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TRANSLATIONS IN CONCRETE
Tracing Material Co-productions in Montreal's Place Victoria, 1960-1965

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In July 1964, a group of journalists, politicians, developers, and a select public assembled outside the newly completed Stock Exchange Tower at Montreal's Place Victoria. Microphones and camera crews stood by as Montreal's mayor (and 1960s champion) Jean Drapeau announced the completion of the world's new tallest reinforced concrete tower. Set against a backdrop of the dark aluminum curtain wall and the tower's wide corner columns, the press conference was transmitted to a broader audience as an image of the city's modernity, of its place on an international stage (fig. 1). Cameras rolled, Drapeau and others spoke and applauded, and the tower was officially inaugurated as a symbol of civic pride and technological advancement in Montreal's downtown core.

Yet what else was this tower conveying? Quiet and elegantly tapered in its 47 storeys, today adjacent to buildings of similar or greater height, the Stock Exchange Tower was designed by the offices of famed Italian architect Luigi Moretti and Italian engineer Pier Luigi Nervi, in collaboration with local professionals, as an anomaly for North America at the time. That is, it was designed as a reinforced concrete tower that eschewed the typical North American steel frame. Yet while it was a novel project for Canadian soil, tied in part to Italian expertise in concrete construction,[1] the building goes beyond the mere import of a foreign approach. The tower's reinforced concrete structure and prefabricated corner casings instead speak to a deeper transnational history of technological expertise, of cross-border collaborations and financial flows, and the mechanisms through which architectural

FIG. 1. TOPPING OFF CEREMONY OF THE STOCK EXCHANGE TOWER ON JULY 27, 1964. | HENRI RÉMILLARD, BIBLIOTHÈQUE ET ARCHIVES NATIONALES DU QUÉBEC.

knowledge was increasingly circulating in the postwar period. Conceived initially in Italian offices, foreign technological expertise in reinforced concrete was translated into Montreal's Stock Exchange Tower through local innovation and intensely local conditions of climate, materials, and labour. Among others, the project's Montreal-based associate architects Greenspoon, Freedlander & Dunne and consulting structural engineers D'Allemagne & Barbacki were integral to a series of key modifications.[2] Through examining these translations, this paper aims to situate this "International Style" tower—a layered site of international exchange—as a transnational co-production, attributed to Italian authors yet dependent on, and resulting from, highly local conditions in Montreal.

The use of reinforced concrete offers a particular entry point into this project. Since its inception in the nineteenth century, reinforced concrete has been tied to notions of modern nation-building and progress, to possibilities of global standardization and an international architecture, and to permanence.[3] It has equally been a point of contention amongst architects and theorists of architecture—ambiguous as natural or unnatural, historical or atemporal—and today constitutes the most widely used building material across the globe.[4] To examine concrete as a medium here, this essay first looks briefly to developments in concrete in Italy in the first half of the twentieth century, and to the material's prevalence in the postwar architecture of Northern Italy.[5] The focus remains on the arrival of and interaction with this expertise in Montreal in the 1960s through the Stock Exchange Tower project. As what would be the tallest building in Canada and the tallest reinforced concrete tower in the world at the time, widely celebrated for its innovative structural and mechanical systems, the project received ample coverage in building industry press over the course of its construction. These accounts in Canadian periodicals and trade journals (such as *The Canadian Architect*, *Architecture–Bâtiment–Construction*, and *L'Ingénieur*) serve as key archival sources for detailing the transnational collaboration, exchanges, and networks of actors involved in the tower's production.[6]

At the same time, the notion of *translation* provides a framework for examining these same phenomena: to follow Esra Akcan, a history of translation examines the processes of transformation that occur when people, objects, technology, and ideas move from one place to another.[7] Such translations are tied to situated geographies and speak to an intersection of the local with the global, of seemingly transportable ideas and expertise that are altered by a place's conditions upon arrival. Rather than representing a neutral bridge between places and cultures or smooth processes of influence, looking at translations means recognizing agency on both sides of the transformation—along with the sociopolitical contexts in which that transformation takes place.[8] In the case of Place Victoria, considering translations both enables an understanding of the project's *co-production* across transatlantic networks and speaks to the position of Canada's postwar architectural production within broader, intertwined histories of modern architecture. Such translations, here, are grounded in the use of reinforced concrete.

