cause, the way it is experienced by the individual and its potential design solutions. For example, some disabilities derive from birth, whether through heredity (such as muscular dystrophy) or complications during pregnancy and the birthing event (such as Fetal Alcohol Spectrum Disorder or cerebral palsy). These root causes result in a range of challenges that the individual will experience throughout their lives.

Fast fact

It's estimated that one in seven Canadians has a disability.

Disabilities such as paraplegia, vision loss or stroke, on the other hand, may be acquired later in life, due to an accident or illness or the process of aging, and may intensify over time. And these too result in a range of challenges for the individual, from physical, to sensory to cognitive.

Despite the difficulties associated with classification, this handbook attempts to define the different types of disability for the reader, in hopes of simplifying the application of universal design principles. To sum up, this section describes increasing disability rates among different age groups and regions in Canada, and explains how these rates are related to population aging. As well, a means of distinguishing different types of disability is provided in the attached checklist in Section 3.3.4.

3.2 DISABILITY: AN INCREASING REALITY

The World Health Organization (WHO) has developed a broad definition for disability as "any restriction or lack of an ability to perform an activity in the manner, or within the range considered usual, for a human being."

Population projections for the city of Calgary demonstrate that disability rates among Calgarians are increasing significantly. While it is commonly accepted that individuals aged 65 years and older are reporting the highest incidents of disability, trends demonstrate that an emergent population of adults between the ages of 45 and 64 are already reporting high rates. In Calgary, this age group shows an estimated increase of 27 per cent (see Figure 1).

Figure 1. Number of Persons with Disabilities in Calgary, 2006-2013 (by age group)

■ 2006 ■ 2013 (projected) ━━ Projected increase 2006 – 2013
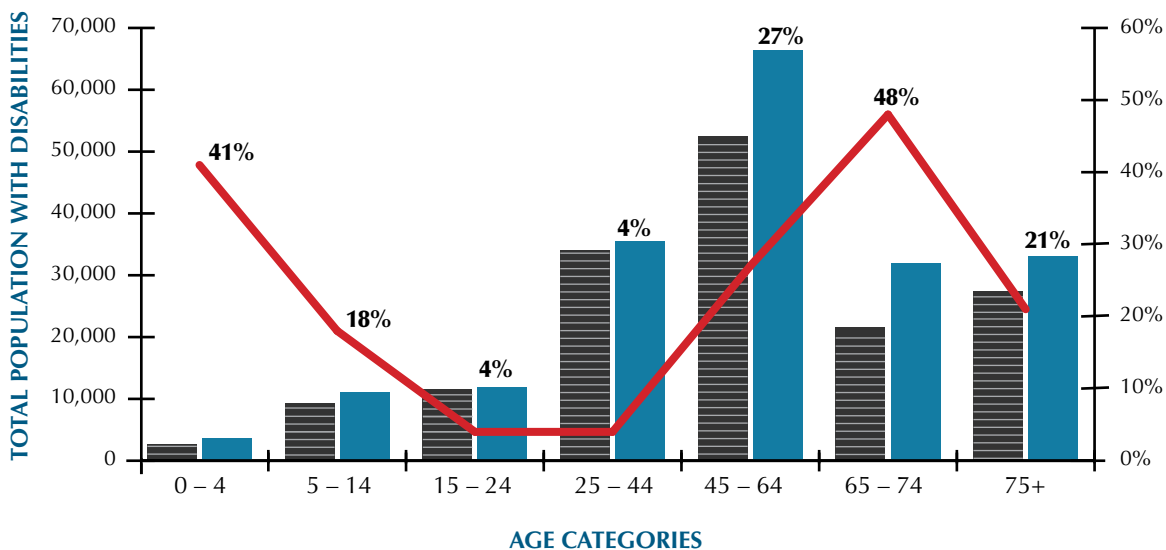
Source: Statistics Canada, 2006g & 2006h; The City of Calgary 2008b

When compared against the 2001 and 2006 Federal censuses, which reveal a 17 per cent increase in 2001 and an 18 per cent increase in 2006 (see Figure 2), one can only conclude that the number of disabled individuals in Calgary (and Canada) will continue to multiply in coming years.

Many factors contribute to the increase in disability rates, three being:

- More people are diagnosed because of increased education and awareness.

- More people survive difficult births, accidents and diseases because of medical technology, therefore more people are living with disabilities.

- In general, life expectancy is increasing. In 2004, life expectancy in Canada for both genders surpassed 80 years for the first time, increasing from 79.9 years to 80.2 (Statistics Canada, 2006c).

A disability rights model describes accessibility as a societal responsibility to ensure people with disabilities get the support they need to participate and contribute to society (Konrad et al., 2007).

Therefore, 30 years from now, disability will likely be treated differently than it is today. People with disabilities are not a small, insignificant group or silent minority. As people with disabilities and other members of society continue to lobby for equal opportunity, change is inevitable and much needed. Political, economic and social changes will continue driving the movement to recognize differences among people.

Figure 2. Disability Rate for Canadians in 2001 and 2006 (by age group)

■ 2001 ■ 2006
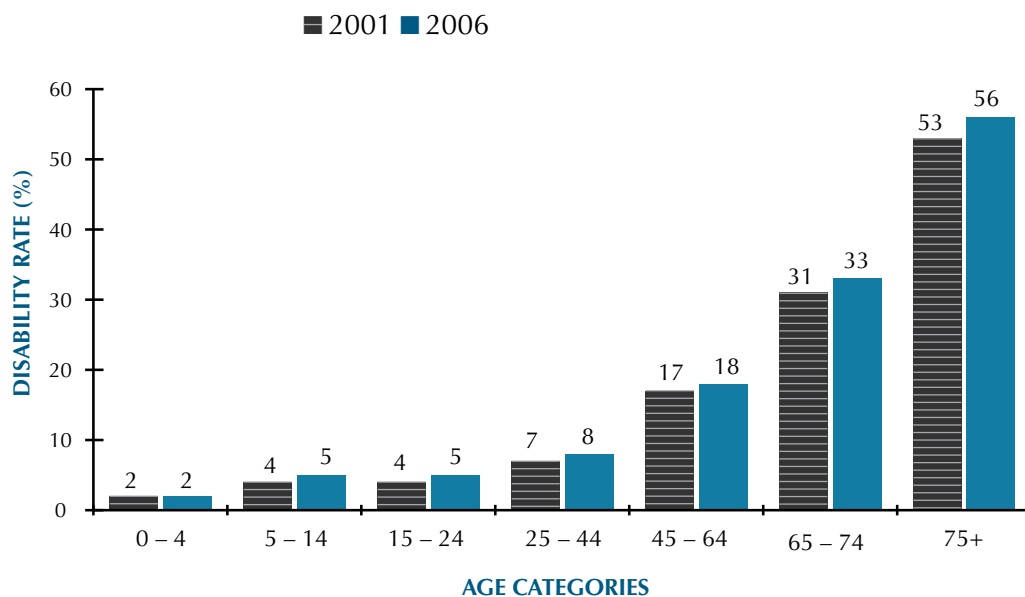
Source: Statistics Canada, 2006b

3.3 TYPES OF DISABILITY

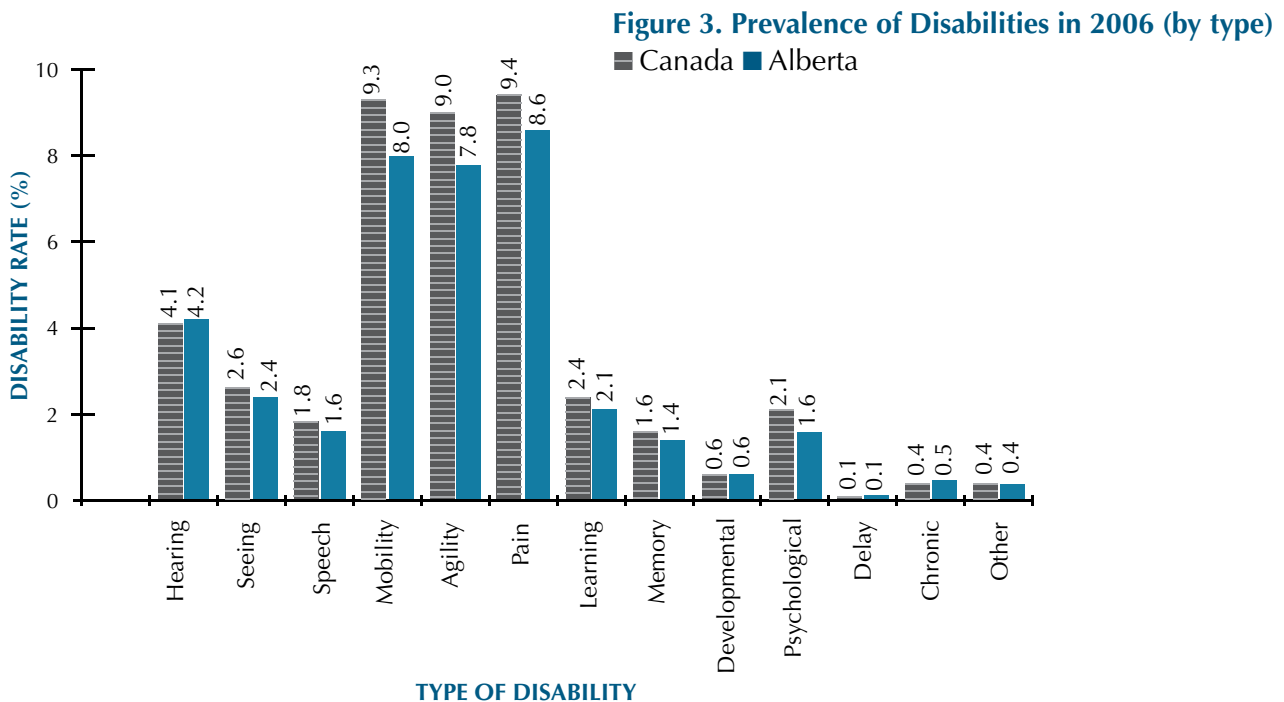Many know the saying, "no two snowflakes are alike." The same can be said about people with disabilities, who may demonstrate a range of characteristics. In fact, many people with disabilities look like able-bodied individuals, but their disabilities are hidden.

In 2006, Alberta was more-or-less on par with national statistics regarding disability type, with mobility (9.4 per cent), agility (9.0 per cent) and pain (9.3 per cent) reported as the three most prevalent (see Figure 3).

The following paragraphs describe the different types of disabilities including physical, sensory and cognitive disabilities, and provide general design considerations for each type.

3.3.1 Physical disabilities

There are two types of physical disabilities: agility and mobility. Many able-bodied people associate a physical disability with a person using a mobility device or who has a mobility challenge. However, some people with physical disabilities do not use a device, or their immobility may not be noticeable at first. For example, a person on a bus with early onset of Parkinson's disease may not appear to have a disability until they stand to leave. That's when an observer might notice a tremor in their hands and an unsteady gait.

Figure 3. Prevalence of Disabilities in 2006 (by type)

Canada ■ Alberta

Type of Disability	Canada	Alberta
Hearing	4.1	4.2
Seeing	2.6	2.4
Speech	1.8	1.6
Mobility	9.3	8.0
Agility	9.0	7.8
Pain	9.4	8.6
Learning	2.4	2.1
Memory	1.6	1.4
Developmental	0.6	0.6
Psychological	2.1	1.6
Delay	0.1	0.1
Chronic	0.4	0.5
Other	0.4	0.4

DISABILITY RATE (%) — TYPE OF DISABILITY

Source: Statistics Canada, 2006d

A. Agility

Agility is the loss of dexterity, co-ordination and/or sensation which can affect a person's ability to function in the areas of daily living activities, leisure and vocation (Waugh, 1997). The inability to bend or reach out, dress or undress oneself, get out of bed or a chair, use fingers to grasp, open or handle objects, cut food and so on, can be very frustrating.

When designing for this population, consider that people who have problems with their sense of touch and dexterity may have trouble distinguishing textures and shapes, surface temperatures or substances and changes in pressure (Johnson et al., 1999).

