



The Art of Better Buildings:

A Pre-construction Guidance Book

*Strategies towards Rick Hansen Foundation
Accessibility Certification™*

hygge ARCHITECTURE

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1. Introduction

A [study by hcmc architecture + design in 2020](#) found that with thoughtful planning and design, meaningful access can be achieved at a minimal cost if it is considered in the early stages of the project. This Guidance Book provides strategies for delivering a successful building project from start to finish with meaningful access in mind. Drawing on both professional anecdotes and generic case studies, it explores various pathways to achieving **Rick Hansen Foundation Accessibility Certification™ (RHFAC)** certification levels for new construction.

If developing buildings were easy, we would be better at it ... but we're not. In fact, construction productivity has declined dramatically: in the U.S., the average construction worker's output has dropped by 40% since 1970. Building today is more complex than ever. To illustrate that point, productivity in the Construction Sector has fallen significantly over the past 50 years in the US where the work output value of the average construction worker has fallen 40% since 1970.^{C9F} One way to bring efficiency to this complexity is through **repetition** ... repeating unit types vertically and horizontally wherever possible. But even repetition has limits. Despite common design elements, **no two buildings are the same**, because every project contends with unique variables.

Variables that make each project unique:

- **Market expectations** (e.g., minimum unit sizes differ by region)^{R1V}
- **Property dimensions** (lot size, shape, slope)^{R1W}
- **Municipal zoning regulations**, which differ between and within municipalities:
 - in allowed building height, setbacks,^{L1Y} density,^{L1Z} and parking ^{L1H}
 - in accessibility requirements and environmental restrictions^{L1A}
 - **proximity to conservation areas** differs from project to project
 - **Structural system choices** (wood, steel, concrete, etc.)
- **Climate zone impacts**
- **Soil/geotechnical conditions** (e.g., bedrock, brownfield, waterway sites^{L1C})
- **Design and construction quality tiers** (economy to luxury)
- **Project financing and purpose** (e.g., for-profit, non-profit, etc.)
- **Unique logistical or social constraints** (e.g., delivery limits, public opposition, non-traditional contracts)

All of these factors affect decision-making from Design Day 1. Furthermore, the jump from a Part 9 small building to a Part 3 large building under the National Building Code is exponential,

not linear. Assuming otherwise is a classic planning fallacy^{T1PF} ... and a mistake that can undermine the entire project.

Adding a goal like RHFAC Certification into this already complex mix introduces another layer of planning. There's no software button labeled "Make My Design RHFAC Certified." But there are simple strategies that can frame design decisions for meaningful access:

- Design with universal design, for as many people as possible.
- Where accessibility makes business plan logic for profit, savings, or good PR

To integrate meaningful access properly, we must first understand the full development process, from concept through construction. Accessibility considerations should be embedded early, within the project's "priority tree": decisions range from inflexible (site conditions, regulations) to flexible (finishes, furnishings). The following visual, the Net Zero Graph[©], illustrates how successful projects focus effort over time to constrain chaotic variables into a successful, on-time, on-budget outcome.

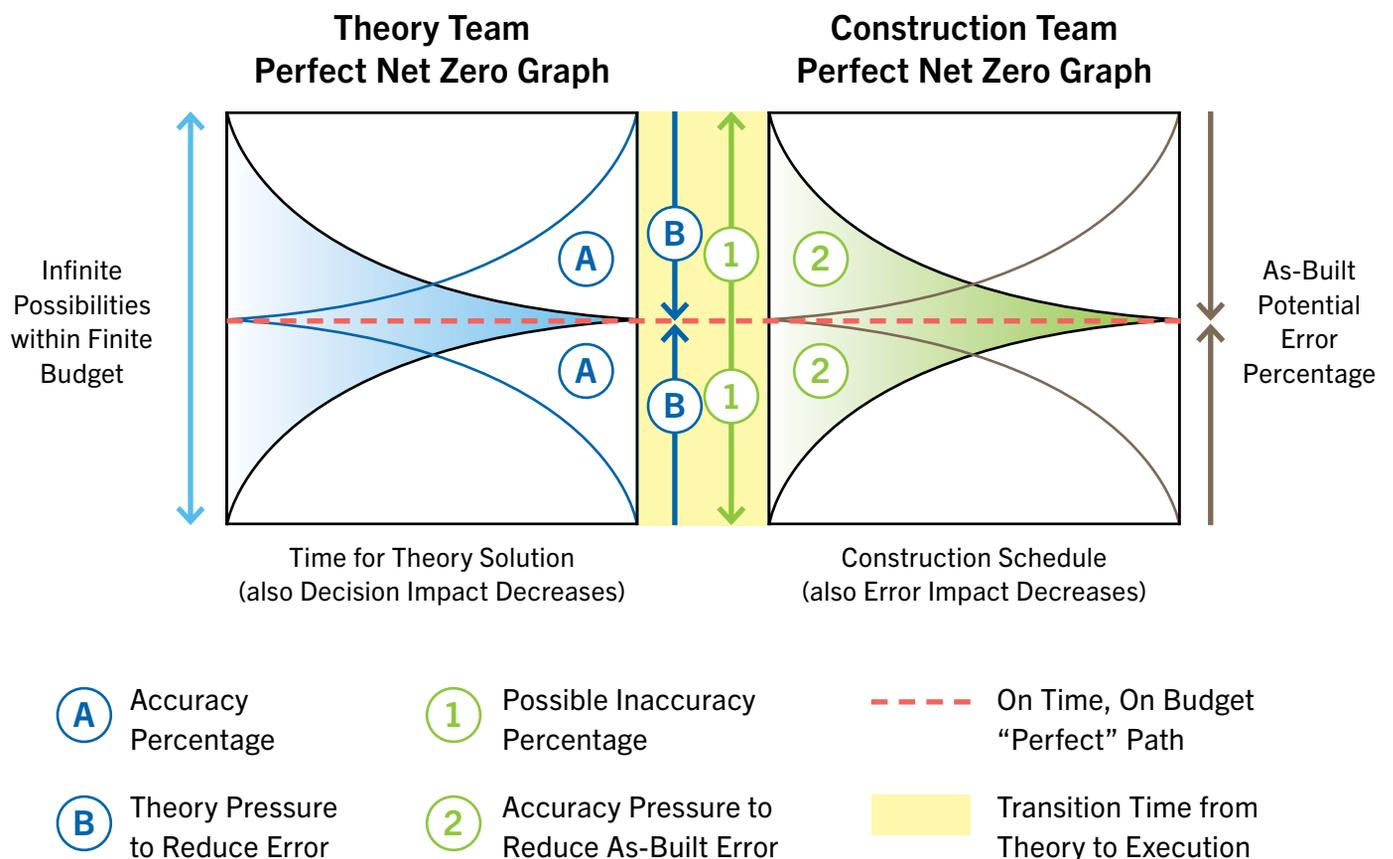


Figure 1: Net Zero Graphs of Building Design and Construction

Renovations and retrofits are not topics or strategies covered by this Guidance Book. The focus is on helping various parties understand how to integrate meaningful access into building projects and understanding how to strategize towards RHFAC certification, from inception to final build.

Cost Considerations of Accessibility

The majority of accessibility features can be included at little to no added cost ... if planned for early. According to the RHFAC Retrofits and Upgrades Cost Study (January 2024) by hcma architecture + design, late-stage changes can be expensive, while early design integration keeps costs low. These must be discussed early with all interested parties and collaborators, such as the Owner, Architect, Engineers, Cost Consultant, and others. The path to RHFAC Certification (and a successful project) lies in applying proven strategies for solving complex problems. These include:

1. **Prioritize All Decisions** ^{YC2}

- Use the inflexible-to-flexible spectrum to order decision-making in priority order and into digestible chunks.
 - Examples of inflexible variables in building designs: physical laws/phenomena (gravity,^{YE8} wind loads, climate,^{YT9} Earth curvature, etc.), applicable legislation, project budget
 - Examples of highly inflexible variables: front door location, major interior circulation clear widths and locations, specs of manufactured horizontal or vertical rail cars, major vehicular and pedestrian site traffic
 - Examples of highly flexible variables: Exact locations of plugs, interior finishes categories
- Re-confirm all assumptions regularly.

2. **Assemble Your Best Team** ^{YA3}

- A project is only as strong as its weakest member.

3. **Establish Effective Communication** ^{YN4}

- Information is useless if it's not shared.

4. **Do Your Due Diligence**

- Ask the Who, Why, and How. Identify risks. Stress-test assumptions.

5. **Forecast a Realistic Schedule**

- Assume mistakes will happen — and plan for them.

6. Spend Time, Effort & Budget Wisely ^{YT5}

- Simplicity is often more efficient.

7. Seek Multi-Benefit Solutions

- Always look to solve more than one issue with each action.

8. Identify Conflicts Early

- Solve the impossible and improbable before you waste time on them.

9. Assume Everyone's Work is Flawed — Including Yours ^{Z1W}

- Double-check. Redundancy is your safety net. Unchecked errors become major problems.

10. Do the Job Well ^{V1GJ}

- If it's worth doing, it's worth doing right.

2. Abbreviations, Definitions, & Legend

2.1 Abbreviations and Definitions

The following are abbreviations or definitions that are used in this document:

AFF	Above finished floor
AoR	Architect of Record. Meaning the architecture firm responsible for and author of the architectural design of the building that sealed the drawings and documents submitted for building permit and the Issued for Construction document sets.
AHJ	Authorities Having Jurisdiction (e.g. Municipal Building Department, Planning Department for Site Plan Approvals, Ministry of the Environment, Ministry of Labour, local Conservation Authority, local Fire Department, etc.)
Alternate Solutions	Building codes are typically organized as objective-based documents or legislation that cannot anticipate every possible iteration or possibility in a building design or building functional configuration. Alternate Solutions are substitutes for acceptable solutions of Part 3 to 12 in Division B of NBC. Alternative Solutions require approval from the AHJ through an application process stating the functional requirement of the building and the proposed alternate solution to meeting applicable code requirements with rationale on how the solution maintains the original objective behind the code requirement that the Project Team is asking relaxation or relief from.
AODA	Accessibility for Ontarians with Disabilities Act
asap	as soon as possible
ASTC	Apparent Sound Transmission Class is an as-built measurement of the successful blocking (or sound-resistance) of walls and floors to minimize sound traveling from one space to another. This differs from STC in that this is an as-built measurement that can only be estimated during building design phases.
A/V	audio visual

B	Billion
Base unit	In this book, a <i>base unit</i> shall mean repeated units within a building design's considerations with the same measurements in x, y, and z dimensions. These can include but are not limited to typical parking space, a repeated office space in size and configuration, a repeated dwelling unit design that is stacked identically and vertically from floor to floor, concrete blocks, columns, stud walls, property lot sizes, floor-to-floor heights, right-of-way municipal property widths, etc.
BER	Building Efficiency Ratio (real estate term for space efficiency ratio) that shows the ratio of usable or rentable space to a building's gross floor area.
CD	Contract Documentation or Contract Drawings phase of design
Civil	Civil Engineer
CM	Construction Management delivery method or Construction Manager. This is typically more expensive than other construction delivery types due to higher risk of E&O in favour of a faster construction schedule. The CM will implement sequential tendering and potentially escalating piecemeal permits from Foundation, Superstructure, Shell, etc.
CMHC	Canada Mortgage and Housing Corporation
CSA	Canadian Standards Association
DBB	Design Bid Build delivery method is considered the traditional method where the Owner hires design consultants for a building design that is then described in drawings and specifications as a contract that General Contractors or Builders bid on. Once awarded, the Builder builds the building. If the Owner has opted for regular on-site reviews by the authors of the drawings and specifications,
DBF	Design Build Finance delivery method of the P3 strain of Design Build. This is often used in public infrastructure projects where the Owner opts to take on debt with the Design Build Consortium.
DBFM	Design Build Finance Maintain method of the P3 strain of Design Build. This is often used in major public infrastructure projects where the Owner opts to take on debt with the Design Build Consortium.
DD	Design Development phase of design
Design Builder	The lead company of a consortium of companies for a construction

delivery method that provides an owner with a single point of contact for both the design and construction phases of a contract

Design Day 1	This is ideally the first day of design by the architect or building designer when they begin the feasibility study but can also mean the first day of iterative design by the architect or building design who will draw the site plan application and/or building permit drawings.
Design Team	The entire team of building designers, including but not limited to architects, engineers, subject matter experts, specialty consultants, etc.
Design Fat	The amount of theoretical additional real estate and building construction in xyz dimensions that a building designer can add to a theoretical building design's minimum building code xyz dimensions along with margin of error of other designers (internal and external) as well as the Builder/Construction Lead/General Contractor and all their subcontractors.
Dwgs	Drawings
E&O	Errors & Omissions
Elec	Electrical Engineer
FF&E	Furniture, Fixtures, and Equipment
FS	Feasibility Study
GFA	Gross Floor Area
HAL	Hygge Architecture Ltd.
HVAC	Heating, Ventilation and Air Conditioning
IntD	Interior Designer
IIC	Impact Isolation Class is a rating that measures a floor assemblies' ability to reduce structural-borne impact noise such as footsteps, dropped objects to a building's lower levels. IIC may be a client-directed performance target.
IP	"Intellectual Property" means any intellectual, industrial or other proprietary right of any type in any form protected and protectable under the laws of Canada, any foreign country, or any political subdivision of any country, including, without limitation, any intellectual, industrial or proprietary rights protected or protectable by legislation, by common law

or at equity. The following is considered IP:

1. All material provided or authored by the architect or similar design or specialty consultant.
2. All deliverables
3. All reports and other information created, generated, output or displayed by the deliverables or as a result of the performance of any architectural consulting services performed for a project.

IPD	Integrated Project Delivery – a project delivery model where Owner, Consultants, Builder, and Subcontractors all collaborate under one “roof” in a non-adversarial relationship where the project losses are shared by all major parties but also where project profit and wins are shared by all major parties.
Landscape	Landscape Architect
LEED	Leadership in Energy and Environment Design, a globally recognized green/sustainable building certification system
M	Million
Mech	Mechanical Engineer
MES	Mechanical Electrical Structural Engineering Design. These are usually subconsultants under the Architect who acts as the Prime Consultant for the Owner if that is in the services contract between Architect and Owner.
MEP	Mechanical Electrical Plumbing Engineer Design. These are subconsultants who can be under the same roof in one engineering firm.
min/max	minimum or maximum
MLI	Mortgage Loan Insurance
MOE	Ministry of the Environment
NBC	National Building Code of Canada (2020 Edition)
OBC	Ontario Building Code
OP	Official Plan
Ops	Building Operations / Facility Management
P3	Private-Public Partnership
PD	Pre-Design Phase of Design

PDI	Pre-Delivery Inspection
PR	Public Relations
Project Team	The overall team of companies and parties that are involved with the production of both the design and construction of a building. This team includes the Design Team as well as the Owners and their forces, financing parties, and builders and their sub-contractors and forces.
PSOS	Project Specific Output Specifications
PUDO	Pick-Up and Drop-Off area such as those found at the terminations of public transit lines, hotels, or other large buildings where vehicles travel into the property through a driveway that can park temporarily to pick-up or drop-off passengers.
QAQC	Quality Assurance and Quality Control
QQ	Quantities and Quality
RFI	Request for Information
RFP	Request for Proposal
SD	Schematic Design phase of design
SME	Subject Matter Expert
SOW	Scope of Work for a Project under the Construction Lead
SPA	Site Plan Application
Spatial Dimensions	Any dimension that exists in the x, y, and z Cartesian coordinate system to define 3-dimensional space. Also, any length, width, and height dimension.
spec'd	specified
STC	Sound Transmission Class is a single-number rating system that measures a wall or floor assembly's performance to separate sound travelling from one space to another. Manufacturers will test assemblies in a laboratory. STC measurements neither account for sound flanking paths through floors or ceilings nor possible compromising of an assembly such as power outlets, light switches, pipe penetrations, duct penetrations, etc. as the tested assemblies are isolated to its simple and basic components.
Struc	Structural Engineer

VP	Vice President
XP	Experience
xyz dimensions	See <i>spatial dimensions</i> .

2.2 Reference Codes

Example: The specification options for windows alone could be a full-time 4th year course.^{A#Eg}

“A” prefix	Architectural subject
“B” prefix	Related to a Construction Standards Association document or standards
“C” prefix	Construction sector subject
“D” prefix	Demographics subject
“F” prefix	Financing subject
“GPR” prefix	RHFAC Gold Prerequisite
“L” prefix	Legislation subject
“NBC”	NBC in superscript indicates an example of an NBC requirement
“O” prefix	Owner or landowner subject
“Q” prefix	Questions or Qualification
“R” prefix	Real Estate Market subject
“RS” prefix	RHFAC Rating Survey reference
“T” prefix	Trivia and facts subject
“V” prefix	Value engineering subject
“Y” prefix	Further explanation of why

Reference List is in Chapter 17.

3. Project Inception

“It depends.”

~ the most common answer by a senior architect to a junior architect’s question

Translation: Buildings are always custom designed. What works for one project may not be fully (or even partially) applicable to another, even if both are similar in size, occupancy, or location. Design solutions often need to be tailored to specific municipal requirements, site conditions, and client goals.

Ultimately, what type of building is needed depends entirely on what the Owner needs ... and who the building is intended to serve.

3.1 What type of building are you planning?

How one approaches a building project is highly dependant on what type of building it is meant to be and *who* the building is meant to serve.

The National Building Code of Canada (NBC) 2020 describes requirements in its Section 3.2.2 for 73 building categories using six main occupancy types: Assembly, Care or Treatment or Detention, Residential, Business and Personal Services, Mercantile, and Industrial. Within these main six occupancy types, there are over 125 classifications of buildings or occupancies that each usually have their own unique NBC requirements.

Understanding the building’s classification early in the process is essential. It shapes how the Design Team will approach everything from life safety systems to meaningful access.



3.1.1 Building Types Based on Occupancy Category

Buildings that can comfortably accommodate three generations of people under one roof offer a distinct market advantage. These are the places where memories are made: where accessibility, inclusion, and emotional connection can be embedded into the user experience.

And ultimately, a building is a product. Products that foster positive emotional associations, by being welcoming, functional, and inclusive, are the ones people want to return to.

3.1.1.1 Occupancy Group A: Assembly Occupancies

Assembly occupancies include spaces where people gather for civic, political, religious, social, educational, recreational, or similar purposes, as well as for travel or the consumption of food and drink.^{NBC} Applicable building codes typically mandate baseline accessibility provisions for individuals with mobility, visual, and hearing impairments.

However, achieving RHF Accessibility Certification can ensure more consistent, meaningful, and user-friendly accessibility throughout the entire facility. As the diversity of users in a building increases, so does the range of needs that must be addressed. A broader, more inclusive demographic not only enhances usability but also increases the potential for greater revenue and utilization. Strategically removing access barriers enables more people to participate in events and services resulting in generating positive public relations, and expanding the building's customer or user base.

The disability community is a large and underserved segment. For assembly occupancies, especially, the question becomes whether a relatively modest capital investment in accessibility upgrades is justified by long-term returns in revenue, attendance, or public goodwill. In many cases, the answer is clearly yes.^{DIS}

In the case of public infrastructure projects involving assembly occupancies, governments have a duty to ensure full accessibility, as these projects are funded by taxpayers. While such facilities may technically comply with building codes or even enhanced accessibility standards, poor implementation or overlooked user needs can still result in public backlash where minimum code may not be enough public defense.



3.1.1.2 Occupancy Group B: Care, Treatment, or Detention Occupancies

Care and treatment occupancies must often accommodate a wider range of disabilities than any other occupancy type, due to the high concentration of individuals with varying accessibility needs in these facilities. While building codes set minimum standards, they do not always result in Group B buildings that function optimally for all users, particularly those with disabilities.



Targeting RHFAC in new construction projects offers a scalable approach to design excellence. It allows for strategic capital planning, while providing a recognizable, marketable certification that appeals to prospective clients, their families, and the public. For government-led healthcare or public facilities, RHFAC also delivers reputational benefits, demonstrating a commitment to inclusive design and responsible public investment.

Detention occupancies can similarly benefit from improved accessibility, especially in areas accessed by visitors, legal counsel, and service providers. At a minimum, public infrastructure projects should consider how RHFAC can enhance accessibility, even beyond code compliance. These improvements not only support equity and human dignity but also help public institutions avoid reputational risks tied to inadequate accessibility.

3.1.1.3 Occupancy Group C: Residential Occupancies

Residential buildings will always need to accommodate accessibility. Everyone needs a place to live ... but when it comes to housing, one size does not fit all. Minimum building code standards are just that: the minimum. They do not reflect the diverse needs of today's population. If new housing stock continues to be built only to these bare minimum standards and sold at inflated prices, public frustration will grow.



People will increasingly resent developers for delivering low-quality, inaccessible homes while maximizing profits and hold governments accountable for permitting such practices. Governments can assist with more than just financial incentives: imagine a commitment towards developing do-it-yourself design software that bakes in current building code and throttles for structural spans, building envelope

assemblies, floor assemblies, and interior wall partitions or allowing 3D model files for building permit applications or harmonizing and consolidating building standards laws. Totally doable.

3.1.1.4 Occupancy Group D: Business and Personal Services Occupancies

Although the COVID-19 pandemic temporarily reduced office usage and demand in Canada, there continues to be strong interest in having employees physically at the workplace.

Attracting and retaining exceptional, reliable talent is a defining characteristic of successful organizations.

Companies that have benefited from high performing employees understand the immense value these individuals bring to a team. The South Korean TV series *Extraordinary Attorney Woo* exemplifies how individuals who are neurodivergent can become invaluable contributors to an organization. These individuals often seek environments that stimulate, inspire, and support their productivity, while avoiding spaces that feel confining or uninspiring.

Designing workplaces to attract and retain top talent benefits everyone. A well-designed office that meets the needs of all employees naturally creates a more functional, comfortable, and engaging environment for all staff. In this way, prioritizing workplace design for everyone becomes a rising tide that lifts all boats.



3.1.1.5 Occupancy Group E: Mercantile Occupancies

Retail buildings include stores, exhibition halls, markets, small restaurants, shops, stores, and supermarkets. Similar to for-profit assembly occupancies, larger retail operations often depend on high-volume sales. Enhancing accessibility for the public not only improves the customer experience but also enables these businesses to reach a broader range of customers within the community.



3.1.1.6 Occupancy Group F: Industrial Occupancies

Improved accessibility may not always directly align with business interests in industrial occupancies, such as repair garages or factories.

However, any facility that includes a public-facing, customer-oriented area should prioritize full accessibility. When industrial spaces add co-located, adjacent spaces (such as large pubs, restaurants, or event venues) are designed to be accessible, they can attract a broader customer base, including older individuals and those with mobility needs. This is particularly important for group gatherings and family-oriented events where a multi-generational family may be more inclined to visit a brewery's attached pub.



Examples would also include a tour of a beer distillery or a winery or a large-scale tourist attraction like a giant apple farm with mumble crumble apple pies. Other industrial building classifications where improved accessibility can add value to the business include dry cleaners, laboratories, repair garages, service stations, television studios, parking structures (aka storage garages), and storage rooms.

3.1.2 What activities will be undertaken in the building?

“Form follows function” is a design principle first coined by 19th-century architect Louis Sullivan.¹⁰⁰ While Sullivan’s architectural style may no longer dominate 21st-century design, the core idea remains highly relevant: the form of a building should be determined by its intended function. To design a building that is truly fit for purpose, the Design Team must understand the full range of activities that will take place within it. These functions will, in turn, dictate which areas must be accessible and which may be exempt based on operational requirements.

A building should support the people who use it and the activities they perform. For instance, Design Teams should be able to justify to the Authority Having Jurisdiction (AHJ) that accessibility may be limited to public-facing areas if certain back-of-house functions cannot reasonably be performed by people who are blind or mobility related disabilities.

All buildings are designed with a purpose, or multiple purposes, and those objectives shape the design approach. Just as car manufacturers design different models ranging from basic economy vehicles to high-end luxury cars, architectural design varies according to function,

budget, and audience. ***That's the great thing about architecture: logic should always prevail.*** Even the most dramatic, expressive buildings follow a logical narrative; often one that reflects the prestige, identity, and public image of a family, corporation, or government. These iconic structures not only serve their functional roles but also become landmarks, drawing attention and reinforcing brand or institutional messaging.

In Canada, buildings need higher performance when compared to many other countries: our buildings often have to adapt to extreme climates from hot, humid summers to stark, frigid winters^{T1C} as well as survive earthquakes, ocean storms, and fires igniting wood “stick” construction. The strength of Canada’s resource-rich environment can be seen also as its weakness: there is an overdependence on wood stud construction due to its low cost, construction industry familiarity, and abundant availability ... that any other type of building construction is considered premium.

Achieving lasting, high-quality buildings in Canada remains an elusive goal for a plethora of reasons. Too often, low-quality construction has become the norm, even as they’re sold at premium prices in or near major urban centers.^{C1Q} Condominium buildings are often handed over to a group of owners where eventually the liabilities of the developer’s and consultants are arguably shed very prematurely when compared to the same group of owners engaging an architect to act as their agent to design and defend their interests during the construction of the same building. Imagine a government program that helped people to join to invest in a condo development and eliminate the middle-person condo developer who can just walk away with short-term profit and no liability? This same program could help inform legislators on how to improve the laws of construction and consulting.

Public infrastructure projects are typically awarded to the lowest bidder, both in consulting and construction. This practice often drives a race to the bottom, as firms strive to remain solvent while delivering on tight margins. Meanwhile, within this ecosystem, some parties manage to extract more value than they contribute, further distorting incentives and undermining project quality. At the same time, we’ve overlooked a simple truth: people with disabilities are taxpayers too. Public buildings should welcome everyone: no member of a village, town, city, or country should ever be excluded.

Building code legislation today remains outdated and reflects only the bare minimum requirements. A building constructed to current minimum standards will always fall short on accessibility as their objective is not to look at a building from a holistic and user experience perspective. This was also reflected in the 2020 hcma study comparing building codes to RHFAC. This is why RHFAC exists: to look at accessibility from a human-centric perspective and ensure that buildings serve everyone. *If only federal, provincial, and municipal governments being one crown corporation wasn't a science fiction dream.*

3.1.3 What is the reason that you want to build this building?

Form follows rationale and budget.

That's the less glamorous (but more accurate) reality of designing and constructing buildings. When undertaken, a new building is often one of the most significant investments individuals or organizations will make in their lifetimes. And in nearly all cases, debt is the primary financing vehicle ... whether the project is privately or publicly funded. Few have millions of dollars readily available to finance a construction project outright. As such, how the lending industry engages with property development shapes the business plan to which a project must adhere.



“It’s a really pretty building” is not a compelling business case. Lenders want to see robust, market-based evidence, financial feasibility, and clear repayment capacity. Property development today often relies on a form of subscription model: lenders front the money based on a projected income pipeline, and developers must prove that the project will deliver. A building’s form, then, is directly influenced by its source of capital, as well as the budget, time, and risk constraints.

Integrating meaningful accessibility into new construction is a strategic investment in the building’s future. As legislation and public expectations trend toward higher standards of accessibility, designing for inclusive accessibility now protects against expensive retrofits later. *It eliminates the need to rely on “grandfathering” clauses, reduces legal and reputational risk, and enhances long-term adaptability and market appeal.*^{Y6} A Project Team can do 99 things right, but it will often be remembered for the one thing it got wrong. In contrast, **a building that is convenient and inclusive for everyone naturally expands its market reach and enhances its long-term financial stability. It simply is a better product ... that can be achieved with negligible cost upgrades if planned early.**

The purpose for a new building tends to fall into the following categories:

- Leasing/Renting Real Estate
 - i.e. rental apartment buildings, retail mall, hotels, offices, etc.
- Selling Real Estate
 - i.e. condominium buildings, single-detached houses, etc.
- Public Infrastructure or Community Centres

- i.e. hospitals, city halls, courthouses, public transit stations, first responders' stations, water filtration facilities, energy substations, community hockey rinks, etc.
- Direct Commercial Purpose
 - i.e. headquarters buildings, restaurants, pubs, markets, labs, etc.
- Hybrid Mixed-Use Buildings
 - i.e. condo buildings with retail podium, airport with retail & hotel, etc.

These categories differ from how the NBC classifies buildings, which are more based on fire safety and egress. The categories above reflect business models and use cases, which have a more direct influence on design priorities, especially when it comes to accessibility.

Buildings designed with long-term operational goals ... such as minimizing maintenance costs, optimizing usability, and maximizing lifecycle value ... tend to be of higher quality and provide better accessibility. Conversely, buildings driven by short-term investment returns, cost-cutting, or “what the market will bear” often reflect compromises in both design and performance. These compromises can stem from limited financing, lack of experience among the Project Team, or a narrow business focus that deprioritizes human experience with sole focus on short-term profits or schedule.

3.1.4 What is the Rick Hansen Foundation and the RHFAC Program?

The Rick Hansen Foundation is a Canadian non-profit organization dedicated to inspiring, creating and delivering innovative solutions that accelerate a global movement to remove barrier to inclusion for people with disabilities. Globally, over 1.3 billion adults (16% of the world's population)^{D1WHO} experience significant disability. The Canadian Survey on Disability (2017-2022) reports 1 in 4 Canadians identify as having a disability. The following is a breakdown of disabilities distribution among the country's population:

- Pain (16.7%)
- Flexibility (10.9%)
- Mobility (10.6%)
- Mental Health (10.4%)
- Vision (7.4%)
- Hearing (5.6%)
- Learning (5.6%)
- Dexterity (5.0%)
- Memory (4.9%)
- Developmental (1.5%)

Disabilities rarely occur in isolation. In fact, most Canadians with disabilities live with two or more co-existing conditions. This complexity is often overlooked in building design. When public buildings are not usable by a significant portion of the population, architects and designers risk failing the very public they are meant to serve by not fully understanding or advocating for how diverse people interact with built environments.

In profit-driven industries, like automotive manufacturing, it's common to design for a majority range of average user types, needs, and dimensions to maximize returns. However, publicly funded buildings operate under a different mandate. As non-profit, taxpayer-funded assets, they have a fiduciary and ethical responsibility to be designed for as many citizens as possible, not just the able-bodied majority.

The [Rick Hansen Foundation Accessibility Certification™ \(RHFAC\)](#) is a rating and certification program that measures the meaningful accessibility of buildings and sites from the perspective of diverse disabilities. It was created to promote meaningful access, guiding building owners and design professional to approach buildings holistically and with a focus on the user experience, while encouraging them to go beyond code-minimums. NBC primarily addresses wheelchair accessibility, often neglecting the needs of the other 75% of people with disabilities, such as those with sensory, cognitive, or episodic conditions.

“When barriers within the built environment are removed and people with disabilities can live, work, and play to their full potential, the entire community and economy benefits.”

~ The Rick Hansen Foundation

At the heart of the RHFAC program is the principle of meaningful access. This means looking at how the entire building functions for all users, not just evaluating individual features in isolation. The program uses a performance-based survey and a numerical scoring system to assess a building's level of meaningful access across a broad range of criteria.

This approach aligns with Canada's Charter of Rights and Freedoms, which guarantees all citizens the equal protection and equal benefit of the law, regardless of physical or mental disability, religion, language, ethnic origin, or belief.



3.1.4.1 What is the process of achieving RHF Accessibility Certification?

For preconstruction projects, the RHFAC Professional, an individual who has been trained and designated to apply the RHFAC methodology, will review drawings and specifications or similar documents or designs of:

- Architectural Design
- Landscape Architectural Design
- Civil Engineering Design
- Interior Design
- Electrical Design
- Mechanical Design
- Signage Design
- Electronic Security Design, if applicable
- Acoustic Design, if applicable
- Audio Visual Design, if applicable
- Possibly Structural Design, if not shown in architectural drawings
- Operations' policies
- Building's Website

To successfully achieve RHFAC certification, accessibility design targets must be integrated from the very beginning of the design process. Design teams should be aware of RHFAC requirements from Design Day 1, allowing time to assess any potential cost implications and obtain approval from the Owner well before an RHFAC rating is conducted by the certified RHFAC Professional. A well-organized Project Team will keep an informal, ongoing checklist throughout the schedule as the design evolves.

The most efficient team structure includes having the lead architectural designer, typically the individual responsible for early floorplans: dual-trained as both an architect and a certified RHFAC Professional. This dual expertise allows accessibility considerations to be embedded directly into the early design decisions, avoiding the inefficiencies of retroactive corrections identified by a separate consultant who may not be closely involved in the day-to-day development of the design.

