CHAPTER 2

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Nicknamed the Jewel in the Wilderness, the City of Elliot Lake is located in Northern Ontario, approximately halfway between Sudbury and Sault Ste. Marie and 20 minutes from the north shore of Lake Huron. The US–Canadian border is 180 km west of the city. The relatively remote northern community is surrounded by countless lakes and rivers, beautiful rolling hills, and the Boreal forest. Elliot Lake itself is a small one on the city's northern edge.

Elliot Lake is no stranger to collapses, adversity, and recovery, as seen in the following brief history. As well, this chapter includes a brief overview of how a building such as the Algo Mall is designed, built, and maintained in Ontario.

History of Elliot Lake

Although modern-day Elliot Lake dates back only to the 1950s, the region has been inhabited for centuries. Elliot Lake first appeared in 1910 on a Dominion Map. It is widely believed that the name Elliot belonged to a logging camp cook who drowned in the lake before that date. This part of northeastern Ontario's Algoma District is rich in folklore of the early Ojibway Nation, the fur trade, and, in later years, the vast logging operations that continued until 1950.[1] A seasonal Ojibwa village extended along the lake's shoreline near the present hospital.

Modern-day Elliot Lake owes its existence to uranium mining. With the Second World War and the development of the atomic bomb came renewed interest in uranium. The discovery of a huge ore body of uranium in the Canadian Shield near Elliot Lake in the early 1950s ... prompted the "Back Door Staking Bee" in June 1953 that ultimately saw the opening of 12 uranium mines in the area.

Modern-day Elliot Lake owes its existence to uranium mining. With the Second World War and the development of the atomic bomb came renewed interest in uranium. The discovery of a huge ore body of uranium in the Canadian Shield near Elliot Lake in the early 1950s – the so-called "Big Z" uranium field, a 100-square-mile corridor – prompted the "Back Door Staking Bee" in June 1953 that ultimately saw the opening of 12 uranium mines in the area. Eighty prospectors, along with geologists, lawyers, cooks, accountants, clerks, and secretaries, were assembled near the middle of the Big Z and told to stake quickly and quietly. When they had finished, more than 1,400 claims covering 56,000 acres had been filed in one of the world's largest uranium discoveries.[2] According to a 1996 historical overview of the city

> [t]he establishment of 12 uranium mines in a small area, in such a short time, had no precedent. The mines were identified, and some of them built, before there was any community to accommodate the avalanche of people who flooded into the area to work in them. Only in the fall of 1955 were plans made to house the workers of all 12 mines in a common townsite. This was quite unlike the prevailing practice of building a company town for each separate mine.[3]

The Ontario government decided Elliot Lake would be a well-planned permanent community and a role model for other towns. In October 1955, it created a special agency, the Planning and Development Department of the Ontario Ministry of Housing, to ensure the development of Elliot Lake as a viable community. The project combined the efforts of the federal and provincial governments, four mining groups, and 12 contracting firms. Architectural students at Cornell University in New York State designed the town plan.[4]

The town was built rapidly, and numerous mines were brought into production. By the late 1950s, Elliot Lake was complete.

> Neighbourhoods of from 300 to 1,500 single-family residences had been built, each with schools, churches, parks, recreational facilities, shopping, and other services. There was a central downtown core for the entire community. All roads were planned on a circular pattern, to reduce speeding and allow for the eventual return to the main thoroughfares. By 1956, downtown Elliot Lake had a theatre, billiard hall, church, school, and banks, and construction continued. By 1958, the town was near completion, with a solid downtown business core, schools staffed and churches opening, streets being paved, street lights being installed, and the population nearing 18,000. With mine bunkhouses and trailer parks taken into account, the population was actually closer to 25,000.[5]

For 40 years, Elliot Lake was dubbed the "uranium capital of the world" and produced most of the world's uranium. The principal mining companies were Denison Mines and Rio Algom. The local economy and population of this one-industry town increased and decreased along with the world's demand and prices for uranium. Strong demand for uranium first came from the US military. The Canadian government had negotiated contracts with the US Atomic Energy Commission for more than $1.5 billion in uranium oxide, with more than two-thirds of that total to be produced by the Elliot Lake mines.[6] Then, in 1959, the United States declared that it would buy no more uranium from Canada after 1962.

As a single-industry community, Elliot Lake experienced a dramatic downturn in its fortunes – from a high of 26,000, the population dropped to 6,664 by 1966. Five mines closed in 1960 alone. Residents erected signs declaring Elliot Lake "the world's most modern ghost town," and a delegation of housewives visited Ottawa in 1960 to plead with Prime Minister John Diefenbaker to save their town.[7] The expansion of the nuclear power industry in the late 1960s led to a renewed boom. A federal government uranium-stockpiling program initiated in 1966 by the Rt. Hon. Lester B. Pearson, the local Member of Parliament, kept the town alive until prices recovered.

During the 1970s, federal plans for CANDU (Canada Deuterium Uranium) reactors and Ontario Hydro's interest in uranium led the town to expand again; Ontario Hydro signed long-term purchasing contracts with the mining companies in the 1980s.[8] In the early 1980s, the two mining companies that operated in Elliot Lake anticipated a boom in the world uranium market and therefore expanded the community's infrastructure so it could accommodate a population of 25,000. Unfortunately, the boom did not occur – in fact, the reverse took place.