Personal encounter

Eva's arthritis was restricting her daily living more and more. Opening cupboards was difficult if the handles had little surface to grab. When she bought a new home she requested the builder install D handles on all cupboards so she could open the doors with little effort.

B. Mobility

Mobility limitations pertain to the ability to walk, move from room to room, carry an object for 10 metres or more, and stand for long periods of time (Waugh, 1997). Long-term mobility challenges may include amputation, arthritis, multiple sclerosis (MS) or spinal cord injury. Short-term mobility challenges may include a bone fracture or sprain (Waugh, 1997).

People with reduced strength and range of motion may be unable to stand or carry objects. They may be unable to lift, push or pull objects. They may be unable to reach, extend their arms or bend, or to proceed easily towards their destination (Johnson et al., 1999).

3.3.2 Sensory disabilities

Physical disabilities are usually easy for people to notice, but not all disabilities are visible. Two types of hidden disabilities are hearing and vision loss.

A. Auditory

Hearing loss varies in degree from mild (almost unnoticeable hearing loss) to the total inability to hear and understand speech and other sounds. Hearing loss can be a result of age, heredity, illness or accident and may inhibit communication. It is defined by its varying degrees of loss as late deafened, hard of hearing and deaf (Waugh, 1997).

Hearing loss is the largest disability within the sensory disability category affecting Canadians. Projections are that the number of people living with hearing loss will increase at a faster rate than the total rate of population growth. Current estimates are 15 per cent of Canadians live with some sort of hearing loss, though many do not readily identify themselves as having hearing loss. Aging baby boomers are expected to drive the numbers of people living with hearing loss to even higher levels. Listening to iPODs and MP3 players at high volume over a sustained period of time also causes hearing loss in younger generations.

When designing for individuals with auditory loss, remember that people with a hearing loss vary in the range of sound they hear. Some people cannot hear at all. Others can hear sounds only when they are very loud, and others have difficulty hearing certain tones. Therefore, it's important to consider acoustics when designing spaces (Johnson et al., 1999).

Personal encounter

Damien – who has some hearing loss – has been instrumental in securing a visual fire alarm in his office building.

When the alarm sounds and flashes one afternoon, Damien heads toward the nearest exit. He notices one of his co-workers still hunkered over his desk and taps him on the shoulder to get his attention. When the co-worker looks up and removes his headphones, he is alerted to the alarm and immediately gets up to leave the building.

On the way out, Damien shares how it's possible to be disabled by one's surroundings, even if one doesn't have a "disability."

Projections are that the number of people living with hearing loss will increase at a faster rate than the total rate of population growth.

B. Vision

Many people will experience various types of vision loss at some point in their lives. Some will gradually lose their ability to see objects far away. Others may have problems reading small print. These types of conditions are often easily treated with eyeglasses or contact lenses. Visual disabilities, on the other hand, include a range between visual impairment and blindness.

A person who has vision loss may have limited ability to read regular-sized print, or can only see someone four metres away with corrective lenses (Waugh, 1997).

At the other extreme, a person who is blind has less than 10 per cent vision with corrective lenses. A person with this condition may only be able to see the large E on the eye chart. This category can be further subdivided into long-term visual disabilities such as cataracts or glaucoma, and short-term visual disabilities such as a temporary blindness that results from an accident or illness (Waugh, 1997).

Things to consider when designing for people with vision loss include understanding that they may have difficulty distinguishing small details in their environment. They may only see things through a blur and be sensitive to abrupt changes in lighting and glare. They may also have difficulty with depth perception (Johnson et al., 1999).

3.3.3 Cognitive disabilities

Cognition is the act of knowing, which includes one's ability to pay attention, to perceive, to memorize, to reason, to judge, to imagine, to think and to speak. Many able-bodied people have experienced some degree of cognitive impairment during periods of high emotion (which can interfere with the brain being able to process information) and/or high stress (which can result in distracting thoughts going through their heads).

Persons with a cognitive disability, on the other hand, may find it persistently difficult to concentrate and organize their thoughts in a logical manner. They may also become easily distracted and have difficulty accomplishing certain tasks that others find easy.
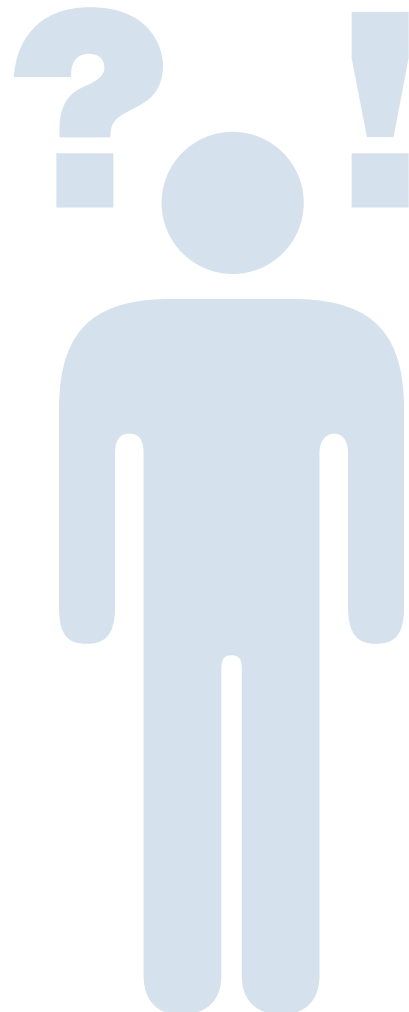
There are two types of cognitive disability: developmental (previously referred to as intellectual) and learning. Both affect one's ability to acquire knowledge, but only the first has any relationship to intelligence.

A. Developmental

There are many causes to this disability, ranging from maternal illness or damage to the brain during labour, to genetic conditions. Approximately three per cent of the population is considered to be affected, the vast majority (80 per cent) having a mild condition. A person with a developmental disability develops intellectually and socially at a slower rate than able-bodied individuals. Examples of developmental disabilities include autism and Down's syndrome (Waugh, 1997).

B. Learning disabilities

It has been estimated that learning disabilities affects one in 10 people and inhibits their ability to either interpret what they hear or see, or to link information from different parts of the brain. Although an individual with a learning disability will likely have an average, or above average IQ, their disability becomes evident in both academic and social situations where a pattern of excelling at certain types of tasks is often countered by marked difficulties at others.

Learning disabilities – of which Attention Deficit Disorder (ADD), Attention Deficit Hyperactivity Disorder (ADHD), dyslexia and dysgraphia are but a few – arise from perceptual problems leading to significant delays in important learning challenges. Often, this condition is referred to as a "hidden disability" since few-to-no obvious external characteristics cause the individual to be seen as "different." To accurately diagnose individuals with learning disabilities, professionals rule out other conditions first, such as a developmental disability, emotional disturbance, cultural disadvantage, and sensory deprivation (Learning Disabilities Association of Alberta – Calgary Chapter, 2004).

3.3.4 Acquired brain injury (ABI)

The brain is a very complex organ and various parts of it are responsible for certain functions. Therefore, injury to one part of the brain potentially produces specific deficits across all the body functions listed above: physical, sensory and cognitive. For this reason it's been given its own category.

ABI refers to damage caused by a traumatic, chronic or pathological injury, and is not related to a congenital disorder or a degenerative disease such as Alzheimer's disease or multiple sclerosis.

In all cases, traumatic injuries to the brain result in bruising, tearing, or bleeding into soft brain tissues – or, as in "non-traumatic" brain injuries (e.g. near-drowning, choking or strangulation), chronic and pathological injuries resulting from interference with the oxygen supply to the brain (Association for the Rehabilitation of the Brain Injured, 2009).

3.4   AGING

The various types of permanent disability examined so far have their common root in heredity, illness or accident. Of course any – or all – of them can also be attributed to aging. So, unlike some of the disabilities previously discussed, disabilities brought on by aging may be cumulative, as well as intensified over time.

It is frustrating for some older adults to balance what they want to do with what they are capable of doing. Independence is often their greatest loss and the built environment may either help, or hinder this. Older adults are looking for supportive environments to maintain their level of activity.

It's imperative to keep this in mind when designing for an aging population. The built environment should enable active community participation and independence for all ages and abilities. Most of all, like everyone else, older adults want a setting that continually enables them to be as active in society as they wish to be, despite their age. A strong desire to maintain independence and participation in society appear to be critical factors.

In addition to changes in the social, economic and technological environments, some older adults must also grapple with stereotypes about the roles and abilities associated with aging. These may make them feel vulnerable and less valued as a person, which can contribute to suspicion and resistance to change.

Designers have a unique opportunity to decrease the level of apprehension people may have about aging. According to the World Health Organization (WHO), an "age-friendly" city adapts its structures and services to be accessible and inclusive of older people with varying needs and capabilities (WHO, 2007). An age-friendly built environment can extend independence, lessen the impact of diminishing ability and its associated costs to society, and add immensely to the quality of life for an aging population.

3.4.1 The 65+ age group

We know disability tends to increase with age. Forty-four per cent of Alberta seniors report a disability, slightly higher than the national rate of 41 per cent (The City of Calgary, 2007a). In 2006, 9.4 per cent of Calgarians were 65 years and older. By 2036 this figure will double to 18.5 per cent (see Figure 4).

Figure 4. Percentage of Calgarians comprised of persons aged 65 or older, 1936 to 2036
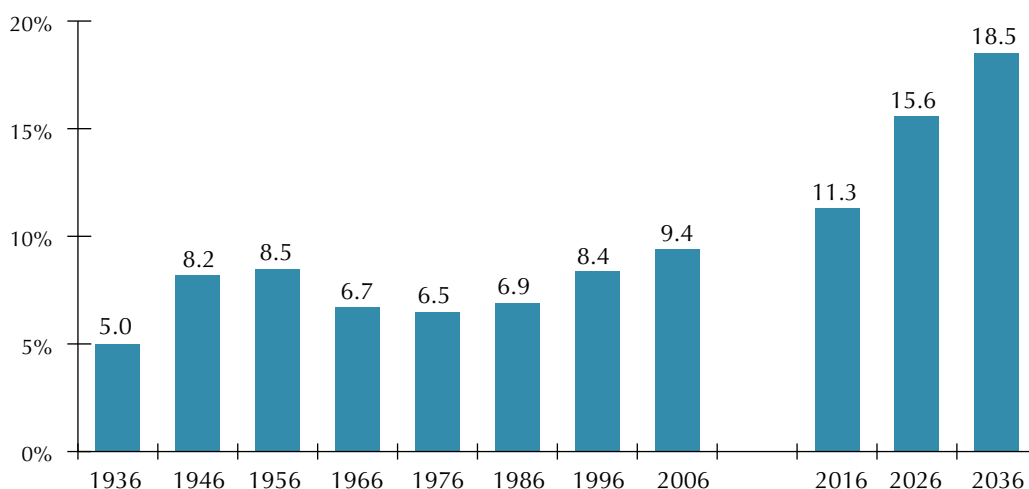
Source: Statistics Canada 2006e, Censuses of Canada; City of Calgary 2006d, Corporate Economics

3.4.2 Boomers – an emerging reality

Baby boomers are the generation born between 1946 and 1964, and the first wave of them is set to retire in 2011. As they age, they will continue to influence social, economic and political environments, much as they have throughout their lifetimes. In all probability, they will become even more influential when work is no longer their primary focus. To support this notion, projected growth patterns for Calgary indicate that individuals 65 years and older will outnumber the 0-14 cohort by the early 2030s (see Figure 5). This will be the first time in our history such a demographic shift has occurred.