If a dual-role designer is not available, the next best approach is to engage RHFAC Professional as early as possible in the project timeline. They should be asked to provide informal reviews at key design milestones (preferably at mid or end or both of the first three initial design phases)

and offer recommendations to ensure that RHFAC requirements are being addressed before conducting a preconstruction RHFAC rating:

- Phase 1 Feasibility,
- Phase 2 Logistics, and
- Phase 3 Functionality

It is recommended that the preconstruction RHFAC rating is conducted in Phase 4 Description when most RHFAC requirements can be demonstrated in drawings or specifications.

Chapter 6 goes into more details of the different Phases.



3.2 How will the building project be financed?

The source of funding has a foundational impact on how a building is designed.

Buildings often reflect the values, priorities, and accountability structures of the organizations that finance them. In many cases, the nature of the funding source influences everything from project goals to design decisions, material choices, and timelines. As a result, **buildings often “radiate” the intent and constraints of their financial backers.**

Below are examples of different funding sources for construction projects, along with how their underlying motivations tend to shape building design.

3.2.1.1 Public Funds: Infrastructure

Public sector buildings are often guided by a responsibility to serve the broadest segment of the population. These projects tend to prioritize inclusive, responsible design choices and, in some cases, offer the opportunity to become landmark buildings ... setting the standard for what other buildings should aspire to achieve in terms of accessibility, sustainability, and public service.

While execution may sometimes fall short of intent, the commitment to public good is there. Public sector clients are funded by taxpayer dollars and thus held to higher standards of accountability. They are often more informed and sophisticated clients, with access to current legislation, codes, and accessibility best practices.

Additionally, because governments are generally risk-averse and highly sensitive to public perception, there is often less, if any, pressure to cut accessibility features for the sake of cost savings in these projects.

The core purpose of a public infrastructure building is to serve its community and thus its objectives will align well with the RHFAC program.

3.2.1.2 Private Funds: Corporation Building

A private sector headquarters presents a unique opportunity to showcase innovation, market leadership, and corporate identity. These buildings are often designed to be one-of-a-kind



architectural statements, drawing public attention through striking massing, bold design, and cutting-edge features.

They serve not only as functional workspaces but also as symbols of a company's strength, vision, and brand prestige, attracting top talent and reinforcing the organization's market position. In cities like Tokyo, major corporations invest heavily in headquarters buildings that project power, innovation, and brand identity, clearly visible markers of corporate success to both the public and their competitors.

The primary purpose of a corporate building is to serve the business interests of the company. As such, for accessibility strategies, such as those promoted by RHFAC, to be adopted, they must be positioned as aligning with corporate objectives, such as:

- Enhancing employee well-being and productivity
- Improving public perception and brand reputation
- Future-proofing the asset against changing legislation & demographic needs
- Demonstrating leadership in ESG (Environmental, Social, and Governance) commitments

When accessibility is seen not just as a compliance issue but as a strategic business advantage, it becomes far more compelling within the private sector development context.



3.2.1.3 Private Funds: For-profit Building as an Investment Product

For-profit development projects often reflect the minimum standards that the target market will accept, whether that means basic functional design for the intended end-user, or the lowest-cost aesthetic enhancements that meet the expectations of a commercial client. When projects are heavily dependent on high loan-to-value financing and must operate within tight financial constraints, the budget is limited across all phases, from design and consulting to construction and materials.

As a result, these developments are frequently driven by a hyper-focus on cost control, where even a modest budget overrun could mean the difference between project success and failure. The core purpose of an investment building is to generate revenue for its investors. Such a primary objective does not see as much alignment with RHFAC objectives as other models

when looking through a short-term profit lens. However, alignments do exist when looking through a long-term lens of product quality recognition and brand reputation along with more target customer reach with greater accessibility achieved.^{A15}

The design struggle between minimizing costs and increasing value can sometimes create the tension and struggle where innovation is born and these strategies being so efficient that they can become the industry standard. A development company that produces the new industry standard has limitless potential if they've achieved preferred construction mortgage insurance terms, minimized cost overruns, built exemplar quality per dollar spent, and can consistently reproduce the formula.



3.2.1.4 Private Funds: Higher Education Buildings

A private university project will typically aim to entice both international or national teaching talent to work for them or new students to enroll in their institution. As sophisticated clients, universities have a deep understanding of the value of brand recognition, public relations, building performance, operational efficiency, and more inclusive accessibility standards.

Much like globally recognized municipalities or major corporations, prestigious universities operate at a high level of design literacy and project management sophistication. However, unlike many public sector clients, universities have a unique advantage: direct access to leading-edge human resources, from innovative students to renowned faculty in architecture, engineering, and other design-related disciplines.

These individuals are often highly motivated to contribute to signature campus projects, knowing the experience can elevate both their portfolios and future opportunities. Furthermore, funding for higher education buildings is often more flexible, with access to capital from endowments, donations, grants, and research funding. This allows universities to take greater creative and financial risks, aiming to deliver buildings that spark national and international conversation and become landmarks of innovation.

The core purpose of higher education buildings is to support the education and development of future generations. In Canada, younger demographics increasingly embrace values of inclusion, diversity, and accessibility, making it essential for post-secondary institutions to reflect those values in both policy and design. As such, the goals of the RHFAC program are well-aligned with the mission and ethos of most Canadian universities.

After all, **any university would be thrilled to attract the next Stephen Hawking**, *a brilliant mind whose contributions to theoretical physics advanced humanity's understanding of the universe; an amazing legacy gifted to us from someone who knew his time on the planet was limited far more than most.* Buildings that enable full participation for people of all abilities increase the chances of supporting the next generation of world-changing thinkers driven to find more answers and make sure their lives matter.



Modern psychologists have also theorized that Isaac Newton, Alan Turing, and Albert Einstein may have been on the autism spectrum.^{T3G} The so-called “myth of the autistic genius” is not entirely myth: it reflects real patterns observed throughout history.^{Y17} Universities that prioritize enhanced accessibility are better positioned to attract and retain exceptional talent across a wider range of cognitive and physical profiles.

By designing environments that remove barriers to participation, higher education institutions can not only foster academic excellence but also demonstrate leadership in equity and inclusion ... qualities that resonate strongly with students, faculty, and global audiences alike.

3.2.1.5 Funding and objectives desire alignment

The Owner's objectives must be clearly communicated to the Design Team from the outset so that budget, schedule, and project targets can be aligned early and consistently. This clarity allows all stakeholders to make informed decisions and avoid misalignment throughout the design and construction process.

When RHFAC considerations are introduced with a full understanding of the project's priorities, they can be seamlessly integrated into the design process through the appropriate consideration filter/lens. ***You don't add accessibility like a hat; you have to weave it into the design fat.*** This ensures that accessibility is not treated as an afterthought, but rather as a natural and strategic part of the design directions that, in turn, enable a less bumpy ride from Design Day 1 to building occupancy.

3.2.1 How is the project's budget determined?

Many project budgets are based on feasibility studies that are often produced quickly and without the involvement of senior or highly experienced designers.

While Cost Consultants may provide preliminary feasibility studies as an available consulting service, these typically include disclaimers that place the full risk of inaccuracies on the Owner. Unfortunately, budget shortfalls (caused by optimistic assumptions or inadequate early quantification of building design objectives) remain one of the most common and consequential risks to project success.

Budget issues often arise when feasibility studies rely on overly simplistic assumptions about design, construction variables, and flawless execution: a perfectly orchestrated and predicted run from design to construction completion involving possibly dozens of companies, dozens of consultants, and dozens of construction workers or more with few, if any, people talking to each other within a constrained time schedule and limited drawings or written instructions and unconfirmed assumptions that all unconfirmed variables are the same as the data of the last comparative project.

Sound impossible? Of course: a production of people where they are not effectively communicating will likely be a self-fulfilling failure since inadequate time predictions of parties involved ... is a fundamental error. If it is a success, it may be through blind luck or the hidden work of consultants and/or construction managers working unpaid overtime.

Simply put, bad projects are failures because they didn't quantify the time required accurately to make the productions that were envisioned by its creators. If vision and reality are too far apart, this is when people fight and lawsuits get filed. If vision and reality are the same, there were no surprises and everyone had agreed on the same things without misinterpretation.

Time is money, so get the time right.

Projects are subject to unpredictable delays, scope changes, coordination challenges, and lots of human error. Project Teams with bruising firsthand experience of what can (and often does) go wrong are more likely to build in realistic contingencies and implement strategies to proactively manage complexity and risk. ***Basically, you get the time***

right by mapping out all the things that can go wrong and then finding the path that feels right. Building projects are not a science ... let's be honest: science would never tolerate growth in such vast error margins.



The best way to improve the accuracy of feasibility studies is to invest in Phase 1 by engaging experienced architects and consultants to assess the property's potential, explore viable and variable building configurations, and provide informed guidance. Early-stage input from key stakeholders can also reveal hidden constraints or opportunities that impact feasibility.

To incentivize quality work at this stage, procurement strategies should be structured so that the feasibility architect is compensated and has a reasonable expectation of being awarded the full project design. When feasibility work is treated as a throwaway or competitive “test-fit” done for free, designers are less likely to put forward their best thinking, knowing their work may be used by others with no further engagement.

Owners or Developers who rely on simplistic square-foot multipliers, based on previous projects or generalized market data, assume enormous risk. While cost-per-square-foot is a convenient financial metric, it does not reflect the real complexity of a new, three-dimensional building with unique site conditions, programmatic requirements, and regulatory demands that is scheduled to be designed and built over a finite period of time by dozens if not well over a hundred people who are not talking to each other constantly or effectively.

This approach is akin to a scientist arriving at a conclusion without validating the key variables or assumptions ... something the scientific method explicitly warns against. *Just because the financial industry simplifies real estate down to 2-dimensional areas and simple cost metrics doesn't mean that design and construction professionals should too when planning real-world 4-dimensional products such as building projects.*

The most critical assumption miscalculation that can jeopardize a project is underestimating the time required ... either for design, training, or construction. Inaccurate scheduling is a common pitfall, often stemming from the belief that timelines from past, similar projects will apply and be identical to the current one. This assumption ignores the countless dynamic variables that impact every project.

- Key personnel may have changed, either moving to different firms or being replaced with less experienced staff. There's always a hidden Jock Callander behind every Stanley Cup win who make teammates shine brighter, like salt in salsa.
- The lowest bidder is rarely the same team as before, and even if the company name is familiar or the same, the quality of execution can vary significantly simply based on who's doing the work and for how long.
- Regional differences matter. Contractor availability, local permitting processes, and supply chain logistics vary from town to town.
- Market conditions evolve. Global and national events can introduce major disruptions. A project that once benefited from a free trade agreement may suddenly face surprising new tariffs, delays in material delivery, or price volatility due to geopolitical shifts that change either foreign exchange rates or supply.

In short, each project exists in a unique context. Assuming stability or repeatability across time, place, and people is a high-risk strategy. ***A low-risk strategy is when repeatability has been confirmed across all considerations.*** To protect timelines (and ultimately, the success

of the project) teams must approach schedules with realistic contingency planning, updated market intelligence, and an understanding that design and construction are never copy-paste exercises.

The best way to determine the design schedule and the construction schedule is:

- Consult with an experienced Prime Consultant and provide realistic expectations and assumptions of consultant fees^{A2F} to provide input on the design schedule.
- Consult with an experienced Builder or General Contractor on the most cost-effective construction schedule based on orchestration of sub-trades.
- Work backwards with both schedules and identify all the assumptions and risks for the Project Team to create a risk register.



3.2.2 How are risks identified?

There is no greater teacher than experience. Across all phases of a building project, from feasibility and design to construction and handover, the greatest risk is inaccuracy: inaccurate assumptions, timelines, scopes, budgets, or expectations. Understanding the motivations, limitations, and risk profiles of each party involved is one of the most effective ways to anticipate and manage project risks. Below are some observed patterns and risk factors seen in the construction market that can impact project success:

- *Accessibility consulting is scheduled to begin in Phase 3 Functionality or even worse in Phase 4 Description, when some elements could have easily been accommodated in the building design in Phase 1 Feasibility.*
- Liability is often shifted to the weakest link: the party with the most liability exposure may also be the least experienced, most financially strained, or least capable ... and probably the least sophisticated in understanding risk.
- Owners may oversimplify complex variables and assume repeatability across projects, especially regarding time and budget.
- Stakeholders without financial accountability may request major changes, even full redesigns, based on internal policies, tenant agreements, or safety procedures.
- Lack of stakeholder engagement early can create costly revisions later.

- Contract models shape incentives
 - Lump-sum contracts encourage consultants to minimize work to preserve margins above the “complete write-offs” line.
 - Hourly contracts lack incentive for efficient work delivery.
- Architects’ and Owners’ egos can sometimes interfere with collaborative, merit-based decision-making. *When people stop learning, so does success.*
- Electrical engineers focus on their electricity-related calculations and less on whether electrical elements spatially fit in the architectural design.
- Stormwater management proposed grading slopes by the Civil Engineer can conflict with shallower slopes required for wheelchair or mobility aid users.
- Poor coordination among consultants, especially if the Prime Consultant has a passive leadership style rather than proactive style, leads to conflicting drawings, missed details, and inefficient designs.
- Construction workers may not be provided with drawings or specifications prior to doing their work on site and are unaware to what the design is supposed to be.
- Small town AHJ’s may not have the in-house experience to evaluate a large building’s permit submission and may commission a code consultant to review the application, where that code consultant will be motivated to demonstrate that their meticulous scrutiny is worth repeat business.
- Building Permit approvals do not guarantee full code compliance: AHJs rely on professional seals/stamps and may still flag issues mid-construction if non-compliance becomes evident. The AHJ inspectors or reviewers can point out and demand code compliance at any point of the construction if the as-built construction is non-compliant to applicable building code.
- Accelerated design schedules correlate with higher error rates.
- The lack of quality control and quality assurance (QA/QC) protocols will increase the likelihood of error and omissions.
- Sophisticated Owners may ask for compliance to additional arbitrary design standards, their own in-house design standards, and other catch-all requirements and not realize there are conflicts within those documents.
- Project Teams may fail to forecast recurring risks or embed mitigation strategies in their business plans.
- Insurance terms and exclusions have not been accounted for in the design.^{A1E0I}

The following are example of strategies to provide defenses to the above risks:

- Require that the project can only use an architectural team with a key senior designer having accessibility design specialty and Prime Consultant coordination experience for the first 3 design phases of the project.
 - It's amazing how well a project can be developed when there are only minor changes to the final building design that came out of Phase 1 Feasibility due to adding the correct amount of design fat for other consultants' designs: with workable future design space already provided and efficient paths within the limited building footprint.
 - Finding talented senior designers is easy: *just find the hidden stars of previous successful productions* and just make sure that they are on your next design project.
- Select a capable Prime Consultant with a proven track record in coordination, large project delivery, and conflict resolution.
- Adding "design fat" for construction tolerances to design requirements since the construction crews' accuracy is not the same as computer design software. We're not building space shuttles here; we're building buildings where both designers and builders want to reduce their inadequately allocated time on it as much as possible so they can go home for dinner. **Always add design fat for known errors ... and accuracy can be yours.**
- Develop realistic budgets and schedules that account for unknowns, escalation, and coordination complexity.
- Stakeholder management strategies and engagement as early as possible.
- Due diligence on consultant contracts and the quality of consultant teams as well as embedding incentives towards teamwork rather than contracts that regardless of project success reward individual parties for maximizing their profits by reducing value that they add to the project.
- Owner education of the complexity of building projects and how "bigger" means an exponential increase in scale, and not a simplified linear 2D multiplier. *Count the unique 3D intersections of materials instead.*
- Periodic AHJ discussions so that there's nothing surprising to them when they receive your Site Plan Application or Building Permit Application.



4. Contracts: What, Why, Who, and How

Consultant contracts are the key documents that can pave the way for a project to be successful in its design phases or be doomed from the start. The same errors seem stuck on auto-replay:

- Inadequate accommodation of site conditions leading to catastrophic fails.
- Selection of consultants who were inexperienced to tackle the project difficulty.
- Inadequate pricing in consultant contracts translating into insufficient senior-level hours throughout the project, including reviewing the construction progress.
- Inadequate project timelines that led to Design Teams rushing a large volume of work that inevitably led to errors and omissions.
- Lack of coordination between consultants for any of the above reasons.
- *Choosing the lowest priced but inexperienced consultant or contractor was the critical mistake.*

Multiple major questions need be answered before the appropriate consultant contracts can be determined and what, if any, supplementary (customized) contract terms are needed. ^{L2C} On a fundamental level though, the entire consultant team needs to be aware from the start that meaningful access cannot be achieved strictly by following minimum building code, time and effort is needed.

4.1 What Project Delivery Models are there?

The following are building construction contract types that are used in Canada:

1. Fixed price (or stipulated sum) with Architect-of-Record (AoR) as agent of the Owner
 - E.g. Design-Bid-Build (DBB)
2. Fixed price with AoR as consultant under the Builder
 - E.g. Design Build (DB), Design Build Finance (DBF), Design Building Finance & Maintain (DBFM), Integrated Project Delivery (IPD), etc.
3. Builder and AoR work as separate agents of the Owner
 - E.g. Construction Management (CM)
4. Other
 - E.g. Unit Price Contracts, Cost Plus Contract

Who the architect works for will have a great influence on the design priorities. When an architect is an agent for the Owner, their obligation is to design a building that meets their project needs and vision, to be built within the project's budget, and to protect the interests of the Owner where/when the architect is contracted to have responsibility for.

The construction phase is an impossible phase for an architect to price out as lump sum as there are any number of things that can go wrong, especially if awarded to a General Contractor who made a mistake in their rushed, but lowest, bid and is trying to claw back money. Smaller projects can make the mistake of minimizing senior consultant reviews on-site or even worse to use in-house staff who may not be motivated to defend the drawings and specifications.

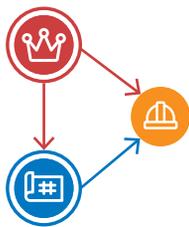


An early construction mistake can result in catastrophic consequences if not caught early by senior and experienced site reviews.

Mistakes always happen, especially with the lowest bidder in a business landscape where value is neither transparent nor obvious between the lowest bidder and the highest bidder.

The second type of delivery model above, Design Build, has several variations and is the current preferred delivery model for large public infrastructure in Ontario, despite criticisms from the Auditor General of Ontario.^{F10} That said, the IPD variant of Design Build is often described by participants as the first time that they've worked truly collaboratively.

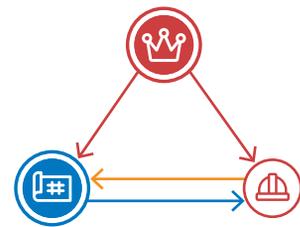
The project delivery model for a project can determine how the consultant contracts are organized. **For a project aiming to achieve enhanced accessibility in its design, the best consultant configuration is to have an in-house accessibility consultant in the architecture firm designing the project, regardless of delivery type and especially to have the person designing the floorplans as being one and the same person as the accessibility specialist.**



DBB with AoR and RHFAC Professional in one company.



Design Build with AoR and RHFAC Professional in one company under the Design Builder.



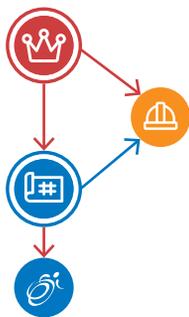
Construction Management with AoR and RHFAC Professional in one company for the Owner.

Due to the typical aggressive schedules in Design Build or Construction Management projects that will result in sequential tendering before the architect, engineers, and other consultants have completed the building design, *it is imperative that the accessibility consultant/ RHFAC Professional is integrated in the designing from Design Day 1 of Phase 1 Feasibility:*

- Slightly wider main corridors can affect the superstructure design.
- A sloped floor entrance without stairs or ramps to the main entry can affect the proposed grading design, stormwater management, the geodetic elevation of the ground floor, and the superstructure.
- More designated parking spaces than the minimum required by the municipal zoning by-law can affect both superstructure and useable real estate.
- A canopy to cover the path from outdoor designated parking to the principal entrance may conflict with a front yard zoning setback and require a minor variance from the Municipality.



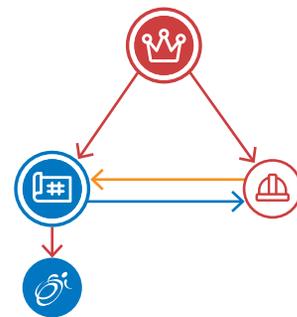
The second-best consultant arrangement is to have the Architect be the Prime Consultant while having the accessibility consultant or RHFAC Professional as their sub-consultant; this arrangement loses significant efficiency unless the accessibility consultant has constant reviewing access to the evolving building design and can provide recommendations at any given time. The more frequent the feedback throughout the process, the lower the likelihood of major redesigns later.



DBB with AoR and RHFAC Professional in one company.



Design Build with AoR and RHFAC Professional in one company under the Design Builder.



Construction Management with AoR and RHFAC Professional in one company for the Owner.

The worst consultant arrangement with an accessibility consultant is for this consultant to be under the Owner (such as part of a Planning, Design, and Construction/PDC consultant team) and doing only periodic reviews of major milestones of the consultant team's drawings and specifications. The very worst arrangement with this sub-group would be if this consultant does their first accessibility reviews at any time during Phase 3 Functionality (aka Design Development) or Phase 4 Description (aka Contract Documentation phase) as the vast majority of the design decisions have already been made and cannot be undone with such late feedback. ***When accessibility design feedback is treated like an afterthought rather than a primary objective, the results can be predictably unsuccessful.***

See 4.3.1 below for more detailed organizational charts of possible consultant contracts that may help bring greater understanding to how a project's consultant contracts can be organized.

4.2 Motivations Inherent in the Contracts

Contracts have inherent motivations that materialize in the production of products. The strategy that generates the most revenue or the least costs or risk exposure under the terms of a contract is the likely path taken for contracting parties who may or may not do another significant contract together in the future. If the motivations of the parties in a contract are not aligned, the risks exist that the product will not be as expected, unless all parties are motivated to achieve the exact same result and act like a true team.

Contracts that shed unreasonable liability risk to other team members is the exact opposite of a strong team as team members spend more time on paper defenses of their liability.

The main objective of typical building project is how to save costs in time and money without sacrificing essential value and functionality in the new construction.

The building design and construction industries have an interesting belief in Canada: there's an inherent belief that picking the lowest bidder for all parties involved in the project will still be able to produce a satisfactory product. That's like believing that you can build an NFL championship-capable team by using the cheapest coaches, players, and training facilities along with the most superficial due diligence possible, if at all, on all team members. Good luck with that.



A project manager with a successful track record of leading consultants in an NBC Part 9 small building may have the skills needed to fulfill the same role in an NBC Part 3 high building but will not have critical experience needed. It would be just like putting a coach who led an amateur hockey team to a beer-league championship and place that person as head coach of an NHL team: they can learn on the job, but they don't have the nuanced experience needed for the bigger arena, the instant-replay level scrutiny of miniscule but important rule details, and the higher stakes.

Project budget accuracy = accuracy % in 4D X communication efficiency %

Building designs are human stories like everything else we do. When people work together towards a common goal with efficient and transparent communication, visions can become true, even despite overwhelming challenges. When the same mistakes keep happening such that there

is error stability in the system, it usually means there's a critical system failure somewhere: like ... designing buildings without knowing who is using them.

The general pattern is that the bigger the building then:

- the more pressure and more volume of work required to orchestrate all the consultants' designs and the quickly ballooning complexity,
- the greater need to navigate increased volume of possible conflicts between subconsultant designs and between the increase in building code requirements and possibly other design standards,
- as well as find efficiencies to reduce the overall complexity of the project.

Building design requirements, options, and complexity scales *exponentially* as a building design gets larger. Similar to trees, larger building projects do not scale linearly from scopes of work and requirements of smaller buildings, especially when there a lot of people designing, constructing and occupying the building.^{Y11} Saplings need short-term growing conditions; trees need stability over long periods of time.



4.3 What is the Best Contract for my Project?

It depends.

Project-specific constraints and objectives vary wildly across building projects. **There is no current “silver bullet” for guaranteed project success** for every possible new construction building type and size based on what type of contracts are used. That said, multiple players in the design and construction industry have said that the most successful project that they worked on was the IPD model where consultants and construction trades are all involved with the planning of the building design from Design Day 1 as well as have contractual motivations towards the overall success of the project.

This higher frequency of success comes at a much higher up-front cost of having so many senior people in the same room to design the building as well as having financial rewards based on the success of the project. Unfortunately, IPD is harder to implement for smaller projects with smaller budgets.

4.3.1 Possible Design Team Organizational Charts with Accessibility Specialist

Due to a lack of legislation to force Owners to use the standard contract templates provided by licensing bodies,^{L2C} there is a large variety of possible contract types including contracts authored by a sophisticated client’s legal counsel either in-house or retained. As such, below is not a comprehensive list of possible contract hierarchy organizations; it covers one possible arrangement in each of the three aforementioned types: DBB, Design Build, and Construction Management. The below diagrams also assume that every possible sub-consultant is not in-house. *Critical success needs efficient communication.*

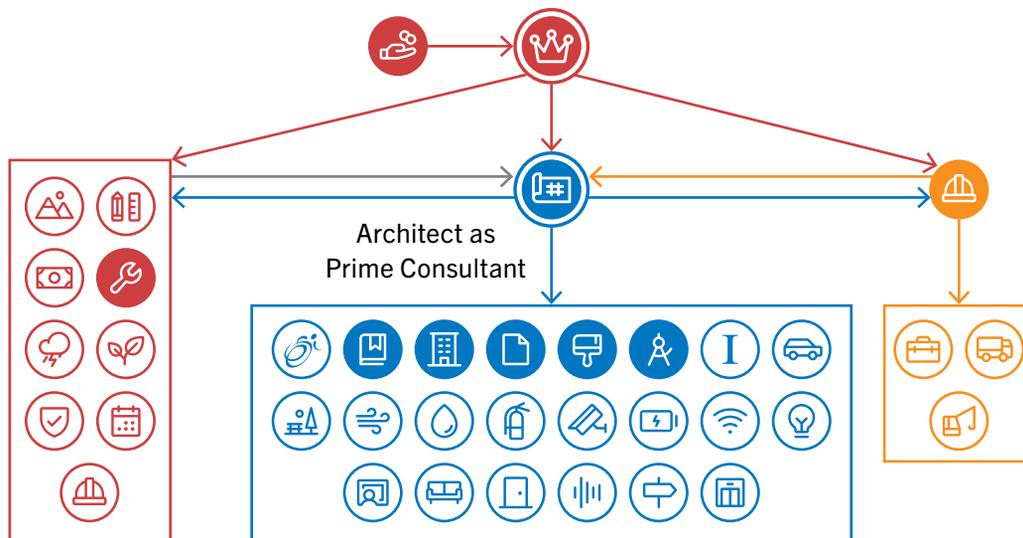
In all cases, the accessibility consultant should be closely tied to the Architect. This consultant should join the other consultants that should be subs under the architect in every project: building code, building science, interior design, spec writer, landscape architect, and acoustics.

4.3.1.1 Possible Consultants Arrangement in a DBB Delivery Model

The diagram on the next page is an arbitrary consultant arrangement. That said, the Structural, Mechanical, Electrical, and Civil Engineers as well as the Landscape Architect are usually sub-consultants under the Architect. Some of the consultants under the Owner such as Cost Consultant, Energy Modeler, Sustainability Consultant, Planning Consultant, and Construction / Phasing Advisory Consultant are possibly better under the Architect but this is not common. It is entirely possible to arrange consultants similar to what is shown in 4.3.1.3.

The accessibility consultant must be closely aligned with the architectural designer and the Prime Consultant, as early as Phase 1 Feasibility.

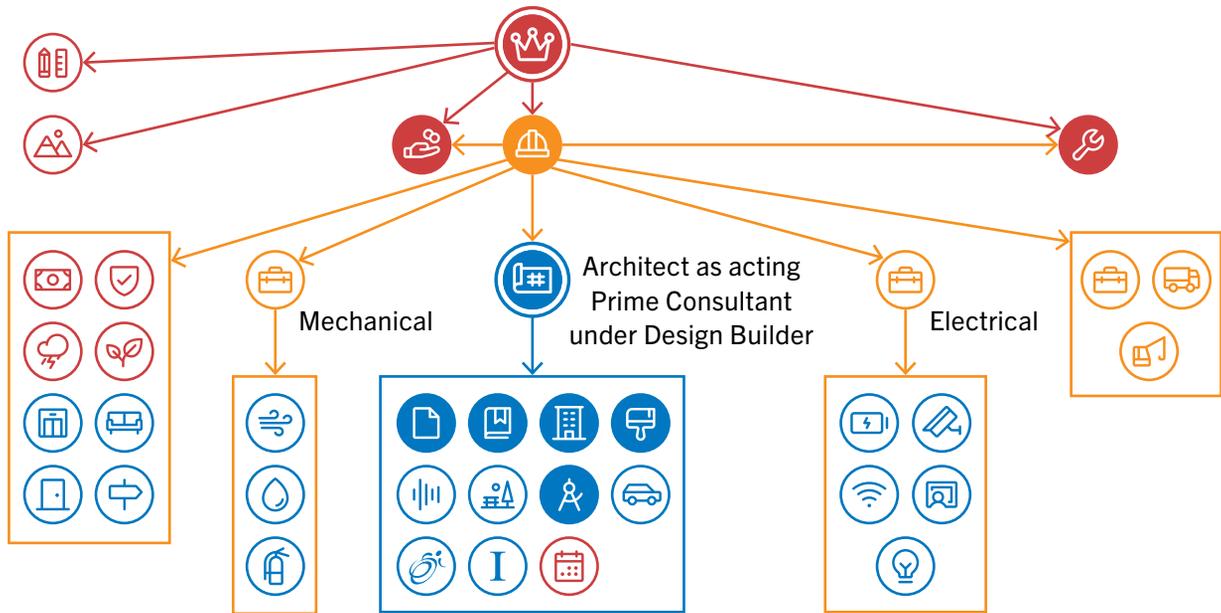
The Land Surveyor and the Geotechnical Engineer are preferably always under the Owner as their information and reports of the property site are required before any contracts or any designing can commence by the Architect. There's a great difference in design effort between a flat site with good soil versus a steeply sloped site with bedrock present in possibly the worst spots.



4.3.1.2 Possible Consultants Arrangement in a DBFM Delivery Model

The diagram on the next page is an arbitrary arrangement of consultants, sub-consultants, and sub-trades. Usually, the Design Builder determines the consultant contracts' hierarchy while the Owner's RFP determines what minimum requirements are for the consultant teams. That said, there are some consultants best under the Architect due to how completely intertwined their design scopes of work can be where having to communicate through middle people creates coordination delays.

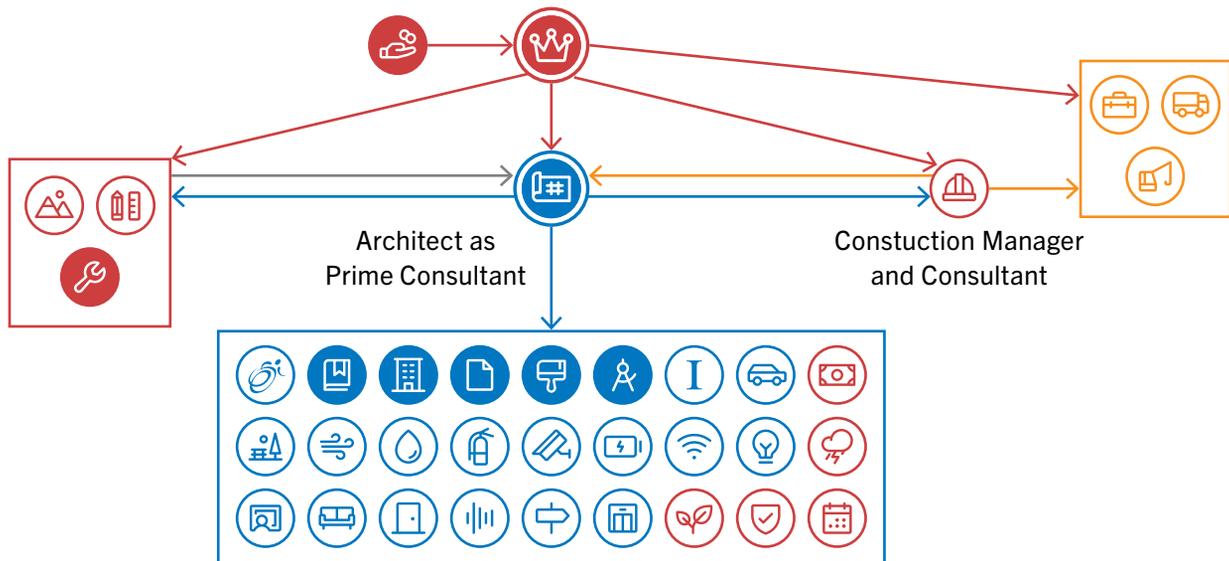
Structural and architectural designers can gain better efficiency by working close together. Acoustic performance must be integrated into wall and floor assembly designs. The Site Plan designer trio (i.e. Arch, Landscape, and Civil) are best working closely together due to the need to reconcile stormwater management versus shallower slopes for mobility devices. RHFAC requirements affect architectural, structural, acoustic, site plan layout designs, thus **the accessibility consultant needs to be able to work closely with all those designers.**



4.3.1.3 Possible Consultants Arrangement in a CM Delivery Model

The diagram below is an arbitrary consultant arrangement. When a Construction Management delivery model is contemplated, there is usually a very aggressive construction schedule being pursued and are often costly or overbudget projects.