In January 1990, Rio Algom announced it would be closing two of its three remaining Elliot Lake mines. The closing affected 1,600 miners – about 25 percent of Elliot Lake's workforce. That February, Denison announced it would lay off 650 workers because of low uranium prices. Between July 1 and December 31, employment in the town's mining industry was nearly halved, and over the next several years the layoffs continued. In 1991, after Ontario Hydro announced it would no longer be buying uranium from Elliot Lake, Denison decided to close its operations there, costing 1,000 jobs. Stanleigh Mine, operated by Rio Algom and the last of the 12 uranium mines brought into production with money provided by Ontario Hydro, was to close in June 1996.[9]

The city was devastated and its future placed in jeopardy. Economic development agencies projected that, if the lost jobs could not be replaced, Elliot Lake's population would decline from 18,000 to 500 by 1996, with hundreds of housing units left vacant.[10] For more than 40 years

> the words "uranium and "Elliot Lake" had been married to one another. It was impossible to think of the community without its uranium association, yet at the end of June 1996, the last active uranium mine was to close … If Elliot Lake was to exist without uranium, it would have to find a new role. Its assets were good infrastructure and good houses set in a natural paradise of sparkling lakes, pristine beaches and unspoiled nature.[11]

Rather than close the city, Elliot Lake devised a new economic strategy: it would position itself as a retirement living community. Vacant homes were marketed and sold or rented to retirees. Non-Profit Retirement Residences of Elliot Lake was created in July 1991 as a non-profit corporation that owned and rented out more than 1,000 housing units. Thousands of new residents from Canada, the United States, and Europe stabilized the population and economy, which was now based on tourism, cottaging, retirement, and health care.[12] In addition, compensation related to the termination of Ontario Hydro uranium contracts was used to establish the Elliot Lake and North Shore Corporation for Business Development (ELNOS), a development agency that aimed to help support and diversify the local economy.

In January 1991, the provincial government officially proclaimed Elliot Lake Ontario's 15th city. In 2005, Elliot Lake celebrated its 50th anniversary. According to the 2011 census, Elliot Lake's population was 11,348 – practically unchanged since 2006 (11,549). However, the median age of the population was 57.1, up from 54.8 in 2006. (The median age in Ontario as a whole was 40.4). Ninety percent of the population of Elliot Lake was over age 15, and 45 percent was 60 or over.

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A 1980 history of Elliot Lake, *Jewel in the Wilderness*, stated that the 1970s saw the development of the city's commercial sector to match the expanding industrial and population base. The book featured the new Algo Mall on its back cover and called the building "the crowning achievement in this trend," adding that the "town has been identifying just such a development for years and its construction is, in a sense, an affirmation of Elliot Lake's future security, a symbol of prosperity."[13]

The Mall also became an important element in the city's attempts to attract residents to its "active retirement community." Residents used it not only as a source of employment and shopping but also as a social destination and exercise and walking facility.[14] When the Mall collapsed in June 2012, the City of Elliot Lake suffered a significant economic blow – the loss of more than 200 jobs in a city where only 3,385 people were employed, given its position as a retirement-living community.[15]

In addition to the loss of jobs in the community, the city also lost an important source of tax revenue. Before 2012, the Mall paid annual municipal taxes of $363,857. This amount was adjusted for the 2012 tax year owing to an assessment appeal. The assessment of the Mall was reduced from $8 million to $4.1 million, with a tax revenue $182,489. The annual revenue from taxation for 2011 for the entire municipality was $9,055,422, of which the Mall assessment represented 4 percent of the tax base. For 2012, the city's budgeted revenue from taxation was $9,004,579, of which the Mall taxation represented 2 percent of the tax base. Thus, 2 percent of the municipal tax base was lost by the Mall assessment, and a further 2 percent of the tax base was lost as a result of the loss of the Mall.

The history of Elliot Lake is aptly summed up in a song written for the city's 50th anniversary and recently updated:

> Back in 1955,
> A northern town had come alive.
> Men had come from all around,
> To get that uranium out of the ground.
> These were times of prosperity,
> A great time and place to raise a family.
> People worked and children played.
> Some came to visit, but instead they stayed.
>
> Where do you go when you want to be with friends? Elliot Lake.
> Makin' the drive about 30 k up the 108, to Elliot Lake.
>
> Boom turned to bust, then bust to boom.
> These are the cycles of a mining town.
> But the cool, clean lakes and the crisp fresh air
> Are some of the reasons people choose to live here.
> Flora and fauna and the scenery
> Inspire my creativity.
> Where eagles soar so wild and free,
> It touches my heart, means a lot to me.
>
> Where do you go when you want to be with friends? Elliot Lake.
> Makin' the drive about 30 k up the 108, to Elliot Lake.
>
> Twenty-twelve was the year
> Disaster had reared its ugly head here.
> Some had died and many cried,
> And the news affected people far and wide.
> But the spirit lives strong in this community.
> We're full of faith and not of fear.
> We'll rebuild and persevere.
> For the next generation on this frontier.[16]

The design, building, and maintenance of a large construction project in Ontario

This section outlines the general procedures involved in the construction of commercial buildings such as the Algo Mall. This description does not reflect the process actually followed prior to, during and after the construction of the Algo Mall. Unfortunately, due to the passage of time, little to no evidence was provided to explain what actually took place during the construction of the Mall. Instead, the following description should assist the reader in understanding what could or should have occurred.

Construction projects in Ontario vary widely in both size and shape, from ordinary residential construction to industrial, commercial, and institutional projects. This section describes the typical phases of a commercial construction project from the viewpoint of the key players: the owner, architect, engineers, general contractor, subcontractors, and municipality (see figure 1.2.1). All participants have overlapping roles and responsibilities to ensure that the building is structurally sound and safe for public use. The description that follows is largely based on the presentation and testimony of Dale Craig, an Ottawa engineer retained by the Commission as engineering consultant.* [17]