Figure 5. Number of persons 0 – 14 vs. 65 and older, Calgary, 2006 to 2036

━━ 0 – 14 years old   ●●●● 65 years and older
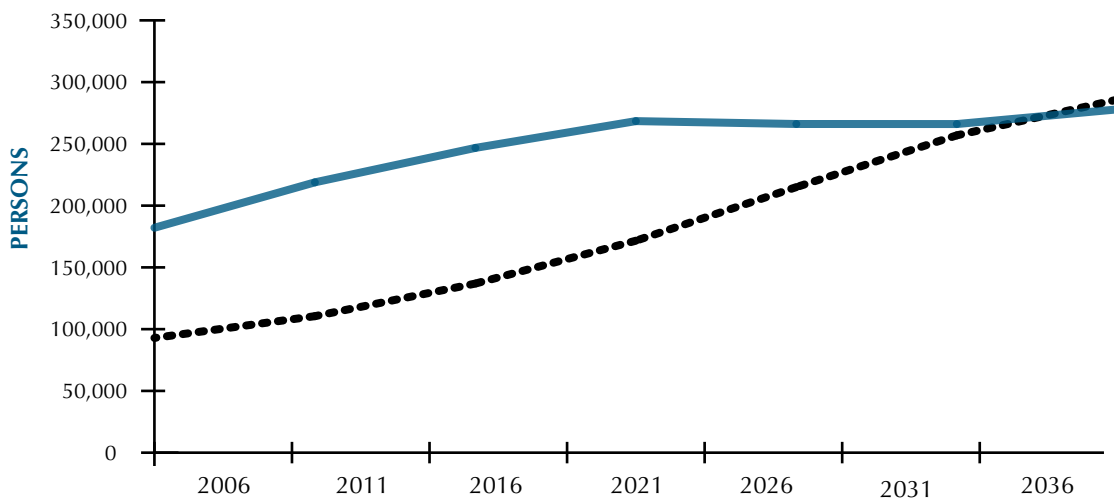
Source: City of Calgary 2006d, Corporate Economics; Statistics Canada 2006e

3.5 TYPES OF DISABILITY CHECKLIST

The following checklist provides an overview of the diverse types of disabilities – from those acquired through genetic inheritance, accident, the process of aging or a combination of these – and how each carries its unique attributes and accessibility requirements.

Readers will also find common terms that help demonstrate what it's like to live with a disability and lastly, this checklist includes various assistive devices/measures that people with disabilities use/need to help them move through, participate with and communicate in the built environment.

Disability type	Physical: agility/mobility	✓
Common terms	**Ambulatory:** able or strong enough to walk.	
	Semi-ambulatory: able to walk short distances with small steps.	
	Non-ambulatory: unable to walk.	
	Fractures: the breaking of bones and cartilage (note: persons confined to wheelchairs have more brittle bones and are more susceptible to fractures).	
	Paraplegia: a break or lumbar injury causing total or partial paralysis of the lower limbs, which may be spastic or flaccid.	
	Quadriplegia: total or partial paralysis of all four limbs and the torso.	
	Amputation: loss or removal of limb.	
	Prosthetic: an artificial extension that replaces a missing body part.	
	Spinal cord injury: causes damage to white matter, or myelinated fiber tracts that carry signals to and from the brain. It also damages gray matter in the central part of the spine causing segmental losses of interneurons and motorneurons. Spinal cord injury can occur in many ways, including accidents, tumours (cancer), developmental disorders (spina bifida), inflammation (stroke) and vascular malformations (aneurysm).	

Disability type	Physical: agility/mobility (continued)	✓
Assistive devices	**Wheelchair:** average manual chair measures 92 cm height to handles; 76 cm height to armrest; 66 cm width; 106 cm length. (Power chair dimensions vary greatly and are not included here.)	
	Cane: used by people who may experience lack of stability or balance. The foot of the cane may vary according to its application (see tripod and quadripod below).	
	Crutch: underarm (wooden and aluminum); primary use for people with a temporary disability.	
	Canadian Crutch: underarm rest accompanied with full arm or forearm handle; for use by people with a permanent injury.	
	Tripod: cane with three prongs at its foot.	
	Quadripod: cane with four prongs at its foot.	
	Walker: used like crutches, with enhanced stability advantage. (Walkers equipped with wheels or castors are extremely unstable on inclines.)	
Disability type	Sensory: auditory/vision	✓
Common terms: auditory loss	**Conductive hearing loss:** usually caused by disease or destruction in the middle ear, and generally not severe.	
	Sensorineural hearing loss or nerve deafness: damage to the sensory hair cells or nerve fibers of the inner ear. This loss can range from mild to severe deafness.	
	Acquired hearing loss: the sudden or slow loss of hearing in adulthood. The primary mode of communication for persons with this type of hearing loss is the spoken language.	
	Congenital hearing loss: occurs at birth or at a very early age. If profound, the most common mode of communication is sign language.	

Disability type	Sensory: auditory/vision (continued)	✓
Assistive devices: auditory loss	**Hearing aid:** miniature audio amplifier that increases (all) sound within its range, including background noise. User must learn to adjust the volume to suit their needs in relationship to ambient noise.	
	Assistive listening device (ALD): used in addition to, or instead of hearing aids (some older adults prefer it to a hearing aid). ALDs use infrared light wave; FM radio wave and magnetic loop induction transmissions which helps reduce the effects of background noise and reverberation.	
	Captioning (open, closed, real-time): used primarily in courts, during government proceedings and by the broadcast industry. This subtitling service is performed by a trained typist in excess of 225 w.p.m., with a 99 per cent accuracy level. To view it, one's television must be equipped with an internal or external decoder chip.	
	Telecommunication device for the deaf (commonly referred to as TTY): portable telephone amplifier, which is added on to an existing telephone, enabling the listener to type and read their messages over phone lines.	
	Hearing ear dog: companion dogs trained to alert their master to noise – usually identified by an orange collar and leash.	
	Sign language interpreters: dedicated person to translate conversation (not participate in it), trained to maintain confidentiality and discretion at all times.	
	Oral facilitator: dedicated person to take spoken words and make them more visible for those who are lip-reading.	
Common terms: vision loss	**Visual acuity:** this represents the eye's ability to perceive detail – more specifically, to differentiate between two close points.	
	Visual field: the entire range the eye can see, extending to 180°, which is much larger than that of any optical instrument.	
	Macula: the specialized portion of the retina responsible for colours and small details, reading and differentiating between faces.	
	Deaf-blind: people with a dual disability who communicate by finger spelling on the palm of their hands. Usually accompanied by an attendant and/or interpreter.	

Disability type	Sensory: auditory/vision (continued)	✓
Assistive devices: vision loss	**Cane (rigid or collapsible):** white, long and fitted to the individual's height and walking style.	
	Service dog: individual preference for animal or cane, not related to degree of vision loss.	
	Braille: tactile system of raised dots representing letters of the alphabet for reading purposes.	
	Sighted guide: a person who offers their relaxed arm to the visually-impaired person to grasp, and then leads by announcing such upcoming features as handrails, doors, stairs, or slopes in the flooring, always allowing the visually-impaired person time to interpret and react.	
Disability type	**Cognitive: developmental and learning**	✓
Assistive communication	Be sure to have the attention of the person while communicating (i.e. maintain eye contact, place bold signage, etc.).	
	Keep sentences short and clear, and simplify vocabulary as necessary.	
	Persons with a cognitive disability often confuse **up** with **down**, **right** with **left**, **back** with **front**, etc. Combine words with images to help clarify messaging.	
	Be prepared to repeat and rephrase (i.e. provide adequate destination signage throughout one's path of travel).	
	Pilot test any or all communications endeavors with a focus group, such as signage or interpretation. Never assume that your intention will be understood without testing it first.	

| Disability type	Acquired Brain Injury (ABI)	✓
Common terms	**Traumatic brain injury:** an assault to the brain resulting from a number of causes including, but not limited to, a motor vehicle accident, a fall, a sports injury or a job-related accident.	
	Chronic brain injury: occurs as a result of substance abuse, including the inhalation of toxic substances or chronic alcoholism.	
	Pathological brain injury: may involve a viral infection (for example, Encephalitis), cerebral vascular disease (e.g. a stroke), tumours, cysts or metabolic disorders (for example, liver or kidney disease).	
Assistive devices and/or communication	Consider all of the above (the entire checklist) as potential aids to persons with ABI.	

3.6 TYPES OF BARRIERS

A barrier is an obstacle that makes it difficult for people to get where they need to go in life. In other words, environments have the potential to enable, or disable, all of us. This subsection details those barriers – from tangible, to behavioural – that prevent people from moving forward.

In his book, *High Access Home,* Charles Riley III sums up the toll that built environments have on people with disabilities when he quotes George Covington, co-chair of the Universal Design Task Force of the President's Committee on Employment of People with Disabilities: "Most of the elements in our society that define us as 'the disabled' are caused by poor design. If I cannot find a building's address because the numbers are tiny or artistically hidden, I am 'visually impaired.' If a friend of mine in a wheelchair blocks the narrow aisle in a grocery store or cannot get onto a sidewalk because there is no curb cut, my friend is 'mobility impaired'….A landscape architect, a designer of furniture and a computer engineer are all designers, no matter what their titles. There is not a single aspect of our daily lives unaffected by designers. Too often their creations throw up barriers that result in our being labeled 'the disabled'" (Riley C., 1999).

Barriers can be classified into four categories: physical, attitudinal, financial and systemic and are important considerations for both users and design professionals.
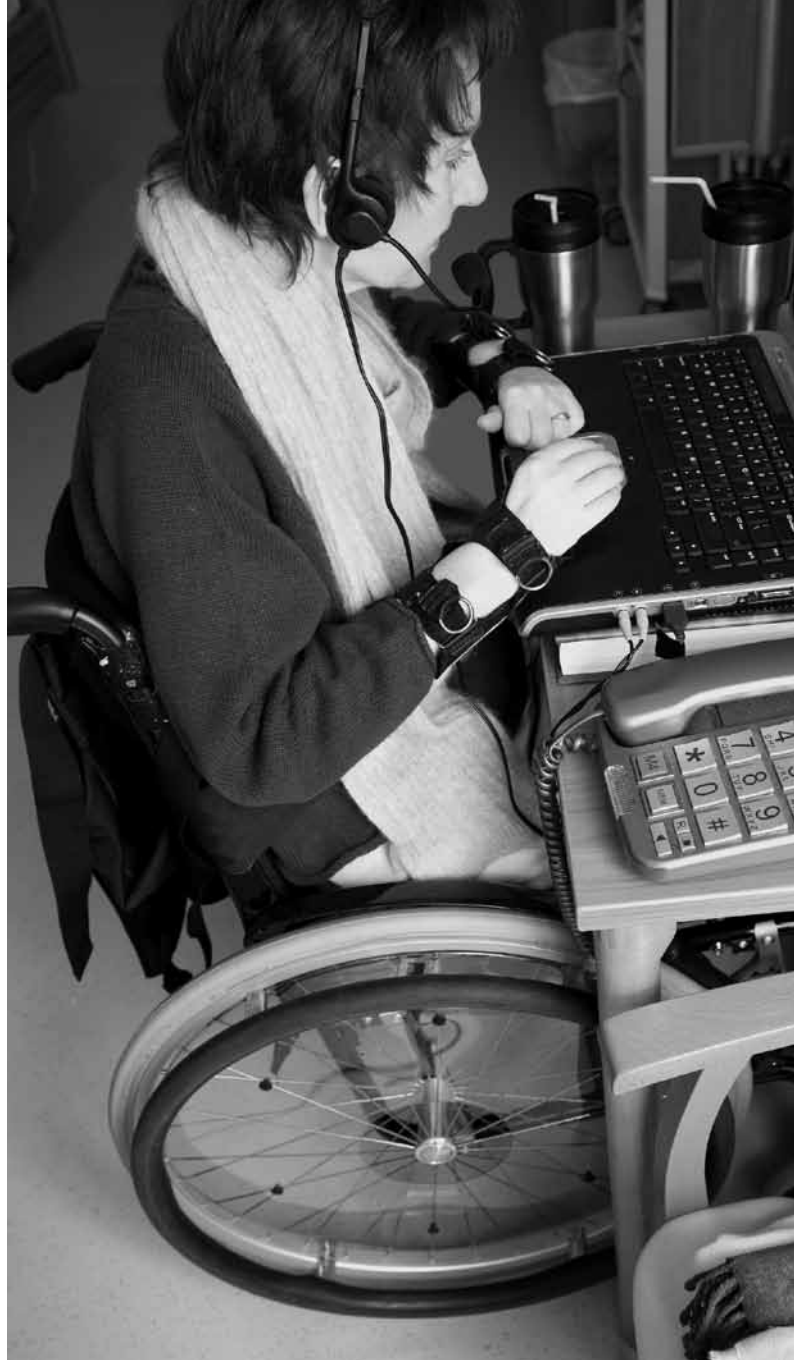
3.6.1 Physical barriers

A physical barrier pertains to accessing public and private spaces within the built environment. This notion means more than an obstructed entrance. It can have quite subtle implications, depending on one's type of disability and whether or not universal design principles are applied throughout.