The increased speed required of a CM project increases the need for an accessibility consultant to be involved not only as early as possible but also intimately throughout the design process. Building a design decision tree quickly is not recommended unless the project is based on a prototype that is near identical to a previous project; thus, a construction management project should provide enough schedule for enhanced accessibility design integration. It is also possible to arrange consultants similar to what is shown in 4.3.1.1 above.



4.3.2 Contract Diagrams Legend

 Architect	 Elec Engineer: Power Design	 Geotechnical Engineer
 RHFAC Professional with Prime Consultant Experience	 Elec Engineer: Communication Design	 Land Surveyor
 RHFAC Professional as Subconsultant to Prime Consultant or Owner	 Elec Engineer: Lighting Design	 Cost Consultant
 Building Code Consultant	 Electronic Security Engineer	 Energy Modeller
 Building Science Consultant	 Audio Visual Consultant	 Sustainability Consultant
 Interior Designer	 Vertical Transportation Consultant	 Commissioning Consultant
 Civil Engineer	 Door Hardware Consultant	 Planning Consultant
 Master Specifications Specialist	 Signage Consultant	 Construction / Phasing Advisory Consultant
 Traffic Engineer	 Vibration / Noise/ Acoustics Consultant	 General Contractor / Builder / Developer / Design Builder / Construction Manager
 Landscape Architect	 FF&E Consultant	 Subcontractors / Subtrades/ SOW Bidders
 Structural Engineer	 Owner / Landowner	 Suppliers / Manufacturers
 Mechanical Engineer: HVAC	 Financing Party	 Site Works Subcontractor
 Mechanical Engineer: Plumbing (Pipes)	 Insurance (Various)	 AHJ: Building Department
 Fire Protection Consultant	 Facility Management / Property Manager	



AHJ: Planning
Department



AHJ: Fire Department



AHJ: Conservation
Authority

These symbols are intended to help describe the multi-company teams in the diagrams above in contract hierarchies and communication corridors to help different readers of different training backgrounds to visualize how information of the building design development flows through a Project Team.

5. Feasibility Studies: The Critical Beginning

5.1 The Study That All The Numbers Are Based On

An Owner's first understanding of the scale of the new construction project is the first cost estimate. If a Cost Consultant is consulted on this exercise, this is usually a Class D "Indicative" or Elemental Cost Estimate (similar to Class 4 in the USA) that presumes a 20% design allowance based on a feasibility study that has how big the building is, the general level of finishes, the general site layout work required, and all based mostly on quantity takeoffs. All budget or project or schedule approvals assume this upward range of possible costs and start the project planning.

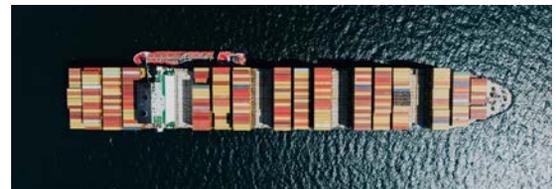
The feasibility study is a design exercise usually done with the least time, effort, liability, and fees that is invested into the study during the most important time for any decision tree: *the beginning that becomes the tree trunk*. This is sometimes authored by parties who have limited experience in the actual construction of similar projects. Cost estimates are based on the premise that a variable market cost of an item and quantity can be treated as a constant in the business math to predict the future.

Usually in math, it is a critical mistake to assume a variable is a constant.

Cost estimates take the assumption that variables can be treated as constants. While certain variables may be observed to vary within a minor range (such as lumber prices, exchange rates, bond rates, etc.), you're still operating at risk by assuming the upper range of variables and then replacing them as constants in the business plan math.^{YR10}

Class D Cost Estimate is just a ballpark figure and does not account for any black swan events like COVID-19 or the 2025 US Tariffs. Proceed with caution.

Designing with meaningful access in mind means designing for everyone and most importantly people of varying abilities. It requires a team that understands how the users of the space, including those with disabilities interact with the built environment.

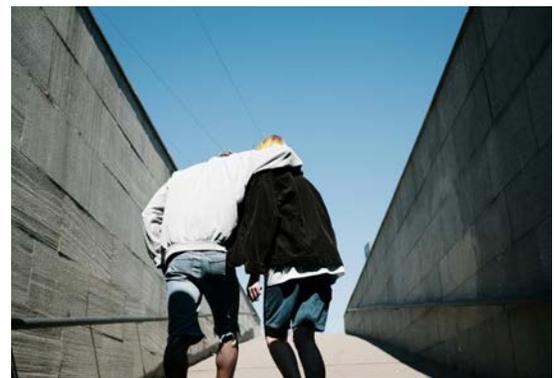


5.1.1 Early RHFAC Design Integration = Better 1st Cost Estimate

The more that a Cost Consultant has to work with in terms of specifics and quantities that can be quantified in the feasibility study, the higher the likely accuracy of their cost estimate. Inadequate budget or schedule for desired outcomes is a frequent problem on building projects where some projects manage to find a satisfactory but compromised solution after heroic efforts of the Design Team while others simply end in disputes on who is to blame for what went wrong.

Major design elements need to be included in the feasibility study. Some upgrades for accessibility may be fairly minor in time and capital costs if placed and accounted for early in the building design. *Again, accessibility design is a design methodology, not a hat.* Examples of basic Phase 1 Feasibility design elements (in drawings or in written description blurb) that can be affected by RHFAC requirements include but are not limited to:

- Elevator type, location, and impact on interior circulation
- Size of egress stair footprints
- Structural supports needed
- Main corridors clear widths and other interior circulation designs
- Access to all building amenities
- Dimensions of designated accessible parking spaces
- Number of designated accessible parking spaces
- Number of universal washrooms
- Floor-to-floor heights
- Geodetic elevation of the ground floor's FFE
- Main entrance design and clear spaces
- Vehicle paths design within the site
- Removing slanted walls or columns from consideration
- Additional site protection from weather
- Audio and visual building technologies
- Intuitive wayfinding



- Generic interior finish types
- Outdoor pathways and rest areas in the site
- Electronic security options
- Door sizes, hardware, and swings
- Open-plan or large open area design and configurations
- Fixed carpentry design of counters and cabinets
- Plumbing fixture and other equipment selections
- Acoustic design provisions
- Major signage strategies
- Major furniture selections and accommodations

5.1.2 Experience is the Most Valuable Asset Along with What Happens After

Feasibility studies are usually given so little value that these can be authored by Cost Consultants so that the Owner can have a one-stop shopping opportunity and get both feasibility study and initial cost estimate for the contemplated new construction. Other feasibility studies can be as little effort as a coloured pen sketch on thin paper showing a conceptual site plan with little to no accuracy. The variation on quality of feasibility studies can be directly correlated with the consultant fee for the study,^{L1P} the experience of the author, and what is scheduled to happen after.^{A1IP}

5.2 Central or Repeated Units Finalized as Early as Possible

An efficient building design depends on repetition for both design and construction teams. Repeated elements can be wall or floor assembly types but also underground parking spaces or a collection of rooms that are repeated vertically or horizontally. Singular but central elements can be the stage of an auditorium or an ice hockey arena built to professional major league dimensions.

The best way to include accessibility design is from the very beginning in Phase 1 Feasibility. This means that either the feasibility study author has the necessary accessibility design experience, or the author should be teamed up with an accessibility subject matter expert who is familiar with the project's design targets. **Financial backing can be dependant on producing an accessible building** so this major design consideration should neither be overlooked nor underestimated at the beginning of the design. A townhouse complex project that repeats inaccessible units can pose a major problem as a project continues too far in details without accessible design embedded in.



5.2.1 The Repeated Units that Determine the Entire Project

The most repeated building units of a project are usually those that determine the spacing of the structural skeleton of a building, specifically due to their repetition. Much like the width of the horsedrawn carriage determined the diameter of the rocket boosters for space shuttles^{YA11} or the width of Hong Kong streets to transport modular building units, a building's base units and critical dimensions are sometimes surprising on what the rest of the building's design is subservient to. If a building repeats suites or units or parking spaces or has a central focus space with repeated fixed seating, those spaces tend to determine most of the building design.

Examples of the largest but most basic units determining the whole building or major section or wing of a building:

- Municipal by-law definition of minimum dimensions for parking spaces and two-way drive aisles will likely completely constrain the design of all the lengths and widths of the suites of any condominium building that has underground parking^{L1H}

- Workstation products in an open-concept office or individual offices layout
- The school desks and aisle configurations used in a school
- The courtrooms of a courthouse
- The standard prisoner cell size and the clusters in detention centres
- The size of hotel rooms for a hotel with an outside parking lot
- Lab counters and spacing in a laboratory
- Room configurations of residential apartment suites

Any building portion that is repeated and needs accessible design must logically have those provisions in place in the feasibility study that the cost estimator quantifies.

It is much easier to make things smaller or subtract elements as a project progresses versus trying to add space and building elements that were not accounted for in the beginning.^{A1A}

Examples of a repeated elements around a centrepiece space or element:

- Seating for a movie theatre
- The pedestrian waiting platform for a subway station
- The size and ideal viewing clearances and seating for artworks in a museum
- The fixed seats and rows distribution in an NBA arena or other arenas



If these spaces do not consider accessibility design in Phase 1 Feasibility, the entire project will begin off-course from its start. It will be substantially more difficult to include accessibility design in building design the longer the delay that these foundational considerations are first talked about as a Design Team discussion subject. This conversation being early is critical to the schedule, otherwise there may be consultant designs increasing in intricate technical custom-detailing and multi-discipline coordination built upon the project's first design assumptions of a standard code-compliant building design ... when those assumptions were missing a key objective.

A building designed for RHF Accessibility Certification can see a very minor or modest increase in size over a minimum building code design, but **a minimum building code design will not achieve RHF Accessibility Certification.** A building designed for RHFAC Gold will likely need more space and capital investment to achieve the higher level so these must be captured in the Feasibility Study so the first cost estimate can be more accurate.

6. Design Phases and Prioritization

6.1 Renaming Traditional Design Phases

The traditional design phases of a building project are as follows:

- Pre-Design (PD) or Conceptual Design
- Schematic Design (SD)
- Design Development (DD)
- Construction Drawings & Construction Specifications (CD) or Contract Documentation

For the purpose of this Guidance Book, these phases have been relabeled as follows:

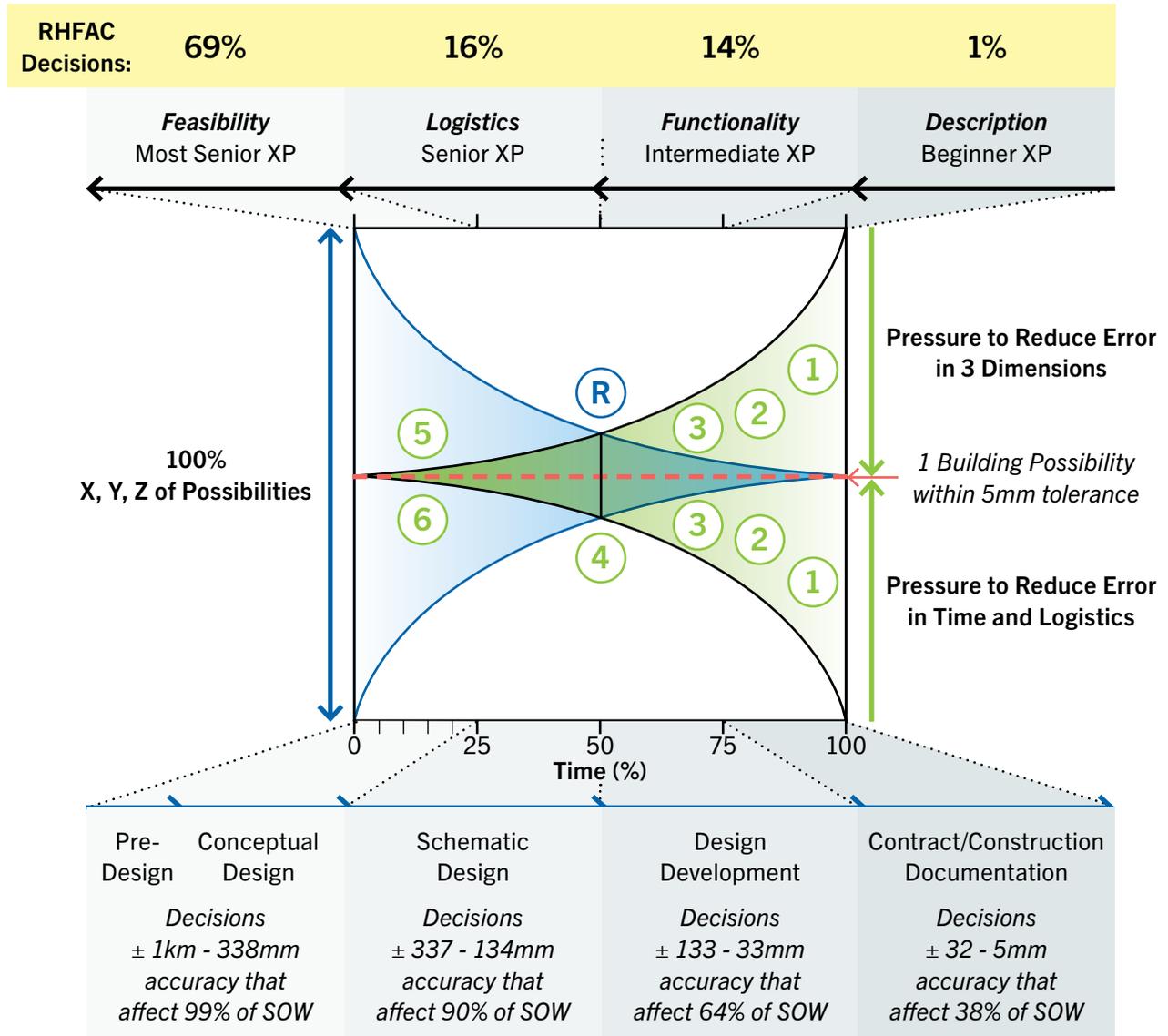
- Pre-Design Phase and Conceptual Design **Phase 1 Feasibility**^{A2Ph1}
- Schematic Design Phase **Phase 2 Logistics** ^{A2Ph2}
- Design Development **Phase 3 Functionality** ^{A2Ph3}
- Contract Documents **Phase 4 Description**

Most architects believe their main deliverable is a building design. This is only partially true. An architect's main deliverable is contract drawings and specifications so that their Client, the Owner, can put the building design on the market for pricing via the Bidding and Negotiation phase.^{A1D}

And after award of the project, these Contract Documents need to be able to defend the original design intent in quality, quantity, and location by reducing any possible misinterpretation by the General Contractor/Builder, or any of their Subcontractors.

6.2 Net Zero Graph© of a “Perfect” Design Process with RHFAC Decisions

Designing a building project appears linear but in fact the work scales exponentially and parametrically. The first project decision becomes the first parameter for the next two decisions. Those first 3 decisions become the frozen parameters for the next 5 decisions, and so on and so forth. **A building design is essentially a giant decision tree.** An ideal building project design unfolds per the Net Zero 4D graph© below:^{YL14}



- (R)** 90% Possibility Reduction
- (3)** 11-36% Work of Team
- (6)** Most Impactful Executive Decisions
- (1)** 62-100% Work of Team
- (4)** 1-10% Work of Team
- (---)** On Time, On Budget “Perfect” Path
- (2)** 37-61% Work of Team
- (5)** Heaviest Executive Decisions

Buildings are inherently four-dimensional products—they exist in three physical dimensions and are constructed over a specific period, beginning at a particular time and location. Therefore, relying solely on square footage for estimates is inadequate, as it reduces a complex, time-dependent process to just two dimensions, measured in dollars per square foot. This approach fails to consider the unique characteristics of each site, the time and expertise required for design and construction, and the influence of current market conditions. The same building on the exact same sized lots could be both a different price, different quality level of construction, and a different construction schedule due to simple market differences between one municipality and another.

The Building Development industry suffers from oversimplification and frequent false equivalencies that business plans often go sideways. The frequent problem is usually a fundamental misunderstanding or collection of wrong assumptions in the very first design phase: the Feasibility Phase. Any mistake or wrong assumption on budget, achievable schedule, adequacy of human resources, the communication effectiveness of those human resources, and appropriate quality control on errors and omissions will create ripples towards project failure.^{01B} The severity of an early error will see the error escalate in speed and impact towards terminal velocity if not addressed immediately and effectively to minimize the impact.

Feasibility errors are best corrected in the Feasibility Phase. And yet this is the phase that too often that too little attention and too few of the Owner’s resources are spent to confirm whether overall project objectives can actually be achieved. The range of RHFAC target decisions varies from the sizing and placement of the building in the property in the first feasibility studies down to which side a flush lever on a toilet goes. The vast majority of RHFAC requirements need to be discussed and known by Owner, Prime Consultant/Architect, and Cost Consultant/Estimator in the first design phase to achieve the following objectives:

1. Budget Accuracy
 - a. Ballpark estimates on the range of extras targeted
2. Project Timeline Accuracy
 - a. Adequate time for design based on size and competency of Design Team
 - b. Adequate time for construction based of project delivery type
3. Site Plan and Building Concept Accuracy
 - a. Accurate sizing and placement of building footprint in site and internal circulation and accurate sizing for repeated units.^{YC2}
4. Understanding Scale of Design Work
 - a. the feasibility study with conceptual site plan and building size and massing that assumes no critical errors often serves as the basis of consultant contracts,

- b. the extra RHFAC design work needed by which consultants *before* the consultant contracts are signed and project schedule understood, and
5. The Design Team Composition and Contracts
- a. Sufficient skills and experience of the Project Team with accurate and realistic estimations and terms of their contracts
 - b. Understanding if specialty or subject matter experts are required and when.

6.3 RHFAC Design Target Categories by Phase

It cannot be said enough that RHFAC requirements should not be seen as an add-on at the end. Most of these requirements need to be on the Project Team's radar at the very beginning. Anything that may affect building footprint location in the site, structural design spans and locations, site plan layout, front door location, exterior and interior pedestrian and vehicular circulation, and general quantities and qualities of materials and building products should be established in the feasibility study for an accurate 1st cost estimate.

6.3.1 Phase 1 Feasibility: Accommodate the Most Inflexible

The Feasibility Phase (aka Pre-Design Phase) is the most critical phase of the entire project. **It is in this lone phase that the worst mistakes are made**, as errors and omissions in this phase can turn into uncorrectable disasters later. There are no shortage horror stories that could be told on early but avoidable mistakes.



Image: City Block Development Proposal with High Density Residential

6.3.1.1 Site Selection

Site conditions vary in soil conditions, zoning by-law requirements, height restrictions, density restrictions, easements, and topography. **Site conditions serve as the #1 reason why each building project requires customization.** Canadian Shield bedrock doesn't typically obey any property lines, nor does it care where you want to place a basement. Until we invent inexpensive large-scale rock lasers, dynamite has to suffice.

NBC already requires that main building entrances be on the *barrier-free path of travel*, so the number of ramps that may be needed to connect the site to the building entrances may subtract from available space for other beneficial site elements such as parking spaces. The RHFAC Rating Survey does not apply a difficulty modifier for a New Construction building that

exists on a flat site versus a sloped site. *An Owner of a flat site will be awarded the same RHFAC points for a barrier-free main entrance as that of a severely hilly site.* Things don't need to be unnecessarily difficult.

The easiest decision to make your project easier to achieve RHFAC certification is to buy or select a plot of land that is as flat as possible. The more that designers need to devote real estate to sloped walkways or ramps towards building entrances, the less site plan room there is for things like parking and other site features that may affect the asset value of the building.

Further analysis needs to be done to confirm that RHFAC requirements do not conflict with applicable legislation such as Zoning By-laws (see Appendix A about confirming legislation). If a municipality does not allow canopies within a yard setback, then a covered walkway from accessible parking cannot be considered by the Design Team for that particular property. Such a feature should never be added after the Feasibility Phase, unless the municipality has agreed in writing that a zoning by-law requirement will be relaxed if there is a conflict.

6.3.1.2 Conceptual Site Plan

Every building project starts with a conceptual site plan that fits a building to the unique parameters and constraints of its site: zoning by-laws, scale/massing of building, path to the entrances, pedestrian traffic, vehicle traffic, parking dimensions and number of spaces, loading/unloading, shelter from the elements, how the internal building interacts with its exterior environment, etc. As such, this means RHFAC requirements that affect or need to navigate any of the aforementioned subjects need to be known to the Design Team in the Feasibility Phase. Some of these requirements may need to be discussed with the Municipality early in the project to ask for relief to their zoning by-laws and pursue a minor variance with them.^{L1V}

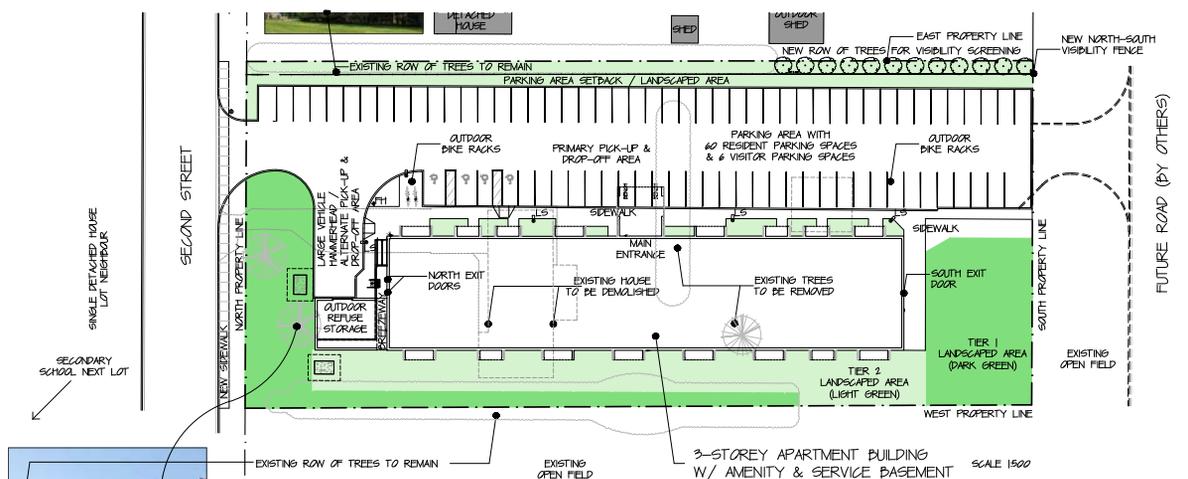


Image: Feasibility Study with Site Plan Test Fit against Zoning By-law Requirements

RHFAC requirements related to Site Plan include but are not limited to the following:

- **Upgrades to designated accessible parking spaces** above applicable legislation: number of spaces required and possibly larger dimensions of spaces and transfer aisles, accessible EV charging station, shelter.
- **Sidewalks upgrades:** clear widths, number of curb cuts, pedestrian scale lighting, bollards, edge protection, covered shelter extents, operations protocols in advance of occupancy, intuitive wayfinding, 5% slope ramps (unless in a municipality limiting ramps to 4% max. slope), max. 2% cross slopes, maximum number of steps in stairs, shallower stair risers and deeper stair treads.
- **Site/Building Interface upgrades:** minimum clear space requirements for multiple objectives, additional site protection against weather, number of accessible entrances, room for seating at entrances, shelter.
- **Site lighting upgrades:** target lux, pedestrian scale lighting.
- **Site space allocations:** passenger pick-up and drop off, exterior seating, service dog relief areas, site equipment, passing/rest areas, etc.

6.3.1.3 Conceptual Building Design

Every Feasibility Study should start with a building footprint and massing that is fundamentally both sized appropriately and placed well in its site within about $\pm 14"$ (350mm) accuracy in an ideal world. In order for consultants to price the scope of design work of a project aiming for RHFAC certification, they need to know the scale of how much design work is needed and whether they even have the relevant experience (although an inexperienced design firm may not realize or fully disclose how inexperienced they are). Also ideally, the Design Team knows, at the end of this phase, what type of structural system is being pursued, whether it is a concrete, concrete block, steel, structural steel stud, wood stud, or heavy timber.

The more design issues that are addressed early in this phase, the greater the savings and efficiencies later—potentially tenfold. If the design “theory” developed here stands up through Phase 2 without clashes or major changes from other consultants, and continues to support their work through Phase 3, then the Phase 1 design can mostly carry forward, with only details and descriptions added in Phase 4.

Why is getting the design right in Phase 1 so beautiful? *Because the more the designer’s idea of the building is the same from Phase 1 to Phase 4, the less likely the errors.* Changing something major in Phases 3 or 4 may significantly impact the design considerations of a consultant unaware of the change or its impact.

RHFAC requirements related to the building's general size and site location include but are not limited to the following:

- **Site/Building Interface upgrades:** those noted above in 6.3.1.2, vertical height clearances, emergency operation of automatic doors, electronic security. Vertical upgrades in floor-to-floor heights or building structure: elevator interior cab dimensions, refuge areas in egress stairwells (size of landings), provisions around escalators, platform lifts, roll-in showers, accessible balconies.
- **Interior horizontal circulation upgrades:** widths of main corridors, rest areas, escalators not doing double duty for egress stair width calculations, access to any and all spaces including stages and back-of-house in performance halls, ramps, intuitive and logic wayfinding and circulation routes, accessible path of travel connecting all building amenities and key functional spaces.
- **Building unit upgrades:** number of accessible/adaptable hotel rooms or dwelling units, parking items noted above in 6.3.1.2 if indoor parking units, number of accessible seating and their lines of sight, number of universal washrooms, etc.

6.3.2 Phase 2 Logistics: Anything affecting Structural Design or Site Plan

By the end of the Logistics Phase (aka Schematic Design), the Design Team should have the “bones” (both the foundations and the superstructure) of the building and the general site plan layout finalized within about ± 6 ” (150mm) in an ideal world. Structural design member type, sizing, and spacing should all be mostly finalized by the end of this phase. This requires a strong confirmation of the sizing and placement of critical functions of a building both the main feature rooms of a building as well as all mechanical and electrical spaces with large equipment.

In Phase 2, the Design Team will want to work out the main loads of the building that they need to calculate to confirm the general scale of the sizes needed to make the building work. Due to the in-flux nature of a building design in this phase where walls and rooms can move unpredictably, detailed drawings are usually avoided in this phase except for repeated elements or details that form the basis of the entire building design.

- Architectural Design:
 - Confirm the building code requirements in the building design for occupancy type, occupancy loads, egress travel distances, required fire resistance of building structure and spaces, building envelope performance such as thermal resistance needed for climate, barrier-free path of travel, number of plumbing fixtures and washrooms, building code matrix, etc.^{YC2}

- Confirm sizing of rooms, interior circulation, and vertical circulation as well as building entrances and exits
- Provide initial assignments of exterior finishes to help both structural engineer and building science to understand the proposed conditions
- Provide initial general assignments of interior finishes
- If Prime Consultant, initial coordination of the other consultants' designs and resolving identified conflicts
- Structural Design:
 - Confirm with the architect the expected human occupant loads for levels
 - Review the geotechnical report for soil and foundation conditions
 - Calculate the vertical loads of the building and provide general sizing and confirm spacing for the foundations and superstructure for the Design Team
 - Confirm wind loads or other lateral forces on the schematic building design
- HVAC Design:
 - Review the occupancy and volumes and window sizes of each space and propose the HVAC design for volume, solar heat, thermal insulation, etc.
 - Proposing initial sizing of large mechanical units and initial duct paths
- Plumbing Design:
 - Once the Architect has provided the number of plumbing fixtures and locations along with other site-specific info such as municipal water supply numbers, the mechanical engineer can calculate the number and sizing of major water supply equipment and general assessment of pipe pathing
 - Probable sizing of equipment and pumps needed by the Fire Protection engineer if sprinklers or standpipe are required in the building design
- Electrical Design:
 - Based on architectural design, initial quantities and distribution of lighting, power, and communication systems.
 - Sizing of large equipment is the most important item needed from Electrical, such as switchboard and/or transformers, as well as electrical panels' and servers' impacts on space
- Civil Engineering Design:
 - Based on the barrier-free path of travel identified by the architect, provide initial

proposed site grading so that both stormwater drainage and barrier-free path of travel slopes are achieved, despite their inherent conflicts

- Possible need for traffic engineer to assess vehicle circulation impacts of site design and its impact on the Municipality's roads and traffic impact assessment
- Based on the schematic site plan and building design, calculate the stormwater loads that are a consequence of the building
- Landscape Design:
 - Review of existing site and identifying trees that need tree removal permits
 - Initial proposals of site design of landscape features of paths, seating areas, new planting areas, new proposed trees and other foliage, etc.
- Other Consultants' and possible other Project Team's initial feedback:
 - Sustainability Consultant if such objectives are being targeted
 - Energy Modeler's initial review (if different than Sustainability Consultant)
 - Facility Management initial concerns
 - Construction / Phasing Consultants initial concerns
 - Vertical Transportation Consultant confirmation of number and size of vertical transportation and their minimum hoist way shaft dimensions
 - Furniture, Fixtures, and Equipment consultant's (or architect's or interior designer's) initial assessment of sizing of rooms and furniture distribution

RHFAC requirements related to the building's structural design and finalized site design include but are not limited to the following:

- **Vertical Circulation:** items noted in 6.3.1.3 above related to vertical circulation, critical details in stairs that could affect location of the structural design such as handrail extensions or limitations on number of steps per flight.
- **Interior horizontal circulation:** items noted in 6.3.1.3 above, handrails in long corridors, clearance around doors and other interfaces.
- **Building Envelope relative to Structure:** window distribution and assemblies.
- **Building Element upgrades:** clear width of openings (e.g., doors, windows, corridors, etc.) through structure, accessible plumbing fixtures, accessible cabinetry assignments, accessibility with raised flooring, mailboxes all at accessible heights, accessible path of travel connecting all building amenities and key functional spaces, acoustic upgrades of walls or ceilings, accessible seating in places of assembly.

- **Furniture, Fixtures, and Equipment upgrades:** sizing range of all furniture and their placement configurations that could affect the size of rooms or the weight loads on a floor area, etc.

6.3.3 Phase 3 Functionality: Interior Walls Frozen at the End of this Phase

By the end of the Functionality Phase (aka Design Development), the Design Team should have the walls finalized within about $\pm 1.5"$ (38mm) along with ceiling design accuracy and all discipline coordination accuracy in an ideal world. **Owners and stakeholders should be clearly informed ahead of time that, following this phase, the Design Team will not make any changes to wall locations.** Basically, this is the phase that confirms that the rooms function as intended, and the engineers can finalize their calculations based on the work of the two prior design phases and coordinate work between architectural, mechanical, and electrical designers as well as finalize any additional work not already finalized with the structural, civil engineering, and landscape designers.

This phase is also where certain consultants can confirm the scope of their part of the design with the Owner and Stakeholders with alignment with the Project Budget and objectives or coordinate their designs further with greater certainty that wall locations and ceilings are “frozen”:

- Interior Design general design and assignments
- Electronic Security Design
- Electrical quantities and preliminary locations
- HVAC equipment and coordinated duct sizes and paths
- HVAC plumbing fixtures and coordinated locations
- Fire Protection design in ceilings and system pathing
- Specifications’ table of contents
- Signage Consultant preliminary review and strategy
- Energy Modeller first run modelling
- Audio Visual Consultant servers & equipment locations
- Door types, materials, glazing, auto door operators

RHFAC requirements related to the finalization of wall locations and general scope of finishes and details include but are not limited to the following:

- **Interior horizontal circulation:** confirmation of items noted in 6.3.1.3 and 6.3.2 above, line-up and queuing configurations, more accurate arrangement of FF&E.