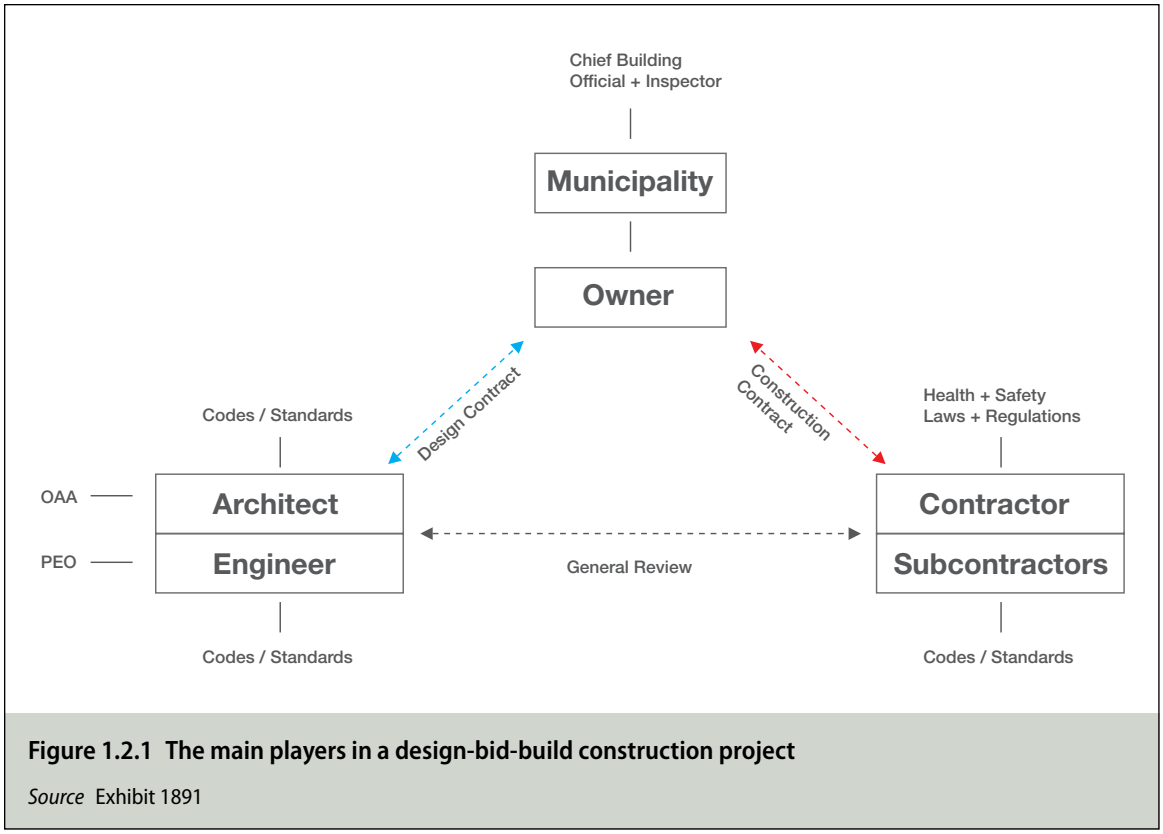

Figure 1.2.1 The main players in a design-bid-build construction project

Source Exhibit 1891

* Mr. Craig graduated from Carleton University in engineering in 1970 and shortly thereafter joined the J.L. Richards professional engineering firm, where he has worked for more than 40 years, practising as a structural engineer for 20 years before becoming chief structural engineer. For the past 20 years, he has been involved in project management for major and multidisciplinary construction projects: Craig testimony, March 5, 2013. A more complete biography appears in Appendix G.

Owner

The owner of a project bears ultimate responsibility for ensuring that what has been built is structurally sound. If anyone is injured because of negligent or faulty construction, the owner could be held responsible. Also, if an owner fails to ensure that provisions of the Ontario *Building Code*[18] (OBC) are properly followed during construction, the owner could face prosecution under the Ontario *Building Code Act*.[19] Generally, the owner can fulfill its obligations by hiring the appropriate professionals to be responsible for the planning, design, and construction of the project.

Architect

A licensed design professional, the architect is responsible for the aesthetics, appearance, and functionality of a building. Functionality includes such things as health and safety and general *Building Code* compliance. The practice of architecture in Ontario is regulated and governed by the Ontario Association of Architects and the *Architects Act*.[20] Architects are expected to operate in accordance with the guidelines and practices dictated by the Ontario Association of Architects.

A licensed design professional, the architect is responsible for the aesthetics, appearance, and functionality of a building. Functionality includes such things as health and safety and general *Building Code* compliance.

The 1975 Ontario *Building Code*[21] provided that an architect *or* a professional engineer *or* a combination of both were responsible for the design of a building exceeding either 600 square metres in gross area or three storeys in height, such as a shopping mall. Today the Ontario *Building Code* clarifies that an architect *and* a professional engineer are responsible for the design of such a building, with each practising his or her discipline.[22]

The customary procedure in the construction industry – though not a legal requirement – is that an architect is retained by the owner to act as the "prime consultant" responsible for the overall design and coordination of the project, including the design of the building envelope. The design and installation of the waterproofing system for the roof is part of the building envelope. Structural, mechanical, geotechnical, electrical, and other engineering or specialty consultants are retained by the owner or the architect, as needed, to complete the design of the building to meet the OBC requirements. The architect, as prime consultant, is in a direct contractual relationship with the owner.

The prime consultant may also assist the owner with the tendering process, help qualify subcontractors, coordinate drawings and other documentation, oversee changes to the construction documents, and approve payments on the owner's behalf. The architect and the engineering consultants are required by the OBC to provide general site review during construction in accordance with the performance standards set out by the Ontario Association of Architects and the Association of Professional Engineers of Ontario.[23]

Although the architect may have been designated the prime consultant, the architect is not responsible for producing detailed drawings for the structural elements of the building. The architect is involved in, and drives, the layout of the structure and other building elements and the choice of materials (wood, concrete, steel); however, the design details needed to meet the structural requirements in the OBC are to be completed solely by the structural engineer.

In some situations, an engineer is retained by the owner to act as the prime consultant, responsible for the project's overall design and coordination. Just as when the architect is acting as prime consultant, the engineer or the owner (or both) will retain specialty consultants, including architects, to ensure that the design and construction of the building meet the OBC requirements. As prime consultant, the engineer is in a direct contractual relationship with the owner.