For instance, buildings may appear to be accessible at first glance – such as having a designated area for wheelchair seating – but not every person using a wheelchair may wish to sit where their choices are limited. Choice is given to able-bodied individuals and people with disabilities deserve the same degree of choice and independence.

3.6.2 Attitudinal barriers

People with disabilities face many barriers every day, from physical obstacles in buildings, to systemic barriers in employment. Yet, often the most difficult barriers to overcome are attitudes other people have regarding people with disabilities. Whether born of ignorance, fear, misunderstanding or hate, these attitudes keep people from appreciating and experiencing the full potential a person with a disability can achieve. The most pervasive negative attitude is focusing on a person's disability rather than ability.

People do not go where they feel uncomfortable, unwelcome and excluded (Waugh, 1997). Attitudes influence people's involvement in the community, workplace and other social environments. Design professionals are in a key position to ensure users enjoy a positive experience while in one of their spaces. Professionals achieve this by dispelling myths that may affect their own attitudes.

The following are different types and explanations of attitudinal barriers provided by the National Collaborative on Workforce and Disability (2007):

Inferiority

Because a person may be impaired in one area, some people believe they are a second-class citizen. However, most people with disabilities have skills making the impairment moot.

Pity

People feel sorry for the person with a disability, which can lead to patronizing attitudes. People with disabilities generally don't want pity and charity, just an equal opportunity to earn their own way and live independently.

Hero worship

People consider someone who lives independently, or pursues a profession while having a disability to be brave. But most people with disabilities do not want accolades for performing day-to-day tasks. The disability is there: the individual has learned to adapt by using their skills and knowledge, just as everybody adapts to features such as being tall, short, strong, fast, easy-going, bald or shy.

Ignorance

People with quadriplegia drive cars and have children. People who are blind tell time on a watch and visit museums. People who are deaf play baseball and enjoy music. People with developmental disabilities can be creative. However, if physical barriers are in place because someone overlooked their significance, then many of these people cannot enjoy what life has to offer.

The Spread effect

People often assume that an individual's disability negatively affects other senses, abilities or personality traits, or that the total person is affected. For example, many people shout at someone who is blind, or don't expect people using wheelchairs to have the intelligence to speak for themselves. Focusing on the person's abilities rather than their disability counters this type of prejudice.

Stereotypes

The other side of the spread effect is the positive and negative generalizations people form about disabilities. For example, many believe people with vision loss are great musicians, or have a keener sense of smell and hearing. People who use wheelchairs compete in the Paralympics. People with developmental disabilities are innocent and sweet natured, or people with disabilities are generally sad and bitter. Aside from diminishing the individual and their abilities, such prejudice can set too high, or too low a standard for individuals who are merely human.

Backlash

Many people believe people with disabilities are given unfair advantages such as easier work requirements. Employers need to hold people with disabilities to the same job standards as co-workers, although the methods for accomplishing the tasks may differ from employee to employee.

Denial

Many disabilities such as learning disabilities, mental illnesses, epilepsy, cancer, arthritis and heart conditions are hidden. People tend to believe these are not bona fide disabilities needing accommodation. By valuing and understanding their needs, design professionals help individuals with these types of disabilities enjoy more opportunities.

Fear

Many people are afraid they will do or say the wrong thing around someone with a disability. Therefore, they avert their own discomfort by avoiding the individual entirely. As with meeting a person from a different culture, frequent encounters can raise the comfort level.

3.6.3 Financial barriers

One way to look at financial barriers is to understand the ways they impede innovation. If funding is limited, the chance to develop universally designed projects can be constrained. Also, if a person with a disability cannot access, or has limited access to an environment where they work, live or play, they will never attain full representation among the able-bodied people who also use the space. In turn, low representation disqualifies financial investment in designing or retrofitting environments that accommodate individuals with a disability. It is a "Catch-22" situation.

3.6.4 Systemic barriers

The term systemic barrier refers to situations, policies and/or practices that unfairly exclude members of designated groups from participating in the community. Systemic barriers are often hard to detect and even harder to prove. Again, regardless of ability, many people face systemic barriers and these will be discussed in Section 4.

The latter two obstacles to universal design, financial and systemic, apply to both clients – who may have their quality of life affected by these barriers – and design professionals – who may experience challenges negotiating for them when forwarding the cause of universal design.

4　Accessibility = inclusion

4.1　AN INCLUSIVE ENVIRONMENT

Whether or not one has a disability, access is the determining factor whether an individual is included or excluded in society. Therefore, accessibility is the umbrella term that examines the ways people participate in the world around them – and enjoy the same choices as able-bodied persons.

When a design professional assesses how the environment can be adapted to meet the needs of its users, it's important to understand those needs. As mentioned in Section 3.3 Types of Disability – people with physical, sensory or cognitive disabilities need to be included in shared spaces, and for this to happen design professionals must understand the range of activities in which these users will be engaged. Thus, when people and their activities are fully understood, the environment can be modified accordingly.

This section discusses the importance of accessibility, the impact of employment on people with disabilities, the availability of accessible, affordable housing, examples of universally designed homes and facilities and what real access to public buildings entails.

As well, an abridged checklist for building modifications based on the Access Design Standards, published by The City of Calgary's Advisory Committee on Accessibility (ACA) is provided. For the full set of these standards, please see Appendix A (print version), or the Access Design Standards PDF, posted on The City of Calgary's website: **calgary.ca.**

4.1.1 Making a case for accessibility

Accessibility is more than meeting minimum building codes. It's creating an atmosphere where every person is enabled and given opportunities to live with freedom and dignity. It's about improving quality of life.

Designing with accessibility in mind improves people's ability to participate safely, independently and with dignity. Three areas pertaining to accessibility are as follows:

Social inclusion: people with disabilities are included in mainstream society when they are not denied access.

Right to access: all people have a basic right to access. People with disabilities are not second-class citizens.

Usability: access is important. However, it must go a step further and be practical to use.

Figure 6: Interconnectivity model

Activity

Environment

Person
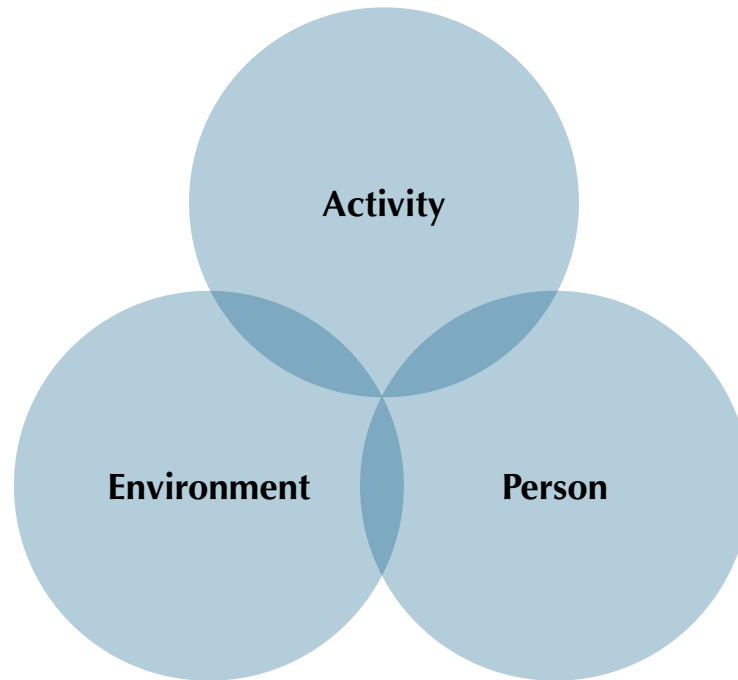
4.2 INCLUDED IN EMPLOYMENT

When you create appropriate physical environments in the workplace, from workstations and transportation, to ease-of-use in the staff kitchen and washroom, you create successful employees. Inviting, attractive spaces influence how well employees are recruited and retained. If these environments were also more accessible, a higher representation of people with disabilities would be found in the workplace.

Bearing this in mind, many employers are now recognizing that the work environment has the potential to be an unsafe, hazardous place. They are taking steps to remedy this for all of their employees.

Universal design in practice

Employers, including The City of Calgary, have provided ergonomically supported workstations for their employees since 1999. Ergonomics, the science of designing the job, equipment and workplace to fit the worker, is as proactive in preventing a chronic disability as it is in compensating for existing disabilities. Proper ergonomic design is necessary to prevent repetitive strain injuries from worsening over time and developing into long-term disabilities.

People with a disability are frequently denied the opportunity to work due to discriminatory attitudes by employers, inaccessible working environments, lack of access to education and training opportunities, lack of suitable information and support, and assumptions that work is not a suitable place for the disabled. To ensure people with disabilities are fully included in working life, new developments – including office space and other employment locations – should be fully accessible (Greater London Authority, 2004).

Figure 7. Median income for Canadians with and without a disability (2001)
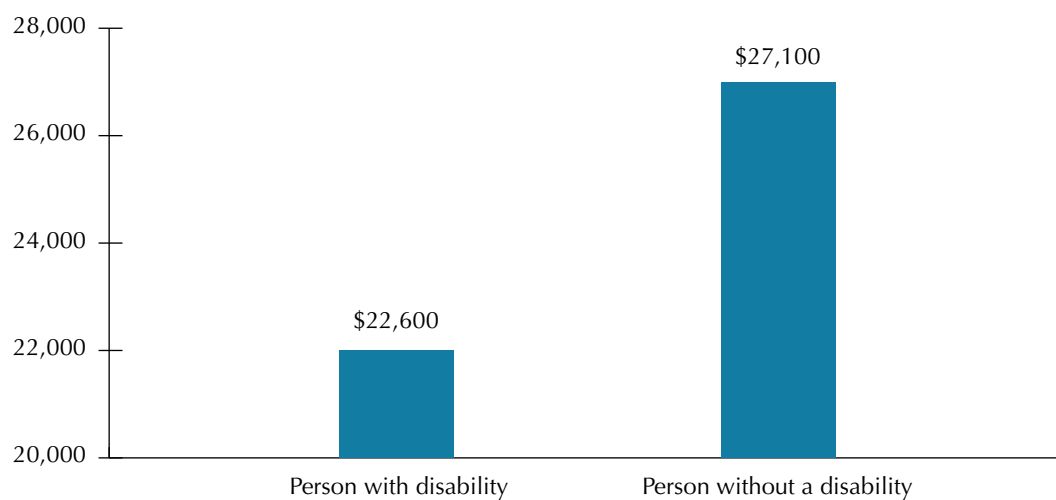
Source: Statistics Canada, Participation and Activity Limitation Survey, 2001

4.2.1 Employment policies

Once policies are written to include people with disabilities in the workplace (see Section 5.4, The City of Calgary Corporate Initiatives), systemic barriers are reduced. The Alberta Human Rights and Citizenship Commission (2008) introduced the *Duty to Accommodate* policy under the ruling of the Supreme Court of Canada. This ensures employers take reasonable steps in policies or conditions of work to accommodate an employee's individual needs.

This duty, further explained in Section 5.2.2, is the obligation of the employer to meaningfully incorporate diversity into the workplace. This policy involves eliminating or changing rules, policies, practices and behaviours that discriminate against persons based on such characteristics as race, national or ethnic origin, colour, religion, age, gender (including pregnancy), sexual orientation, marital status, family status and disability (Canadian Human Rights Commission, 2004).

4.3   ACCESS TO HOUSING

Statistics Canada defines the Presence of Disability in the Household (PDIH) as at least one person in the household having long-term disabilities or activity limitations. According to 2006 Federal census data, PDIH represents 29.3 per cent of all 383,640 households in Calgary (Statistics Canada, 2006f). Twenty-two per cent of PDIH households need affordable housing because they also are low-income and spend more than 30 per cent of their gross household income on shelter (Statistics Canada, 2006f).

Fast fact

In 1990, a U.S. survey by DuPont de Nemours revealed that 86 per cent of employees with disabilities were rated average or above for attendance. DuPont's 30-year analysis also showed that Americans with disabilities have equal or higher performance ratings, less absenteeism and better retention rates. The result was reduced costs associated with turnover (DuPont, 1996).