- **General finishes and detailing:** size and location of doorlites, floor finish restrictions and requirements, door hardware, wall-mounted controls, cabinetry interaction, plumbing fixture mounting heights, washroom accessories' selection and heights,
- **Mechanical system upgrades:** temperature consistency between spaces.
- **Electrical design upgrades:** level of lux for illumination, variety of interior lighting, balance of light levels between spaces, audio visual system building-wide or room-specific systems, dimmer switch assignments, emergency systems interfaces, electronic security interfaces.
- **Earlier Operations considerations:** intuitive room numbering, initial signage and wayfinding strategies, interactivity and logistics with occupant devices or info or self-serve kiosks, etc.

6.3.4 Phase 4 Description: Specifications

At the Description Phase (aka Construction Drawings or Contract Documentation Phase), the Design Team should only be adding drawings and specifications that simply describe already generally agreed upon elements of the building design between the Owner, Stakeholders, Architect, Engineers, and all other consultants. **Walls should not be moved in the design; the category of floor finishes should not be changed.** If a Project Team has done their job collectively well, this phase should only see very minor corrections as they try to describe the design so that General Contractors and Subcontractors can quantify/estimate their scopes of work to submit a price quote. Typically, the same drawings and specifications are also submitted for building permit.

Examples include but are not limited to:

- Door weight and door hardware finalizations
- Carpet tile product pattern versus another, upholstery details
- Furniture heights
- Correcting which side of the toilet that the flush lever goes
- Final locations of electronic security elements, etc.

This is also the phase that consultants like Signage can both start and complete their work without worrying about moving walls or rooms being switched around far too late.

This is also the phase where any major design changes can be disastrous. If a Phase 1 design item needs to be significantly changed in Phase 4, entire swathes of the entire Design Team's work could be thrown out the window with not enough time or human resources to resolve a Phase 1 problem in Phase 4. Imagine a massive decision tree where one of the first branches was incorrect and how many subsequent decision branches that can be affected by that one early mistake ... how impossible to quantify and communicate.

Are mistakes made during Phases 1 to 3 often discovered in Phase 4? Absolutely—they are quite common. Attempting to make all RHFAC-related decisions or scheduling the RHFAC rating during Phase 4 is essentially equivalent to repeating major errors from earlier phases. Such missteps can significantly affect building design professionals, potentially leading to ongoing stress and frustration. Be kind, rewind. In short, it's best to address RHFAC requirements early and thoughtfully to avoid costly problems later.

6.3.5 Occupancy Phase: Owner or Tenant Responsibilities

There are RHFAC requirements that the Construction Team, the Owner, Operations, or the Tenant would be responsible for rather than the Design Team. These include but are not limited to:

- Accessibility information on website
- Timing of elevator door closures
- Timing of auto door operators, this especially needs to be known by the facility maintenance operator since the timing can be easily changed unknowingly to an incorrect timing by a maintenance worker or due to a building user complaint
- Vending machine selection
- Assignment of book sizes on library shelves
- Alternative media for temporary audio/visual presentations in Exhibit Halls
- Operations staff taking the RHFAC Training Course
- Sensory friendly toys and other mind-friendly environment resources such as noise-cancelling headphones
- Indoor plants and planters: their distribution and keeping them alive, etc.

As such, the Owner has work to do as well. That work should be coordinated with any relevant or affected consultants for the RHFAC Pre-construction Rating.

7. RHFAC Strategies

7.1 Meaningful Access

The Rick Hansen Foundation defines meaningful access as “access that meets the real accessibility needs of all users of a site, regardless of their physical ability.” Meaningful access refers to a built environment where every individual, regardless of ability, is afforded equal opportunity to engage with and utilize all aspects of the building. It ensures that no one is excluded or unduly hindered from participation or enjoyment due to a disability, promoting dignity, independence, and full inclusion for all users.



Where applicable building code is an objective code with minimum requirements for building buildings, the RHFAC looks at the entire user experience and sees the whole as greater than the sum of its parts the usage as a building. When applied to a preconstruction building, the RHFAC Rating Survey evaluates how the proposed design is likely to meet meaningful access requirements before construction begins by thoroughly reviewing its architectural drawings, specifications, and other key design documents.

New construction buildings have the advantage of not needing to work around existing building elements that cannot move or are expensive to retrofit like in heritage designated buildings. There is no valid justification for failing to achieve meaningful access in new construction. Buildings should be designed and constructed without barriers, ensuring that everyone, regardless of ability, can engage fully with the built environment.

7.2 Designing our Built Environment for Everyone

There are three main ingredients to meaningful access design:

- Experience
- The stories of others: their challenges and solutions
- Imagination



With those three tools in your kit, it becomes increasingly easier to identify the patterns of both the problems of other people trying to engage with the same built environment and the solutions to those issues. Ask yourself the following repeatable questions:

- Who is using the space? How would people with varying disabilities interact with the built environment?
- Can everyone use the space independently and safely?
- Does the space consider the full user journey?
- Is the space functional for its intended purpose and use?
- How can we design this future built environment so that it is fair for all?

The above questions can act as governing principles in the design of the built environment and guide every design decision towards a better solution for all people if one has not experienced a disability firsthand. Firsthand experience, whether by the designer or by stakeholder groups, is one of the best ways to understand a disability and its specific impact on how one engages with the built environment. Compromises will need to occur wherever there is a conflict between needs of different groups.

The best Project Team is one that can produce a built environment that not only recognizes the pressures of budgets, capital costs, legislation, demographics, and operational costs but also accommodates multiple types of people. To do that effectively, **the team needs to know the Why and the How of each disability.**

One of the major disconnects is that architects and other building designers do not fully understand the people who the building should be designed for. Despite being in the 21st century and the Information Age, there are multiple areas where major gaps of knowledge needlessly exist, such as how people with disabilities interact with the built environment. ***Simply put: architects are typically trained to design to minimum building code standards ... not how to change them for universal design.*** Additional training is thus required until universal design is a standard building code requirement.

While universal and inclusive design experience can come from working on projects that require focused attention to accessibility, the RHFAC Professional Training bridges the knowledge gap so designers can understand the what, the why, and the how of achieving universal design. The Rick Hansen Foundation is in particularly unique position as a repository of the voices and stories of people with disabilities.

7.3 Conflicts and Compromises

Addressing accessibility in building design can often feel overwhelming, as different disabilities may require design solutions that are at odds with each other. When certain sensory or mobility abilities are lost, individuals must rely more heavily on their remaining capabilities, which can create unavoidable conflicts in how spaces are designed to meet everyone's needs.

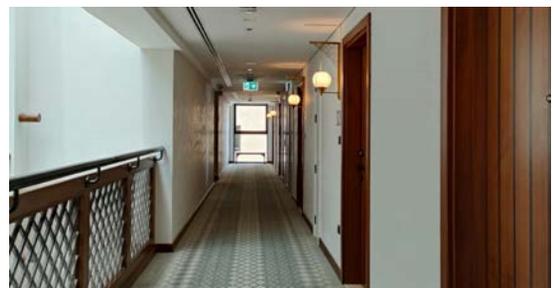
Building design should always follow a logical framework, meaning the guiding principles behind any design decision must be clearly thought out and defensible. ***Establishing a prioritization hierarchy in building design helps structure and guide major decisions, ensuring they are both rational and cost-effective.*** For example, roof structures are typically engineered to withstand a 100-year storm event, rather than the far less likely 1,000-year event, to balance safety and practicality.

In cases where design requirements for different disabilities come into conflict, the approach should focus on finding compromise solutions that can accommodate as many needs as possible. When feasible, the design should aim to support multiple disabilities, or, if the building is intended for a specific group, tailor solutions accordingly.

7.3.1.1 Flooring Surfaces

Sound from hard floor and wall surfaces can reverberate in the space for their echolocation skills and be beneficial for people with vision disabilities. Buildings for people with hearing disabilities should emphasize softer floor and wall surfaces to minimize sound reverberation. Less background noise through soft surfaces is ideal for other disabilities as well. Buildings for people with hearing disabilities should use rounder corridors and corners whereas such configurations are not the norm and may confuse people with vision disabilities trying to navigate that more unique environment.

A compromise solution could be a building with corridors and rooms with modest acoustic panels and some softer surface finishes to help reduce sound reverberation but not eliminate it completely. Carpet tiles shouldn't have high piles as this can impact wheelchairs.



7.3.1.2 Lighting

People with low vision may be sensitive to bright lights while people who are D/deaf or hard of hearing will depend on well-illuminated spaces as they primarily depend on their vision sense to navigate.

A compromise solution is to increase lighting levels, so interior spaces are not dark but also have dimmer switches to adjust lighting in every shared space and as many spaces possible. Interior finishes should also be non-glare and non-reflective as no one likes glare.



7.3.1.3 Sensory Input

Multiple disabilities have solutions that allow for alternate ways to gain information if one or more senses or motor abilities are compromised while other disabilities can be overloaded by too much sensory input from their built environment. Simplified building and room layouts and configuration can reduce the need to explain the building to users. Communication and signage strategies should be simplified in general.

7.4 Built Environment Alignments between Disabilities

There are some building design strategies that see repetition due to the same solution being able to accommodate multiple disabilities simultaneously. Some of these have already been incorporated in NBC as requirements in applicable building code, so a Project Team has to incorporate some of these targets anyways.^{Q1C} The below strategies will be referenced later in this Guidance Book.

7.4.1.1 STRATEGY A: Two-way Paths of Travel for Mobility and Other Disabilities

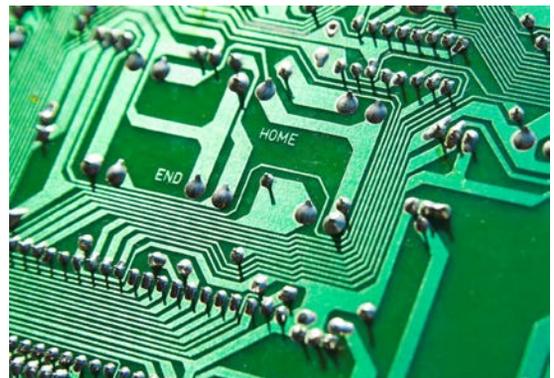
All outdoor and indoor pathways affording enough clear width for two-way travel works for all people of all ages and abilities. Minimum clear widths of public corridors have only increased over time in applicable building codes. When walking strides are compromised, more width to pathways help the flow of people.



7.4.1.2 STRATEGY B: Simple Floorplan Layouts

Space-efficient design depends on less interior circulation spaces when compared to floor area of functional spaces. Developers and Owners frequently focus on Building Efficiency Ratios (BER) to analyze quickly whether a building type is comparably efficient to others of the same type. **Centralizing amenities with intuitive layouts and have shorter distances to travel to them maximizes BER as well as work for multiple disabilities.**

In building designs (and other product designs as well), it is disadvantageous to overcomplicate the overall design configuration. Intuitive designs that are fully functional and simple are the signs of a seasoned and talented building designer. Overly long and detailed and semantics-cautious guidebooks can be signs of an author of information-heavy technical documents of creative and custom-building designs.



7.4.1.3 STRATEGY C: Colour Contrast

Colour contrast interior finishes strategies can be an organizing principle to simplify both outdoor and interior colour schemes as well as create lines of wayfinding. Incorporating high colour contrast between features can frame spaces and make visual cues within the built environment more intuitive and easier to perceive.



7.4.1.4 STRATEGY D: Easier Door Operation

Providing automatic sliding doors, an automatic door operator, or open entry/passageways can help people with baby strollers, shoppers carrying bags, bicyclists, and delivery workers as well as multiple disabilities.



7.4.1.5 STRATEGY F: Stable, Firm, and Slip-Resistant Floors

Stable non-slip floor finishes can lower risk exposure to Owners although there may be additional maintenance costs to upkeep the floors. This is a mainstay in applicable building codes.



7.4.1.6 STRATEGY MF: Mind-Friendly Environments

Designs supporting mental health and neurodiversity promote emotional calm by integrating natural elements and outdoor views, fostering connection and belonging.



7.5 Designing with Meaningful Access in Mind

Fundamentally, a building project design should prioritize the core function and purpose of the building as well as its ability to serve as many people as possible who could feasibly use the building. **If a Design Team aims to achieve all the RHFAC Gold, it needs to ensure that all the Certificate Prerequisites are met as a baseline.** Certification prerequisites exist to guarantee that buildings lacking essential accessible features are not certified as accessible.

The RHFAC Gold Certification prerequisites, when treated like organizing design principles, can help guide a building designer to create a building with meaningful access. For example, it's much easier to achieve the various accessibility requirements associated with a main entrance if, in Phase 1 Feasibility or Phase 2 Logistics, the Architect has already allocated for ample clear exterior space at the doorway with a shallowly sloped path towards it as well as ample manoeuvrability space inside the entry vestibule.



The RHFAC Gold Certification prerequisites are:

1. Designated accessible parking spaces, if parking is provided.^{L3P}
2. Access to public transit, if the site is in an area that is served by public transit.
3. Accessible path(s) of travel leading to the building entrance(s).^{NBC}
4. **Accessible primary entrance(s) for public^{NBC} and/or staff.**
5. Access to all floors by elevator if all floors are usable by everyone. ^{NBC}
6. At least one universal washroom. ^{NBC}
7. Emergency systems with visual and audible fire alarms in both public and private areas.
8. Wayfinding strategies to navigate throughout the site.
9. Safety warning features, such as tactile warning indicators at the top of stairs ^{NBC} and cane-detectable features, if there are overhead or protruding hazards along the path of travel
10. Tactile markings for permanent room identification signs.
11. Audio accessibility and communication enhancement technologies, when applicable to the site.

12. **Accessibility provision(s) for the key functional facilities of the site.**^{NBC}

13. Accessible or adaptable residential unit(s) for each type of dwelling unit (e.g. one bedroom, 2 bedroom, etc.) in a multi-unit residential building.

The prerequisites bolded above are the two Prerequisites for RHFAC Certification. Things will likely line up during the building design's development if the Architect or building space designer follows the simple principle that all key places throughout a project's exterior and interior site are designed so that all have equal access.

7.5.1 Possible Overlap with Applicable Municipal Accessibility Standards

Metropolises can sometimes have a separate accessibility standards by-law that new construction buildings need to be compliant to, due to having enough public funding to hire SME consultants to author such by-laws. These commissions are often being done by possibly unique consultants at different points of time and locations; as such, these accessibility standards are not identical but likely do have *overlaps in intent* if not in specific dimensions or requirements. Imagine a Canada being first to incorporate federal, provincial, territorial, and municipal governments under one roof with the same building code and accessibility standards and the same interpretations of them. Silly dream, eh?

That said, the RHFAC methodology is a standardized approach to assessing the meaningful access of sites whether it be in Canada, the US, or globally (with some translation efforts).

Designers and Owners should recognize that relevant legislation always takes precedence over RHFAC requirements. However, it remains crucial to pursue creative solutions to ensure environments are accessible for individuals with disabilities. ^{LOL}

7.5.2 Demographics Analysis and Better Occupant Experience

A building always has demographics of people who it is intended to serve. These demographics should always inform the building design versus a simple generic residential or commercial design approach of design. When a building provides dwelling units for an aging population, incorporating universal design principles is a smart approach. Universal design not only accommodates disabilities that are common or increasing within these demographics—such as mobility challenges, low vision, memory or cognitive disabilities, and hearing loss—but also supports the needs of most people, regardless of age or ability. By maximizing amenities and focusing on accessibility for all, designers create buildings that are simply better for everyone. Better buildings attract more people.

Buildings designed as mind-friendly environments for people with neurodiversity disabilities such as people on the autism spectrum who have much higher sensitivities in environmental

stimuli and may live with more intense emotionality every day. A building that is designed to be mind-friendly is not only supportive of neurodiverse individuals but also fosters well-being and accessibility for everyone who uses the space.

A respite room need not be relegated to a forgotten corner or be an afterthought. Instead, it can be intentionally designed as a premium amenity, enhancing the appeal of your building for neurodiverse individuals—including those who consistently excel and value supportive environments—as well as anyone who appreciates a welcoming space with attractive views.



8. Site Design: Vehicular Traffic

Vehicular traffic design within a property lot or building can have some of the most significant impacts to a project by eating up real estate very quickly both horizontally and vertically.

Space-efficient design for vehicles on sloped sites is in direct conflict with mobility aid accessibility design: drive aisles and ramps want to economize on horizontal real estate with steepness while the adjacent sidewalks and pedestrian paths want to be level and shallow.

Space-efficient vehicle route design on sloped sites often comes at the expense of the needs of people with mobility disabilities: drive aisles and ramps are typically designed with steeper grades to conserve horizontal space, which results in accessible sidewalks and pedestrian pathways being compromised, as they require gentle, level slopes for safe and convenient access for all users.

Vehicular traffic, stormwater drainage, and pedestrian pathways and entrances are Phase 1 Feasibility items.



8.1 Site Selection

The most effective way to avoid design conflicts between vehicle routes and accessible pedestrian walkways is *to choose a property lot that is mostly flat*.^{C15} RHFAC does not give extra credit or allow for more leniency when achieving accessible paths for mobility aid users on sloped sites compared to flat ones. In other words, designers are expected to meet the same accessibility standards regardless of the terrain, so it is much easier to meet these requirements on a level site. In some municipalities in the Rocky Mountains and on the Canadian Shield, finding flat sites are not always common. Try to pick the flatter site ... for an easier design.

Nearly 40% of the thirteen RHFAC Gold Prerequisites are notably more straightforward to fulfil when the site is relatively flat, removing the challenge of contending with significant slopes during the design process. For NBC Part 3 larger buildings that require an access route for fire department vehicles the slope of access routes need to be shallow. The flatter the site, the easier it is to adjust the approach to the main entrance for both fire trucks and people with mobility devices.

8.2 Principal Entrance, Fire Trucks, and Designated Parking

In larger buildings governed by NBC Part 3, a common design challenge is ensuring that fire trucks can access the main entrance within a distance of 3 to 15 metres, with a fire department connection located nearby. At the same time, designers must position designated accessible parking spaces as close as possible to this entrance to provide convenient access for people using mobility aids.



In Phase 1 Feasibility, this potential conflict needs to be resolved especially if there is a municipal accessibility standard that requires easy and convenient access from designated accessible parking to the main entrance. Some municipalities' zoning by-laws do not permit any parking in the front yard setback so there may be an additional challenge to the site design.

Depending on the building type, the size of the property lot, allowances of the municipal zoning by-laws, and the surrounding urban density, one solution (that may hit multiple birds with one stone) is to create a wide drive aisle configuration to the main entrance that can serve as a fire truck access route with turnaround space for the fire truck and then double as a passenger pick-up and drop-off area (PUDO) with waiting areas with outdoor seating with walkable surfaces with maybe an overall maximum slope of 5%.

With a PUDO area defined in front of the principal entrance, this may lead to a logical placement of designated accessible parking spaces adjacent to this area with close and convenient access to the main entrance. The fire truck access must take always priority in a site layout design, but opportunities may exist to take advantage of the firefighter vehicle access required to provide additional accessibility features with perhaps only minor adjustments to the site design. A PUDO area can create convenience and safety for both building occupants as well as neighbours since it can eliminate issues of double-parked delivery or ride app cars in the street.

8.2.1 Principal Entrance Potential Conflicts

Determining the location of a building's principal entrance is arguably the most vital and impactful design choice, as it significantly influences the building's overall functionality and accessibility. How a principal entrance is designed or where a principal entrance is located can create space efficiency or, on the other hand, require inefficient secondary entrances or circuitous and unnecessarily long service routes for incoming water, sanitary or stormwater drainage, and electrical power.

The shortest path from a municipal sidewalk to a building entrance is the least distance from Point A to Point B. The municipal Right-of-Way (ROW) road is usually where municipal domestic water, municipal drainage networks, and utility providers' electrical and communications arteries are located. The further a building entrance is from the street that the property lot faces, the more expensive it is to path all its services to service rooms in the building as well as provide constant and immediate access for utility providers' personnel. Sometimes a separate service entrance or cluster of rooms may be required.

The most efficient interior circulation systems obey the maximum allowable travel distances as determined by applicable building code. Due to NBC's maximum allowable travel distances to universal washrooms being at 45m, a large Multi-Unit residential building or office building should not have a typical floorplan's main corridors or path of travel extend more than 45m from the building core with its elevators and washrooms; as well the building core usually wants to be in the middle or critical nodes of a building for maximum internal space-efficiency. For one-story buildings however, the elevator and washroom issues provide less design pressure to locate the building entrance in the middle of the ground floor plan since vertical stacking pressures are not present.

Factors that can influence principal entrance design include, but are not limited to:

- Location of building core versus the economy of electrical, water, and drainage routes to the building and their associated service rooms
- Gentle and shallow floor slopes to the building entrance and snow accumulation or storm exposure if no entrance canopy is provided
- The further away a principal entrance is located from the closest municipal sidewalk, the less intuitive the wayfinding might be, unless the building massing expresses its entrance with a differentiator from the rest of the building such as placing an entrance canopy.
- Stuff happens on the ground floor that is not necessarily repeated on upper floors so typical floor plan designs must jostle structure with the ground floor plan design
- Creating wider and larger entrance areas, entry vestibules and lobby areas may seem to conflict with rentable or sellable real estate, but **good entrance designs actually uplift the overall value of all the building units** and provides both a premium quality design aesthetic as well as provide the spatial means for meaningful accessibility.



8.3 Parking Areas

Parking area designs, whether indoor or outdoor, is a unique puzzle on every project. No matter what, there is no greater efficiency parking distribution pattern for standard parking spaces than a double-loaded parking space arrangement. When designing parking areas, designers need to pay attention so that accessible parking spaces do not cross drive aisles.

One in five car accidents happen in parking lots so designers should design parking lots to protect the more vulnerable members of our population who have mobility challenges and who may not be able to see or quickly get out of the way of an errant car whose driver is not paying attention. When a project appears to prioritize the cars over people, it is just a bad PR accident waiting to happen.



8.3.1 Designated Accessible Parking Spaces

The design of designated accessible parking spaces is a Phase 1 Feasibility item: their size, their number, their location, the curb cuts, the surface material, the achievable slopes, and their path to the main entrance or accessible entrance. The dimensions and types of accessible parking spaces can vary quite a bit between municipal zoning by-laws. Drive aisle and transfer aisle minimum widths can also vary between different municipalities. CSA B651 is another set of parking dimensions to be reconciled.^{L1D}

8.3.2 Public Transit and 21st Century Vehicle Provisions

The 21st century has introduced a new supply of ride app drivers beyond taxi drivers to the public as well as phone app food deliveries. In metropolises, this enables people to live without owning a car or similar vehicle. Public transit systems sophistication varies from villages to small towns to cities to world cities but also enables people to be independent from car ownership to get from Point A to B.

As such, designing buildings in the 21st century requires attention to outside areas to support public or private transports. Areas for pick-up and drop-off should be given design attention to provide accessible building entrances, convenient waiting areas, and protection from climate events for everyone.

8.4 Access for Various Vehicles

Floor-to-floor heights are an important design decision to get right in Phase 1 Feasibility. Floor-to-floor heights have a direct relationship to building envelope costs due to the area take-offs that a Cost Consultant would do for a Class D Cost Estimate. The floor nearest to grade is always a critical floor to have accuracy as soon as possible since this floor affects all others in the design.

The following vehicles could prompt a higher ceiling on the ground level which would then assist designers to have an easier time to project canopies from the building structure to protect people from the weather near the building as well as accommodate accessible vans with wheelchair access:

- Garbage or recycling trucks with front forks or side loading and their critical height clearances needed with the loading action with a full-size refuse bin in the mix^{G1G}
- Delivery trucks in a loading bay
- First responder vehicles such as ambulances

Each municipality may have different vehicles makes and models so there is no standard floor-to-floor height for the ground floor that works in every building design. Due diligence should be done asap by contacting the AHJ, utility and service providers so the correct vehicle design criteria has been accommodated in the building design's ground floor ceiling height.

9. Site Design: Pedestrian Approach

“If your first step is in the right direction, you are one step closer to the finish line. If your first step is in the wrong direction, who knows where you’ll end up? You didn’t even know which direction you were supposed to go.”

~ Taiwanese Saying

The main entry door is *the most critical design decision* in any project as it must navigate nature, physics, multiple legislations, vehicular circulation, pedestrian circulation, and utility services.

The principal entrance acts as the critical node for occupants, staff, firefighters, first responders, utility service providers, other service providers, and visitors. Typically, the main entry should be the location that is not only the least resistance of all related design pressures but also the most counter-balanced node in design tensions related to **the most legislated location of any building.**

The front door is the critical connection point between outside and inside.

Design pressures of the principal entrance include but are not limited to:

- A. Protection of the building from outside natural elements
 - i. Stormwater management design considering shedding water away from all building entrances.
 - ii. Protection from pests, such as termites, from entering at the exterior walls above the top of the foundation walls.^{A4P}
 - iii. Protection of front door from snow accumulation or excessive wind pressures.
- B. Proximity of principal entrance for fire alarms, fire fighters, fire fighting, and risk exposure to potential fires:
 - i. Close location for a fire truck along the fire dept access route^{NBC}



- ii. Close location for fire truck water connection^{NBC}
- iii. Close location for interior annunciator alarm panel^{NBC}
- iv. CACF Room^{NBC}
- v. Fire alarm pull station^{NBC}
- vi. Fire fighter access strategy
- vii. Door requirements and limitations
- viii. Exterior wall fire resistance to withstand fires from nearby buildings.



- C. Calculations towards egress of total occupant load counts if principal entrance is counted for emergency egress in specific circumstances.
- D. Safety for an approach by a person in a mobility device or an elderly person
 - i. Adequate clear space to maneuver with a mobility device both outside and in entry vestibule^{NBC}
 - ii. Automatic door operator^{NBC}
 - iii. Allowable vertical distance change at door threshold^{NBC}
 - iv. Allowable ground surface materials for exterior sidewalk approach from collective-ownership sidewalk to principal entrance^{NBC}
 - v. Allowable exterior ground surface slope from municipal ownership sidewalk to clear and level exterior area at the principal entrance^{NBC}
 - vi. Close to designated accessible parking^{RS1.1.2}
 - vii. Pathways to principal entrance do not cross vehicular traffic^{RS1.1.8}
- E. Safety for an approach by a person with vision disabilities
 - i. Tactile warning indicators and/or vibro-tactile walk indicators for safety from vehicle paths or to indicate vertical drops such as stairs or change in floor slopes such as ramps^{NBC}
 - ii. Tactile information on emergency response controls^{NBC}
 - iii. Cane-detectable
 - iv. Railings to protect people from out-swinging doors
- F. Proximate location of washrooms, if required^{NBC}

G. (Front) yard setback per municipal zoning by-law and allowable canopy or balcony projects per municipal zoning by-law ^{L2P}

H. If applicable, centreline of main road setback

I. If applicable, achieving minimum green landscape requirement per municipal zoning by-law

J. Distance from the principal entrance for a fire truck so that the truck is not within the collapse zone for wood construction buildings.

K. Utility service provider access to utility rooms being efficient using the same principal entrance.

L. Ground level geodetic finished floor elevation per construction industry recommendations for top of concrete foundations above grade^{A4P}

M. Proximate location of elevator shafts, with ideally a line of sight

N. Proximate location of stairs, if no elevators are provided & with line of sight of the stairs upon entry

O. Proximate location of front desk or reception or similar visitor or occupant intake point

P. Physical security design to limit the potential threats at the principal receiving door of strangers or visitors and potential threats for occupants exiting principal entry

Q. Electronic security design to limit the potential threats at the principal receiving door for strangers or visitors at nighttime or similar hours with less staffing and potential threats for occupants exiting principal entry after-hours

R. Intuitive wayfinding of an obvious principal entrance

S. For buildings that are symbolic targets or critical infrastructure, the principal entrance is often required to be protected from a backpack bomb, a ramming truck, or a ramming vehicle with an improvised explosive device. When bollards are used as a solution, the clear accessible width between bollards will be determined by applicable legislation which can vary from project to project.

T. Convenient usage of principal entrance by elderly people or people with mobility devices or people with vision disabilities.

i. Waiting areas that are companion to a pick-up or drop-off area



U. ... and any additional Owner objectives or design standards for the front door.

All the above design pressures should be considered and all conflicts resolved.

The Phase 1 Feasibility Study needs to maximize the accuracy of the first and most important cost estimate.

The front door design is a great example of how spatial efficiency can achieve multiple objectives with only a few design moves. A wide, level, and sheltered principal entrance with space for seating and scooter manoeuvrability in concert with a wide and adequate depth of entry vestibule with wide doors can potentially achieve the following 20+ objectives listed above:

- A(i) via shelter like a canopy, A(iii) for snow, B(iii) (iv)(v)(vi), C, D, E(ii), K, easier lines of sight (M or N or O), P, Q, R, and T

But may conflict with the following and should be resolved in Phase 1 Feasibility:

- If site is sloped and stormwater could drain into entrance level area ((A(i)), E(i)(iii), G, H, I, L, if shaft location requires blasting bedrock (M), and S.



A well-designed main entry will always feel right as the most efficient and convenient flow of pedestrians will be self-evident, either in theoretical design form or as-built form accommodating the volume of people anticipated.

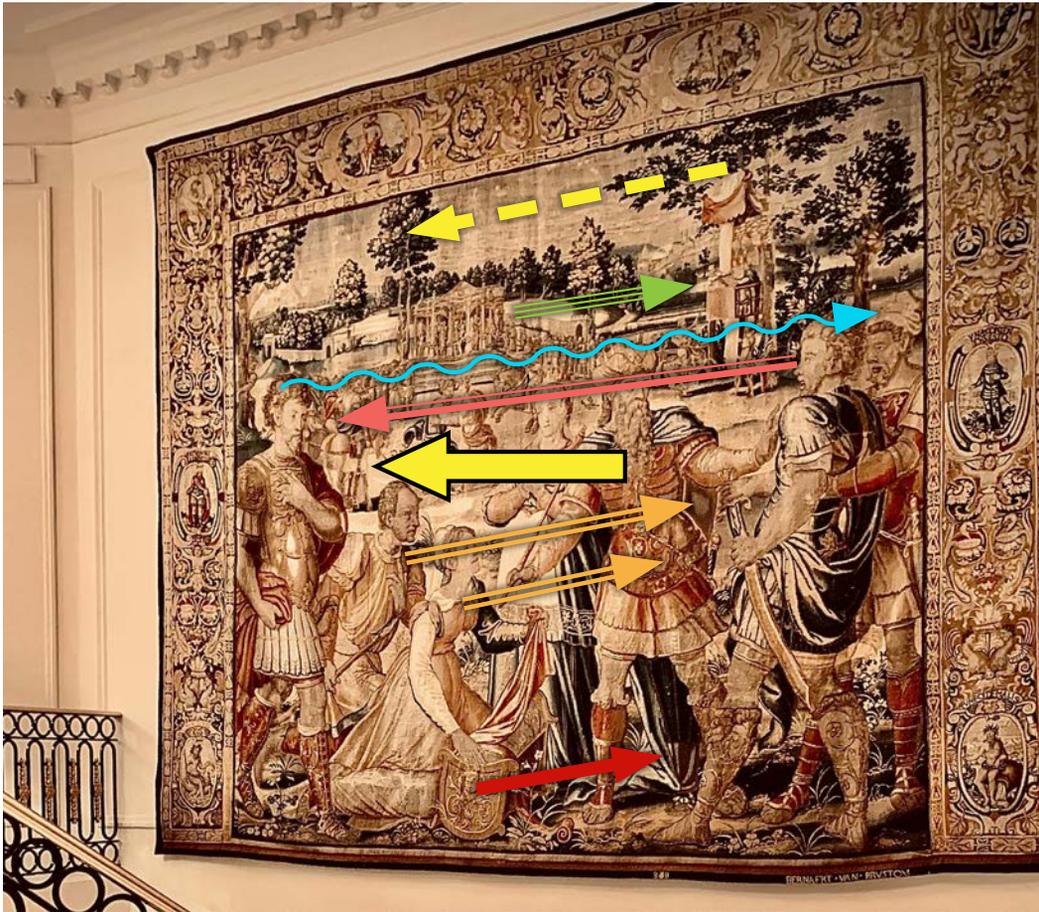
The best front door design relieves the most design tensions both outside and inside by placing the bottleneck in the perfect spot.