Engineers

For a major construction project such as a shopping mall, the architect invariably requires engineering expertise to complete the design. The input of a structural engineer is required for the building's structure. Other engineering disciplines, depending on the nature of the project, are hired to test the soil (geotechnical engineer); design the mechanical systems, such as heating and ventilation, fire protection, and plumbing (mechanical engineer); and design the electrical systems (electrical engineer). Although the term civil engineer is sometimes used to describe a generalist, civil engineering also describes the discipline that deals with the site as a whole. In particular, a civil engineer is responsible for the design of the water and sewer services, as well as drainage, grading, roads, and parking.

For a major construction project such as a shopping mall, the architect invariably requires engineering expertise to complete the design. The input of a structural engineer is required for the building's structure.

The engineering profession in Ontario is regulated and governed by the Association of Professional Engineers of Ontario (PEO) and the *Professional Engineers Act*.[24] To become a licensed member of the PEO and practise engineering in Ontario today, an individual typically needs a bachelor's degree in engineering from an accredited university, as determined by the Canadian Engineering Accreditation Board, and at least four years of verifiable, acceptable engineering experience under the supervision of a licensed professional engineer. The candidate is also required to pass a professional practice examination on ethics, professional practice, engineering law, and liability. After the candidate successfully completes these requirements and submits the appropriate documentation, the PEO reviews the file, verifies references for the engineering experience, and determines if the candidate is qualified to be licensed. Once approved by the PEO, the licensed member may use the title "professional engineer" (P. Eng.) and sign and seal professional documents.

The PEO publishes practice guidelines on the various services that an engineer may be called on to deliver as a professional. Guidelines published by the PEO include

- Professional Engineers Providing Structural Engineering Services in Buildings[25]; and
- Professional Engineers Providing General Review of Construction as Required by the Ontario *Building Code*.[26]

These guidelines were not in place at the time the Algo Mall was constructed. However, they were in place at the time some of the inspections were carried out by the various engineers. All the practice guidelines published by the PEO are available on its website.[27]

Some of the other services offered by a structural engineer on a commercial construction project include:

- determining precise design calculations to establish member sizes for structural steel (steel beams, columns, etc.), design of reinforced concrete foundations, columns and slabs, design of reinforced masonry, precast concrete elements, etc.;
- preparing detailed design drawings meant to convey information to the contractor and structural subcontractors;

- defining the materials and procedures to be used in construction through contract specifications;
- reviewing shop drawings from the fabricator's engineer for the fabrication of steel beams, columns, connections, open web steel joists, precast concrete, reinforcing steel, etc.;
- providing periodic field reviews by the architect or engineer, or their delegate (these reviews do not necessarily occur at regular intervals but rather can occur as required to ensure that construction takes place according to plans and specifications);
- revising drawings throughout the process of construction to accommodate changes; and
- arranging for third-party testing to verify quality control of materials used in the construction of the project.

General contractor

The general contractor is retained by the owner to undertake the construction of the building in accordance with the plans and specifications (construction documents) and other contract documents. It is common practice for general contractors to subcontract many or all components of the building process to subtrades and suppliers (subcontractors). The general contractor's duty is to act as a coordinator and ensure that all subcontractors perform their work in accordance with the plans and specifications and that the work is carried out according to the provisions of the relevant health and safety legislation.

Subcontractors

A significant number of subcontractors may be involved in a large construction project. It is not unusual on a project to have a subcontractor for each division of the work (e.g., excavation, concrete and formwork, structural, mechanical, electrical, drywall, masonry and insulation, hardware, painting, or plumbing). Indeed, often the general contractor does little or none of the actual construction work, carrying out only the hiring, supervision, and coordination of the subcontractors. That said, coordination and direction of the many subcontractors is essential and sometimes complex and difficult.

Municipality

A municipality plays a regulatory role in the construction of a commercial project. The municipality is concerned mainly with ensuring that local zoning requirements are met and that the buildings conform to the applicable *Building Code*. Pursuant to the province's *Building Code Act*, municipalities are responsible for the enforcement of the Act and the OBC through the building permit review (plans examination) and inspection processes. Plans examination and inspection services are undertaken by the chief building official (CBO) and such other building officials as may be necessary. The *Building Code Act* provides that the CBO and other building officials are not permitted to perform their duties unless they have the qualifications set out in the OBC.

Although large cities such as Ottawa and Toronto generally have engineers on staff, smaller municipalities (including Elliot Lake and those similar to it) do not normally have a staff engineer to review building design drawings. Municipalities without an engineer on staff may choose to contract out the municipal building inspections to local engineering firms.

The construction project

Choosing where to build

Before starting a project, the owner needs to determine:

- the size of property required;
- the existing zoning for the selected property;
- the municipal parking requirements for the planned commercial development and the setbacks dictated by the zoning by-law;
- the green space and/or other amenities required to be included around the building; and
- the availability of services such as water and sewer.

Once a location has been selected, the owner may need to obtain a survey of the property to determine its legal boundaries, identify any encumbrances or easements on the property that could make it unsuitable for the proposed construction project, and establish what zoning by-laws apply in order to determine whether the project is feasible. The owner may also need to apply to the local municipal government to amend the zoning for the property to allow the project to proceed.

A prudent owner will hire a geotechnical engineer to determine the ground conditions, such as the depth and location of the bedrock, the water table, and the suitability of the soil for construction. This investigation usually involves drilling or digging test pits to sample the soil. The resulting report should include recommendations for the design of the footings and the building's foundation along with detailed information on the properties of the soil and/or bedrock. The report should provide the information needed to determine the type of shoring required for the excavation.

Depending on the historical use of the property, an environmental assessment may be required to determine if any contaminants are present at the site and the level of cleanup, if any, needed. If a site is found to be contaminated, it will have to be remedied in accordance with the applicable legislative and regulatory requirements before any construction can start. When the lot has had a previous use, environmental assessments are often conducted before the purchase of the land; or at the least, a prudent owner will make obtaining such an assessment a condition of the purchase.