This section focuses on local and international examples of universally designed homes, and introduces some success stories of affordable housing in Calgary.
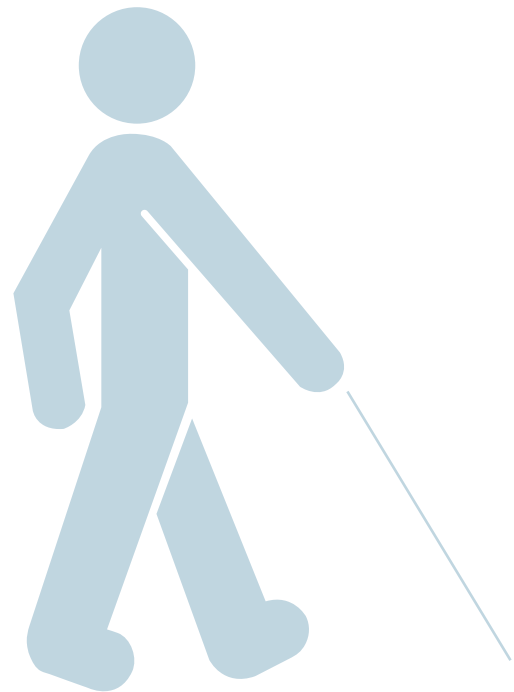
4.3.1 Local case studies

Crestwood

In 2006, a $13.2 million, 60-unit affordable housing development in Millican-Ogden, a community in southeast Calgary, took an important step forward. The Crestwood Affordable Housing Development was created to help working families and persons with a disability in Calgary access below-market housing, with money remaining to meet other basic quality-of-life requirements (The City of Calgary, 2006b).

The building includes seven one-bedroom and three two-bedroom wheelchair accessible units. Other features include balconies and courtyard patios, underground bicycle and automobile parking, a child play area, laundry area, resource centre, administration office, on-site security, and a drop-off area for residents with mobility restrictions.

The development uses sustainable Leadership in Energy and Environmental Design (LEED™) features to reduce energy consumption and operation costs over the life of the building. High quality construction materials further the development's long-term sustainability.

Universal Home for Safe Living

The Universal Home for Safe Living pilot project featured a house built for accessibility and safety. This house was created in partnership with the Calgary Police Services, The City of Calgary Planning & Building department, Homes by Avi, and Linnie Tse, a local environmental designer.

Designed for people with varying disabilities, the home maintains décor while remaining user-friendly and crime-resistant (The City of Calgary, 2007e). It features an elevator, wheelchair access, textured paint, reinforced walls, rounded corners, indirect lighting, movable cabinets, surveillance cameras, laser-triggered light switches and much more. As such, it addresses the safety and crime prevention needs of people with various disabilities while remaining applicable to any homeowner's needs, regardless of ability (The City of Calgary, 2007e).

Furthermore, the Universal Home for Safe Living included green initiatives such as low-flow plumbing fixtures, low-emitting paint and adhesives, efficient lighting and acoustic sound-reducing floor matting. It is LEED™ certified. The Universal Home for Safe Living was awarded the Alberta Home Builders Association 2000 Award of Excellence in Innovation and received the Mayor's Award for Accessibility that same year.

Personal encounter

Camika is invited to be the guest speaker at an awards luncheon. Knowing that she requires accessible facilities, the organizer calls the conference facility where the function is being held and asks if the facilities are accessible.

"Absolutely," replies the manager. Camika is pleased to find automatic doors entering the facility and a ramp onto the platform where she can deliver her address.

After speaking, Camika goes to use the washroom and is extremely disappointed to find that although there is an "accessible" washroom, it is nearly impossible to use. Her mobility device barely fits into the stall and the door doesn't close. The toilet paper dispenser is placed too high and behind the toilet on the adjacent wall. Seeing this, Camika leaves the washroom and heads straight to the manager. She brings him into the washroom and shows him the problems. He promises to have the alterations done immediately.

4.3.2 International case studies

Lifetime Homes

An example of a universally designed home is Lifetime Homes, based in London, England. This development company's objective is to make life as easy as possible for users, for as long as possible. They build homes for people of all ages to ensure anyone residing in them benefits from the many customized choices individuals can make. The flexibility and adaptability of Lifetime Homes accommodate life events quickly, cost-effectively and without upheaval (Lifetime Homes, 2007).

Lifetime Homes includes 16 design features to ensure a new house is flexible enough to meet the existing and changing needs of most households. Lifetime Homes include a number of attractive features to help make homes universal in their appeal and application, yet do not substantially increase the construction costs (Lifetime Homes, 2007).

Because Lifetime Homes builds structures/homes suitable for older people (the vast majority of which have a disability) they have a wide market of potential buyers and residents, thus increasing their value and the ease with which they are resold (Lifetime Homes, 2007). These homes are ideal in the context of an aging population.

4.3.3 Visitability

When envisioning an accessible home, many believe only people with disabilities reside in these types of homes. Actually, accessible homes also refer to residences a person with a disability may visit (e.g. a friend or family member's home). The Canadian Centre on Disability Studies (CCDS) defines visitability as:

"…a movement, as well as a policy and a technical strategy, to change home construction practices so that virtually all new single-family homes offer a few specific features that make the home easier for people with a physical disability to live in and visit. Visitability ensures that everyone, regardless of mobility, will be able to at least visit someone else's home, use the washroom and exit the home" (The City of Calgary, 2007d).

The three minimum standards for a visitable home are: 1) a zero-step entrance at the front, back or side entrance (located on an accessible route from the street), 2) wider doorways on all main floor doors (minimum 813 mm clear door opening), and 3) a half-bath on the main floor (minimum requirements include a sink, toilet and a wider doorway) (Canadian Centre on Disability Studies, 2007).

4.4 USING PUBLIC BUILDINGS

The Award for Accessibility recognizes buildings in Calgary significantly exceeding the minimum requirements of the Alberta Building Code for accessibility. The City of Calgary Access Design Subcommittee chooses the recipient each year and in 2007, the Calgary Award for Accessibility was presented to the Alberta Children's Hospital.

The Alberta Children's Hospital was designed by Kasian Architecture Interior Design and Planning Limited. Every area of the facility is accessible by wheelchairs, including exam rooms, washrooms and playgrounds. Other features include a playground tree house with wheelchair access, a parkade with low-sloped floors for easier wheelchair and stroller travel, motion-sensored sliding doors, lowered counters at nurse stations and reception desks, and low-placed windows and aquariums (760 mm above floor elevation) to ensure small children, including those in wheelchairs, can see the view.

4.5   ACCESS DESIGN CHECKLIST (ABRIDGED)

This checklist for building modifications is based on the Access Design Standards (2010), published by The City of Calgary's Development & Building Approvals. For the full set of these standards, please see Appendix A (print version), or the Access Design Standards PDF, as posted on The City of Calgary's website: **calgary.ca.**

A*	Exterior Barrier-Free Path of Travel			
	Category	**Requirement**	**Detail**	**✓**
A.3.1	**Surfaces and textures**	proper drainage		
		slip resistant		
		stable and even texture		
		consistent tactile qualities 👁		
A.3.2	**General**	path		
		sidewalk joint 👁		
		rest areas		
A.3.3	**Obstructions**	horizontally projecting obstructions		
		sidewalk/electrical vault gratings 👁		
		parked vehicles and vegetation		
		street furniture		
		temporary signs		
		guy-wires		

*In the interest of clarity, categories "I" and "O" have been deliberately omitted from the following tables.

A*		Exterior Barrier-Free Path of Travel		
	Category	**Requirement**	**Detail**	**✓**
A.3.4	**Curb ramps (designed to The City of Calgary standards)**	location 👁		
		specifications 👁		
		indirect placement on corner 👁		
		clearly defined		
		surfaces		
A.3.5	**Snow removal**	unimpeded travel 👁		

B	Interior Barrier-Free Path of Travel			
	Category	**Requirement**	**Detail**	**✓**
B.3.1	**General**	corridors wide enough for two wheelchairs to pass 👁		
		include footrest in turning radius for doorways and corners		
		consistency of materials and colours		
		materials to promote balanced sound attenuation		
B.3.2	**Obstructions**	staircases		
		signage 👁		
		protrusions		
B.3.3	**Floor surfaces**	unimpeded pedestrian movement 👁		
		slip-resistant		
		unimpeded perception		

B	Interior Barrier-Free Path of Travel			
	Category	**Requirement**	**Detail**	✓
B.3.4	**Wall surfaces**	smooth surfaces		
		unimpeded perception		
		unimpeded pedestrian movement 👁		
C	Vehicular Access			
	Category	**Requirement**	**Detail**	
C.3.1	**Lay-bys** 👁	close to main entrance		
		curb separation		
		cover adjacent entrance		
C.3.2	**Layout of parking areas**	safe, clear path of travel		
		differentiated pedestrian routes		
		gravel lots		
		subdivide large lots with vegetation 👁		

C		Vehicular Access		
	Category	**Requirement**	**Detail**	
C.3.3	**On-site road parking**	accessible stalls at both ends of block 👁		
		near sidewalk and ramps		
		parking meters/machines that do not require twisting or pinching action to operate		
C.3.4	**Parking stalls** 👁	individual parallel stalls		
		two or more adjacent stalls		
C.3.5	**Signage**	international symbols		
C.3.6	**Parkades** 👁	accessible stalls on each level		

D	Illumination and Acoustics			
	Category	**Requirement**	**Detail**	**✓**
D.3.1	**Illumination**	control glare		
		enhance illumination at critical locations		
		controls and operating mechanisms		
		enhanced level of illumination outdoors		
D.3.2	**Acoustics**	sound-absorbing materials		
		switches to turn off noisy devices		
		loud speakers away from crucial areas of communication		

E	Location of Controls, Dispensers and Receptacles			
	Category	**Requirement**	**Detail**	**✓**
E.3.1	**General requirements**	operation		
E.3.2	**Safety and Emergency Controls**	placement 👁		
E.3.3	**Lighting fixtures**	light switches 👁		
		rocker switches preferred		
E.3.4	**Electrical outlets**	placement		
E.3.5	**Faucets**	water taps 👁		

F	Building Entrances, Doors and Doorways		
	Category	**Requirement**	**Detail**	**✓**
F.3.1	**Entrances**	distinguishable facade		
		consideration of weather effects		
		good lighting and signage		
		sliding doors 👁		
F.3.2	**Specifications for people with vision loss**	transition space		
		door push plates		
		marked glass doors		
		numbers on doors 👁		
		exit doors opening into high traffic areas shall be recessed		
F.3.3	**Door openers and hardware**	opening doors		
		door-release hardware 👁		
		handles 👁		
		security		
		smooth kickplate 👁		

F	Building Entrances, Doors and Doorways			
	Category	**Requirement**	**Detail**	✓
F.3.4	**Doors and gates**	door opening		
		doors in a series shall be power assisted		
		door width 👁		
		revolving door or turnstile		
		timing 👁		

G	Ramps			
	Category	**Requirement**	**Detail**	✓
G.3.1	**General requirements** 👁	locate on private property, outside of road right-of-way		
		slopes		
		width		
		wheelchair passing		
		landings 👁		
		for people with vision loss		
		cross slope		

G	Ramps			
	Category	**Requirement**	**Detail**	✓
G.3.2	**Exterior ramps**	weather 👁		

H	Stairs			
	Category	**Requirement**		✓
H.3.1	**General requirements** 👁	location		
		dimensions		
		illumination		
		nosing		
H.3.2	**Interior stairs**	do not use heavily patterned carpet		
H.3.3	**Exterior stairs**	weather		

J	Handrails and Guards			
	Category	**Requirement**	**Detail**	**✓**
J.3	**Handrails** 👁	located on both sides of a ramp or stairway		
		tactile cues and arrows on handrail at top and bottom of stairs and ramps		
		handrails to contrast with surrounding surfaces		
		leave space between handrail and wall		
K	Elevators			
	Category	**Requirement**	**Detail**	**✓**
K.3.1	**General requirements** 👁	all elevators to be accessible		
		follow Alberta Building Code		
K.3.2	**Elevator lobbies**	elevator doors 👁		
		call buttons		
		signage		
K.3.3	**Floor registration buttons**	inside elevator 👁		