Let the people flow.

Any project that moves the main entry in Phase 2 Logistics must proceed with extreme caution as doing so may invalidate or compromise entire main branches of unwritten or written design assumptions and embodied efficiencies in Phase 1 Feasibility and the Class D Cost Estimate, unless the Feasibility Study itself missed the location of the least resistance.

Moving the principal entrance in the building design beyond Phase 1 is *not* recommended as potential major re-design and recalculation of the entire building or significant portion of the

building may be required. Changing early big design decisions past Phase 1 is akin to moving major subjects in a tapestry mid-production. The more connections, threads and subsequent decisions attached to a Phase 1 decision, the more workload to re-work the entire tapestry.



9.1 Front Yard and Principal Entrance Design

Once threats from vehicles have been strategized to acceptable minimums, the daily usage of the building is the next design cluster to tackle: ease of pedestrian approach in anticipated climate events (i.e. best practices is to design for the worst-case scenario), how many types of people to design the entrance for, in terms of accessibility and safety, architectural or major signage branding of the Owner if any, and intuitive wayfinding for as many people as possible.

9.1.1 Overlap of Municipal Landscape Design Minimums and Accessibility

A building's front yard is like the trailer of a movie: what people see and experience in the front yard is what they expect of the rest of the building and can create permanent positive assumptions and feelings of the Owner by people who haven't even entered the building yet. Front yard design is an art where you can load up positive elements that help people love the building instead of being annoyed by it or even hating it. Too many people involved with building projects see the front yard design as a nice-to-have and the landscape design in the front yard is one of the first targets for cost-cutting if a project is discovered to be overbudget in Phase 3 or Phase 4 design.

As densities increase in a neighbourhood, the municipalities' zoning by-laws (at least in Canada) trend to allow shorter and shorter front yard setbacks. Metropolitan skyscraper areas tend to have less natural landscaping in their front yards for the sake of density and efficiency, to their detriment. Studies show that regular walks in forests are correlated with more positive health benefits both physically and mentally.^{YV12}

The three areas that a building design can quickly gain and maximize positive influence are actually the first three major spaces that a person encounters in sequence:

- The Front Yard
- The Principal Entrance
- The Main Lobby

Unless the building has an exhibit of art, performances, or arena skirmishes, these three



areas can influence how a building user experiences the rest of the building. If a residential building has amazing dwelling units but the entry into the building is tiny and minimal, a resident may develop a conflicted perception that may affect their desire to live in the building long-term.^{A15}

It's like going on a first date and wearing pajamas to the venue: no matter how awesome you are in dashing good looks or inner personality ... it's still all ice-skating uphill from there. **Building designs that do not focus on the first 3 sequential spaces are missing easy opportunities to create happy building users, potential building subscribers, or dwelling unit buyers.**

Easy front yard design moves such as adding trees and shrubs, seating and rest areas, and a two-person wide sidewalk approach with gentle sloping to the principal entrance and a safe PUDO area can go a long way towards a better building design and better building accessibility.

It can pave the way for creating the belief that this building is the best building in the neighbourhood. You can't build any building in the front yard setback anyways and there is often landscape demands from the applicable zoning by-law, so take the inexpensive opportunity to design the best front yard on the block with sensible small upgrades above the low-bar minimum which may be a grass yard or even a yard of dirt.

Desirable buildings can easily be achieved by paying attention to the design of its first three experiential spaces. *For example, a building that accommodates our dog companions at the building entry makes **marketability sense**.* Humans have had friendships with canines for tens of thousands of years with intensely strong emotional connections.

The Canadian dog ownership rate was 38.1% of households in 2024. A multi-unit residential building that makes it pleasant to own a dog versus other buildings can have a competitive edge. Just a picture of a happy dog can make reading this paragraph more positive.

*Incorporating features that support individuals with service or support dogs not only enhances accessibility and inclusivity for all building users but also offers a potential **38% market advantage** by attracting a broader range of residents and visitors.*



10. Building Design: Interior Circulation

10.1 Building Core Design

Repetition remains the most efficient strategy for building designs (or anything really) and maximizing simplicity. Vertical repetition gets increasingly critical as buildings have more storeys and the need for simplicity becomes increasingly paramount.

Building core design is designing and locating one of the most critical parts of the building: the parts that are identically repeated on each floor and can serve as a cluster for vertical circulation, the building's "spine" for the structural design, the vertical path of services from either basement or mechanical penthouse services rooms (such as fresh air ducts, exhaust ducts, fresh water pipes, sanitary drainage pipes, fire protection pipes, power conduits, communications cabling), or repeated rooms on each floor.Y1T

The building core can include, but not limited to, any of the following:

- Elevator shafts
- Egress stairs
- Mechanical Shafts
- Exhaust Shafts
- Washrooms
- Electrical Rooms
- Janitor closets
- Storage
- Repeated rooms on each floor

A good architectural design will locate building cores to minimize interior circulation and be the minimum required number of and size of elevators and stairs as well as provide lateral structural stability. Owners should agree with the building core design and interior circulation design before the Design Team gets too deep in developing the design beyond Phase 1 Feasibility ideally or latest in Phase 2 Logistics.

Any accessibility decisions that could significantly affect the spatial dimensions of the building core needs to be considered from Design Day 1. Building core design is ideally done in Phase 1 Feasibility but at the latest in Phase 2 Logistics.

10.1.1 Elevators and Elevator Shafts

Elevators are vehicles for vertical human transportation that guide a car along steel rails. It's like an indoor vertical streetcar. When a building design incorporates a vehicle path, that path becomes central to the building design and one of the first things that is finalized with accuracy. A subway station is a building built around subway tracks just like a skyscraper is built around the elevators.

Elevator shafts are the natural building cores in the design and act as spines to a building. As such, elevators should be one of the first things to get accurate and finalized with a Design Team. Ideally, an experienced architect can guess the number and size of elevator shafts at Phase 1 Feasibility.^{Y1E} At the very latest, elevator shafts should be finalized in Phase 2 Logistics. The elevator manufacturer is already obligated to provide an elevator product that is compliant with CSA B44:22 Safety Code for Elevators and Escalators; available options are typically already aligned to be compliant to that standards code.

10.1.1.1 Elevator Manufacturer Standard Options

Elevator options available or considerations that need to be selected asap that affect critical xyz dimensions as well as costs:

- maximum travel distance of floors served
- weight capacity rating
 - (i.e. how many people or how heavy loads can be lifted)
- type of lifting mechanism^{T2E}
 - hydraulic elevators have a limited vertical maximum distance due to pistons
- speed^{Y1E}
- manufacturer^{T1E}
- cab height^{Y1E}
- elevator machine room or control closet minimum size
- door widths

Elevator options available that may need special attention from the Owner and Design Team:

- **elevator controls at accessible height**
 - Low to mid-rise buildings should achieve this if the resultant control panel and its buttons remain compliant to CSA B44

- CSA B44:22 subclause E-9.2 conflict for high buildings
 - If floor designation buttons are not located at a maximum 1220mm (48”) AFF measured to the centreline of the group of buttons and the emergency control buttons centrelines are not minimum 890mm (35”) AFF, the AHJ may need to approve this control panel variance from CSA B44/NBC.
 - High buildings may have conflicts with too many buttons, insufficient cab wall space fitting into a standard control panel let alone acceptance from AHJ. A horizontal control panel may be contemplated but may be a premium custom upgrade cost.

Elevator options or features that are usually included in typical elevator selection and assumed pricing by the Cost Consultant should be coordinated with RHFAC decisions:

- interior clear space for a patient stretcher (2.01m x 0.6m) in a prone position^{NBC}
- handrails on non-entrance walls^{B44}
- self-levelling device^{B44} that brings the car to a stop within 6mm of the landing level
- cab control buttons are raised and have braille^{B44}
- elevator signage by manufacturer with raised characters and in braille^{B44}
- emergency communication system^{B44} with a button
- audible verbal announcements and signals^{B44}
- door automatic reopening device^{B44}
- colour contrast in interior cab finishes with no glare and including elevator doors
- mirror with safety glass at rear of cab for single entrance elevators
- visual elevator light indicators^{B44}
- well-illuminated elevator cab to be brighter than the 100-lux minimum
- timing of closing of doors



10.1.1.2 Example RHFAC requirements related to the Architectural Design, Interior Design, and Signage Design

RHFAC requirements that should be assessed in Phase 1 Feasibility:

- Physical Location: easy to find from entrance(s) or other pedestrian high volume traffic areas aligned with intuitive wayfinding
- Maneuvering clear space in Elevator Lobbies
- Wayfinding Innovation Bonus for Elevators: possibly adding TDI from entrances to elevators but the Owner must consult with Ops for possible conflict with assumed methods of cleaning or polishing floor surfaces.

10.1.1.3 Example RHFAC requirements related to the Electrical Design

The following are RHFAC requirements that the Electrical Engineer (and possibly the Vertical Transportation consultant or whoever is writing the specifications) needs to be aware of:

- Audible Location Indicator: audible tones that help with locating the elevator. Owners should assess the possible conflict between audible tones along the path to the elevator versus possibly compromising an otherwise mind-friendly environment
- Communications and power systems coordination with elevator communications interface and electrical needs
- Well-illuminated elevator lobbies with brighter than 100 lux

10.1.1.4 Example RHFAC requirements for a Vertical Circulation Consultant or Manufacturer

The following are RHFAC requirements enhance accessibility^{G8T}:

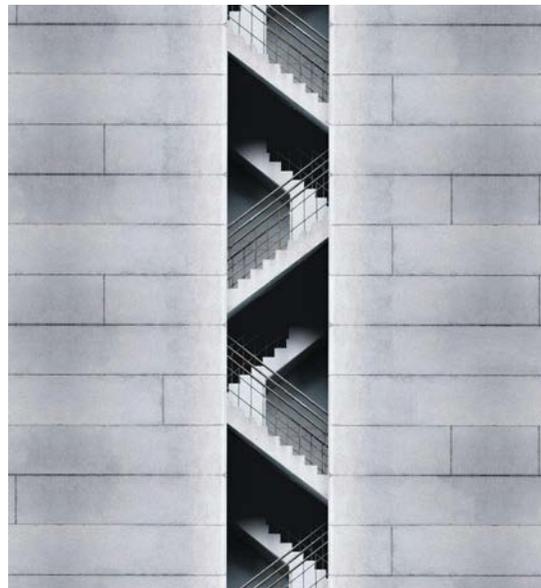
- Location of control panel on side wall and hall call controls at different heights
- Elongated or horizontal cab controls at a consistent accessible height
- Text-to-text communication system for emergency communications
- Alternatives to audible-only information for emergency communications

10.1.2 Egress Stairs and Stair Towers

In Canada, the building codes usually require two emergency exit routes out of a building once a certain threshold of people or storeys is reached.

^{NBC} Due to their inherent rectangular floorplan shape and their tendency to be located at the perimeter of a building footprint, egress stairs are one of the easiest ways to help the structural engineer to create lateral bracing for the overall superstructure.

Stair widths and stair landings for exit/egress paths out of a building should be a Phase 1 Feasibility priority, at the latest they should be finalized in Phase 2 Logistics. Signage and interior design can be designed at later phases.



10.1.3 Service Rooms, Mechanical Shafts, & Other Potentially Stacked Rooms

Service rooms, janitor closets, and mechanical shafts are ideally located adjacent or across the main corridor of either elevator shafts or egress stair towers as they afford opportunities for straight lines of solid structural walls or columns. Main structural gridlines will gravitate towards elevators, egress stairs, and main corridors repeated on each floor. As such, consideration should be given to what other repeated rooms could be included in the “building core” and could benefit from proximity to elevators or stairs for easy and intuitive wayfinding.

Such rooms that could benefit from the vertical stacking available beside or across from elevators shafts and stair towers include but are not limited to:

- universal washrooms
- washrooms repeated on each floor with accessible stalls
- family/nursing rooms
- drinking fountains
- rest areas
- reception areas or service counters
- kitchens
- or alternation/staggering vertical distribution of any of the above if they can fit in identical room footprints

It's not only electrical rooms, comms rooms, and mechanical shafts that benefit from vertical stacking beside elevators and stairs, but also publicly usable rooms needed on every floor. The more rooms that can be repeated vertically and the more mechanical, electrical, and plumbing services can have a simple vertical path up the building ... the more efficient the building design.

Office building design particularly shines when the washrooms on every level are adjacent or across from elevators and stairs and can become included in the building core. In residential building towers, pipe chases for washrooms of suites are ideally located adjacent or across from elevators and stairs. Basically, if there is anything ideally vertically stacked and occurs on every floor, then the designer should add it in the name of design and construction simplicity.^{YE13}

10.2 Path of Travel, Main Corridors, and Ancillary Corridors

Main interior circulation corridors of a mid-rise or high building are a Phase 1 or 2 design element as the Structural Engineer's design instincts will gravitate towards the horizontal and vertical alignment of vertical and horizontal interior circulation paths. Similar to the human body, we have blood arteries near the bones of our body just as main interior circulation paths and superstructure are usually paired together in a building.

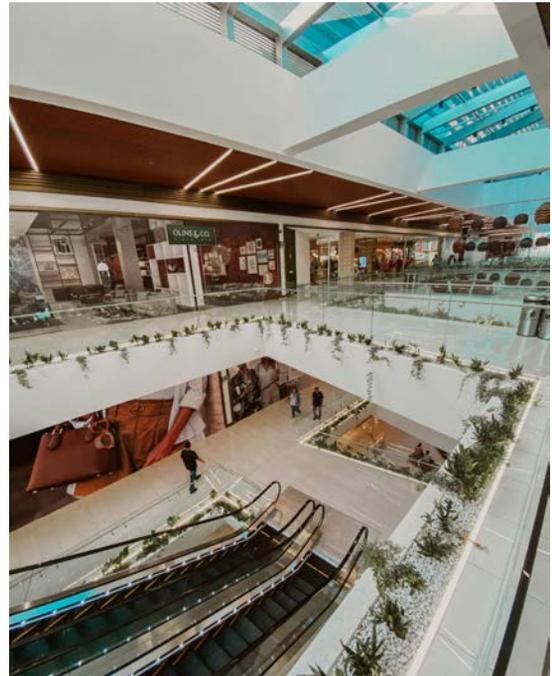
In larger buildings with high volumes of people, main corridors are also where architects like putting giant holes in the floor for mezzanines, open atriums, and escalators so this architectural tendency can doubly incline the Structural Engineer to use main corridor walls as opportunities for superstructure.

Integrating accessibility into main circulation routes is a priority design item as building structure design needs to be finalized, at the latest, at the end of Phase 2 Logistics. ***Access to all key spaces and amenities in a building is a RHFAC Prerequisite and thus a building design without access to a key building space shall not pass.***

10.2.1 Escalators and Moving Walkways

Escalators and moving walkways are one of the best ways to quicken pedestrian travel. Where elevators create an ebb and flow for interior circulation, escalators and moving walkways act as fire hoses if people were water. These people-moving devices come at a cost but have proven benefits if a building's function requires the fastest and convenient movement of large volumes of people between two points.

Like elevators, escalator planning requires looking at the manufacturer's design options and required dimensions. The difference is that where elevators help create stable superstructure to a building ... escalators cut giant open holes in the floor and superstructure. ^{T1Esc}



10.2.1.1 Example RHFAC requirements for Escalators and Moving Walkways

Escalator options available or considerations need to be selected asap that affect critical xyz dimensions as well as costs, as a long-lead item with preferably little customization.

The following are RHFAC requirements related to escalator selections in Phase 1 by the Architect:

- space for mobility alternatives, such as golf carts, adjacent to the moving walkways
- stairs, elevators, or accessible passenger lifts are available as alternatives
- clear spaces in front of emergency stop controls for easy access

The following are RHFAC requirements that need to be considered by the architect or interior designer in later design phases:

- colour-contrasted detectable features at top and full width of device to surrounding built environment
- colour-contrasted nosings and side edges^{B44}

The following are RHFAC requirements that Elec or the manufacturer to review:

- audible signals entering and exiting escalators or moving walkways
- emergency stop buttons at an accessible height and within reach of all users ^{T1Esc}
- well-illuminated (i.e. not as dark as this Narita International Airport gate corridor)



The following are RHFAC requirements that the Owner or its Ops manager should consider:

- providing golf carts or similar vehicles in addition to an accessible path of travel as an alternative to moving walkways.
 - If so, such vehicles and their energy/fuel, storage, repair, and maintenance needs have to be known by the Design Team.

10.3 Interior Ramps, Stairs, and Sloped Floors

If a building project requires raised or sloped floors (such as for a judge's dais or a loading bay platform or subway platform), interior ramps and stairs may be required to bridge the vertical distance for a continuous path of pedestrian travel.

Ramps and stairs can eat up real estate quickly as well as create obstacles in achieving the clear widths of interior circulation routes. All of a sudden, a corridor that was originally envisioned as a 1600mm (6') wide corridor must be significantly wider if a 1200mm (4') ramp needs to be added which results in a significantly wider corridor to achieve building code egress widths let alone a client's possible building standards' clear circulation widths. That's also not mentioning possible doors swinging into the same section of corridor where the ramp needs to be added.

Needless to say, ramps and stairs should always be a Phase 1 or 2 design item as whatever can affect interior circulation ... can affect where the superstructure design can be. The sooner that interior ramps and sloped floors are finalized in the design, the calmer things will be for the Design Team in Phase 3 Functionality and Phase 4 Description.

10.4 Doors, Doorways, and Gates

Doors can be a problematic design item due to a variety of issues including standards and codes are not harmonized with each others' requirements (like a lot of legislation and standards) among other problems to solve.^{A3D} Careful door selection and design is required during Phase 1 and 2 or else requirements may trigger invertedly on a junior architectural designer and their team in later stages of design. The only good news about doors is that the door hardware specialty consultant is typically a door supplier whose only compensation for their design work is being eligible to bid on a project's doors and having the advantage of the project's entire inventory of doors and door hardware before the project's Contract Drawings are put out for tendering/bidding.

Door design and selection should be compliant to applicable legislation and building codes first, before any RHFAC requirements as always for *any* building design element under consideration. Automatic door operators are synonymous with accessibility so focus on them is inevitable. Doors can cause problems in a building design if placed without strategy or technical knowledge of doors, their frames, their hardware, their applicable legislation, and their performance ratings. If a gate or turnstile is contemplated for general use in a building like a subway station or secure building or stadium, then there should always be enough accessible gates for the demographics served by the building.

10.5 Open Concept Rooms with Furniture or Equipment Layouts

While it is the responsibility of the Architect to help an Owner estimate and establish furniture layouts with adequate pedestrian and accessible flow between furniture and equipment locations in the design phases, it is the responsibility of the Owner to make sure egress pathways are maintained and uncompromised during occupancy. As such, RHFAC will look at intended and as-built furniture and equipment layouts.

This also means that the theoretical furniture and equipment sizes need to be fairly accurate by the end of Phase 2 Logistics as the Structural Engineer may need to assess the additional localized weight on the floor structure as well as the Architect needs to establish adequate sizing of the overall room with adequate maneuvering space between all floor elements. A circuitous dead-end corridor created by workstations could put a person in danger in the case of a fire, and even more so if they have any disability that could compromise their egress out of the room, let alone the building.

Thus, **furniture and equipment sizes and weights** (not necessarily manufacturers) are ideally **finalized by the end of Phase 2 Logistics** with the Architect and Structural Engineer working with the most onerous spatial and heavy versions of the furniture and equipment contemplated. Large open spaces with furniture and equipment layouts can be tricky: you have to create layouts that work with the likely distribution of columns and perimeter walls, provide out-of-sight paths for power and communication cables, and still make it easy for someone to navigate the maze of furniture if there is ever a fire.

10.5.1 Accessible Path of Travel and Maneuvering Space

Furniture and equipment layouts should not be left for finalization in Phase 3 Functionality but sometimes this does happen. It's an unfortunate chicken before the egg situation: furniture is seen as a Phase 3 or 4 design consideration when it is ideally finalized in Phase 2 because it is otherwise a Sisyphean task to work out significant workstation layouts *after* the columns and building footprint has been finalized. While it may seem counterintuitive, it's better to design distributions of furniture or equipment early with superstructure in mind when its design is not finalized.



Per the Pauli Exclusion Principle, matter cannot occupy the same space as other matter, no matter how insignificant one is valued versus the other.

Space is space. In places of assembly, fixed seat upgrades towards accessibility will move the design priority of seating finalization to as early as possible as their locations are directly related to superstructure.

Stage design also may need some earlier design priority if the following are RHFAC requirements related to interior circulation are pursued:

- Universal access to stage or podium by performers/speakers and audience
- Universal access to backstage



11. Building Design: Key Support Spaces

Every building has a primary objective in concert with secondary objectives that serve that main purpose, especially within a capitalistic context. A building is a manifestation of an attempt to organize multiple Owner objectives while obeying legislative pressures under the same roof.

Examples:

- An arena aims for profit from both attendees and virtual subscribers to a broadcast
- A courthouse seeks to administer the volume of court cases of a community within the limits of that community's budget allocation
- A retail store seeks to funnel desirable goods and customers buying those goods
- A condo building seeks to make profit from selling a big building in legal pieces
- A purpose-built apartment building shelters subscribers in the form of tenants

While current legislation aims to be reasonably inclusive of a building's primary objective, secondary spaces are not as well protected in either legislative interpretation or enforcement.

The argument that the private market will provide the most efficient products frequently falls short for accessibility as the market tends to cut out access to minority people in order to save costs by playing a game of numbers instead of practicing in conscious capitalism. Speech-to-text or text-to-text building messaging or digital menus with pictures can and will probably become the norm.

What are support spaces? Google AI Overview says that these are areas within a building that aren't the primary workspaces or living areas but are essential for supporting the main functions. Such rooms are necessary to support the human body or human activities.

Whatever the human body or psyche needs, a building should accommodate: ^{YE13}

- potable water supply
- oxygen intake



- carbon dioxide exhaust
- human waste disposal
- hygienic sanitization
- heat in winter, cooling in summer
- presentable personal appearance
- communication
- food storage or preparation
- food and other waste disposal
- daylight and plants

Buildings are an extension of the human body, like a giant and clunky group spacesuit that neither moves nor is necessarily airtight. We just need to make sure everyone can participate in the group. It is actually a matter of societal will towards prioritizing fairness that produces change towards inclusion versus exclusion in our shared spaces.

Architecture is always changing to suit the mainstream adoption of the technology of the time.

Legislators should try to use available technology, too ... it wouldn't be so hard to reconcile building codes and standards if they were all harmonized.

The Information Revolution is as transformational as other technological revolutions. The prevalent use of smartphones are essentially portable and handheld computers that would be called a "tricorder" on Gene Roddenberry's TV series, "Star Trek: The Next Generation" in the late 1980's to 1994. These smartphones have lessened demand for fax machines, stereos, physical letters, cameras, libraries, small TVs, bookshelves, telephones and all the related physical support spaces and servicing needs.

With the mainstream adoption of motorized mobility devices like scooters as well as breakthrough advances in prosthetic technology, we are seeing more people out and about versus half a century ago where the same people would be limited in their ability to interact with the buildings. Proximity detection unlocks doors better than Star Trek sets.

Our Baby Boom Generation is not going quietly into that good night ... they are cruising through



shopping malls, texting their grandchildren, and posting on social media. Designing to building code minimums would be like going forward with site plan layout designs with a hitching rail for horses instead of parking spaces while Henry Ford was pumping out millions of cars.

3D printing has revolutionized prosthetic design and empowered more people with dexterity and flexibility disabilities to go confidently out into the world and reclaim their lives. In another half century, it may be possible that cyborg prosthetics fully mimic human body abilities. Until then, simple and easy choices such as lever-type door hardware is a simple way to include people.



Like it or not, the future is coming. And it won't be the same as today.



11.1 Washrooms and Showers

Accessible washrooms have been in our built environment in Canada for some decades now, but these designs and applicable building code were based on manual wheelchair usage. With the increasing use of motorized mobility devices like scooters as well as breakthrough advances in prosthetic technology, we are seeing more people out and about versus half a century ago where the same people would be limited in their ability to interact with the built environment.

Owners and architects may lament on committing more space to washrooms and losing useable or leasable real estate versus previous projects, but this is probably the same complaints heard when barrier-free accessibility was introduced to NBC in 1965. How many buildings have needed very expensive retrofits due to inability to be “grandfathered” further into the future and maintain lack of facility accessibility? **Where a short-term lens may see an unacceptable loss of profit now, a long-term lens may see an unacceptable 10x retrofit cost two or three decades later.**^{A1S}

We can create more time; we cannot create more space in a finite box.



11.1.1 Accessible Washrooms Design

Despite washrooms being needed in every building with human activity, there are cultural differences in washroom design across the planet. Instead of re-inventing the wheel, designers should look at how other countries design their washrooms rather than focus only on industry standards or familiarity in North America.

For instance, it is very standard for Japanese washrooms to integrate a floor drain for an entire residential washroom as there is a tradition of washing one’s body before getting into the nice, hot bathtub. Leveraging proven washroom design methods and then adding grab bars, fold-down shower seats, and sufficient room for maneuverability may help reduce design time and expand ideas and methodology.

11.2 Other Shared or Public Spaces

Spaces for everyday use require consideration for meaningful access for all citizens. Designing buildings to welcome and accommodate everyone, regardless of body type or ability, helps ensure inclusive environments and protects organizations and owners from potential reputational harm caused by exclusionary practices.

11.2.1 Common Spaces in Buildings

The Main Lobby is one of the three most important spaces in any building after the front yard and the principal entrance (see Chapter 9). Investing unique design, premium finishes, and real estate to the main lobby can spread positive sentiments across the entire building.

The main lobby is the main interior introduction to the building, as the central node between inside and outside. Strategy MF always helps to improve the lobby design.

Sometimes common spaces are deeper inside the building journey. Allocating premium space with a window for a respite/sensory room may help recruit or attract more individuals to the building by providing a social and overstimulation decompression room for chronically overachieving neurodiverse individuals.

A designated respite or sensory or privacy room (aka “quiet room”) is for shelter or mental recharging for people with different neurological experiences to retreat to this room and block out an overload of senses (like interior noise pollution) to recharge.

While some organizations will designate multiple purposes for a respite/sensory room, maximum RHFAC points can be achieved if the room’s sole purpose is to be a quiet room away from environmental, social, and noisy chaos.



11.2.2 Shared Kitchens and Lunchrooms

While some organizations assign shared kitchens and lunchrooms to landlocked, leftover areas away from the windowed premium spaces at the perimeter, they indicate indirectly that they view employees as less important than the least priority space given a window. When filing cabinets and printers are given daylight while the lunchroom has none. it speaks volumes.



12. Building Design: Key Spaces

Most shared spaces in assembly, mid-rise, and high buildings must comply with applicable legislation for accessible design.

As the Baby Boom Generation approaches their sunset years, there will be a greater demand on facilities and buildings of all types for greater accessibility by our elders with various possible disabilities ranging from mobility to memory challenges. This generation has only recently been passed as the largest population group in Canada which is now held by the Millennial generation.

That said, the Baby Boom generation currently holds significantly more wealth compared to the other generations. To provide access to the wealthiest and second largest generation across the country, building designs must aim for higher design targets than simply minimum building code.

If there is a pattern of grandparents loving to pay for the bill and spoiling their kids and grandkids or preference for convenient living, these are missed opportunities, market share, and possibly negative PR, if buildings do not provide access to this demographic.



12.1 Specialty Spaces

12.1.1 Swimming Pools

Pools are extremely valuable spaces for multiple disabilities. Bodies of water offer relief from the effects of gravity and enables people with disabilities to move about as fast as anyone else and with reduction or absence of pain.



Moving without pain can be an addictive joy: swimming without feeling back pain or kayaking or floating without leg pain. Every facility that contemplates aquatic recreation should consider higher demand by people with disabilities from the parking lot, the entrance, the locker/ changing area, the shower spaces, and the pool itself. Pools are already a complicated function to include in a building design due to introducing moisture, vapour, and different temperatures into a building so accessibility design must be contemplated from Design Day 1.

3D software allows designers to mold almost any logical pool design for the concrete sub-trade to form on site with appropriate slopes to enter the pool and the tiling sub-trade to cover the concrete base with waterproofing layers and tiles. More space-efficient designs can contemplate advances in pool lift or hoist systems that can have a seat to transport a person from deck to submergence or entire wet area wheelchair or different hoist connections to switch from seat to stretcher.

Pool designs should employ Strategies A, C, and F to all facilities including change rooms, lockers access, whirlpool, sauna, etc. including any raised or sunken areas as well as around the entire pool. Accessible means for entry and exit into pool (e.g. ramp/sloped entrance, pool lifts, or other transfer systems) but ramp or zero-depth entry ramp is preferred. If a mechanical pool lift is the only means to enter and exit the pool, there should be two lifts in case one breaks down or deal with peak hour usage.

Additional designated parking spaces should be considered to match expected demand. The more accessibility features that a swimming pool offers, the more users with disabilities will likely be motivated to visit more frequently. A project may have a solid business case to receive AHJ approval for exemption from standard parking space numbers in lieu of providing more designated parking spaces due to the advanced accessibility offerings of the aquatic recreation facility.

12.1.2 Cafeterias, Restaurants, and Bars

Eating is embedded in human cultures so deeply that love can be associated with food and are strong expressions of familial or romantic love that create lifetime memories. Drinking coffee, tea, or alcohol are also embedded as cultural social vehicles.

A venue that is accessible-to-all is a venue that allows all people to create stories at their tables.

That said, restaurant business owners are forced to focus on volume and frequency of sales through maximizing seating and occupancy numbers due to potentially high lease agreements for properties due to visibility from high-volume



pedestrian traffic. As such, increasing clear width of aisles between tables along with ground floor access washrooms is a challenge due to high rents and strategies of faster table turnover.

When the numbers don't work, accessibility design can be compromised. Grandfathering businesses to operate without accessibility can create an unfair business landscape between older venues versus newer ones. Governments should look at incentivizing businesses that provide accessibility since the real estate market may be too ruthlessly efficient to foster access-for-all implementation on valuable real estate that is conducive for the hospitality industry.

Washrooms in Montreal, QC tend to be on the 2nd floor while washrooms in Toronto, ON tend to be accessed by stairs to the basement. This pattern restricts access to people with various disabilities and yet this is the current norm to maximize venue revenue on the ground floor and businesses lean on "grandfathering" to maintain building code compliance with venues that would not be compliant to today's building code.

Hospitality venue design could benefit using STRATEGY A for all dining areas, amenities, washrooms, outdoor areas, and point-of-sale (POS) locations as well as STRATEGY B for all arrangements of tables chairs, and places meant for customer access. STRATEGY C is a good rule to follow for all check-out counter surfaces, tables, and wayfinding in general.

12.1.3 Specialized Learning Spaces and Arenas

Universities and other lecture or presentation spaces fall into the assembly occupancy building types. Assembly occupancy already requires provision for accessible and adaptable seating so Project Teams should consider providing excellence in universal design.



Learning environments are designed to foster intellectual growth. Access to these spaces must be designed to ensure that no individual is prevented from fully participating, whether as a member of the audience or as a presenter.



Arenas are places for assembled crowds of spectators, who may be cheering on family or the reputation of their city, province, or their country.

While the TV comedy show "Shoresy" is fictional, the characters kept talking about their "bums in seats" strategy not to go bankrupt ... this is the business reality of arena design.

12.1.4 Hotels, Lodging, and Temporary Accommodations

Temporary accommodations are the bedrock of any tourism industry: visitors won't come if their sleeping and temporary residential arrangements are less than ideal. Experiences that become nostalgic memories can earn permanent positive PR through word of mouth by people who enjoyed their stay.



Memorable hotels are often spoken about years later. Hospitality businesses that have figured out that it is the experience that matters most have the most staying power.

12.1.5 Fitness and Sports Facilities

Gyms become increasingly important to people with disabilities as they try to strengthen other parts of their body as well as being mindful of current research that physical activity is incredibly beneficial for health, longevity, and for the mind. Space-fits for equipment should have meaningful accessibility needs considered.



12.1.6 Exhibit Spaces

Exhibit space layout design is very much aligned with accessibility design. To maximize sightlines of crowds and creating the ambience of value through the luxury of clear space, clear maneuvering room and resting areas for people with disabilities comes quite naturally to the building design and interior layouts of the exhibits.



See 12.1.7 on the next page when considering a retail companion revenue-making space.