Choosing the prime consultant

The next step for the owner is to choose the person or team that will design the building. As noted, the OBC requires that all buildings used for "assembly occupancy" and those over 600 square metres or three storeys high used for business and personal services and mercantile occupancy, such as a shopping mall complex, be designed by an architect and a professional engineer. Each professional provides services according to the expertise required. The owner determines which one of the two will lead the design and coordinate the work of the other professionals on the team as "prime consultant." The prime consultant is the owner's primary contact for the design and contract administration process.

The term prime consultant is not defined in the *Building Code Act*,[28] the *Building Code*,[29] the *Professional Engineers Act*,[30] or the *Architects Act*,[31] although the last two statutes provide that a professional engineer or an architect may act as a prime consultant for the construction, enlargement, or alteration of a building.[32] Nor are the role and responsibilities of a prime consultant outlined in any of these Acts or their regulations.

The full design process for a large project usually involves an architect, engineers, surveyors, and other design and testing specialists. It includes a process of repeated reviews by building officials and approval agencies such as the Office of the Fire Marshal.

The Ontario *Building Code* and by-laws

The Ontario *Building Code*[33] applies to all construction within an Ontario municipality, and it must be enforced by the designated chief building official for the municipality. Municipalities often supplement *Building Code* requirements with by-laws dealing with land use and building construction. These, too, are enforced by the municipality through the site plan control and building permit process.

Conceptual design

The design process begins with the conceptual design. It provides the general layout and size of the proposed building, including the facade, elevations, orientation on the site, and building materials to be used to carry out the architect's vision of the building. The conceptual design is reviewed in detail with the owner and used to establish a preliminary budget for the project. At this stage, several versions of the design concept may exist.

Site plan and approval process

Before completing the detailed design, the architect and/or civil engineer create a site plan that shows the placement of the building and its position relative to property boundaries. The site plan also sets out additional details such as site grading and drainage, building elevations, parking, sidewalks, curbs, entrances from the roads, site services (sanitary, water, septic, gas, power), lighting, landscaping and vegetation, fire hydrants, manholes, catch basins, and stormwater management. If this work is led by a civil engineer, it requires careful consultation with the owner to ensure that the owner's needs are met; with the architect about the building (orientation, size, etc.); and with the other engineers who need to design the systems that are fed by the services that enter the building.

Section 41(4) of the *Planning Act* provides:

> No person shall undertake any development in an area designated under subsection (2) unless the council of the municipality or, where a referral has been made under subsection (12), the Municipal Board has approved one or both, as the council may determine, of the following:
>
> 1. Plans showing the location of all buildings and structures to be erected and showing the location of all facilities and works to be provided in conjunction therewith and of all facilities and works required ... including facilities designed to have regard for accessibility for persons with disabilities.
> 2. Drawings showing plan, elevation and cross-section views for each building to be erected, except a building to be used for residential purposes containing less than twenty-five dwelling units, which drawings are sufficient to display,
>
> (a) the massing and conceptual design of the proposed building;
>
> (b) the relationship of the proposed building to adjacent buildings, streets, and exterior areas to which members of the public have access;
>
> (c) the provision of interior walkways, stairs, elevators and escalators to which members of the public have access from streets, open spaces and interior walkways in adjacent buildings;
>
> (d) matters relating to exterior design, including without limitation the character, scale, appearance and design features of buildings, and their sustainable design, but only to the extent that it is a matter of exterior design, if an official plan and a by-law passed under subsection (2) that both contain provisions relating to such matters are in effect in the municipality;

(e) the sustainable design elements on any adjoining highway under a municipality's jurisdiction, including without limitation trees, shrubs, hedges, plantings or other ground cover, permeable paving materials, street furniture, curb ramps, waste and recycling containers and bicycle parking facilities, if an official plan and a by-law passed under subsection (2) that both contain provisions relating to such matters are in effect in the municipality; and

(f) facilities designed to have regard for accessibility for persons with disabilities.[34]

Once the site plan drawing is complete, it is submitted by the prime consultant on behalf of the owner to the appropriate person within the municipality for approval, in accordance with section 41(4) of the *Planning Act*. During the site plan review process, the municipality considers issues such as building placement, parking, site access, drainage, and site services and their compliance with the zoning by-laws and standards in effect at the time.* The comments and concerns raised by the municipality during this process may lead to further revisions in the site plan. The municipality may also have to deal with a variance request from the owner to accommodate the project.

When the municipality has approved the site plan, a site plan control agreement† is signed by the owner and the municipality and registered on title.

Detailed design

After the owner has reviewed the budget and the feasibility of the project, a detailed design is prepared. The architect and the different engineers need to work together, contributing their individual expertise to the overall design.

The engineer responsible for the structural design of the building calculates numerous loads and load combinations to ensure that the structure can perform its required function under a variety of conditions. Several types of load calculations are considered at the detailed design stage (see figure 1.2.2). "Live" loads are the estimated weights of the things and the people using, occupying, and filling up the space in the building at any given time. This calculation could include, for example, "live" loads from people, vehicles and furniture. "Dead" loads – the weights created by all the building components (steel beams, concrete slabs, etc.) and permanent equipment – are also considered at this stage.

In addition to calculating the live and dead loads, the engineers have to consider the loads created by climatic influences such as wind, snow, rain, and ice. These loads vary according to the location of the project site and the orientation of the building. Seismic conditions are also considered and calculated for the specific site. For example, at a site in Northern Ontario, where buildings are often built on the bedrock of the Canadian Shield, seismic effects are less of a concern than in the southern part of the province, but wind effects more strongly influence how the building is designed. Seismic and wind loads are lateral loads that require particular consideration in the design of a building.

* Section 3(12) of City of Elliot Lake By-law No. 06-99 (Building By-law) provides that, where a building location survey is not available, site plans shall be submitted which are to include the information prescribed by s. 41(4) of the *Planning Act*.