K	Elevators			
	Category	**Requirement**	**Detail**	✓
K.3.4	**Exterior elevators**	weather		
		security		

L	Public Washrooms			
	Category	**Requirement**	**Detail**	✓
L.3.1	**Entrances** 👁	avoid vestibules with two doors		
L.3.2	**Stalls**	clear opening		
L.3.3	**Fixtures** 👁	toilet paper dispensers		
		soap dispensers		
		hand towels/dryers		
		toilet seat cover dispenser		
		waste receptacles		
L.3.4	**Knee space** 👁	"P" traps offset horizontally		
L.3.5	**Universal washrooms**	easily accessible		
		located on main floor near main entry		
		call buttons in buildings with security personnel		

M	Recreational and Cultural Centres			
	Category	**Requirement**	**Detail**	**✓**
M.3.1	**Swimming pools**	ramp and stairs with handrails 👁		
		power hoist 👁		
		signage		
M.3.2	**Ice rinks and exercise areas** 👁	plexiglas for sledge hockey viewing		
		player and penalty boxes		
		seating and handrails		
		raised platforms for stretching		
		wheelchair access to some exercise equipment		
		tactile signage		
M.3.3	**Exhibits**	more than one method of presentation		
		display cases 👁		
		signage		

M	Recreational and Cultural Centres			
	Category	**Requirement**	**Detail**	✓
M.3.4	**Drinking fountains**	placement 👁		
		controls		
M.3.5	**Shower fixtures**	diverter mechanism		
		storage shelf		
M.3.6	**Common showers** 👁	bevelled threshold		
		flexible hand-held sprayer		
		1:20 slope for drainage		
M.3.7	**Individual change/shower room** 👁	space for family member and caregivers		
		elevated change platform		
		turning radius		
		grab bars, coat hooks and shelving		
N	Public Facilities			
	Category	**Requirement**	**Detail**	✓
N.3.1	**Counters** 👁	service counters/work surfaces		
		knee space		
		speaker system for two-way communication		

N	Public Facilities			
	Category	**Requirement**	**Detail**	**✓**
N.3.2	**Cafeterias** 👁	counter		
		liquid dispensers		
		location of food		
N.3.3	**Assembly seating in public facilities** 👁	chairs		
		sightlines		
		level spaces for wheelchairs		
		accessible seating space 👁		
N.3.4	**Permanent barriers** 👁	removable posts		
		pedestrian flow barriers		
		avoid use of cables, chains or ropes		

P		Parks, Pathways and Playgrounds		
	Category	**Requirement**	**Detail**	**✓**
P.3.1	**General considerations**	parks to be accessible from other communities		
		fences, earth berms, etc.		
		signage		
		rest areas 👁		
		layout		
		weather 👁		
P.3.2	**Pathways**	surfaces 👁		
		flow 👁		
		weather		
P.3.3	**Posts and maze gates**	posts		
		maze gates 👁		

P	Parks, Pathways and Playgrounds			
	Category	**Requirement**	**Detail**	**✓**
P.3.4	**Benches**	seat and armrest 👁		
		include heel space		
		weather		
		use contrasting colour		
		adjacent to accessible routes		
P.3.5	**Picnic tables**	location 👁		
		knee space		
		weather		
P.3.6	**Trash containers**	location		
		operation		
		weather		
P.3.7	**Children's play spaces**	designed in accordance with CAN/CSA – Z614-07, Annex H		

Q	Patios			
	Category	**Requirement**	**Detail**	✓
Q.3	**General considerations**	width of entry and exits		
		clear turning radius 👁		
		at least one eating surface		
		surfaces		
		decor		

R	Emergency Egress, Alarms and Warning Surfaces			
	Category	**Requirement**	**Detail**	✓
R.3.1	**Emergency evacuation**	exits and pull stations easily located		
R.3.2	**Visual fire alarm devices**	visual and auditory signal 👁		
R.3.3	**Detectable warning surfaces**	consistent use of tactile surface		
		detectible warning strips on walking surfaces		

R	Emergency Egress, Alarms and Warning Surfaces			
	Category	**Requirement**	**Detail**	**✓**
R.3.4	**Areas of refuge**	stairwell safest place 👁		
		fire rated		
		served by an exit or firefighter elevator		
		obstruction		
		two-way voice communication system		
		directional and identification signs		
S	**Communications**			
	Category	**Requirement**	**Detail**	**✓**
S.3.1	**Telephones** 👁	availability		
		location		
		specifications		
		weather (for exterior phones)		

S	Communications			
	Category	**Requirement**	**Detail**	**✓**
S.3.2	**Transactions**	require both audio and text messaging		
		automatic teller machines		
S.3.3.	**FM Radio frequency systems**	in large public facilities such as airports		
S.3.4	**Infrared systems**	contain in enclosed space		
		block interference with solid barriers		
		shield from sun		
S.3.5	**Signage**	simple and consistent, symbols preferable to words ☉		
		washrooms		
		public buildings		
		preferably both auditory and visual information presented		

S	Communications			
	Category	**Requirement**	**Detail**	**✓**
S.3.6	**Lettering and numbers**	raised letters 1,350 from floor max., with separated characters and standard location 👁		
S.3.7	**Location of signs**	directional signs at focal points on main traffic routes, and at destination		
S.3.8	**Building directional maps**	tactile maps		
		audio maps		
S.3.9	**Intelligent Navigation System**	encouraged where warranted		

T	Plus-15 System			
	Category	**Requirement**	**Detail**	✓
T.2	**General requirements**	width		
	See also Land Use Bylaw 1P2007 +15 Policy for more details on these requirements 👁	elevators		
		accessible bridges, walkways and lane links		
		hard flooring surfaces		
		stairs		
		sliding doors		
U	Light Rail Transit (LRT)			
	Category	**Requirement**	**Detail**	✓
U.3.1	**Ramps**	weather		
U.3.2	**Handrails and guards**	circumference		
U.3.3	**Communication and security**	pay telephone		
U.3.4	**Elevators**	refer to Section K		
U.3.5	**Announcements**	announcements of delays and emergencies		
U.3.6	**Platforms**	ground surfaces		
U.3.7	**Benches**	benches		
U.3.8	**Transit shelters**	decal around glass panels		

V	Pedestrian Traffic Signals			
	Category	**Requirement**	**Detail**	✓
Contact also the Advisory Committee on Accessibility (ACA) for regulations governing audible pedestrian Traffic Signals.				
V.3.1	**Pedestrian push buttons**	tactile directional arrows		
		audible and visual signals		
V.3.2	**Audible signals** 👁	to be heard above ambient noise		
		located in high-traffic areas		
		unified constant tone for duration of crossing		
		signal posts to emit a low slow sound		
		distinct tones		

pending Council approval

W	Crime Prevention through Environmental Design (CPTED)			
	Category	**Requirement**	**Detail**	**✓**
For more information, or to receive a CPTED review of designs, please also contact: Calgary Police Services.				
W.3.1	**General requirements**	surveillance (compensate for lack of expensive human resources with adequate design elements)		
		walkways/transitions from public to semi-public to private spaces		
		public gathering areas		
		scheduling		

X	Universal Dwelling Units			
	Category	**Requirement**	**Detail**	**✓**
For more information on these requirements, see the *Alberta Building Code 2006, 9.5.2.2, STANDATA 06-BCI-010,* the *Canadian Institute for the Blind (CNIB),* CAN/CSA-B651-04, and the Canadian Mortgage and Housing Corporation (CMHC)				
X.3.1	**General considerations**	turning spaces		
		doors		
		handles		
		light switches		
		breaker panel		
		plumbing under sink		
		electrical outlets		
		wall thermostats		
		sliding shelves		
		cabinetry		
		walls		
		baseboards		
		thresholds		

X	Universal Dwelling Units			
	Category	**Requirement**	**Detail**	**✓**
X.3.2	**Entrances**	closets		
X.3.3	**Living spaces**	shelves		
X.3.4	**Kitchen**	countertops/work surfaces		
		drawers		
X.3.5	**Washrooms**	toilet		
X.3.6	**Laundry room**	in-suite laundry room		
		common laundry room		
X.3.7	**Bedroom**	telephone jack		
		closets		
X.3.8	**Visual emergency and non-emergency alarms**	visual signal devices		

5   Policies supporting universal design

"The object of universal design is to create a building or a product that can be used by both someone who is eight years old and one who is 80. By designing for as broad a market as possible, it's no longer special – setting a certain consumer apart from everyone else. Universal design at its best is seamless, almost invisible."

— *George Covington*

Basic human rights legislation forms the backbone to how accessibility and social inclusion are practised in regards to people with disabilities. The goal of this section is to convey the various international, national, provincial and local policies in place to encourage citizens to re-think accessibility rights for people with disabilities.

Legislative directives ensure there are the means of enforcing such policies. Most importantly, this section asks design professionals not to be limited to what is outlined in policy or legislation, but to exceed these minimum standards and aim to achieve the highest standards of safe, easy and inclusive access.

5.1   INTERNATIONAL AND FUNDAMENTAL HUMAN RIGHTS POLICIES

Proclaimed in 1948 by the United Nations (UN), the *Universal Declaration of Human Rights* states:

"…recognition of the inherent dignity and of the equal and unalienable rights of all members of the human family is the foundation of freedom, justice and peace in the world…"
(United Nations, 2008a).

Many policy makers use the UN's *Universal Declaration of Human Rights* as a foundation to develop or enhance policies within their own area of interest. Further to the *Universal Declaration of Human Rights* is the UN's *Adequate Standard of Living and Social Protection, Article 28 (1)*:

"Parties recognize the right of persons with disabilities to an adequate standard of living for themselves and their families, including

adequate food, clothing and housing, and to the continuous improvement of living conditions, and shall take appropriate steps to safeguard and promote the realization of this right without discrimination on the basis of disability" (United Nations, 2008b).

5.2 CANADIAN HUMAN RIGHTS POLICY

5.2.1 The Canadian Charter of Rights and Freedoms states:

"Every individual is equal before and under the law and has the right to the equal protection and equal benefit of the law without discrimination and, in particular, without discrimination based on race, national or ethnic origin, colour, religion, sex, age or mental or physical disability" (Canadian Charter of Rights and Freedoms, 2004).

The cornerstone of many government policies and legislation is the fact that all people are considered equal under the law. However, many of these laws may not be adopted, enforced or translated into daily life for people with disabilities.

5.2.2 The Canadian Human Rights Commission and the *Canadian Human Rights* Act

Article 28 (1) of the UN's *Adequate Standard of Living and Social Protection* (see Section 5.1) provides a solid foundation for the *Canadian Human Rights Act* for people with disabilities. The Act supports universal design on the premise that basic human rights include access to services and facilities for people with disabilities. The Act (and the Commission itself, by its very existence) recognizes that individuals with disabilities must have access to premises, services and facilities without discrimination (Canadian Human Rights Commission, 2003).

Although accessibility is embedded in the *Canadian Human Rights Act*, it is the responsibility of the community and design professionals to ensure access is provided to people with disabilities. Using *The Canadian Human Rights Act* as a base for providing access, projects need to go above and beyond province-specific building codes.

5.3 SECTION 3.8 OF THE ALBERTA BUILDING CODE

The Alberta Building Code (2006) governs design professionals on minimally acceptable levels of safety for a project. A component of this is Section 3.8, Barrier-Free Design. This code provides a baseline for providing access and safety to all building projects. Going above and beyond these minimum requirements is the desired goal of many design professionals, who seek to accommodate a universally designed environment for all users.

Section 3.8, Barrier-free Design can be found at: **www.safetycodes.ab.ca.**

5.4 THE CITY OF CALGARY CORPORATE INITIATIVES

In keeping with The City of Calgary's corporate vision, "Working together to create and sustain a vibrant, healthy, safe and caring community," the following policies are a concrete, tangible way of accomplishing The Corporation's goals and objectives.