12.1.7 Retail Outlets or Visitor Centres

While Amazon has changed the retail landscape since the COVID-19 pandemic, retail stores still have a remaining place and purpose. People who have lived the majority of their lives going to stores will be motivated to eschew online retail modes and prefer to go see products in person and be able to sample or try them out before paying.



12.1.8 Office Spaces

Current trends of business office policies is a return to a 3 to 5-day work schedule at the company's offices. The hybrid work structure of part-time in-office presence and work-from-home modes is trending back to full-time at the office. With senior positions filled by an aging population, accessibility with offices remain a priority.



12.1.9 Libraries

While the Information Age is reducing the relevance of libraries, the need for libraries will not vanish in the next 50 years. Libraries are already adapting to 21st century needs, such as fighting misinformation in society, and realizing that they still defend democratic intellectual freedom with their fair and equitable public spaces for all citizens.



The library of the future will likely be a combination of:

- Centralized digital storage infrastructure of purchased digital copy licenses of audible and visual versions of books.
- Digital reader assets for loan while at the library with possible one-time-per-person discount sales program of older models to the public to rotate stock.
- An acoustically separate space for group reading and discussions.

- Increased real estate dedication to specialized rare book storage to honour and protect the importance of physical books before the Information Age and provide delicate physical access to all; and
- The continuity of sharing information as freely as possible to as many citizens as possible.

12.2 Earlier Furniture, Fixtures, and Equipment Decisions

Accessibility design can have a significant impact on furniture, fixtures, and equipment (FF&E) layouts. Large open areas dedicated to FF&E require structural design attention to create those large open areas in the superstructure.

Any designer who has had to redesign FF&E layouts, such as workstations, printers and file cabinets in an open office layout can tell you what a nightmare it is to try and fit the number of required workstations to accurate sizes and an accessible path of travel after the initial schematic design was deemed final. With the superstructure design finalized and priced, the Project Team will always default to resist to move columns and beams ... just for furniture.

Any project contemplating enhanced accessibility design that will involve FF&E layouts should bring the necessary subject matter experts earlier into the design process, ideally in Phase 1 Feasibility or latest in Phase 2 Logistics with worst-case furniture and equipment sizes for the architectural designers to lay out spaces that the structural engineer will then evaluate and create a superstructure solution to accommodate. There is simply too much early structural design work to change FF&E arrangements and configurations after Phase 2.



12.3 Possible Exemptions from Barrier-free Accessibility Design

All common areas and amenities of a building are required by NBC to on the barrier-free path of travel unless a space or room is specifically listed in the building code to be exempt from requirement from a barrier-free path for persons in wheelchairs.

The other major exemption is a small building design (NBC Part 9), like a house, with one or two dwelling units that typically neither requires accessibility design provisions nor sprinkler or standpipe fire protection systems. Fire protection systems and barrier-free accessibility are critical areas of design experience needed for larger NBC Part 3 building design and discipline coordination; inexperienced architectural designers should not be sought for quotes for design services if they do not have the appropriate level of experience, even if the low consultant fees are attractive.

13. Building Design: General Strategies

How people feel about a building can be easily swayed from positive to negative due to simple and small details or factors. Just like a good chair is one that you can't feel when you sit down due to the seat height and the curvature of the seat back, a good building doesn't annoy its occupants and provides convenience by removing any possible inconveniences out of the path of travel and any annoyances in its daily usage.

13.1 Building Wide Systems and Considerations

13.1.1 Illumination Strategies and Building Automation Systems (BAS)

The Project Team should always pay attention to the items that are repeated the most times, even if each one is a relatively minor cost. Multipliers are where efficiency can be found the easiest because repetition is how efficiency itself is always achieved. Investing more design and capital costs in the public spaces but reducing costs in the private spaces is a cost-effective way to maximize sentimental value per dollar spent. Good lighting can purchase easy positive PR.



It's like wearing an expensive jacket over an inexpensive button-down shirt but a building instead. Aesthetic architectural design is mostly hiding or protecting ugly services and building functions like our skin over fat insulation, organs, and bones.

As such, Phase 1 Feasibility should always take into account widespread building product strategies that are slightly upgraded to create a building that is more than just minimum standards. In large facilities, the number of light fixtures and fire alarms can add up to a substantial amount by themselves so strategic upgrade of interior finishes and lighting design in select areas should minimize premium cost assignments. The Cost Estimate Class D in the beginning should capture any upgrade in lights or other systems.

13.1.1.1 Fire Alarm Systems and Equipment

Timely building evacuation is a critical consideration. For smaller buildings, providing audio and visual fire alarms can be an easy and minor upgrade but for larger facilities, the number of units can make this a noteworthy cost and must be captured in Phase 1 Feasibility for the first cost estimate.



The life safety of people with disabilities, must not be compromised in any building in an emergency; they must be immediately alerted to a building evacuation or lockdown like everyone else as sometimes the difference between life and death. England's Grenfell Tower tragedy in North Kensington had the first responders' incident commander abandon the "stay put" policy at 2:47am; the fire had spread to the western façade of the building and over half of the dwelling units were on fire by 2:51am per BBC News. 41% of the tower's disabled residents died in that tragedy.

13.2 Acoustics and Acoustic Separations

Whenever one considers acoustic considerations, one must remember that sound is simply pressure waves. Airborne sound is a change in pressure in the air. A tree in an empty forest always makes sound, a tree in outer space crashing into a satellite does not.

- No air = no airborne sound.
- Wherever the air can go, airborne sound can go.
- Wherever sound can air-bounce, sound can travel.
- Wherever strong sturdy surfaces are connected, impacts or bangs on those surfaces can travel far like hitting the steel hull of a transport tanker with a hammer. A building is no different (i.e. this is what IIC ratings talk about).



Another way to understand how sound travels through a building is simply to know the two opposite types of corridors:

1. sound reverberates well in corridors with perfectly parallel walls, floors and ceilings and hard surfaces (ideal for sound waves bouncing)
2. airborne sound can get muted if that same corridor is covered with soft or perforated surfaces and more unparallel, preferably, triangulated wall and ceiling surfaces to trap sound and minimize the changes in air pressure through the space (like an anechoic chamber)

In the 2020 version of NBC, the right to quiet enjoyment of one's dwelling unit was assisted by adding a minimum as-built performance rating of *apparent sound transmission class* of not less than 47. Wall and floor assembly solutions can be found in *The Guide for Sound Insulation in Wood Frame Construction* of March 2006 by the NRC Institute for Research in Construction. The typical design of corridors and suite door walls with air flow are usually not achieving ASTC-47 but this is rarely enforced in practice due to an industry-wide unspoken assumption of suite doors being the exception.

13.2.1 Controlling For Sound

13.2.1.1 Minimizing the Travel of Unwanted Sound

In addition to the strategies noted above, airborne sound can be minimized through increasing solid mass between spaces, removing air gaps between spaces, and minimizing wall and

floor assemblies acting like a drum and transferring sound from one space to another. The aforementioned NRC guide is recommended reading to understand how floors and walls need to act together with sufficient solid layers to stop sound transference, especially with Canada's preference towards wood building construction.

Double-stud walls are usually laughed at, during initial considerations of design options, even though acousticians consistently say that they are very effective in inhibiting the transfer of sounds from one room to an adjacent room. Also, a sound lock vestibule is the acoustic design solution to make sure a confidential court case is not heard from the main corridor. Oddly though, many buildings do not have them.

13.3 Mind-Friendly Environments

Good building design minimizes annoyances and inconveniences with great efficiency in costs, schedule, and real estate usage rates. Functionality itself is only one goal, creating positive emotions is another.

Great building design enables users to live the stories of their lives with dignity, calm, and inspiration at the same time as being on budget at occupancy.

Great designs balance capital costs versus benefits as well as social, audio, and visual noise balanced with private and public places connecting to the outside. When building users feel that a building is old and obsolete, that negative PR is painted on the Owner. When new construction feels inadequate and cheap due to a simplistic focus on short-term costs or profits, that negative PR is painted on the Project Team.^{A1S}

Pleasant and memorable buildings that enable people to create great memories can be fondly remembered for decades, granting possibly years of good PR to Owner, Financiers, Builders, and Designers and future business. The Coca-Cola is a brand that is not built on a drink with the most desirable taste but a taste that nostalgic memories are attached to.^{T1CC}

Empathy is one of the greatest tools to design products, including building designs. **Mind-friendly environment strategies and elements are treated as *bonus points* in the RHFAC Rating Survey** to encourage their consideration and implementation in modern building designs. This is why STRATEGY MF is a very effective 2-birds-with-1-stone strategy.

13.3.1 Ways to create Mind-Friendly Environments

Buildings that make users unintentionally feel trapped are likely unsuccessful building designs. Feeling trapped can be very subjective for neurodiverse people, depending on our phobias, social adeptness, or physical or mental disabilities that can create barriers in built environments designed for the lower sensitivities and higher tolerances in social, audio, or visual noise that are found more frequently in neurotypical people. Predictable environments are highly valued while chaotic environments are feared and stressful.

Access to calming spaces is key to creating mind-friendly environments, especially if not all rooms are designed to be calming spaces. There is a need to balance out all sensory-noisy



spaces with their opposite: designated areas of calm that reduce or minimize sensory stimulation and ability to connect to the outdoors, like well-designed respite rooms.

High stress can be found in places like airports, subway stations, crowded retail malls, or high-density offices, where large volumes of stressed-out people, line-ups, and feelings of lack of self-power can be prevalent. Reducing stress and feelings of being trapped is the best way to calm people down for efficiencies in pedestrian flow, productivity, and occupant experience.



Example RHFAC requirements for Architectural Designers in Phase 1 or 2:

- If the essence of the building function does not align with mind-friendly environmental design, the building should provide features and designated spaces to achieve inner calm that can be accessed by any user, such as a respite room. Connections to nature and outdoor views is an easy strategy for calm.
- Alternatives to noisy plumbing or electrical fixtures such as HVAC fan noise dampers, quiet-flush toilets, and manual paper towel dispensers if electric hand dryers are used. This is a strategy of either replacing products with quieter upgrades or providing quiet alternatives to reduce overall frequency of sound noise pollution.
- See 13.2 above on containing sounds within and between functional spaces through selection of tested and proven wall and floor assemblies for better STC performance ratings and resultant ASTC as-built performance of building spaces. The side benefit of creating sound separations for airborne sound is that scents can also be contained within their designated areas.
- Distribute flora features throughout the site and building (both outdoors and indoors). A concrete building with grey exterior and interior colours only and a site without plants or trees is a depressing building for anyone.



Example RHFAC requirements for Architectural and Interior Designers in later Phases:

- Landmarks along circulation routes to improve site orientation and memory recall along with STRATEGY B.
- STRATEGY C with purposeful use of neutral colours, natural wood, warm lighting, soft textures, minimal reflections, minimal noises, etc.
- Well-designed and calming built spaces will have a resonance immediately for all users, especially for the neurodiverse who need predictable and familiar.
- Avoidance of visually busy surfaces and patterns. The more a building reads like a cartoon of its essential elements the better ... and not like a collaboration painting of Pablo Picasso, Jackson Pollock, Salvador Dali, M.C. Escher, and random graffiti.
- Designated places for storage and usage of sensory-friendly toys, tools, noise-cancellation, puzzles, etc. so individuals can regain their focus by decompressing from social pressures and audio, visual, and olfactory noise. People with the ability to ultra focus may have developed that ability due to oversensitive senses.



Example RHFAC requirements for Electrical Designers:

- Consider the quiet version of similar products and the background noise level of current products selected.
- Avoidance of lighting fixture prone to or designed to strobe, flicker or produce noises. Fluorescent lighting doing their doom flicker can cause headaches or seizures in people with epilepsy or similar conditions.
- Lighting design has is not interrupted between spaces, including between outdoor and indoor, and reduction of abrupt changes in light levels.

Example RHFAC requirements for Mechanical Designers:

- Design conditioned air spaces to achieve consistent temperatures and comfort throughout the site, based on cultural acclimatization (i.e. Canadians prefer an indoor temperature range of 20°C to 22°C or 68°F to 72°F while citizens of Cartagena, Columbia can find comfort with indoor temperatures of 23°C to 30°C or 73°F to 86°F) A1C
- HVAC design to contain scents within their designated areas

13.4 Wayfinding and Signage Design Considerations

Intuitive wayfinding should be a core design criterion for most building types unless there is a specific business objective to increase the likelihood of building visitors getting lost in a maze (e.g. casinos, multi-mode entertainment spaces, and large retail stores) without compromising users' life safety. **Buildings are tools, just really big ones.** Intuitive use of buildings by design should be a primary goal for all Project Teams and designers.

As a reminder, the signage design of a building project must be available, or Project Team must attest to their provision according to RHFAC requirements when submitting an RHFAC Preconstruction Rating.

This means that the Signage designer must be involved in the project's design much earlier than typical schedules where the Signage Consultant is engaged after the building permit application or even later.



Signage consultants should start no later than the end of Phase 3 Functionality but are better to start their initial feedback to the Project Team at the midway to end of Phase 2 Logistics when site plan layout and general interior spaces have sufficient design stability.

Signage is the simplest and most effective way to enhance accessibility and improve the user experience at any site. Clear signage and well-planned wayfinding systems help all users navigate buildings intuitively, reducing confusion and stress. Signage and wayfinding are not only cost-effective but also highly impactful in supporting accessible environments, while meeting RHFAC requirements towards certification at the same time.

13.5 RHFAC Incentive Points

RHFAC recognizes innovation and encourages projects to go above and beyond by rewarding them with bonus points. Technology is advancing at an incredible pace. The horse drawn carriage and the car were separated by two centuries. The telegraph and the telephone: 39 years. The gap between the Apollo mission guidance computer being shrunk into a home desktop computer ... a decade.

Almost 50 years later after the microcomputer, 2025 smartphones are *millions* of times more capable in speed and data storage. They can access global info instantly, play videos, learn human owner patterns, and translate languages.

The building industry is having problems keeping up quite frankly. USB B power outlets are barely made available in new construction when our smartphones use USB C chargers or even cordless charging. Building communication designs still primarily rely on cable infrastructure when a well-designed Wi-Fi network with integrated community security could provide wireless mobile data for an entire residential building. Modest technology infrastructure can be installed to help people with hearing and vision disabilities navigate the building and the fellow occupants within it, yet these are not the norm.

These bonus points are here to promote less fear in adopting technology and provide more equal access to people regardless of ability.

13.5.1.1 Bonus Points: Technology

Technology bonus points look at environmental controls, communication, navigation, security, emergency egress, mind-friendly environments, and website information. By awarding bonus points, RHFAC incentivizes teams to exceed standard requirements and embrace innovative, accessible design solutions throughout the project's development.

Example RHFAC requirements that may be eligible for bonus points for the Design Team in Phase 1 or 2:

- Environmental controls such as remote adjustable or smart thermostats, dimmer light switchers, automated window treatments.



- Communications infrastructure or systems that enable or improve one-to-one or group communication, in-person or online, that allow Site user to communicate and access information, products, and services in areas where communication takes places such as reception or service counters, public assembly areas, classrooms, waiting areas, exhibits, etc.
 - These include audio accessibility and communication enhancement technologies such as induction loops, teleloop systems, portable hearing systems, accessible conferencing software and hardware, video relay services, closed caption and descriptive video, self-serve interactive kiosks and payment terminals, sign language interpretation, etc.
- Provisions for navigation, security, and emergency egress that help people navigate the site and building as well as notify or alert them of emergency situations so they can exit safely.
 - Examples can include navigational beacons, digital maps, physical 3D maps, LIDAR site mapping, proximity-based security systems, mobile applications (e.g., Blindsquare, Good Maps, Pedesting), and emergency mass communications systems, such as SMS/MMS alerts with coordination on A/V displays, as well as text-to-text communications capabilities as alternates to voice-only intercoms.
- Mind-friendly provisions such as respite rooms with tactile walls or mural, interactive floors or wall panels, sensory lighting, musical water beds, bubble tubes, etc.
- Bonus points are also awarded to technologies that assist specific disabilities:
 - Mobility challenged individuals,
 - D/deaf or hard of hearing,
 - Blind or low vision,
 - Neurodiversity, and/or
 - Other experiences of disability not described above but is providing meaningful access to the built environment.

13.5.1.2 Bonus Points: Website Information

Every project should consider these bonus points by engaging the website designers earlier than occupancy permit so the accessibility/RHFAC consultant can review the unpublished draft website. One way to do so is to ask the website designer what their timeline is to produce or edit the Owner's website.



13.5.1.3 Bonus Points: Innovation

RHFAC encourages Project Teams to demonstrate creativity and ingenuity by awarding up to 20 bonus points for environments that effectively integrate innovation to improve meaningful access for diverse users and Site purposes. Innovation is not limited to built environment features and may include the following:

- Staff responsible for Site operation are currently taking or have completed an RHFAC Training course.
- Site has maintenance polices in place that specifically address accessibility provisions. These can include technology maintenance requirements of electronic infrastructure providing enhanced accessibility to the Site or policy of snow or leaf removal so people with disabilities can enter and exit the building without natural obstacles in the way or causing risks of slipping on the ground.
- Wi-Fi access available to enable smartphone or similar devices to have access to applications, programs, software, products, services, and support when in the building. Airports should always obtain these two bonus points.

13.6 Bonus Points Ideas

As technology progresses at breakneck speeds in today's day and age especially with artificial intelligence grinding out patterns and analyses that humans have insufficient attention span and lifespan to match, it could be entirely possible that some technology-based strategies for building designs become obsolete in a short period of years. Fax machines remain a viable way to contact the Canada Revenue Agency per legislation, but architects don't design them into buildings anymore unless expressly told to do so. New construction buildings rely on cable infrastructure for internet and TV, but it is entirely possible to build a wireless data solution for a tenant with extenders to buttress weak signal areas.

The innovation ideas below are meant only to inspire and to help Project Teams brainstorm more project-specific ideas. HAL cannot emphasize enough that these ideas come with no guarantees or warranties whatsoever from HAL that they will be eligible for bonus points. This is up to the discretion of the RHFAC program.

Someone must voice ideas to get creative minds flowing but, at the same time, this Guidance Book takes no responsibility or liability whatsoever for any of these ideas since every project is unique. The below is simply merging current technology with HAL's imagination. It is recommended for Project Teams to reach out to the RHF directly to see if any of the below could be seen as a valid innovation bonus points for a specific project design.

13.6.1.1 Possible Examples of Innovations

The following are **possible** examples of innovation that **may** be eligible for innovation points:

1. Using current smart technology building-wide to the benefit and convenience of building users such as rough-in for remote camera/voice doorbells that allow residents or tenants to see who is at their door. As well, adding remote unlocking via phone app for a verified visitor.
2. Occupancy sensors distributed throughout a building that interact with similarly building-wide building screen interfaces at circulation intersections or midway on long routes or rest areas, that a user or multiple users can interact with using their smartphone and connected by a robust Wi-Fi system with extenders to strengthen weaker areas.
3. Smart doors with recessed monitor screens in their assembly that can provide variable visual information, a camera instead of a door viewer, and provide an opportunity for each tenant or resident to brand their door like. Or holiday flavouring.
 - This would be an ideal replacement for better privacy than a door viewer as well as allows for remote viewing of who is outside a suite door without needing to be physically proximate to the door.

- These screens could also be connected to the building wide navigation system to temporarily people navigate the building if they are lost as well as provide unlimited possibilities of text over traditional static signage.
 - That said, the room ID sign beside the door should remain as part of the solution with raised characters/symbols and Braille for people who are blind who would not be able to see these door screens.
4. The BIM or Revit model that the Design Team used for the Issued for Construction set could be provided into a phone app interface, maybe using the Unreal 3D engine, that allows users to digitally walk-through a building's interior prior to arriving on site.
- These digital 3D models could participate in a national or global database of digital 3D building maps of public spaces while protecting the security of more private spaces through digital security methods but allow staff or visitors of the private spaces the same 3D walkthrough research through more secure areas but have these unviewable by the public, depending on their security clearance.
 - This would be the natural evolution of Google Maps' ability to help people navigate a city in 2D but a 3D version and at a building scale and be able to detect a phone's location in xyz coordinates and be able to provide automated voice and text assistance to navigate a building both vertically and horizontally.
 - This would require thorough Wi-Fi access throughout and the designers' BIM 3D model file.
5. Provide a building information and navigational package for any personal HUD (Heads-up Display) interface such as headwear or similar.
- Apple has already invented an eyewear product that allows blending of the real physical environment with digital information overlay. An Owner could provide the digital info (including menus, purchases, building tenant directories, etc.) and navigation interface package for any building user to use for their personal eye or HUD headwear.
 - Fears of long-term effects on eyesight may create demand for a HUD version over the current pioneering eyewear products by Apple.
 - This would require thorough Wi-Fi access throughout the Site.

14. Residential Dwelling Units Design

New construction housing supply is not keeping up with demographic demand per the Fall 2024 CMHC Housing Supply Report. The report also concludes that there aren't enough new builds to reduce the existing supply gap and improve affordability for Canadians. The U.S. is also feeling the same lack of new residential construction to match the growing demand with the U.S. Chamber of Commerce stating that there is a shortage of 4.5 million homes in March 2025.

Due to financial incentives to adopt accessibility design into multi-unit construction projects, such as those offered by the CMHC, there is a demand to understand how to make dwelling units that are accessible to people with disabilities. Multi-Unit residential new construction “starts” represented about 78% of the 2024 housing completions in 2024 while single-detached dwelling units represented the rest.

This chapter will review possible strategies for a multi-unit residential new construction. The aforementioned CMHC report noted that half of all apartment housing starts were purpose-built rentals probably due to green-lit pro forma analyses that made the projects viable.

Single detached homes could definitely benefit from accessibility design but without legislative pressure, there is little to no obligation for single detached homes to be designed for anyone with disabilities. For single detached homes, accessibility design is up to Owners and buyers to demand that these homes be configured for people with specific or multiple disabilities so they can live with dignity and convenience.

Applicable building code is a minimum standard document that is slow to respond to the demands of our time but evolves towards an equitable future at its own eventual pace. Accessibility design is a way to futureproof buildings. **For those specializing in accessibility design, the barrier-free revisions in NBC in the last decade are not surprising at all.**



14.1 Overlaps in Accessibility Design for Multi-Unit Residential

Accessibility design objectives, noted in Chapters 7, 8, and 9 for the outdoor elements and Chapters 10, 11, 12, and 13 for indoor elements, have very similar objectives for a multi-unit residential project.

The RHFAC Gold Prerequisites provide a solid foundation for any building design to be able to design to meet the needs of people with disabilities. Further, STRATEGIES A, B, C, D, F, and MF are useful overarching design principles to apply to these projects as can be seen by the accessibility design targets described below. Once one understands the problems that people with disabilities face in the built environment, the repeats become obvious in how to design buildings that we can all occupy and use.



14.1.1 General Accessibility Objectives: Multi-Unit Residential

As noted above, multi-unit residential building designs have accessibility requirements in the RHFAC Rating Survey that are duplicated from other previously covered building areas and types. **The underlying reason for the repeated accessibility requirements is straightforward: individuals with disabilities consistently encounter the same barriers within conventional built environments. *The buildings change, the problems don't.***

Example RHFAC requirements for Architectural Designers in Phase 1 or 2:

- STRATEGY A to principal entrance, all suite entrances, and all common or shared areas such as, but not limited to, accessible entrances, parking, amenities, corridors, washrooms, walk-in closets, etc.
- STRATEGY B for a simple and efficient building design with centralized amenities and short travel distances to them with preferably a flow-through elevator from entrance lobby to main corridors on upper levels if a multi-storey building.

- STRATEGY D for automatic door operators to all accessible entrances and preferably all amenities and ideally entrances to designated accessible or adaptable suites. For additional long-term protection of automatic door operators, provide instructions to building ops on best practices on self-maintenance or operation (such as no-propping open of the door) so the motor doesn't burn out prematurely. Attention should be paid to door access control systems being tied to any power door operator as it will burn the motor if someone activates the door operator while the door is still locked.
- STRATEGY F for all outdoor and indoor floor surfaces
- STRATEGY MF for reduction of noise travelling between suites, better window square footage, and balcony access for both suites and shared spaces to connect residents to the outdoors both views and physical access.

RHFAC requirements for Architectural and Interior Designers in later phases:

- STRATEGY C for interior design strategies to help frame out building
- elements for people with low vision but can also be used for intuitive wayfinding to building exits or desirable amenities, stairs, etc. and outlets recessed in cabinetry.

RHFAC requirements for Electrical or Mechanical Designers:

- Building controls mounted at accessible heights, and if possible, at multiple heights for seated positions and tall standing positions without bending down. These include light switches and power outlets. Thermostats and other sensors should consider access from seated positions at the same time as working with possible conflicts with manufacturers' recommended mounting heights for functionality.
- Well illuminated spaces that are brighter than 100lux as well as ensuring all signage being legible and including dwelling unit ID signage and task lighting in kitchens.

14.2 Additional Considerations for Residential Projects

Dwelling units are used by everyone. In a real estate market with a national housing shortage, accessibility may be placed lower in the design objectives hierarchy for projects solely focused on maximization of profit. Government financing incentives are wisely changing that landscape to encourage accessibility in new construction.

If new construction residential buildings are mostly a race to the bottom on quality, there is a market opportunity to shine above the rest by producing homes that can be used by people with disabilities to live independently and with dignity into their retirement years.

Real estate development is one industry that planned obsolescence should neither inform nor encourage lower standards of building designs.



14.2.1 Designing Dwelling Units with Flexibility

The [Housing Design Catalogue](#) by the CMHC provides drawings and illustrations of accessible dwelling units that are customized for each province and territory in Canada. These designs should be reviewed by every Project Team considering developing a multi-unit residential building as at least a starting point of understanding how to space out and layout an accessible dwelling unit. CSA B652:23 should also be reviewed in concert. This chapter serves only as a companion document to those housing designs and the aforementioned national standard.

Building designs can prepare for the future without investing fully into the construction and purchase of all elements through rough-ins and structural design reinforcements to allow for future installation of lifts, evacuation chairs, and grab bars. Other accessibility design features can create alignments with the varied heights of adults as well as growing up from middle childhood to teenager so the dwelling can work for the whole family. Design targets that are multiplied should always be noted to the Cost Consultant at the end of Phase 1 Feasibility.

While the building industry has not adopted accessible cooktops or ranges that separate ovens as a separate appliance, premium kitchen design offers that exact same convenience of having access to ovens at standing heights with no need to bend down to lift heavy and hot Thanksgiving or Christmas turkeys for insertion or extraction. Accessible cooktops can be seen as a burden or as a premium market offering that distinguishes one Developer's building products from the rest: easier baking and roasting.

14.3 Considerations for Small Residential Buildings

Townhouse and other small multi-unit residential building or complex designs should take advantage of the building type's disadvantage: the lack of vertical stacking pressure. This frees up building designers from considering what happens in the building on Level 3 if there is no third-floor level and they can design a complex that repeats in the middle but has accessible units provided at the ends of the complex.



Another possibility is creating a fire separation between a ground floor unit and a second-floor unit.

Whatever the case, the accessibility design strategy should be understood by all parties with consensus in Phase 1 Feasibility so there is no wasted effort by consultants.

Canada and the US rely heavily on wood construction for small buildings for housing.^{A1L} As such, special attention should be paid to the idiosyncrasies of wood construction and any design conflicts or alignments that wood can bring to the table.

Considerations for wood construction and accessible design:

- Industry recommendation that the top of concrete or concrete block foundations should be minimum 100mm (4") above grade means that the pedestrian approach to the front door and the finished floor elevation (FFE) of the ground floor needs to be considered as soon as possible for an accessible path of travel.
 - This problem only exacerbates when a property lot is on a sloped site.
- Building envelope design and balcony structure should be solved to achieve flush transfer from indoor to outdoors as well as maintaining the integrity of the exterior walls' performance to shed rainwater and snow from ingress into the interior.
- **The change in NBC 2020 for ASTC-47 as-built airborne sound resistance between units means that all previous residential buildings, especially wood buildings, are possibly non-compliant to this new requirement.** See NRC's *Guide for Sound Insulation in Wood Frame Construction 2006* for the testing results of various wall and floor assembly combinations. Before 2020, building designers did not need to account for flanking sound paths. Now they do.
 - The more mass in party walls and floor assemblies between dwelling units along with acoustic seals, the more likely sound transfer can be minimized.

- It might be easier to design the accessible dwelling units first before designing the typical and more repeated dwelling unit in the project.
- Discarded cigarettes from balconies at night is the most common source of fires.

14.4 Considerations for Multi-Storey Residential Buildings

Architects and builders with single-detached housing experience will need to proceed with caution and due diligence as the demands for accessibility and fire protection increase in Part 3 NBC or applicable building code when more than one family is projected to live in the same building. Space efficiency and vertical stacking require special attention to unique spaces like the principal entry, amenities, and accessible or adaptable dwelling units.



NBC 2020 devoted about 850 pages to Part 9 Small Buildings for architectural design as a preventative measure for the volume of building designers and builders and projects that any municipal building department would have challenges policing. In contrast, NBC devoted about 290 pages of building requirements to Division B Part 3 for larger buildings as building permits depend on licensed and experienced designers required to design them and recognizes that describing building possibilities in detail is not feasible for Part 3.

Just as design consultants need to have experience in wrangling chaos into ordered efficiency, the builders as well need the experience to prioritize, strategize, schedule, and enforce quality craftsmanship standards with more people on site at the same time. As teams and buildings increase in size, the pressure on project management explodes exponentially. Building a two-unit house is a far cry from a 50-unit condo.

Considerations for large multi-unit residential buildings and accessible design:

- Accessible or adaptable dwelling units can be vertically stacked for repetition on each floor as well as plumbing, HVAC, and sprinkler efficiencies. Initial planning of the floorplate should be cognizant that the 15% minimum NBC requirement for accessible dwelling units applies to each type (1-bedroom, 2-bedroom, etc.) so distribution of these should be across a given floor and not isolated to one corner.
- Travel distances from the elevator to any part of the floor should not exceed maximum distances as mandated by applicable code. Clustering amenities or similar unique spaces above or around the building entrance and main lobby can be aligned with STRATEGY B as well as encourage flow-through elevators for interior circulation systems.
- STRATEGY A should be used for the path to every suite and every shared or common corridor to any shared or common amenity either indoor or outdoor. This alone can allow the structural design solution to remain intact from Phases 1 to Phase 4.

- Canopy shelter for weather protection if outdoor entries present.
- Confirm what the municipality's Property Standards By-laws are for minimum requirements for dwelling units^{L1PS}

15. Public Infrastructure Considerations

Public infrastructure has the strongest mandate to provide universal access to buildings paid by taxpayers. Buildings like public transit, hospitals, courthouses, government services card or ID interfaces, etc. need to be exemplary buildings for how a universally accessible facility should be designed. These buildings need to confirm accessibility requirements as early as the RFQ stage.



As noted in the previous chapter, **the RHFAC Gold Prerequisites provide a solid foundation for any building design to be able to design to meet the needs of people with disabilities.** Aligning applicable building code with the RHFAC Gold Prerequisites (noted in section 8.16) that may act as 13 “silver bullets” for a strong baseline design for a building that can resist unnecessary design changes if worked out and coordinated well in Phase 1 Feasibility.

The larger the facility, the larger the importance of accuracy of the early design in Phase 1 Feasibility for an accurate budget. Such accuracy is only achievable if all key parties can provide input in the Phase 1 Design stage. These parties include but are not limited to:

- Owner
- Building Ops
- Architect
- Electrical Engineer
- Mechanical Engineer
- Landscape Architect
- Civil Engineer
- Suppliers/ Manufacturers
- Construction Consultant
- Building Code Consultant
- Signage Consultant
- Electronic Security or A/V Consultant
- AHJ Planning Department

- AHJ Building Department
- AHJ Fire Department
- Structural Engineer
- Acoustic Consultant
- Vertical Transportation Consultant
- FF&E Consultant
- Then finally the Cost Consultant

Due diligence on number and demographic variety of people should be known. Again, as in the previous chapter, STRATEGIES A, B, C, D, F, and MF are useful overarching design principles to apply to these projects as can be seen by the accessibility requirements described below.