† A site plan control agreement is required only where the municipality has implemented and designated an area as a site plan control area (s 41(2) of the *Planning Act*). The City of Elliot Lake requirements for site plan control agreements are set out at section 7.15 of By-law No. 06-94, being a by-law to a By-law to adopt an Amendment to the Official Plan No. 98-22 of the City of Elliot Lake.

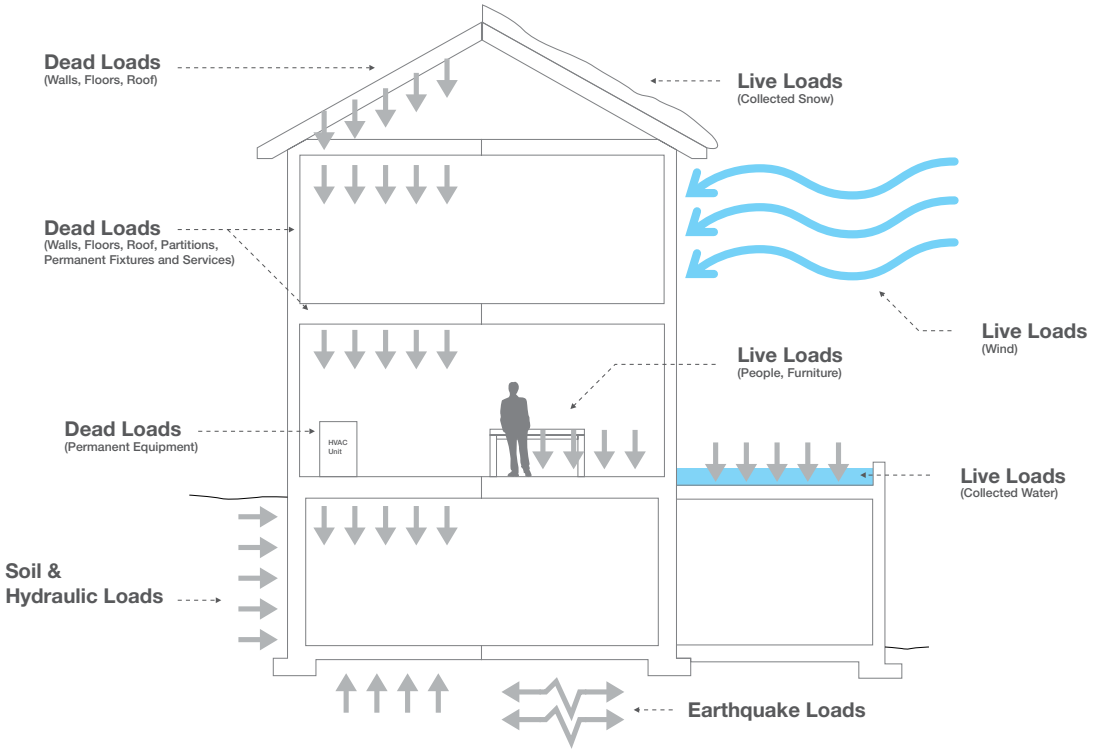

Figure 1.2.2 Various structural loads to be considered during the detailed design phase

Source Exhibit 1891

The structural engineer will calculate these different loads and choose the strength, size, and orientation of the steel, concrete, and other structural elements of the building to ensure that it is designed according to the applicable Ontario *Building Code* requirements. The Ontario *Building Code* includes a complete list of climatic conditions and wind pressures, earthquakes, seismic factors, and ground-snow loads that the engineer must consider in the design calculations. This list is specific to the individual communities in the province. Where a community (such as Elliot Lake) does not appear in the list, the engineer must use the information provided for neighbouring communities in order to triangulate and determine the applicable loads to be used in the design. The design addresses not only the strength of the various elements but also the resulting comfort for people using the building (for example, by ensuring that floor vibrations from footfall are limited).

At the same time, the mechanical, civil, electrical, and other engineers are designing their systems for construction in accordance with the various applicable codes, by-laws, and standards.

Building permits

Building permits are the primary link between the *Building Code* and individual construction projects. An approved project may not begin construction unless it is authorized by a building permit issued by the municipality through its chief building official. With larger commercial buildings, however, the municipal official tends to rely on the architect and engineers to ensure that the proposed building complies with the Ontario *Building Code*.

The municipality usually receives the building permit application just before or during tendering, though it sometimes receives it shortly afterward. The permit application includes commitments from the owner and the design team to undertake the necessary responsibilities for the project. These responsibilities include, but are not limited to

- the owner retaining a licensed professional architect and/or engineer to coordinate the design work and general review; and
- the licensed professional architect and/or engineer conducting a general review of the construction to confirm that the work has been carried out in general conformity with the plans and specification for the project and in accordance with the requirements of the *Building Code*.

At this time, full sets of the design drawings are provided to the municipality's Building Controls Department and to the Fire Marshal's Office. Design calculations (such as load calculations) are not normally submitted during this process. Although some municipalities check the detailed drawings, others do not, relying on the expertise of the design professionals to ensure that the integrity of the detailed design of the building. The *Building Code Act* includes a provision that chief building officials can, if they choose to, send drawings to the Association of Professional Engineers of Ontario or the Ontario Association of Architects for review.[35]

The municipality provides its comments and concerns about the drawings, which must be addressed by the owner, architect, and engineers. If the municipality is satisfied, the permit is issued. As noted, one important aspect of any building permit is the requirement for periodic reviews of the construction by each discipline for its part of the project.*

The tender process

In conjunction with finalizing the design and completing the building permit application, process, the owner must select a general contractor to construct the building. In putting out a call for tenders, the owner puts together a package that, if the project is going to proceed as a design-bid-build,† will include instructions to bidders, specifications, plans, supplementary general conditions, and, if any, geotechnical and environmental assessment reports. This package of documents is generally prepared by the prime consultant on behalf of the owner. The call for tenders can be a general call, open to any interested contractor, or the owner can choose to allow only invited or pre-qualified bidders to participate.