PROJECT CONTEXT: PLACE VICTORIA AND MONTREAL'S DECADE OF CHANGE

On October 20, 1965, a six-page spread in the Montreal *Gazette* celebrated the official move of the Montreal Stock Exchange and the Canadian Stock Exchange to their new premises in the Place Victoria tower. The tone of the articles and the advertisements surrounding the text is one of excitement, of congratulations, of achievement: with its move into the tower, "the investment community [would] take a leap into the future" in the companies' new "ultra-modern and revolutionary premises," marking "a landmark" for both Canada's economic history and "the development of the investment industry."[9] Superlatives abound: the stock exchange is noted as "Canada's tallest office building" and as having the "most modern trading facilities yet developed," together coalescing to make Montreal "one of the major financial centres of the world."[10] The move, it is exclaimed in an advertisement, represents "another step forward for this city."[11]

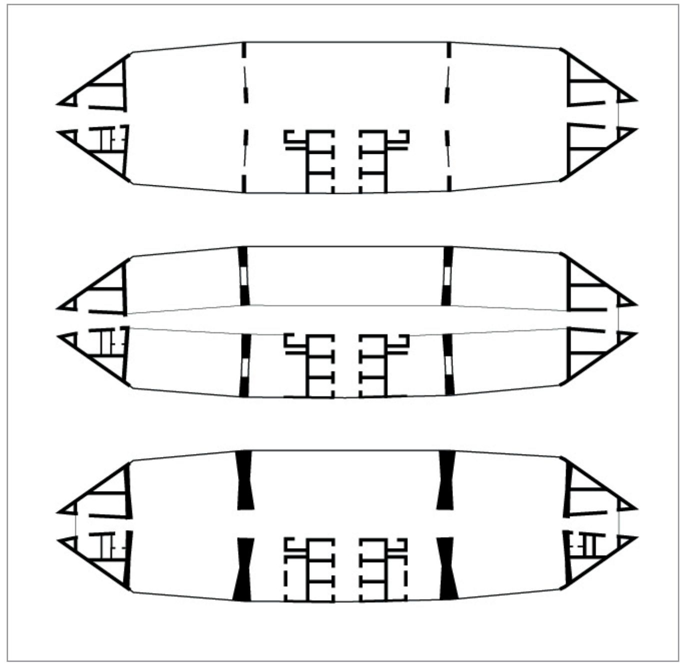
While aimed at promoting the interests of investors and building excitement around the stock exchange, the energetic tone of this special report fits the tower more broadly into a decade of accelerated change for the city of Montreal. The 1960s in Montreal were witness to the city's unprecedented expansion and development, in the decade of dramatic political and sociocultural transformation known as Quebec's Quiet Revolution.[12] The execution of extensive infrastructure and transportation projects throughout the 1960s went hand in hand with planning for Expo '67, in which 62 nations participated and which drew over 50 million visitors to its internationally oriented celebration of Canada's centennial. Montreal was thriving, and the world was welcome to the spectacle.[13] Within a larger national context, this opening up of Montreal corresponded to broader federal policies in the same period which encouraged the influx of both foreign capital and foreign labour.[14] A set of more liberal immigration laws were put in place following World War II that aimed to encourage immigration to Canada, primarily as the country sought labourers in the midst of its postwar reconstruction boom. This included reopening the door to Italian immigration, changing a policy that had been in place since the 1930s, and leading to waves of migration from Italy to Canada, with many of these immigrants settling in the urban centres of Montreal and Toronto—and many finding work in the booming construction industry.[15]