RHFAC requirements for Architectural Designers in Phase 1 or 2:

- STRATEGY A to principal entrance (PR4), all suite entrances (PR12), and all public and staff areas (PR12), but not limited to, accessible entrances (PR4), designated parking (PR1), amenities (PR12), corridors, washrooms (PR12), etc. Building Ops staff may need wide service corridors as well for movement of skids and goods.
 - Building Ops should be consulted for both interior and exterior maintenance. In particular, exterior pathways to a building should have a dependable protocol of snow or wet leaves removal to reduce the possibility of slipping on exterior paths or become inaccessible completely by citizens using mobility aids such as walking canes, walkers, or wheelchairs.
- STRATEGY B for a simple and efficient building design with centralized amenities and short travel distances to them with preferably a flow-through elevator from entrance lobby to main corridors on upper levels if a multi-storey building.
 - If a public infrastructure project is a DBFM P3 RFP, it is in the best interests of the competing Design Builder consortiums to have simple and space-efficient layouts to access spaces in the shortest time and distance and direct route as possible. The most frequently accessed spaces need to be as close to principal entrance as possible; the least frequently accessed spaces logically can be the furthest distance horizontally or vertically from that same entrance.
- STRATEGY D for automatic door operators to all accessible entrances and preferably all amenities and ideally entrances to designated accessible or adaptable suites.
 - For additional long-term protection of automatic door operators, provide instructions to building ops on best practices on self-maintenance or operation (such as no-propping open of the door) so the motor doesn't burn out prematurely. Public infrastructure

frequently uses electronic door access controls to separate public from staff spaces so attention should be paid to door access control systems being tied to any power door operator as it will burn the motor if someone activates the door operator while the door is still locked.

- STRATEGY F for all outdoor and indoor floor surfaces, including avoidance of busy and noisy visual patterns
- STRATEGY MF for reduction of noise travelling between suites or offices, better window square footage and access to as many spaces as possible, and balcony access for both public and staff spaces to connect Site users to the outdoors both views and physical access.
 - While a cost premium, it is entirely possible for an underground space such as a subway station to create light wells and mirrored walls to push daylight down into underground spaces for the benefit of all users. Access to natural daylight is the most efficient ways to make a space feel better to be in.
- EV charger infrastructure design should consider accessibility (See 8.3.2.5)
- See Chapter 9 for front yard and principal entrance design.
 - It cannot be emphasized enough that the front yard, principal entrance, and main lobby design are the highest priority spaces to get right as soon as possible.
 - Wider principal entrances to allow mobility device maneuverability and adjacent rest or waiting areas with seating can go long way to maximize not only pedestrian flow in and out of the building but also be considerate of those with disabilities, including people with vision disabilities who are at risk to outswing doors in the path of travel as well as D/deaf people who have challenges with voice-only intercoms to enter a building after hours or a secure building.
- See Chapter 10 for elevators, egress stairs, areas of refuge, stacking building core spaces, path of travel in corridors, open-plan spaces, ramps, stairs, doors, etc.
- See Chapter 11 for lobbies, mail areas, garbage rooms, reception or service desks, storage lockers and lockers, universal washrooms, accessible washrooms, and showers as well as generic but applicable targets for kitchens, kitchenettes, and coffee stations including knee clearance, counter and cabinet designs incorporating accessible plumbing fixtures, microwaves, fridges, etc. along with storage reachable by people with limited horizontal or vertical movement or using motorized mobility devices.
- See Chapter 12 for swimming pools, cafeteria or similar food preparation and consumption spaces, multi-purpose rooms, fitness gyms, any shared space with furniture, as well as very similar/overlap requirements of any places of assembly that will share logistics and requirements with specialized learning spaces.

- See Chapter 13 for building wide systems, such as lighting, navigational and room ID signage, emergency systems, evacuation, intuitive wayfinding strategies, etc.
- Level thresholds and clear maneuvering space at doorways and preferably at exterior door transitions as well with maximum 13mm (1/2”) vertical level change.
 - Close coordination with the Civil Engineer and the Landscape Architect to ensure stormwater management as well as adequate rest areas and clear widths at all accessible entrances.
- Controls being easy to use or automatic.
- Clear maneuvering space for all major building interfaces such as all doors, washrooms, sinks, appliances, toilets, coffee or kitchenette counters, vending machines, directories, interactive information kiosks, self-payment terminals, etc.

RHFAC requirements for Architectural and Interior Designers in later phases:

- STRATEGY C for interior design strategies to help frame out building elements for people with low vision but can also be used for intuitive wayfinding to build exits or key areas as well as cabinet designs, washrooms, or similar building interfaces.

RHFAC requirements for Electrical or Mechanical Designers:

- Building controls mounted at accessible heights, and if possible, at multiple heights for seated positions and tall standing positions without bending down. These include light switches and power outlets. Thermostats and other sensors should consider access from seated positions at the same time as working with possible conflicts with manufacturers’ recommended mounting heights for functionality.
- Maintaining both lighting and HVAC conditioned air levels to be consistent between interior spaces. Lighting design should also pay attention to consistent lighting levels between exterior and interior spaces at accessible entrances.
- Well illuminated spaces that are brighter than code as well as ensuring all signage being legible and including room ID signage and task lighting in appropriate areas.



16. Reference List and Notes

A1A – This is one of the golden nuggets of advice from Henry Chen’s mentor Dave McIlveen at BBB: “It is always easier to add on things in the beginning then it is to add later on.” This is why RHFAC decisions must be done in the beginning as much as possible.

A1C – Modern strategies for building comfort have made building design complicated. The prevalent usage of air conditioning has introduced increasingly higher performance of airtightness in the building envelopes. The airtightness allows energy-efficient maintenance of comfort of interior conditions that then requires strategies to protect against moisture by usually the “Rain Screen Principle” of exterior walls and roofs (aka “building envelope”) which sheds water from rain by the principle screen but recognizes that water and moisture will still get behind that principle screen, particularly due to condensation from modern conditioned air being either hotter than outside or colder than outside. Essentially protecting against the following natural or physical environmental conditions: heat from the sun (solar heat gain), precipitation from the sky (rain or snow), condensation on the warm side of insulation on an exterior building envelope in summer with air conditioning inside, and problematic condensation on the warm side insulation (i.e. that’s why windows can condense in winter) in winter when interiors are warm and the outside is very cold. Modern buildings with more airtight designs are also more vulnerable to condensation due to that airtightness design target for building energy efficiency to not lose heat or cold conditioned air to the outside due to holes in the exterior wall construction. Older buildings in the 20th century and earlier were allowed to breathe to dry up this temporary moisture but the advent of air conditioning the push for airtightness has created a problem in winter where condensation can form and, if not accommodated to dry out, can be trapped in the building envelope and rot wood or promote mold growth.



A1EOI – Exclusions in professional liability insurance policies can include (or have included) an entire building system type such as new methods like “Insulated Concrete Forms” ICF;

if architects have not read their own insurance policies or not informed their firm, they may be designing a building that is not actually covered by the Errors and Omissions professional liability insurer if the design a cottage using ICF construction. While ICF is more accepted in the province of BC, it has not achieved the same acceptance in other provinces and territories. Architects may also have secured a client who has any projects associated to that client as excluded from policy coverage by the professional liability insurer.

A1IP – If an Owner commissions a feasibility study with very small fees and allows a likely outcome that another company will be given the project’s design work, why would any feasibility study author give a competing design company their design ideas and expertise? It would take a design company with no self-preservation instincts to accept small fees and give away a good project design knowing that another company will be allowed to take the majority of the rest of the design work, which would otherwise be their IP, and the design fees that come with it. If the study’s author has no contractual or implicit motivation to do their best and accurate work, one should not expect an accurate feasibility study.

A1L – Houses in Canada and the US frequently use wood construction called stick-framing due to the abundance of timber in North America. This is significantly different from Europe which uses thicker walls and traditional craftsmanship using masonry that encourages durability and longevity of buildings. In Canada and the US, wood construction is incredibly fast in comparison to Europe, with cost-effectiveness and flexibility in its construction ... but stick-framed wood construction is also much more delicate in comparison to load-bearing masonry construction. If there was a wolf that wanted to huff and puff and blow houses down like in “The Three Little Pigs”, he should live in North America and not Europe.

A1S – Some costs eventually pay for themselves (ROI) in dollars, time and/or efforts while some short-term savings decisions will cost you far more than you realize and there’s no turning back the clock. Some savings are worth pursuing in areas that don’t require extra expense; some areas are worth adding more value as they can augment the value of the property or save high costs to retrofit years later.

A2F – There is a critical fallacy in typical RFPs and competitive environments for architectural services: the workload and level of experience usually will not be accounted for accurately or evenly between the competing architecture firms. Sometimes, procurement departments have personnel who have never designed or participated in the design of a building who are submitting fee quotes. As a service industry, an architecture firm doesn’t want to tell a potential client or retained client that their schedule and consultant fee allowances are not realistic and usually resorts to pressuring employees to work immense overtime and not record all the hours on their timesheets so the project doesn’t look bad to firm leaders. Architectural services RFP for projects should be required to have a 3rd party architectural or similar Prime Consultant reviewer on stating the assumed minimum scope of the architectural services

in quantifiable and comparable ways such as minimum number of floor plans, elevations, building sections, 1:20 or 1:25 details, 1:10 details, 1:5 details, and a draft MasterSpec table of contents that quantifies a minimum number of specifications expected on the project. Leaving the quality and quantity of design work to each individual architecture firm competing for the project for their quote. A race to the bottom for quotes for technical design drawings without prequalifying competitors or mandating minimum workload to compare apples to apples ... is as silly as it sounds. You will get what you pay for: lower prices often come with lower quality, less experience, and higher risk.

A2Ph1 – Examples of things that should be considered in Phase 1 Feasibility: Does the building idea work as a test fit in the site and spaces as well as budget, schedule, legislation, and human resources? Is the design compliant to building code in terms of fire egress paths horizontally and vertically? Have all front yard, rear yard, and side yard setbacks been accounted for in the building placement in the site? Are there enough parking spaces to be compliant to the municipal zoning by-laws? Can all anticipated vehicles use the site as needed? Can all pedestrian traffic use the site and building as intended? If the property is under the jurisdiction of a Conservation Authority, has that AHJ been appropriately consulted and their generic guidance been followed? Do the main external and internal pedestrian circulation networks have clear widths that are both compliant to relevant design standards as well as construction tolerances? Anything that can affect the site plan layout or the structural design or legislation compliance or budget limits should be already accounted for in the feasibility study design. The feasibility study should not assume exact minimum building code dimensions for its basic building units. It should have “design fat.” A good feasibility study will traverse the-egg-before-the-chicken conundrum by integrating a workable and generic building footprint and massing with design and construction tolerances into the feasibility study. The accuracy of a proof-of-concept exercise is dependable only if its critical assumptions are accurate. It is too often already that a feasibility study does not adequately capture the magnitude of scale and required logistics of a project due to its “sketchy” and conceptual nature. Good feasibility plans have worked out and accommodated for all the critical and essential major building components; poorly done feasibility plans result in designers trying to fit 20lbs of bread stuffing into a 10lb turkey with ice-skating uphill for the entire project.

A2Ph2 – Examples of things that should be considered in Phase 2 Logistics: What loads are on the building (legislation, # of people, structural loads, wind loads, climate statistics, fresh air/exhaust volume loads, electrical loads, etc.)? At the end of Phase 2 Logistics, the collective building designers, as a team, should confirm legislation compliance and finalize the site plan layout, structural design, the number of rooms and their assigned purposes as well as all primary service pathways and routes in xyz dimensions for all HVAC ducts and machines, water and their associated equipment and machines, all electrical systems and their associated servers, panels, large equipment, etc., and all relevant maintenance or replacement logistics

of all building components or equipment. Building machines eventually break down or made obsolete by manufacturers discontinuing those products lines in favour of more efficient products. Windows need to be washed somehow without endangering the window washers. Garbage and recycling need to be collected in a location for regular removal by refuse collector service companies. Elevators need machine rooms. Escalators need machine rooms and repair rooms. Building storage needs must be fully accounted for. If hazardous substances are part of a building's regular operations, have all the safety provisions been accounted for in the design? Are there any problems with the interior circulation systems in terms of clear widths, horizontal distances, and access from spaces to other associated spaces across or vertically through the building? Are the exterior finishes at the appropriate premium or low-budget levels?

A2Ph3 – Examples of things that should be considered in Phase 3 Functionality: Does each exterior space and interior space work for its functional purpose? Does the lobby's front counter have all the functionality it needs? Does a laboratory room have all the services it needs and in the correct locations? Does each hospital bed have all the services, clear space requirements, and structural capacity to put ceiling lifts? Can all the human activities be achieved in each room per the functional or aesthetic objectives required?

A3D – Omg, doors. Let me point out some of the ways that they are problematic. Door widths range significantly in size but also come in standard sizes; the allowable width of door that is not designated on the barrier-free path of travel is significantly skinnier than a barrier-free door. There is a planning fallacy that spending valuable design consultant time to custom select door choices to have each door as inexpensive as possible is good for the project when such a strategy may lead to too many door types and sizes when it would be easier to price, coordinate, and build if there are fewer door types. Doors tested for fire-resistant rating may not be doubly tested for acoustic separation performance which in itself may be compromised without seals around the door; often in public infrastructure there is a client expectation that doors and their glazed doorlites can be fire-resistant rated, sound transmission class rated, and physical assault rated when manufacturers are unlikely to invest in testing of a door for all three separate performances just by the nature of the laws of averages of how many doors are needed to do all perform in all 3 scenarios. A polycarbonate (i.e. a plastic) embedded in a glazed doorlite to help it withstand physical assault will melt in a fire and thus is not suitable for a security door that is also meant to act as an FRR opening in a FRR wall separation. Further, acoustic seals around a door to help acoustic separation performance then compromises a suite door from possible HVAC fresh air intake strategies into common corridors through the air gaps around a typical door. Suite doors typically are the acoustic vulnerability where multi-unit residential buildings are frequently non-compliant to NBC's apparent sound transmission class of 47 since the code change in 2019, despite real estate market acceptance that people in a common corridor can hear people in their dwelling unit and vice versa. AHJ's and architects may be completely unaware that a suite door that opens directly into a unit of a multi-unit

residential common corridors is likely non-compliant to NBC or applicable building code. There also the fact that decades old acceptance of wired glass as the standard FRR glazed doorlite for egress FRR doors is now not allowed under the updated CGSB-12.1 standard “Safety Glazing” in 2017 due to statistics of injuries of the wires cutting people’s arms in fires when trying to use egress doors with wired glass that was ironically embedding to help increase safety. Also, fun fact: security glazing should not be specified generically as “bulletproof” due to there being 8 different levels of ballistics resistant glazing having been established by the Underwriter’s Laboratory (UL). These resistant ratings start with Level 1 which can withstand fire from small calibers handguns but not a rifle . . . so don’t specify “bulletproof glass” since it doesn’t quite exist in the nomenclature of the market.

A4P – With wood construction prevalent in Canada and the US, it is imperative that Owners, Architects, and Structural engineers be cognizant of the threat of termites. The first consideration is to see if a municipality or nearby town has a termite problem. If so, design accordingly with full protections as per industry recommendations. The second consideration would be protections in the future if a termite problem in the area ever presents itself. The structural engineer will want to place the first-floor assembly’s rimboard on top of the concrete foundation that has recommendations towards being at least 100mm (4”) above grade; such a solution will put the ground floor FFE high enough that it likely won’t be easy to create a principal entrance without stairs or ramps. As such, the Owner, the Architect, and Structural engineer must weigh the long-term pros and cons of whether to place the first-floor structural assembly on top of the concrete/concrete block foundations or secure them to the inside face of the concrete foundations. The latter may exacerbate the already difficult transition of the insulation and air/vapour barrier from foundations to above-grade exterior walls . . . by choosing a more accessible entrance on limited site real estate that may lose maximum dwelling units if exterior ramps or stairs are added. Back to termites: other protection solutions include pressure treated bottom plates at the transition between top of foundations and exterior walls along with the gasket as well as pest meshes/netting to protect ingress or break and entering of termites into the building.

B44 – Requirement called out in NBC to match the requirements in CSA standard B44 “Safety Code for Elevators & Escalators”

B651 – See CSA standard B651:23 “Accessible Design for the Built Environment” for more details, dimensions, or other information on the subject.

B652 – See CSA standard B652:23 “Accessible Dwellings” for more details, dimensions, or other information on the subject.

C1Q – Several online articles indicate construction quality and issues are prevalent in Canada as well as high construction costs in comparison to other countries. In the CityNews article

October 9, 2019, “Homebuilding horror stories: We’ve all heard them, but is quality actually dropping?” (<https://vancouver.citynews.ca/2019/10/09/homebuilding-quality-housing/>) the article authors, Martin ManMahon and Hana Mae Nassar, interviewed one builder who said that “the situation has gotten so bad that his company has been asked to go in and essentially renovate newly built homes by other companies and bring them up to a higher standard.” The same builder is quoted as saying: “We try to rely on . . . city officials coming out and doing inspections, but they’re not really quality inspectors. They’re just kind of inspecting whether or not homes have been built to code, so therefore it leaves a lot of room for lower quality builders to cut corners. It’s really quite sad, actually, because there’s a lot of products on the market that’s not built up to what should be proper standards.” The November 20, 2024 article in Engineering News Record called “US vs Canada: Which Country is Riskier for Construction?” noted that based on the 2024 CRUX report by HKA, Canadian projects suffered more from design problems with “42% of projects reviewed had what HKA calls a “design-centric failure,” which could be incomplete, incorrect, or late issuing of design information.” Versus the US sample having 36% being design-centric problems. In the December 22, 2020 article “Construction Costs Around the World: How Does the US compare?” on the website Construction Physics, they refer to the Turner and Townsend International Construction Market Survey and provide a graph showing that Toronto single family home construction is significantly more expensive than building a single family home in Chicago, Sydney, Amsterdam, Stockholm, Paris, Zurich, etc. despite those world-class cities having higher labour rates. Construction in Tokyo is notably cheaper than Toronto but the difference in construction quality between Toronto and Tokyo can be easily seen by any layperson visiting both cities. The Construction Physics article notes about the graph: “The first thing that jumps out here is how insensitive construction is to labor costs. Large increase in labour costs translate to very small increases in construction cost.” The author also notes: “We’re constantly told how construction remains a craft-based labor-intensive business, and yet we see almost no influence of labor on construction costs between comparable countries. It only seems to matter with respect to whether you’re in a rich (W)estern country or not.”

C1S – Property lots that slope significantly end-to-end are problematic for mobility aid users let alone trying to accommodate vehicle traffic and stormwater management designs that do not overload municipal stormwater drainage systems.

C9F – In the Freakonomics podcast “Why Is It So Hard (and Expensive) to Build Anything in America?” on November 22, 2023, Stephen J. Dubner described a concerning trend that the Construction Industry is getting less and less productive in the last few decades. This is the opposite trend of how productivity has changed in most other industries in the same time period.⁰⁰⁰ The Canadian Construction Sector will be similar to our US counterpart as methodology, components, assembly testing, etc. are so intertwined and shared. This podcast describes an industry that is getting less efficient per dollar when compared to decades ago;

thus, it tells of a current situation that it would be foolish to compare construction budgets from today as apples to apples (in quality of products, craftsmanship, and time spent) to decades old projects as well as assuming that one's own project will be perfectly executed with little to no errors by any team member or construction worker or Owner decision from start to occupancy.

D1S – See Section 3.1.4 for Canadian statistics on disabilities in the population.

D1WHO – Statistics based on the World Health Organization's "Fact Sheet" on Disability published on 7 March 2023.

F10 – See "Procurement and Delivery of Selected Infrastructure Projects" Annual Report 2024 by the Office of the Auditor General of Ontario

G1G – Garbage trucks' makes and models vary from municipality to municipality. These can have front-loader forks, side-loading forks, or cranes. Private refuse collection is also another possibility. An Owner must be made aware immediately that creating the provision for an indoor garbage pickup location usually requires an investment in both horizontal and vertical real estate: the garbage truck needs to be able to maneuver through the garbage pick-up area, the doors must be large enough to accommodate the garbage truck, and the floor-to-floor height of the entire ground floor may be dictated by the minimum overhead clearance that a garbage truck requires, including the sloped floor of the garbage area where there should be a slope to floor drains to allow for easy washdown cleaning of the garbage room.

G8T – ... at the time of the writing of this guidance document.

L0L – Always confirm applicable legislation, identify conflicts between them (federal, provincial, and municipal), then identify conflicts between legislation and Owner objectives. Then sort out the conflicts. See also Note L1B below. It is unclear to this author why Canada cannot centralize government under one roof between federal, provincial, and municipal governments since private multi-national corporations do it all the time. Imagine a country where each municipality's building and site plan departments had access to a repository of the same information resources, helpful tips on how to interpret legislation related to building code and accessibility and have the ability for instant internal communication across our vast country ... such a repository could even be called a "website" and the communication functionality could be called an "internet forum" with a login name and password feature. *Canada can be first to merge all levels of governments and create a single but meritocracy-based crown corporation, if we dare to dream and have the resolve to make science fiction a reality.* Harmonization of accessibility legislation probably becomes easier after that, once people in silos become the same squad with efficient communication. Furthermore, revolutionary technology should be strategized to lead towards wholesale legislative changes when they can benefit all ... whereas legacy legislation created by English Majors on horseback shouldn't hold

a country back from modernizing its legislation and enabling the sharing of information in the Information Age. When fax machines are accepted by the Canada Revenue Agency, but emails are not ... the self-preservation of unchanging attitudes and methods can only defend so far: banks have figured out how to create secure email systems and how to make secure websites that can be accessed across the world. Canada is perfectly capable of creating its own secure email system and website for its citizens. Imagine a Canada that invested in education as its chief investment and used repeatable webinars from the best teachers in the country from kindergarten to graduate school and beyond: teaching the future generations and elevating the current ones along with keeping all the present teaching staff to focus on the social education and behavioural training of our impressionable young and still-growing citizens. Imagine a Canada with one shared building code with municipal by-laws harmonized within it. Imagine a country where we reduce the wealth gap rather than let it increase. This is all very possible in the Information Revolution.

L1A – Dense metropolises (such as cities small and large) in Canada, tend to have an additional municipal accessibility standard that creates a combination of some accessibility design requirements for exterior parts of a site (particularly the front yard) and a lot of unrequired recommendations and guidelines due to the legal language and semantics of the wording in these standards.

L1B – Applicable building code or other legislation always takes priority and precedence over RHFAC requirements.

L1C – Conservation authorities are an AHJ with a mandate to protect the natural environment with no onus to support any development project that they deem risky or harmful to the natural environment that they are obligated to protect. Human settlements usually historically and generally started around rivers and lakes, so there are inevitably properties adjacent those rivers and lakes. When considering a property near or on a waterway, it is imperative to review which portion of the lot is under the protection of a local conservation authority. The conservation authority will prioritise the natural environment and the natural habitat of the waterway over any short-term (relative to the natural world) new construction project. At the end of the day, a river or waterway is not improved by digging a massive hole beside it and then filling it up with a new construction building that could negatively impact the waterway such as permanent increase in stormwater directed towards the riverbanks that may or may not be pure, uncontaminated stormwater as well as adding unpredictable humans to the mix who may pollute or otherwise compromise the existing natural ecosystem.

L1D – Municipal zoning by-laws, particularly metropolises, can allow a maximum allowable density of a property lot. Such a limiter allows the municipality to mandate that enough outdoor open space ratio relative to other buildings and the neighbourhood is established so as to not compromise the positive nature of the neighbourhood to protect against short-term

business plans that attempt to maximize their profits at the cost of the community's right to resist significant change to either the nature of their neighbourhoods or the real estate value of neighbouring properties.

L1Dim – Should a zoning by-law's minimum dimensions of the designated accessible parking space be smaller than CSA B651's dimensions, the design should choose the larger of the two sets of dimensions to achieve compliance to both design standards. Similarly, a Project Team should consider the larger minimum ratio between CSA B651 and the municipal zoning by-law to futureproof the building from legislation trends towards incorporation of CSA B651 as municipal governments may see the legislative efficiency of harmonizing all their accessibility requirements to CSA B651 like how unique provincial building codes are being abandoned to adopt NBC across the Canada

L1H – Municipal zoning by-laws across Canada are unfortunately not harmonized with municipalities not cooperating with each other to learn from each other's lessons learned. Building height is one such example. In some municipalities, the average grade to the topmost part of the building defined as the building height (depending on the overall roof construction type of sloped versus flat).

L1O – A Project Team must apply to the AHJ for approval if the project requires a variance from a requirement in applicable building code. A typical strategy is to demonstrate how the alternate design methodology still achieves the source objective behind the NBC requirement being requested to be relaxed. For example, a courthouse design must always apply for an official Alternate Solution from the AHJ in order to have electromagnetic locks on emergency egress doors in order to protect the safety of officers or judges, even though electromagnetic locks are prohibited by the NBC on doors for emergency egress. The Alternate Solution proposal typically involves an operational and procedural solution such as a two-stage fire alarm that can minimize dangers to public visitors to the courthouse.

L1OP – Many municipalities have an Official Plan that describes the long-term vision of the future development of the municipality. Owners and architects should review this document if proposing a new building that may be in conflict with the town's vision of the future of their built environment.

L1P – Sophisticated clients, such as government clients, typically contractually make the architects and engineers responsible for the design of a facility ... to bequeath the copyright and intellectual property of the facility when the job is done. This is an unfair practice that current Canadian legislation does not protect against. While it seems reasonable to allow a government client to be unencumbered to use building designs on past projects for future projects without the written permission of the architect and engineers due to doing so in the name of the public good, it is unfair to strip the intellectual property rights of the architect. If

legislation were passed that an Owner/client cannot strip away the IP of the building designers, this would create a more fair business landscape for consulting in building design.

L1PS – In addition to municipal zoning by-laws, some municipalities pass additional legislation called Property Standards By-laws that mandate minimum standards of what is allowable to be considered a dwelling unit in order to protect citizens from desperate or possibly unhealthy living conditions offered by landlords who should not be offering sub-standard housing for lease. These standards can include minimum floor area of a dwelling unit type, minimum kitchen counter space, and minimum storage spaces. Ideally, Canadian municipalities will coordinate with each other and create one national Property Standards By-law that may include ranges of acceptable sized dwelling units based on the density of the area, allowing for smaller units in dense metropolises but requiring bigger dwelling units in smaller towns and rural areas. Architectural designers are operating at risk if they haven't confirmed if there is an applicable Property Standards By-law that may impact the design. Smaller towns may also have requirements that are surprising, like a maximum opening of an operable window being 100mm (4") regardless of the windows sill height matching or being higher than a guard height as per NBC.

L1V – In the current housing shortage in both Canada and the US, there is a demand for housing developments. As such, secondary markets like small towns near big metropolises are more motivated to permit variances to possibly old and outdated municipal zoning by-laws so early consultation with the municipality may produce a mutually beneficial meeting where a developer may be permitted to increase density or building height or reduce yard setbacks for a responsible design that still respects the urban fabric of the neighbourhood. Legislation unfortunately doesn't keep pace with technology, even when the ideal direction or changes to legislation has been known for quite awhile by grinders in the industry who have hit their proverbial heads multiple times on legislation that inhibits progress, development and/or functionality. Being in the Information Age, the need for physical proximity has been lessened that people need not live in dense metropolises in order to collaborate with people in those big cities . . . and all the Lessons Learned could be shared between all municipalities. Thus, housing development further away from large metropolises is now more palatable and more feasible than in the 20th century. The more that people are connected outside of direct physical space, the less need for people to be proximate to each other in business. The more people can get close to living in a village (something that one loses by living in a big city) without being disadvantaged by not living in the city, the more people will be motivated to live in a place where people know each other and are friends with each other. Living in a big city full of strangers is less ideal than living in a neighbourhood where everyone knows your name.

L1Y – Municipal zoning by-laws often have variable distances of minimum front yard, side yard, and rear yard setbacks based on the density of the overall neighbourhood zone. The smaller the front-yard, the less open space and daylight available for citizens on the sidewalk. Without

technology to communicate quickly and remotely (that we have now in the 21st century such as emails and web conferences), world cities developed with dense and closely distributed skyscrapers to allow people to collaborate quickly in person. The municipal zoning by-laws may be risking or sacrificing pedestrian scale density when ultra density is allowed. It should be a right of every citizen to have access to daylight in, at least, the building that they live in.

L1Z – Municipal zoning by-laws often are worded/designed around the density of the neighbourhood or area, such as rural, low-rise low-density residential, medium-rise medium-density residential, high-rise high-density residential, central business district (CBD), industrial, etc.

L2C – Current legislation in Ontario does not require the usage of standardized architectural consulting services contracts, even though they do exist. Without adequate funding for legal representation, a small architecture firm may not be able to have the resources to understand the liability embedded in a client-authored contract or a standard contract with very unfair and one-sided supplementary terms. Architects have little leverage with their clients or potential clients as buildings are often the most expensive investment of any Owner so the supply of potential clients for architects isn't a giant volume of people. If governments would like to see lower rates of building construction and design errors, this may be achieved by forcing Owners to use standardized contracts and any contract must be approved by the licensing body of the architects. It is not an uncommon situation that an architecture firm hits a point where they are working for free on a project due to insufficient hours in the business plan as well as one-sided, unquantifiable, open-ended customized contract terms that their client may be taking advantage of. It is also possible that an architecture firm is barely "breaking even" on projects and is only still in business by doing a project that they can add to their portfolio in order to low bid another project to result in the same lack of profitability. Protections for architects are limited. In Ontario, architects are not entitled to minimum wage, daily or weekly limits on hours of work, daily rest periods, time off between shifts, weekly/bi-weekly rest periods, eating periods, overtime, pay, sick leave, family responsibility leave or bereavement leave, if taking the leave would be professional misconduct or abandoning our duty, public holidays, or public holiday pay, or vacation with pay. While most architecture firms offer most of those benefits to stay competitive, it is very common for salaried architects to be unpaid for any overtime pay despite massive volumes of overtime hours done to make the chasm-sized gaps in the business plans work.

L2P – Municipal zoning by-laws sometimes allow projections such as decks, canopies, and balconies to project into the minimum yard setbacks.

L3P – Municipal zoning by-laws typically have requirements for 1) number of designated accessible parking spaces, 2) types of designated accessible parking spaces, and 3) the dimensions of the various accessible parking spaces defined in the zoning by-law. Designers

should be cognizant that municipal zoning by-law requirements for accessible parking spaces are not harmonized with CSA B651 “Accessible Design for the Built Environment” and that it is **highly recommended** that building designers look at both documents and **design with the more onerous** spatial requirement for dimensions and number of designated parking spaces.

NBC – This is or a likely requirement of the National Building Code of Canada 2020 edition. See NBC for more information.

O1B – See Chapter 5 for feasibility studies and why project budgets are rarely accurate and often too low. If an Owner’s business math is wrong in capital costs, design schedule, construction schedule, risks, or size or scale or complexity of building, the entire project will be very challenging from the beginning to the end. When business disasters happen, blame is the first typical reaction. When an industry is prone to business disasters, teammates spend considerable time creating paper trails that record how they did their scope of work correctly and in a timely manner as well as warned the Owner or other parties of possible risks that the email author has no control over.

Q1C – While Canada is moving towards universal adoption of the NBC, there are unique considerations and requirements in each province or territory. As such, the overlaps noted may not be present but have a strong likelihood of being required per NBC but also awarded points in the RHFAC. Both documents are subject to change, and this Publication was written at a specific time and place as well as does not claim any accuracy to anything written in this Publication. It is the responsibility of the reader to verify overlaps between NBC and RHFAC available points.

R1M – The *Missing Middle* refers to medium-density housing and mid-rise multi-unit residential buildings such as townhouse complexes that exist in the scale between a single detached house and a large apartment or condo building. This is a more challenging building product to successfully produce due to being in the transition zone between small buildings and large buildings where the advantages of either cannot be fully realized: small buildings offer flexibility in design and construction industry knowledge and skills while large buildings offer economies of scale due to massive repetition. The Missing Middle faces inflexibility in design and construction as well as offers only modest economies of scale due to modest repetition that business plans or pro formas cannot make the math work, especially in dense metropolitan areas where property taxes, onerous municipal legislation and building departments, and inflated real estate prices act as confounding variables that result in No-Go assessments of possible Missing Middle projects.