The tender process usually involves a site visit by the bidders to allow the design team to explain the project and permit bidders to ask questions. Questions can also be submitted in writing during the tender process. Answers

* Section 3.5 of City of Elliot Lake By-law No. 06-99 provides that applications for a permit to construct or demolish are to be in the prescribed form and must identify the designer who will review and take responsibility for the design activities.

† Design-bid-build is the traditional method of undertaking a construction project. There are three sequential phases to this method: (1) the owner retains a design firm to prepare the design documents (plans and specifications) for the project; (2) the design documents are used by the contractors and subcontractors to prepare their bids / quotations for the cost to complete the scope of work; and (3) the successful contractor and subcontractors construct the project in accordance with the design documents.

are distributed to all bidders as addenda to the contract specifications and form a legal part of the final contract document package.

Bids must be received at a predetermined location and are date- and time-stamped when received. If a bid package is received after the deadline, it is deemed non-compliant and cannot be considered by the owner. All bids received on time are reviewed for compliance with the requirements set out in the tender package and are ranked. A successful bidder is identified, and then a contract is entered into with the owner.

Contract administration, testing of materials, and supervision

After the contract has been awarded and the building permit issued, the construction starts. At this stage, the owner or its representative needs to work closely with the architect, engineers, and general contractor to administer the contract. The administration of the contract includes dealing with issues arising during construction such as identifying interferences,* discovering unknown conditions, and evaluating substitutions for products because of their lack of availability or long delivery times, as well as organizing and attending to documentation, distributing minutes from regular site meetings, and conducting a general review of the construction process.

During the construction, contemplated change notices, change orders, change directives, or site instructions may need to be issued in order to implement changes to the design or provide clarification on what is required for certain elements of the work. These materials are prepared and issued with the assistance of the owner's prime consultant and form part of the contract administration duties.

The role of the engineer continues even after the tender process is complete as the contractors and subcontractors begin their work. Architects and engineers are obliged under the OBC to review construction periodically to ensure that the general progress of construction proceeds in accordance with the design documents and that the quality of materials supplied on the project is as specified. This process is referred to as general site review. Sometimes, depending on the size and complexity of the project, a full-time reviewer is assigned to be on site, at the owner's expense. Often a local inspection company or testing firm is hired to do the inspections and provide written reports to the designers. At a minimum, the architect and engineers are expected to visit the site periodically to review progress of the work in their disciplines and to attend meetings with the contractor and owner.

The Ontario *Building Code* requires each discipline to review periodically its respective part in the construction project:

> 1.2.2.1(2) A person who intends to *construct* or have *constructed* a *building* or part of it required … to be reviewed by an *architect, professional engineer* or both, shall ensure that an *architect, professional engineer* or both are retained to undertake the general review of the *construction* of the *building* in accordance with the performance standards of the Ontario Association of Architects or the Association of Professional Engineers of Ontario, as applicable, to determine whether the *construction* is in general conformity with the plans, sketches, drawings, graphic representations, specifications and other documents that form the basis for the issuance of a permit under section 8 of the Act or any changes to it authorized by the *chief building official.*
>
> (3) The *architect, professional engineer* or both who have been retained to undertake the general review of the *construction* of a *building,* shall forward copies of written reports arising out of the general review to the *chief building official* or *registered code agency*, as the case may be.[36]

* For example, determining whether the electrical conduits will interfere with the heating, ventilation, air-conditioning, or sprinkler system.

Ongoing review is necessary for a number of reasons. Unknown conditions may be discovered. Occasionally certain products cannot be found and must be replaced with suitable substitutes, and sometimes the architect or engineer must clarify the intent of the design for the contractors.

An important part of contract administration for the engineers is the assessment and control of the quality of materials being used in the construction. Not all steel beams and concrete slabs have the same quality and strength. Indeed, the engineer must take great care to specify the strength of the materials used in construction – based on load calculations – ensuring that they are strong enough to carry their expected loads. Any changes to material strength may be dangerous to the structural integrity of the building.

In terms of quality control, the contractor or subcontractors provide the engineers with shop drawings of the products being supplied under their contract. The design team reviews these drawings to ensure that the products meet specifications. Work may proceed only once these documents have been reviewed by the design team and returned with any comments to the contractor. In some cases, the contractor may propose to substitute an item for one that was specified in the contract. Such substitutions must always be approved by the design engineer because problems may be caused by a product of lesser or greater quality, or a change in configuration. It is generally the contractor's responsibility to prove to the architect's or engineer's satisfaction that a product is equivalent.

In addition to reviewing shop drawings and proposed product substitutions, designers also put in place a program to test the various materials as they arrive on site. For example, tests may be done on the compressive strength of concrete cylinders or on the tensile strength of steel samples. Wood products, masonry, mortar, and protective coatings are all sampled and tested. Typically, these tests are done by independent inspection and testing companies, and the results are reviewed by the design engineers throughout the course of the project.

At this stage, an engineer may be involved in reviewing and testing the mechanical and electrical systems and controls to ensure that they run according to design and manufacturing requirements. Finally, the design team does its last review before giving the approval for "substantial performance" and occupancy.

As mentioned, issues invariably arise during the construction process related to such things as unknown conditions and unavailability of materials. The contractor and subcontractors must work closely with the owner and designers to deal with these matters as well as reviewing the general progress of construction. In addition, contractors and subcontractors must comply with the applicable occupational health and safety legislation throughout construction. In Ontario, the *Occupational Health and Safety Act*[37] and its Regulations are rigorously enforced, and there can be significant penalties for any failure to comply with their requirements, whether or not an accident has occurred on the site.*

Commissioning and substantial performance

Before the owner has a finished project, the mechanical and electrical systems and controls in the building need to be reviewed and tested to make sure they run according to design and manufacturing requirements. This step is the commissioning process.

* Where the owner awards separate contracts to two different general contractors for different parts of the work, the owner becomes responsible for the coordination of the work between contractors and for ensuring that the work is carried out in accordance with the relevant health and safety legislation. (The owner becomes a "constructor" as defined in the *Occupational Health and Safety Act*.)