Five important City of Calgary policies: (1) *Access Design Standards*, (2) *Calgary Corporate Accessibility Policy, (3) The Triple Bottom Line (TBL)*, (4) *Fair Calgary, and (5) Sustainable Environmental and Ethical Procurement Policy (SEEPP),* all use, as their foundation, the *Universal Declaration of Human Rights*, the *Canadian Charter of Rights and Freedoms* and the *Canadian Human Rights Act* – which apply equality under the law for creating a community of social inclusion.

5.4.1 Access Design Standards

The *Access Design Standards* were developed by The City of Calgary's Advisory Committee on Accessibility Access Design Subcommittee and exceed Alberta Building Code Section 3.8 requirements. These standards demonstrate how design professionals, the building industry, government and the community can go above and beyond requirements to ensure equal access for people with disabilities.

Use of the *Access Design Standards* as a reference guide increases awareness of the needs of people with disabilities and older adults. The Standards also focus on hidden disabilities (for instance, sensory and cognitive disabilities) and look at how universal design principles may be applied across disabilities (The City of Calgary, 2009).

5.4.2 Calgary Corporate Accessibility Policy

This policy acknowledges that in order to create accessible environments, the process needs to start with City of Calgary owned and operated facilities and services. As outlined in the *Calgary Corporate Accessibility Policy*, The City of Calgary is committed to…

". . . work towards the reduction and elimination of barriers to the physical access of City-owned and operated buildings, walkways, pathways and parks, transportation access to all its services and communication access in the form of interpretive services" (The City of Calgary, 2005).

5.4.3 The City of Calgary's Triple Bottom Line (TBL) Policy

The City of Calgary's Triple Bottom Line (2005) is an approach to decision-making that considers economic, social and environmental issues in a comprehensive, systematic and integrated way for all Calgarians. Universal design principles align with all five social themes which for Calgary are defined as:

- **An inclusive city:** "The City of Calgary values and promotes independence and is a vital partner in creating an inclusive city where all Calgarians have the opportunity to take an active part in the social, economic and cultural life of the community.

  To accomplish this, The City of Calgary seeks to ensure equitable access to City services and amenities regardless of age, income, culture or physical ability, and fosters participation by persons from diverse populations and seeks to ensure that civic programs and services reflect and respond to the changing social and demographic structure of society."

- **A safe city:** "The City of Calgary seeks to ensure a safe environment for individuals and families through the provision of emergency services (Police, Fire and Emergency Medical Services*). The City also works with the community to promote safety and prevention through programs such as education and appropriate physical design."

*Calgary Emergency Medical Services transferred to the Province of Alberta April 1, 2009, and now operates under Alberta Health Services.

- **A cultural city:** "The City of Calgary seeks to promote and maintain a high quality of life through the provision and support of opportunities for recreation, leisure, artistic expression and appreciation, special events, and the preservation of the city's heritage. The City of Calgary is a vital partner in creating an inclusive community where cultural diversity is embraced and valued as a community asset. The City of Calgary both initiates and supports projects aimed to enhance and support diverse cultures and traditions."

- **An active city:** "The City of Calgary strives to create and sustain a healthy community by promoting active living through the provision of a wide range of sustainable and accessible recreational programs, services, facilities, and amenities. The City of Calgary provides leadership and encourages physical activity through funding, capital, promotion, partnerships and appropriate urban planning and design."

- **A city of strong neighbourhoods:** "The City of Calgary promotes strong neighbourhoods through the development and support of integrated communities with a varied social composition and a strong sense of place. Working in partnership with other stakeholders, The City achieves this through appropriate planning and design that provides easy access to a compatible range of public and private services and amenities that respond to the needs of a diverse population.

A high quality of life in neighbourhoods is maintained through planning approaches that promote privacy, safety and quiet within residential areas, with easy access to transit, community services, parks, open space and amenities.

5.4.4 Fair Calgary Policy

The City of Calgary's Fair Calgary Policy (2006) supports outcomes that directly relate to universal design principles by reinforcing social cohesion, healthy living, social integration and security.

- **Social cohesion** is enhanced by strengthening connections, interactions and accessibility – and allowing for opportunities to participate in the community. As such, formal and informal supports are established and individual support networks are optimized.

- **Healthy living** occurs when the urban system contributes to an individual's physical, social, economic, emotional and psychological well-being, as well as providing for aesthetic enjoyment, recreation and personal development.

- **Social integration** is fostered and supported by The City's contribution to a harmonious and diverse community, where mutual respect is the basis for everyone enjoying the same rights and responsibilities, and where everyone is capable of participating and playing an active role in their community and neighbourhood.

- **Security** is what happens when a city, along with its corresponding neighbourhoods, is dedicated to safe, supportive and healthy environments – be they social, economic, psychological or physical.

5.4.5 Sustainable Environmental & Ethical Procurement Policy (SEEPP)

The City of Calgary's SEEPP (2008) process not only promotes awareness of environmental and ethical issues, it also encourages supply chain practices that have a positive impact on social, economical and environmental sustainability.

The City of Calgary is committed to being good stewards of our natural and economic resources. A sustainable environmental and ethical procurement policy supports the purchase of products and services that will protect the environment and the welfare of workers while representing the best value for The Corporation by taking into account the following:

- Social and ethical aspects – working conditions.

- Environmental aspects – over the life cycle of products.

- Price, quality, availability and functionality.

6   The future of universal design is here

6.1   URBAN BRAILLE SYSTEM

Have you ever walked through a maze and found it difficult to navigate your way? Did you find the lack of signage and lack of orientation provided barriers in locating the exit? This is one example of what people with a visual disability experience when walking downtown. They know where they need to go but have some difficulty getting there with limited, or no signage to direct them.

6.1.1 National initiatives

Hamilton, Ontario is one Canadian city which has taken the lead in providing a way-finding system for people with a visual disability. Urban Braille, developed by the City of Hamilton, is a system of tactile information serving the needs of people with vision loss. Markings are pressed on the concrete sidewalk as a way-finding and safety aid for pedestrians with a visual or physical disability. This system of markings indicates directional changes, sidewalk boundaries, as well as minimum clearances for mobility device access on the street.

Hamilton is one of North America's most accessible cities and is world-renowned for its efforts to improve accessibility for all citizens (Tomic, 2003). The "Made in Hamilton" Urban Braille system was developed through a collaborative effort between the City of Hamilton (Planning and Public Works departments and the former City's Pathway Committee), McMaster University, and the Canadian National Institute for the Blind (Tomic, 2003).

The Urban Braille system is based on three main elements: sensory channels, tactile information and orientation aids.

Sensory channels are based on our five senses: sight, sound, touch, smell and taste. Once a sensory channel is limited or diminishes, the other channels are used as an alternative. The Urban Braille system recognizes that not all users of public space utilize all five senses. That being said, this system has integrated the sense of touch into their way-finding scheme as an alternative to sight and developed ways to navigate public space users more easily (Tomic, 2003).

Tactile information – two types of textures (smooth and grooved) produce up to 10 distinct clues or "letters of Urban Braille" located on sidewalks and other horizontal surfaces (Tomic, 2003). Tactile information is one of the most important ways to guide people with a visual disability through the built environment. The blind and visually impaired can train to distinguish four or five materials and a variety of textures with their hands and a cane (Tomic, 2003).

Orientation aids are another way to help all public space users navigate their destination. The following information is communicated through the Urban Braille system: directional change (compass North, South, East and West), hierarchy of pathways (major path versus minor path), entrance to buildings, sidewalk/road boundaries, ramps versus raised pedestrian crossings/intersections and other/additional information such as underpasses, social activities, building information, addresses and business information (Tomic, 2003).

6.1.2 Calgary initiatives

Calgary is another Canadian city that adopted and incorporated Urban Braille in the plans to revitalize its Centre City. Calgary Urban Braille is a comprehensive, user-driven approach to planning and designing the public realm. In addition to traditional accessibility-related streetscape elements, the Calgary Urban Braille System (CUBS) engages other sensory channels, from tactile to auditory, to serve the needs of people with different levels of vision loss. By utilizing colour and texture contrast and audio devices, it provides warning signals and clues related to orientation in complex urban space (The City of Calgary, 2007f).

CUBS is primarily intended for public areas with high volumes of pedestrian traffic. The system may also be appropriate for special public spaces, or special character areas such as riverfronts and squares, where seasonal events may attract large numbers of pedestrians and users with special needs (The City of Calgary, 2007f).

The public realm can be thought of as the living room of a city. It's a place where citizens sit, watch what's going on around them like watching television, or engage with other citizens as one would at a dinner party. It's an important concept in any locale where individuals converge, live and share, but it's expensive to construct and maintain. The current practice – design for one season (summer) only and predominantly for a young and healthy segment of population – does not provide a safe and inclusive public realm.

Current demographic trends, including a rapidly aging population, challenge previous approaches to the design of public realms. The Calgary Urban Braille System responds to this challenge by providing a range of low- to high-tech solutions that cater to a wide variety of users and ages (The City of Calgary, 2007f).

6.2 ACCESSIBLE WEBSITES

Universal design is not only for those professionals who build physical environments, but also for web developers, information architects, content managers, graphic designers and writers constructing websites.

Web accessibility refers to the degree a site is accessible to the largest possible range of people (Curran et al., 2007). The Web Content Accessibility Guidelines (WCAG) are established for these professionals in order to promote an inclusive digital society.

6.2.1 Research

Research on accessible websites is extensive and a variety of investigators are continually looking into the usability of such sites for people with visual impairments, learning disabilities and older adults.

Karreman et al. conducted a study on how WCAG-designed websites work for people with intellectual disabilities. The results show the adaptation of the website worked well for these participants. The study also showed that users without identified intellectual disabilities were as effective with the adapted site as with the non-adapted site. The results form an empirical basis for recommendations about applying guidelines for easy-to-read text on websites for people with intellectual disabilities (Karreman et al., 2006).

6.2.2 Media

Media reports on accessible websites are also becoming more and more available – predominantly from Europe. For example, an article in *The European Commission* (The Commission Européenne, 2007) headlined, "European Initiative on an All-Inclusive Digital Society: Frequently Asked Questions," noted that inclusion in the digital society (e-inclusion) was a necessity for everyone to be actively engaged with society and the economy. The article goes on to discuss why e-inclusion is important, how accessible Information and Communication Technologies (ICT) products and services are and how citizens and Europe can benefit from e-inclusion.

Another news article found in *The Times Online* headlined, "21st Century Entrepreneurs: Ahead of the Final of Said Business School's 21st Century Challenge." This article showcased modern day entrepreneurs developing leading-edge technologies. For instance, one entrepreneur developed a screen that allows visually impaired users to feel the content appearing on the screen by using their fingers as a mouse. The article reads:

"…[That] disabled people face disadvantages in today's society is sadly, nothing new. But in our increasingly computer-dependent world, the blind community in particular struggles with modern technology so central to most people's personal and working lives. Attempts to make computers suitable for blind people to use have been largely unsatisfactory, says Ethan Smith, 25, the founder of Tactile Response and a finalist in the Tomorrow's People category.

Studying for a master's degree in computer science and psychology at the University of Central London, he spotted a gulf in the provisions for blind was very difficult for blind people to use computer systems. Current Braille display readers just show one line at a time – it's cumbersome and frustrating."

Hence Tactile Response, the company he set up to market BrailleScreen, a revolutionary computer screen that allows blind people to feel the icons, boxes and text, using their fingers as a mouse. Smith estimates equipment will cost less than $200 (£100) to purchase – compared with current readers costing more than £2,000 – and will change the lives of 20 million people coping with sight loss.

"It's been a long time coming," he says (Ford, 2007).

A third article refers to Bill 511, known as the *Illinois Information Technology Accessibility Act,* which became law in August 2007. The law requires Illinois state agencies and universities to make their websites, systems and other information technologies accessible to people with disabilities. Western Illinois University developed a Web Accessibility Policy, which was approved by the President of the University (Western Courier, 2007).

6.2.3 World Wide Web Consortium (W3C) Guidelines

The *Web Content Accessibility Guidelines,* as set out by the World Wide Web Consortium (W3C) Web Accessibility Initiative, explain how to make web content accessible to people with visual, auditory and cognitive disabilities.

These guidelines cover a set of checkpoints outlined in four principles:

(1) **Perceivability:** information and user interface components must be presentable to users in ways that aren't invisible to all of their senses.