R1V – Different real estate markets have different price points per square foot from small towns to metropolitan urban centres and from one province/territory to another and from one country to another. For example, a 475 square foot (44.1m²) junior 1-bedroom dwelling unit is spacious

in downtown Shinjuku, Tokyo but unacceptably small in Squamish, BC and barely acceptable in downtown Toronto, ON. Property lots vary in size in average lot size and width across Canada. Canada is neither flat or rectilinear so of course trying to divvy up land in straight lines into equal-sized property lots has never happened, especially since a standardized methodology was neither exercised nor communicated when property lots were drawn or are redrawn in all the municipalities. This one difference alone makes it challenging for architects or building designers to create a prototype building design and make the design process more efficient. Imagine playing chess on a unique and different chessboard for every game ... that's what it feels like to design and construct buildings. Different skill levels of chess players versus chess masters along with different games and pieces each game with rules that can change significantly every 5 years. That said, if you can find a similar sized lot as a previous project in an identical zone and municipality ... a previous project's details can be substantially recycled. But that's a lot of if's. [INTRO]

R1W – Property lots in any municipality differ in widths, lengths, and shapes. A spatially satisfactory single detached house design may fit perfectly on one site, be too small on another site, and too big on another site. [INTRO]

T1C – NBC divides the country into 6 climate zones based on HDD (Heating Degree Days) which help measure the average demand for energy to heat a building. Due to the large size of Canada as a land mass that extends to into the Arctic Circle, the climate can vary but winter conditions are the primary design concern for building envelope design. That said, some areas (like Zone 5 where Toronto is located) must design a building to withstand harsh cold winters with potential snowstorms and very cold winter days as well as hot, humid summer days. It's easier to design a building for one climate extreme (either hot or cold) than it is to design a building envelope that must protect occupants from both hot and cold weather.

T1CC – See *Citizen Coke: The Making of Coca-Cola Capitalism* by Bart Elmore. Pure capitalism is adept at extracting emotional value from customers to increase the price of what should otherwise be a very inexpensive product, such as one made primary out of local or nearby tap water.

T1E – In Canada, elevator manufacturing is dominated by the Big 4 (Otis, Schindler, Thyssen-Krupp, and Kone). Elevators are manufactured vehicles like a BMW, and just like BMW there is a business model of proprietary replacement parts and interfaces that enables the manufacturer to be also awarded the maintenance contract as well which acts as a subscription business model with most major repairs as extras for possibly the life of the building. At the very least, all proprietary replacement parts must be purchased through them. Choosing which elevator manufacturers is actually a big decision that the Owner should be involved in Phase 1 as elevator maintenance contracts are an important consideration. Canada-based and local elevator manufacturers are likely available and competitive in terms

of cost and durability versus their multinational corporation competition. If an Owner justifiably does not want to work with a manufacturer on the maintenance side, then the Architect should find out asap and not bother wasting time in considering the design dimensions of that manufacturer in the elevator hoistway shaft design or any required minimum sized elevator machine room within the minimum distance of the elevator shaft (usually best to put right beside the shaft whenever possible). If a project aims for MRL (Machine-Room-Less) elevators it may limit options for bidding on the project to the select few manufacturers who have done the research and development of MRL elevators. If a project develops towards an MRL elevator only due to the absence of spatial room available for an elevator machine room, then it is possible that the architect's early floor plans were not sufficient in either Phase 1 or Phase 2. It's easy to avoid using MRL elevators as a solution by providing the minimum requirements (i.e. xyz dimensions and location) for an elevator machine room with early consultation in ideally Phase 1 whether a transformer is additionally needed inside the room. On the other hand, some manufacturers will refuse to bid on a project by an Owner; it is best for the Design Team to know this in Phase 1 so they don't waste time considering that manufacturer's xyz minimum dimensions. It's a bit of a missed opportunity among Owners and Architects that there isn't shared information resource library of unbiased performance evaluations of elevator manufacturers' products and the fairness of their maintenance contracts.

T1Esc – Architects can help the Structural Engineer by lining up building structural elements like columns and shear walls with the structure required to frame the rectangular floor holes of the escalators. As well, always remember that a significant pit with drainage is required at the bottom of each escalator. Architects can also help Electrical Engineers by providing machine rooms. It is noteworthy that CSA B44 prohibits emergency stop buttons unless a jurisdiction is bound to NBC.

T1PF – A planning fallacy is a cognitive bias describing the tendency to underestimate the time, costs, or risks needed to complete a future task or project, even when past experience with similar tasks contradicts optimistic predictions.

T1S – Subway train or railway train network design must take into account the known curvature of the Earth in order to connect the tracks over long distances and minimize the grade/slope as much as possible. Railroad track designers are a great resource for understanding how the curvature of the planet is required and critical to track design.

T2E – Elevator types are offered in two main lifting mechanisms with manufacturers possibly having variants on sub-types of each: traction elevators (ropes and pulley system) and hydraulic (piston and fluid system). Hydraulic elevators are usually faster but have a limited maximum travel distance and is not typically used in high buildings. Most elevators require an “elevator machine room” except for the MRL (Machine-Room-Less) elevators; it is always recommended that in Phase 1 Feasibility that an elevator machine room is part of the building

design as MRL elevators narrow manufacturer options and could possibly create a single-sourced elevator model by a single manufacturer when the project is tendered/put to bid. If contemplating a hydraulic elevator, they also come in hole-in and holeless versions where one has more excavation costs and the other has more elevator installation costs as well as arguably more long-term maintenance costs. Choosing the best elevator type for a project and its site is an important decision.

T3D – See historical photos of the Honest Ed’s store in Toronto, Ontario.

T3G – Those three historical figures are often associated with high likelihood of being on the autism spectrum but were never diagnosed as such due to the limitations of our understanding of autism spectrum disorder in earlier times.

T8H – KenTiohShu Hao is a fictional character on the planet BookKohLing.

V1GJ – The RHFAC Rating Survey uses hundreds of ratings that assesses individual or categories of localized building elements with zero to minimum to maximum points. If a building designer keeps the people with disabilities in mind in the design and prioritizes accessibility to all key outdoor and indoor spaces on a Site and focuses on the thirteen RHFAC Gold Prerequisites (without necessarily aiming for a Gold certification), the building design may be intuitively designed to open up the possibility of a Rick Hansen Foundation Accessibility Certification™ without needing to move walls, parking spaces, entrances, floor levels, etc. in later design phases. If a Project Team only seeks to achieve minimum 60% rating by playing a strategic and ruthless cost-reward analyses (i.e. not really trying to add meaningful accessibility to the project), the Project Team will likely be spending a lot of unnecessary Project Team design time (or worse, construction time) trying to “game out” the RHFAC Rating Survey that can reduce Design Team morale, add unnecessary complexity due to inconsistent approaches to accessibility design in different parts of the building, and end-user satisfaction with the as-built building product. If a Project Team wants to add accessibility for people with mobility devices, people with vision disabilities, people with pain disabilities, etc. then the RHFAC Professional training will be invaluable insight for the building design and learning the rationale behind the repetition found in the RHFAC Building Survey. It’s the same problems for the same people with disabilities, the Design Team simply needs to address reasonably, as many of those problems in the building design.

Y1E – Selecting the various options of an elevator are critical to understanding how much xyz dimensions are needed. How much weight an elevator can carry will affect the size of the elevator. How fast the elevator can go can affect the deepness of the elevator pit. How high the interior cab dimensions are will affect the clear overrun vertical dimension above the last served floor. The interior cab’s horizontal dimensions will directly affect the hoistway length and width. Elevators also represent one of the building’s most valuable and costly assets as

sophisticated manufactured products made to order that often cost far more than a Maserati luxury sports car. Similar to other motor vehicles, elevators are also strictly regulated as a device that transports human cargo so customization beyond the available options can be highly cost-prohibitive for any Owner and is not recommended. If you wouldn't customize the size and shape of a luxury sports car, you shouldn't customize the size and shape of an elevator beyond its established models. Just pick the dimensions shown on elevator manufacturers' websites and brochures for minimum hoistway xyz dimensions and make sure you can fit at least 3 manufacturers' similar sized and similar classed models in the same shaft, so competitive bidding is possible and not sole sourced. If an elevator shaft involves concrete shear walls, the architect should add at least 25mm (1") construction tolerance to the hoistway clear dimensions due to the acceptable construction tolerances of the "rough" accuracy that the concrete sub-trade should be able to achieve. If a building design has no "design fat" (aka construction tolerances) and the early construction isn't perfect (since the workers aren't building a space shuttle), this can create significant re-work and improvisation by the Builder and/or the Design Team to compromise other spaces to achieve the same design objectives with possibly less space between concrete walls or foundations.

Y1T – As the central spine to the building that could include the foundational or critical design of architect, structural, mechanical, and electrical engineers, the building core is designed and finalized first in a preferred design schedule. It's also not an accident that construction mimics the same prioritization of the building core being the center of the construction with the crane typically located in the elevator shaft. A well-placed elevator and washroom core has more space efficiency and less extra elevators if they are centrally placed so the limits of pedestrian or egress travel distances do not trigger a design need for an extra elevator or egress stairwell or universal washroom.

YA3 – See Chapter 4 on selecting project teammates. Each project is unique in its location, scale, time, objectives, and complexity; a team that suits to meet the demands of all 5 aforementioned variables is a team that has higher likelihood of project success and less dependence on blind luck. High-performing team members will naturally be drawn together and will not only work very well together but also will be motivated to work again with those same individuals in future projects. While not standard protocol, consultant firms and Owner organizations should conduct a Lessons Learned review that includes a list of all the people who were or became heavily depended on by multiple people and possibly multiple companies or organizations. Those people should be interviewed at the closure of a project to ask who their favourite people to work with on the project. In the NHL and NFL, fans know the exact players and their level of excellence that they bring to the game; in the architecture and engineering industry, the people behind the teams remain largely unknown (except among the people who did the job) while credit for successes are attributed to the company itself and its leaders who may have had very little involvement with the project itself. Stability in teammates

itself can create higher success numbers: heart surgeons who consistently work with the same cardiac surgery team have been shown to lower mortality rates due to increased familiarity, improved communication, and enhanced coordination. The same can be said of building design ... and if the high performers are asked who they like to work with, then an exceptional consultant team can be formed.

YA11 – One of the fun facts of human innovation in space travel was that the rocket boosters for space shuttles needed to achieve escape velocity from the Earth's gravitational pull were limited to the logistics of manufacturing and transport. The rocket boosters were manufactured away from the launch site and were transported along railroads that had to pass through railway tunnels when completed and being delivered to site. The diameter of the railway tunnels was based on the dimensions of the first trains being used across the United States. The trains evolved from horse-drawn wagonways, so the railroad networks were based on the width of the horse drawn carriage. Thus, the design of the rocket boosters had a constraint in diameter that was due to railway tunnels that themselves were based on the width of a standard horse-drawn carriage. Older revolutionary tech can have a heavy influence on later breakthroughs in technological progress. Similarly in building design, repeated units often determine the majority of the building's superstructure design: dwelling units are repeated but they themselves may be based on the achievable clear spans in concrete superstructure of municipality-determined parking space dimensions. If a building has underground parking, the municipality's arbitrary parking space dimensions will typically determine the spacing of structure for the entire building. Thus, condo buildings are often based on the size of typical parking spaces as dictated by the municipality.

YC2 – Prioritizing design criteria into a hierarchical order is recommended for building designs: 1) laws of physics, 2) federal legislation, 3) provincial legislation, 4) municipal legislation, 5) client objectives, 6) client standards, and 7) guidelines. The chief strategy of complex puzzle solving is organizing all variables and constants into a priority order so that the work is digestible for a single person to conceive. Working with the infinite possibilities of a building design is too much brain power. Working on the pedestrian circulation(s) and structural design first along with all legislative and contractual performance factors as well as the largest equipment (i.e. switchboards, main air handling unit, boilers, etc) and general allowance for vertical (shafts) and horizontal paths that may impact those first two designs will create the starting framework and solid foundation for the rest of the project. Adding the lungs of the building and coordinating with pedestrian circulation and structural designs allows more refinement of the design. Then adding the pipes of the building design, avoiding the HVAC design, the pedestrian circulation (i.e. wherever a person can go and experience), the structural design ... allows for further refinement. So and so forth until the end when the nervous system of the building (e.g. conduits, outlets, junction boxes, switches, etc.) and interior finishes are considered in the design last as the most flexible design elements. Efficient complex puzzle

solving involves dealing with the inflexible first in descending order to the most flexible. The beginning of a project should only quantify the general volume and scope of installation work of the most flexible design items, but the highly flexible stuff should not waste the Project Team's time in the beginning of the design. The beginning must tackle the inflexible items first and foremost.

YE8 – Isaac Newton was the first to propose that there was an invisible force that pulls apples to the ground that was the same attracting the Moon to Earth and being kept in orbit around Earth; he called the invisible force as “universal gravitation” and introduced the concept that all objects with mass attract each other. Structural engineers create a building structural design based on making sure that a building doesn't fall down due to vertical or lateral forces. Vertical forces include gravity but also potentially earthquakes that can shake a building vertically or horizontally.

YE13 – Building core designs are the greatest opportunity of space-efficiency due to the repetition of core to minimize travel distances while maximizing connectivity of various functions. It is not accidental that the human spine is the highway for both structural skeletal design and the interstate highway of the nervous system as well as provides the structure for a parallel path of blood circulation of oxygen-rich blood through our arteries and oxygen-poor blood through our veins. Electrical rooms beside an elevator shaft mimic that same human body design: efficient vertical travel up the building in a central location that can spread equidistant horizontally from as well as connected to an electricity source and possibly command centre. Mechanical oxygen intake and oxygen exhaust follow a similar logic as the human body: they should run parallel to the elevator shaft (the vertical spine of the building) up to a certain floorplate size and volume of air per level and can spread equidistant horizontally from but also need to connect to the central oxygen producing unit to pump the oxygen through the path of duct. HVAC shaft designs follow the same logistical rationale that they are sized as small as possible at their termination points but the sum of all the termination points pathing back to the source fresh air engine (“heart”) requires ducts to be largest when they come out of mechanical conditioned air units. Domestic water pipes and sanitary drainpipes also follow the same logistics as the human body. A Project Team that has not established an efficient building core design in Phase 1 is already at a disadvantage to any Design Team that can establish a highly efficient and unchanging building core design in Phase 1 of their projects. If washrooms or any building core type room are to be vertically repeated by inclusion in or being across the corridor to building cores, then these rooms need to be designed in Phase 1 Feasibility or latest Phase 2 Logistics. Thus, accessibility provisions and spacing need to be included in building core washrooms and other stacked rooms in those first two design phases and no later.

YI1 – See Section 4.2 about the exponential multiplier between a small simple building to a much larger building. The pattern also repeats itself in the design process where the first

decisions in a project have the next layer of decisions grow on top of that first sapling stem and eventually becomes the bark of a tree and the first major decisions become the largest branches of the tree that even more decisions can spawn from. Also see the Net Zero Graph© explanation in Section 7.2 that demonstrates how the decisions at the beginning of a project can have the highest impact on the project like the direction that a sapling grows into its journey to become a tree.

YI7 – See the article “Autistic Genius: Is Autism Associated with Higher Intelligence” at the website of appliedbehaviorsanalysisedu.org

YL14 – HAL claims copyright of the Net Zero 4D graph. This is a two-dimensional representation of a three-dimensional problem over time. This has been represented in a 2D fashion in order to help readers understand the overall concept. However, the concept of the 2D graph is deceptively more complicated. What would be seen as the traditional y-axis of the graph is actually a collapsing of xyz coordinates and the possibilities in 3D space into a single line that gets smaller when possibilities are reduced. What would traditionally be seen as the x-axis is the passage of time. At the beginning of the project there are infinite possibilities due to entire building designs possible if a building footprint is placed anywhere in the site. Legislative and cost pressures allow an architect to eliminate possible building footprint locations from required yard setbacks and other legislative or client requirements of functionality. When a feasibility plan places a building footprint in the most logical and space efficient location ... it will likely not move throughout the entire design process ... as it already eliminated all less efficient solutions. Such ideal placement can only be done by rigorous review of all legislative, building design logistics, and client mandates to find the perfect location where all 3 pressure factors have the least resistance and the least non-compliance. A building placed in the wrong spot will have to move later if any of those three strong factors weren't adequately accommodated in that first location ... which can require inefficient but comprehensive re-designs by multiple consultants that forces an erasure of their previous work. The beginning of a project is the most impactful, the most roughly estimated, and most potential error point in any project. Accuracy in the beginning pays can pay almost a hundredfold at the end; inaccuracy can cost a hundredfold at the end. Each vertical slice of the blue lines shows the amount of work done by the consultants to describe perfectly, with no semantic misinterpretation, the building design that can be quantified by a general contractor and all their sub-trades. Most projects do not spend the time and effort to describe the building in exacting detail as the amount of work to describe 100% of a building design as it becomes cumbersome at the end of the project design. This 4D graph is the reactionary solution to the misleading idea of the 80/20 rule where it is believed that 80% of the work can be done with 20% of the work that assumingly operates in a linear fashion. The reason why excellent early work can result in better outcomes later is that accuracy in the beginning results in less inefficient work to correct early mistakes during the process. It is the elimination of inefficient

outcomes and strategies that help high-performing Project Teams do things faster and better than anyone else. The Net Zero 4D Graph shows the invisible and unrecorded pressures that can keep a project on track. Without the pressure for accuracy, a project can have an unacceptable range of possible outcomes ... usually due to human error. Large projects involve larger teams of humans, so likelihood of human error increases exponentially. The Net Zero 4D graph shows the inverse relationship between opposing forces: infinite possibilities versus project accuracy. As project accuracy pressure increases (such as detailed and coordinated design drawings and specifications as well as schedule and logistics projections and QA/QC protocols), the pressure forces the erroneous possibilities into a single path that the Project Team is aiming to achieve in building a 3D product (a building) over a specific period of time. Conversely, when there is no accuracy pressure on either the first stages of the design process or construction process ... the likelihood of a catastrophic error increases exponentially as the scale of a building project and the volume of people involved increases. It is the accuracy tension that keeps the erroneous possibility pressures at bay. Designing and constructing a building project is like walking a rabid dog: the shorter the leash, the higher the likelihood that nothing goes wrong and that everything goes as planned. Accuracy and error possibility are inversely related in a net zero game: a building that is 20% overbudget had at least 20% inaccuracy in its planning but may have had greater inaccuracy percentage where blind luck reduced the cost overruns to arrive at a final 20%. A broken clock with hands is correct twice a day after all. The final cost of a building project is the sum of all the wins and the failures of the projected time and budget.

YN4 – One of Issac Newton’s Laws of Motion is that two bodies (of matter) cannot occupy the same region of space at the same time. In building design, this is a law that does not apply in 3D software programs. A structural engineer can model a 3D steel flange steel beam in a shared AECOsim or Revit model and a mechanical designer can unknowingly model a horizontal duct path the cuts through the majority of the steel beam and allow both digital objects to exist at the same time. Depending on the software or user, the interference conflict may or may not be flagged. 2-dimensional drawings increase the likelihood of building design elements occupying the same space if the Discipline Coordinator and the rest of the team have not realized there is a conflict. Such conflicts can be found during construction when the steel beam isn’t going anywhere, and the sheet metal contractor is installing a duct that must be now lowered to avoid the beam, and the gypsum board ceiling height will be compromised and must be revised in design and as a Change Order. Lack of discipline coordination between architectural, structural, mechanical HVAC, plumbing, and sprinkler designs is a very, very common error or omission on projects, since matter cannot occupy the same space as other matter with 2D drawings or 3D digital models having interference errors that aren’t obvious even to a trained eye. A 2024 scientific study at the Albert Einstein College of Medicine (first published in the journal Nature) discovered that DNA damage and brain inflammation are vital processes of forming long-term memories as noted in the article “DNA Damage and Inflation

Key to Memory Formation” at neurosciencenews.com; the study found that hippocampal neurons undergo cycles of DNA damage and repair, as part of long-term episodic memories. Even at the DNA level at least for mice, matter cannot occupy the same space as other matter as new memories are formed by destroying the area that brain neurons had existed before. Just as an HVAC duct cannot go through a concrete beam nor can a lighting fixture be in an HVAC duct nor can any of those items be below the required headroom clearance of any path of egress as defined in NBC (Hint: legislated headroom clearance wins first, concrete beam second, HVAC third, and light fixture last). In NBC Part 3 building projects, interference between architectural, structural, mechanical, and electrical designs is common due to designs not being fully coordinated. Lack of coordination can be any number of factors: insufficient business plan hours, insufficient experience of team members, insufficient QA/QC, insufficient discipline coordination, etc. but the central problem is lack of time in all its various forms (i.e. budget, schedule, training, experience, quality control, etc.).

YR10 – Cost Consultants have a difficult job: they are being asked to predict the future based on data from recent and hopefully similar projects and assuming that these values will stay within a certain range of previous costs of materials or building products and their installation or construction. The engine behind these predictions is an assumption that a variable can be treated as a constant which in itself sounds like a paradox. Cost consultants have noted that while they provide a lower and higher range of estimated construction costs in their cost estimates ... they rarely see the lower range of construction costs in their cost estimates ever becoming true. They usually see the higher range estimate be closer to the final construction costs. Predicting the future is a difficult task; success requires stability of all the assumptions being maintained throughout the project. When asked why cost consulting knowingly collapses variables into constants and the risky and unstable math that it produces ... one Cost Consultant’s reply, “I’d love to do it another way, we just don’t know any other way to do it.”

YT5 – There are two main strategies in tackling building design per Henry Chen’s mentor Dave McIlveen at BBB: 1) Keep Things Simple, (Silly) or KISS ... and 2) assume everyone’s work is flawed, including yours, and double-check or quadruple-check for accuracy. Building designs get complicated on their own due to the many different legislation requirements and client objectives; strategic simplicity is the greatest method to reduce complexity. See also Note YC2 above. And then add how many people are involved in the design and construction of the building. Anyone who doesn’t account for error with more and more people involved in any project or production is simply setting themselves and others up for disappointment.

YT6 – Due to the fact that building code is a legislation document, subject to change by legislators, it is often the standard understanding that a building is obligated to be designed to the applicable building code and other legislation at the time of its building permit application. As such, a building represents a fixed point of time in the legislative pressures that it is obligated to be compliant to when it comes to what edition/version of building code has been

referenced. Accessibility in Canada's building codes did not show up until the 1970's so any building older than that is not obligated to be renovated for each and every building code change as the years go by. If a building is contemplating a renovation requiring a building permit, then the AHJ should only approve a renovation that is compliant to current building code. This is why superficial refurbishments of older buildings typically do not trigger the requirement for ground floor accessibility of principal entrance or washrooms, this is called being "grandfathered in" ... and why renovations to older buildings are often not contemplated due the advantageous nature of being able to be "grandfathered in" for cosmetic retrofits and avoid the significant costs of the construction and also the significant reduction in useable/leasable floor area that may lessen future revenue potential and compromise the numbers of the reno business plan.

YT9 – Professor Paul Sandori of the University of Toronto at the turn of the 21st century said that the architect's greatest enemy is water. HAL's principal architect found his advice exceptionally true. Architects are typically responsible for a building design's architectural building code requirements. These include but are not limited to fire-resistant separations, acoustic separation, barrier-free accessibility, widths of corridors and egress stairs, and building envelope performance. Building envelope performance (walls and roofs) must accommodate for both precipitation and condensation. See A1C note above. Protection against rain/stormwater above ground and below ground requires a design methodology that recognizes that water will find a way into a building through any means possible, but usually through the path of least resistance which is usually an opportunistic hole in some part of the assembly ... no matter how small. Where there is an opportune hole (usually the weakest point), it will act as a chute (vertical or horizontal) to compromise the integrity of the building envelope and connect outside to inside. Governments and the NBC should not permit balcony structures to penetrate the building assembly and defy the "Red Pen Test" as structure sticking out of a building is like having a bone sticking out of your body: it's very hard to seal to keep the outside to remain outside. Besides the inherent thermal bridging that can happen, such details need excellent complicated craftsmanship to wrap these concrete balconies and prevent water from dripping into the exterior wall assembly in order to avoid future leak issues. The definition of NBC's 2% allowance of structure sticking out of the building and creating minor thermal bridging should not be permitted at all and require an Alternate Solution to do so. NBC should not allow the bones of a building to stick out of the building without adequate building envelope coverage of the entire element and be able to pass the "Red Pen Test."

YV12 – The value of trees and forests to human health was studied in Japan and found physiological and psychological benefits of forest bathing (shinrin-yoku). A UK study of almost 20,000 people showed that spending at least 10 minutes a week in nature improved self-reported health and well-being per the Harvard Health Publishing website article "Can forest therapy enhance health and well-being?" Humans and trees have co-existed for hundreds of

thousands of years: they provided fuel for essential fires, shelter from predator threats, shade from the sun, construction materials for early shelters, clothing, and sometimes delicious, nutritious fruit. The emotional footprint in the psyche of human beings must be profound. As such, urban design and property lot designs should take into account that trees or views of trees can foster an uplifting experience for users of a Site. Incorporating trees or views of trees in the design of buildings will help them make mind-friendly environments for all users but especially those with depression or people with neurodiversity. Trees can calm people down. There is something about their simplicity and complexity both above ground and below ground that is fascinating and peaceful. A Site design without trees is likely missing out on an easy opportunity to create good and lasting impressions of the building and the Site that is achievable by borrowing the positive feels already associated to trees.

Z1W – This is the second of two main strategies in tackling building design per Henry Chen’s mentor at BBB: always double-check for errors no matter who is the author. Approaching each teammate’s work with the assumption that they may have errors is the safest standard protocol to avoid errors, minor or major, becoming eventual disasters in the project.

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17. About the Author

“Knowledge is power. Power I can share.”

~ KenTiohShu Hao

17.1 Person

Originally born and raised in Vancouver, BC, he grew up around forest trails, ocean breezes, campfires, rainy days, and risks of a big earthquake. He is the son of Taiwanese immigrants who moved to Canada during the KMT White Terror martial law period in Taiwan. His parents grew up with the fresh ghost of Japanese rule and its cultural ideals of hard work, harmony, and aesthetics.



Experience with disabilities:

- Identifies as neurodiverse including but not limited to dyslexia
- Family members clinically diagnosed with autism spectrum disorder
- Noxious reactions to specific frequencies of flickering lights
- Laceration on bottom of foot required cane-assisted walking until healed
- Reduced hearing for unknown years until operation from an audiologist
- Night vision self-training to learn echolocation skills in case of a zombie apocalypse
- Pain from various injuries mostly from playing amateur Aussie Rules Football in Ontario (and being showcased once on Australia’s Footy Show as one of the contestants for their weekly “Tough Man” competition in 2010).
 - 3 broken ribs

- Sternoclavicular injury with torn ligament
- 7cm tear in hamstring
- Concussion
- MCL tear
- Sprained ankle

Official or Unofficial Work Experience wearing various hats:

- Busboy
- Camp Counselor
- Dishwasher
- Marina Worker
- Boat Cleaner
- Janitor
- Cashier
- Inventory Manager
- Forklift Driver
- University Teaching Assistant
- Restaurant Host
- Restaurant Server
- Restaurant Barista
- Restaurant Bartender
- Consultant Contractor
- Junior-level urban designer
- 2D and 3D Architectural Artist
- Architectural Designer
- Intern Architect
- CAD Monkey
- Designated BBQer for Events
- Event Planner
- WoW Guild Leader
- Assistant manager of human resources
- Director of a Condo Board (as President, Treasurer, and/or Secretary)
- Intermediate Arch Designer
- Contract Memorizer
- Design Job Captain
- Accessibility Design Specialist
- PSOS Compliance Specialist
- Architectural Design Translator for Laypeople
- All Disciplines Coordinator
- Assistant Project Manager
- On-site Arch Contract Admin support
- Architectural design technical detailer
- Caterer
- Legal Researcher
- Lead Contract Administrator (Arch, Struc, Mech, Elec)
- Feasibility Study Tester (sketch to CAD)
- Architect-of-Record
- Project Design Scheduler
- Intern Trainer
- Senior Justice Architect
- Personally Supervising & Directing (PSD) Architect
- Architectural Production Lead

- Primary author and coordinator of a Project Specific Performance Output Specifications Section of P3 Contract
- PWGSC Level 2 Secret Clearance
- Primary Author and coordinator of a public sector lab facility's pre-design report
- Principal Architect
- Feasibility Studies Author
- Spec Writer
- Interior Finishes Consultant

He seeks to create order in projects that tend to be given to him in an unnecessarily chaotic and uncoordinated state due to numerous wrong assumptions, failures in communication, and inherently flawed contract types or a fundamentally flawed Building Construction industry that split “the Why” and “the How” into architecture and construction respectively and pit the two houses into a standard adversarial relationship. It’s a team game where each player has different goals and no one is really on the same page.

17.2 Architect

Henry's portfolio of experience is quite the jumble of building types of all sorts of scales. Throughout his career, he officially or unofficially led architectural teams as lead or as second-in-command of \$6.7B worth of projects in construction budgets in the decade before founding the Hygge Architecture Ltd. ... add another \$3B worth as a key individual in chasing complex project pursuits. The bulk of those big budgets is from massive public infrastructure design projects.

He's the team member who can spend an hour talking about any wall in one of his projects.

Experience in various building types:

- Courthouses
- Rapid transit stations & Rail passenger stations
- University buildings
- Arenas and Sports Facilities
- Residential buildings
- Convention Centre
- Laboratories (Wet and Dry) Office buildings
- Special needs school/health care buildings
- Parking Garages
- Long-term ownership real estate asset models: durability cost-reward analyses, maintenance contracts, life-cycle considerations, life safety, accessibility, unionized public sector occupants, multiple stakeholder representatives and departments, etc.
- And experience of being the only one to have read the actual contracts, including professional liability insurance policies.
- And by knowing the contract terms and the rationale behind the intimate details of the multi-discipline building design, he has experience being the only one who truly saw and understood the web of pitfalls, conflicts, loopholes, and advantages so he could captain the ship to stay on course to eventual project success. He has repeatedly achieved critical milestones "on time and on budget" that no one thought possible due to the time constraints and the lack of resources beset upon him and/or the team.

See <https://www.hyggearch.com/about> for more info on the author.

This Publication is meant to serve as both a warning of building design complexity and as a guide on how to attempt to handle the chaos. In just writing this document, there were at least 3,477 errors or revisions that were self-corrected with also feedback effecting an 11% increase

in page-count and a 25%+ reduction of the whole document ... and there was no building design developed here. It's just text and pictures put together on 8.5" x 11" sheets.

If more people understood the sheer volume and complexity of building design (and how easily errors can compound throughout a project) there would likely be far greater public support for stronger legislation to improve construction quality in Canada. It's particularly disheartening that, especially in the single-detached residential market, a realtor can earn more from a single building project than the entire architectural team responsible for designing it.

One simple but impactful legislative change would be to mandate minimum weekly architectural site visits on all construction projects. This would significantly improve construction oversight, reduce errors, and enhance accountability. It would also help standardize architectural service proposals, ensuring firms are competing on quality and expertise, not unrealistic fee cuts.

At a broader scale, provincial and federal governments must push for the harmonization of municipal zoning by-laws. The current patchwork of zoning definitions, dimensional standards, and land-use classifications makes it nearly impossible to create repeatable, scalable housing solutions. A simplified, province-wide or national zoning framework ... based on core typologies such as high-density, mid-density, low-rise, and rural ... would streamline the development process, lower soft costs, and accelerate housing delivery across the country.

In short, Canada needs smarter legislation that:

- Reflects the true complexity and responsibilities of architectural work,
- Prioritizes quality, coordination, and accountability in construction,
- Removes fragmented regulatory barriers that prevent the delivery of efficient, affordable, and repeatable housing solutions, and
- Keeps pace with the technological advances of the Information Revolution.^{LOL}

Yeah ... that would be awesome.

17.3 RHFAC Professional

Due to HAL's original focus on the *Missing Middle* ^{R1M} of multi-unit residential buildings, the recent November 2024 policy changes to CMHC's MLI Select program motivated him to undertake the RHFAC Professional Training course so that a new sub-consultant would be unnecessary in the firm's project Design Team as well as allow him to make good and well-timed design decisions from Phase 1 Feasibility all the way to Phase 4 Description.

His relentless nature towards perseverance resulted in passing the RHFAC Professional Exam after only three attempts.

This Guidance Book is his contribution to the Architecture Design and Construction Sector to help streamline more meaningful access to buildings across Canada and beyond so that building projects can just be better all around for multiple parties and useable for as many people as possible. This document was intended for multiple audiences from various business and personal perspectives: owners, financiers, architects, engineers, stakeholders, building users, students, legislators, municipalities, corporations, universities, etc. This book's design is to accommodate as many perspectives as possible, so it might be hard to digest portions of this document, since building design is hard to digest itself.

Sorry about that.