Typically, at this point as well, the owner's maintenance personnel are trained to operate and perform routine maintenance on the systems in the building. An operation and maintenance manual is prepared by the contractor according to the design criteria set out by the design team. The owner's staff must also be trained on fire, life safety, and exit systems.

The final step for the owner is for the contractor to be granted "substantial performance" on the project. This determination is made by the design team in accordance with the provisions of the Ontario *Construction Lien Act*.[38] The design team inspects the building thoroughly to determine what deficiencies there may be or how much work is left to be done and to make a professional determination on whether the building is ready to be accepted as substantially performed. If it is, the *Construction Lien Act* requires the contractor to advertise this substantial performance in the *Daily Commercial News* so that any suppliers or subcontractors who may have lien rights know when these rights expire and that they need to get their claims in before that date.

Once the design team signs off, notice is sent to the municipality's chief building official, advising that, in the opinion of the consultants, the building is ready for occupancy. That official and the fire department conduct their final reviews and, if all requirements have been met, the owner is given an occupancy permit to the premises.

The contractor continues to finish all outstanding work and correct any deficiencies noted, ultimately receiving a declaration of "completion" of the contract.

Ongoing maintenance and review

All buildings require maintenance of their various systems over time, including the mechanical (heating, ventilation, air conditioning, fire suppression), electrical (lighting, data, controls, fire detection), civil (septic, water, sanitary), and structural and architectural (sealants, roofing and waterproofing membranes, windows, doors) systems. Typically, the mechanical, civil, and electrical systems require review at regular intervals (once or twice a year); the architectural and structural components of a building, in contrast, are often looked at only if a problem is brought to the owner's attention or a failure occurs.

If the owner undertakes major renovations, they must be carried out according to the *Building Code* requirements in place at the time, and not those that were in place when the building was first constructed. During a major renovation, some elements of the existing building may also need to be brought up to the requirements of the *Building Code* in place at the time of the renovation.

Under the Ontario *Building Code Act* and the Ontario *Building Code*, once a building such as a shopping mall has been completed and an occupancy permit issued, ongoing inspections by the municipality of the structural elements of the building are not required. Inspections of the structural elements generally occur only in response to specific complaints. The degree to which engineers and architects carry out ongoing maintenance and review of the structural systems in a building throughout its lifetime depends entirely on the owner. Typically, these procedures take place only if a problem is brought to the owner's attention or a failure occurs.

Notes

1 http://www.cityofelliotlake.com

2 Anne-Marie Mawhiney and Jane Pitblado, eds., *Boom town blues: Elliot Lake, collapse and revival in a single-industry community* (Toronto: Dundurn Press, 1999), 22.

3 Catharine Dixon, *The power and the promise: The Elliot Lake story* (Elliot Lake, Ont.: Gillidix, 1996), xvii.

4 Mawhiney and Pitblado, eds., *Boom town blues*, 23.

5 Mawhiney and Pitblado, eds., *Boom town blues*, 23.

6 Mawhiney and Pitblado, eds., *Boom town blues*, 22.

7 Mawhiney and Pitblado, eds., *Boom town blues*, 24.

8 Mawhiney and Pitblado, eds., *Boom town blues*, 24.

9 Mawhiney and Pitblado, eds., *Boom town blues*, 28.

10 Business Plan for the Purchase of the Algo Centre, Elliot Lake Retirement Living, March 1999, Exhibit 0007-00002.

11 Dixon, *The power and the promise*, 376–7.

12 City of Elliot Lake Community Profile 2008, Exhibit 00007-00001.

13 Elliot Lake Secondary School 455.02 Class, *Jewel in the wilderness, a history of Elliot Lake* (Elliot Lake, Ont.: Inter-Collegiate Press, 1980), 112.

14 Affidavit of Robert deBortoli, Exhibit 00007-00003.

15 Affidavit of Robert deBortoli, Exhibit 00007-00003.

16 https://youtube.googleapis.com/v/damtlSsWmMY. Music and lyrics by John R Cal.

17 Craig testimony, March 5, 2013, pp. 101–82.

18 Ontario *Building Code,* O Reg 332/12.

19 *Building Code Act, 1992*, SO 1992, c 23.

20 *Architects Act*, RSO 1990, c A.26.

21 O Reg 925/75, s 2.3.1(b).

22 Ontario *Building Code*, O Reg 332/12, Division C, Part 1, para 1.2.2.1.

23 Ontario *Building Code*, O Reg 332/12, Division C, Part 1, para 1.2.2.2.

24 *Professional Engineers Act*, RSO 1990, c P.28.

25 Guideline, *Professional engineers providing structural engineering services in buildings* ([Toronto]: Association of Professional Engineers of Ontario, 1995, rev. 12/11/98).

26 Guideline, *Professional engineers providing general review of construction as required by the Ontario Building Code*, prepared by Dick Seal et al. ([Toronto]: Association of Professional Engineers of Ontario, April 2008, rev. November 2008).

27 http://www.peo.on.ca/

28 *Building Code Act*, *1992*, SO 1992, c 23.

29 *Building Code*, O Reg 332/12.

30 *Professional Engineers Act*, RSO 1990, c P.28.

31 *Architects Act*, RSO 1990, c A.26.

32 *Professional Engineers Act*, RSO 1990, c P.28, s 12(6).8; *Architects Act*, RSO 1990, c A.26, s 11(4).8.

33 *Building Code*, O Reg 332/12.

34 *Planning Act*, RSO 1990, c P.13.

35 *Building Code Act, 1992*, SO 1992, c 23, ss 9 and 9.1.

36 Ontario *Building Code*, O Reg 332/12, Division C, Part 1, para 1.2.2.1 (2 & 3).

37 *Occupational Health and Safety Act*, RSO 1990, c O.1.

38 *Construction Lien Act*, RSO 1990, c C.30.