(2) **Operability:** the interface cannot require an interaction that a user is unable to perform.

(3) **Understandability:** the content, operation or interface cannot be beyond their understanding.

(4) **Robustness:** content must be interpreted reliably by a wide variety of user agents as they evolve, including assistive technologies.

If any of these four principles are not inherent in a site, users with disabilities will not be able to use the Web (Web Accessibility Initiative, 2009).
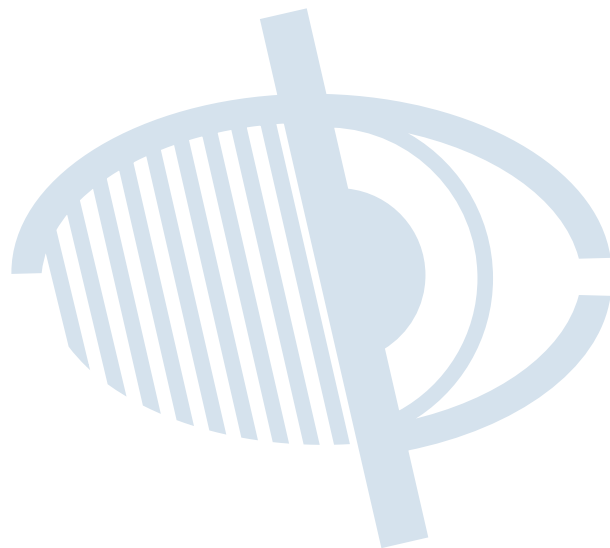
6.2.4 Web accessibility checklist

The City of Calgary – along with a number of city-wide organizations – is committed to producing an accessible website by following the W3C checkpoints summarized below (The City of Calgary, 2006c). A more detailed list, along with instructions about when and how to use the guidelines on a case-by-case basis, are found at the World Wide Web Consortium (W3C) Web Accessibility Initiative website (2009), under the *Web Content Accessibility Guidelines v.2.0.*

Guidelines		Details	✓
Principle 1: Perceivable		**Information and user interface components must be presentable to users in ways they can perceive.**	
1.1 Text alternatives		**Provide varying ways that non-text content can be changed to other forms people need such as large print, Braille, speech, symbols or simpler language.**	
	1.1.1	**All non-text content is presented along with a text alternative that serves the equivalent purpose, except for the following situations.**	
	1.1.2	**Controls, input:** if a control, or accepts user input, then it must have a descriptive name.	
	1.1.3	**Time-based media:** if moving, then text alternatives provide description.	
	1.1.4	**Test:** if a test or exercise that is invalid if presented in text, then alternatives must provide description.	
	1.1.5	**Sensory:** if intent is a sensory experience, provide descriptive identification.	
	1.1.6	**CAPTCHA:** if to confirm that content is being assessed by a person rather than computer, provide descriptors and alternate forms of CAPTCHA-using output modes for different sensory perception.	
	1.1.7	**Decoration, formatting, invisible:** if pure decoration, it must be presented in a way that can be ignored by assistive technology.	

Guidelines	Details	✓
1.2 Time-based media	**Provide alternatives for time-based media.**	
1.2.1	**Audio-only/video-only** (pre-recorded): provide equivalent information.	
1.2.2	**Captions** (pre-recorded): are provided for audio in synchronized media.	
1.2.3	**Audio description or media alternative (pre-recorded):** alternative provided for synchronized media.	
1.2.4	**Captions (live):** provided for all audio content in synchronized media.	
1.2.5	**Audio description (pre-recorded):** provided for video in synchronized media.	
1.2.6	**Sign language (pre-recorded):** interpretation provided for audio in synchronized media.	
1.2.7	**Extended audio description:** where pauses in foreground audio are insufficient to allow audio descriptions, extended descriptors are provided.	
1.2.8	**Media alternative (pre-recorded):** an alternative for time-based media is provided.	
1.2.9	**Audio-only (live):** provided as equivalent information.	
1.3 Adaptable	**Create content that can be presented in different ways without losing information or structure (i.e. simpler layout).**	
1.3.1	**Information and relationships:** where being conveyed through presentation is programmatically determined.	
1.3.2	**Meaningful sequence:** when meaning is affected by sequence, a correct reading can be programmatically determined.	
1.3.3	**Sensory characteristics:** where instructions do not rely solely on sensory characteristics such as shape, size, visual location, orientation or sound.	

Guidelines	Details	✓
1.4 Distinguishable	**Make it easier for users to see and hear content, including separating foreground from background.**	
1.4.1	**Use of colour:** not used as the only visual means of conveying information, indicating action, prompting a response or distinguishing a visual element.	
1.4.2	**Audio control:** mechanism provided to pause or stop or control volume of any audio that plays automatically for more than three seconds.	
1.4.3	**Contrast (minimum):** text and images have contrast ratio of at least 4.5:1 except for large text (3:1), incidentals or logo/brand names.	
1.4.4	**Resize text:** customized ability to resize without assistive technology up to 200 per cent without loss of content or functionality.	
1.4.5	**Images of text:** use of text before images of text, except for customizable text and when the presentation of text is essential to information.	
1.4.6	**Contrast (enhanced):** text and images have a contrast ratio of at least 7:1, except for large text (4.5:1), incidentals or logo/brand names.	
1.4.7	**Low or no background audio:** for pre-recorded audio-only that contains primarily speech in the foreground, is not an audio CAPTCHA or audio logo and is not vocalization intended to be primarily musical (singing or rapping). At least one of the following must be true: no background sounds, has a turn-off background capability and a background of at least 20 decibels lower than foreground speech.	
1.4.8	**Visual presentation:** a mechanism for blocks of text must be available where foreground/background colours can be user-selected, width is no more than 80 characters or glyphs (40 if CJK), text is not justified, line spacing is at least space-and-a-half within paragraphs and text can be re-sized without assistive technology up to 200 per cent without requiring user to scroll horizontally to read.	

Guidelines		Details	✓
	1.4.9	**Images of text (no exception):** only used as pure decoration where text is essential to information being conveyed.	
Principle 2: Operable		**User interface components and navigation must be operable**	
2.1 Keyboard accessible		**Make all functionality available from a keyboard.**	
	2.1.1	**Keyboard:** as is relates to underlying function, not simply input technique.	
	2.1.2	**No keyboard trap:** if focus can be moved to component of page using a keyboard interface. If more than unmodified arrow or tab keys are required as standard exit methods, the user must be advised.	
	2.1.3	**Keyboard (no exception):** all functionality without specific timings for individual keystrokes.	
2.2 Enough time		**Provide users enough time to read and use content.**	
	2.2.1	**Timing adjustable:** for each limit set by content, at least one of these capacities must be provided. Turn-off, adjust, extend, real-time exception, essential exception and 20-hour exception.	
	2.2.2	**Pause, stop, hide:** for moving, blinking, scrolling or auto-updating information, all must be true. Starts automatically, lasts more than five seconds and is presented parallel with other content.	
	2.2.3	**No timing:** not an essential part of event or activity presented by content, except for non-interactive synchronized media and real-time events.	✓
	2.2.4	**Interruptions:** customized postponement or suppression.	
	2.2.5	**Re-authenticating:** when expired, user can continue activity without loss of data.	
2.3 Seizures		**Do not design content in a way known to cause seizures.**	
	2.3.1	**Three flashes or below threshold:** no flashes that occur more than three times in any one second, or the flash is below the general flash and red flash thresholds.	
	2.3.2	**Three flashes:** no flashes that occur more than three times in any one second.	

Guidelines	Details	✓
2.4 Navigable	**Provide ways to help users navigate, find content and determine where they are.**	
2.4.1	**Bypass blocks:** available mechanism to bypass blocks of repeated content on multiple pages.	
2.4.2	**Page titled:** all pages have titles that describe topic or purpose.	
2.4.3	**Focus order:** sequentially navigated components must proceed in manner that preserves meaning and operability.	
2.4.4	**Link purpose (in context):** unambiguous purpose of each link, as detailed in link text or programmatically determined context.	
2.4.5	**Multiple ways:** more than one available path to locate a page within a set of pages.	
2.4.6	**Heading and labels:** accurately describe purpose.	
2.4.7	**Focus visible:** interface where keyboard focus indicator is visible.	
2.4.8	**Location:** information about the user's location within site is available.	
2.4.9	**Link purpose (link only):** purpose of each link is identified from link text alone.	
2.4.10	**Section headings:** used to organize content.	
Principle 3: Understandable	**Information and the operation of user interface must be understandable.**	
3.1 Readable	**Make text content readable and understandable.**	
3.1.1	**Language of page:** default language of each page is programmatically determined.	
3.1.2	**Language of parts:** same as above, except for proper names, technical terms, words of indeterminate language and/or vernacular words and phrases.	
3.1.3	**Unusual words:** available mechanism for defining words or phrases, idioms and jargon.	

Guidelines		Details	✓
	3.1.4	**Abbreviations:** available mechanism for expanding to reveal true meaning.	
	3.1.5	**Reading level:** content not requiring more advanced reading ability than lower secondary education level.	
	3.1.6	**Pronunciation:** available mechanism for identifying specific pronunciation, where meaning of words may be hampered.	
3.2 Predictable		**Make web pages appear and operate in predictable ways.**	
	3.2.1	**On focus:** when any component receives focus, it does not initiate a change of context.	
	3.2.2	**On input:** where changing an interface setting does not automatically cause a change of context, unless otherwise directed.	
	3.2.3	**Consistent navigation:** mechanisms are repeated on multiple pages and occur in same relative order.	
	3.2.4	**Consistent identification:** components with same functionality are identified consistently.	
3.3 Input Assistance		**Help users avoid and correct mistakes.**	
	3.3.1	**Error identification:** if automatically detected, error is identified and described to user in text.	
	3.3.2	**Labels or instructions:** provided when content requires user input.	
	3.3.3	**Error suggestion:** if automatically detected, suggestion for correction are provided.	
	3.3.4	**Error prevention (legal, financial, data):** for inputs that modify or delete user-controllable data, or submit user test responses, at least one of the following is true: submissions are reversible, data is checked for input errors, a mechanism is available for reviewing, confirming and correcting data before final submission.	
	3.3.5	**Help:** context-sensitive help is available.	

Guidelines		Details	✓
	3.3.6	**Error prevention (all):** at least one of the following is true: submissions are reversible, data is checked for input errors, a mechanism is available for reviewing, confirming and correcting data before final submission.	
Principle 4: Robust		**Content must be robust enough to be interpreted reliably by a wide variety of user agents, including assistive technologies.**	
4.1 Compatible		**Maximize compatibility with current and future user agents, including assistive technologies.**	
	4.1.1	**Parsing:** in content using markup languages, elements must have start and end tags, elements are nested according to specifications, elements do not contain duplicate attributes and any IDs are unique.	
	4.1.2	**Name, role, value:** for interface components (including, but not limited to form elements, link and scripts), the name and role can be programmatically determined, states, properties and values set by user can be programmatically set and notification of changes to these items is available to user agents.	

7   Conclusion

Until people find themselves in a situation where they are disabled due to their surroundings, they cannot fully appreciate how the built and virtual environments can throw obstacles in their paths – and indeed, profoundly affect their quality of life. In other words, the spaces where we live, work and play are absolutely, critically and irrevocably tied to where we go and what we do.

The concept of universal design is today's best practice for design professionals seeking to eliminate these obstacles. It supports the idea that the environment needs to be barrier-free for all groups in society, regardless of ability or age.

While it's a given that people with disabilities and older adults benefit more directly from universally designed projects, it is important to remember there is a wide range of ability existing within groups appearing similar. The concept of universal design maximizes the idea of people being able to manipulate their environment to suit individual needs. This minimizes the need for people to compromise on living comfortably.

Throughout this handbook, the concept and practice of universal design is explained and extensive examples provided. Four detailed checklists are provided to assist design professionals in thinking through each individual project that comes across their desk to ensure important elements are not overlooked.

Lastly, while this handbook is primarily intended for design professionals, many sections also apply to the general public. We all face the challenge of building a better future as our population ages and changes. It is imperative to keep universal design at the forefront of our own decision-making, be it on a personal level or in the interest of each other.

Acknowledgements

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