Finally, within this decade of economic and cultural boom, Montreal was also contending with Toronto to remain the major financial centre of Canada. Although the city was home to the head office of the Royal Bank of Canada and to both the Canadian Stock Exchange and the Montreal Stock Exchange, the country's oldest financial trading institution, it was recognized that Toronto was gaining ground in becoming Canada's financial centre.[16] It was in that context of urban development, commercial opportunity, and concerted effort toward financial primacy that the project for Place Victoria was developed. From its onset the project was an intersection of international interests: amidst Canada's postwar economy, increasingly open to foreign capital, early financing for the project came from cooperation between the Mercantile Bank of Canada and the Rome-based developer Società Generale Immobiliare (SGI). The latter—a tycoon in real estate development in Italy and at the time the unofficial arm of the Vatican's real estate investments—had already expanded into the North American market as developer of the Watergate Complex in Washington DC, and was no doubt drawn by emerging, highly profitable investment opportunities in Canada's major urban centre. In November 1960, a group of nine investors formed the Place Victoria–St. Jacques Company Inc. as the project's official developers. The group was primarily international, several of them Italian. Shareholders included the National Handelsbank (NL), Edison International Corporation (US), Efibanca (IT), Italconsult (IT), and Italian Economic Corp (IT), along with SGI as the major shareholder.[17] The project was to be located in the city's growing new financial district. A local project management company, Ediltecno (Canada) Ltd., was formed by SGI in order to supervise the technical aspects of the project from Montreal. This company was to be directed by the Italian engineer G.M. Padoan, who moved to Montreal from SGI's Roman offices to guide the project.[18]

THE DEVELOPMENT OF ITALIAN EXPERTISE

The Italo-Canadian connection was thus written into the formation of the Place Victoria project, supported by assemblies of professionals on each side. Luigi Moretti and Pier Luigi Nervi were brought into the project at the end of 1960. The two Italian professionals had not previously collaborated but moved in similar architectural circles within their own country, both of established international reputation.[19] Moretti had previously worked as a consultant for SGI on housing developments in Rome and on the Watergate Complex. Nervi, almost seventy years of age at the time of commencing the project, offered SGI an internationally recognizable symbol of Italian expertise in concrete construction.

This expertise was part of a longer development set within Italian borders: at the end of a long career that included widely published buildings such as the Artemio Franchi Stadium in Florence (1930-1932), the Palazetto dello Sport in Rome (1956-1957), and the UNESCO headquarters in Paris (1950-1958), Nervi's mastery of reinforced concrete construction was tied to political, economic, and material conditions in Italy. While the use of reinforced concrete in Canada first became widespread in the mid-twentieth century, for reasons that will be elaborated shortly, by the end of the nineteenth century in Europe multiple concrete construction systems had been patented and reinforced concrete was widely embraced for its fireproofing qualities and structural strength. In Italy, instruction in reinforced concrete construction was adopted into the curricula of its engineering and technical schools already in the early twentieth century, while the first Italian national building standard on reinforced concrete was published in 1907 and was updated in 1927.[20] Both industrial practices and the scientific community contributed to the improvement of concrete and its production as it quickly became a standard construction method in the country, constituting much of its public housing following World War I. Nervi himself graduated in engineering from the University of Bologna in 1913 and began his work in reinforced concrete shortly thereafter, joining the Società per costruzioni cementizie in Bologna before founding his own construction company in Rome in 1923.[21] The beginnings of Nervi's international acclaim—tied to the completion of the cantilevering Artemio Franchi Stadium in Florence—coincided with changing political conditions in the country as the fascist regime came into power and, in efforts to boost the nation's faltering economy, as the country shifted to an autarchic policy of resource self-sufficiency. Sanctions imposed on Italy by the League of Nations in 1935 and the material requirements of military operations throughout the war further meant that little metal reinforcement was available for construction projects. In 1939, metal reinforcement was fully banned.[22] During this period, Nervi—already guided by principles of economy and structural optimization—experimented with the technique of *ferrocemento*, in which a thin metal mesh provided reinforcement, and with the production of thin monolithic slabs that would characterize his postwar activity.[23] Many Italian engineers similarly experimented with alternative forms of reinforcement such as bamboo, or with eliminating reinforcement altogether.



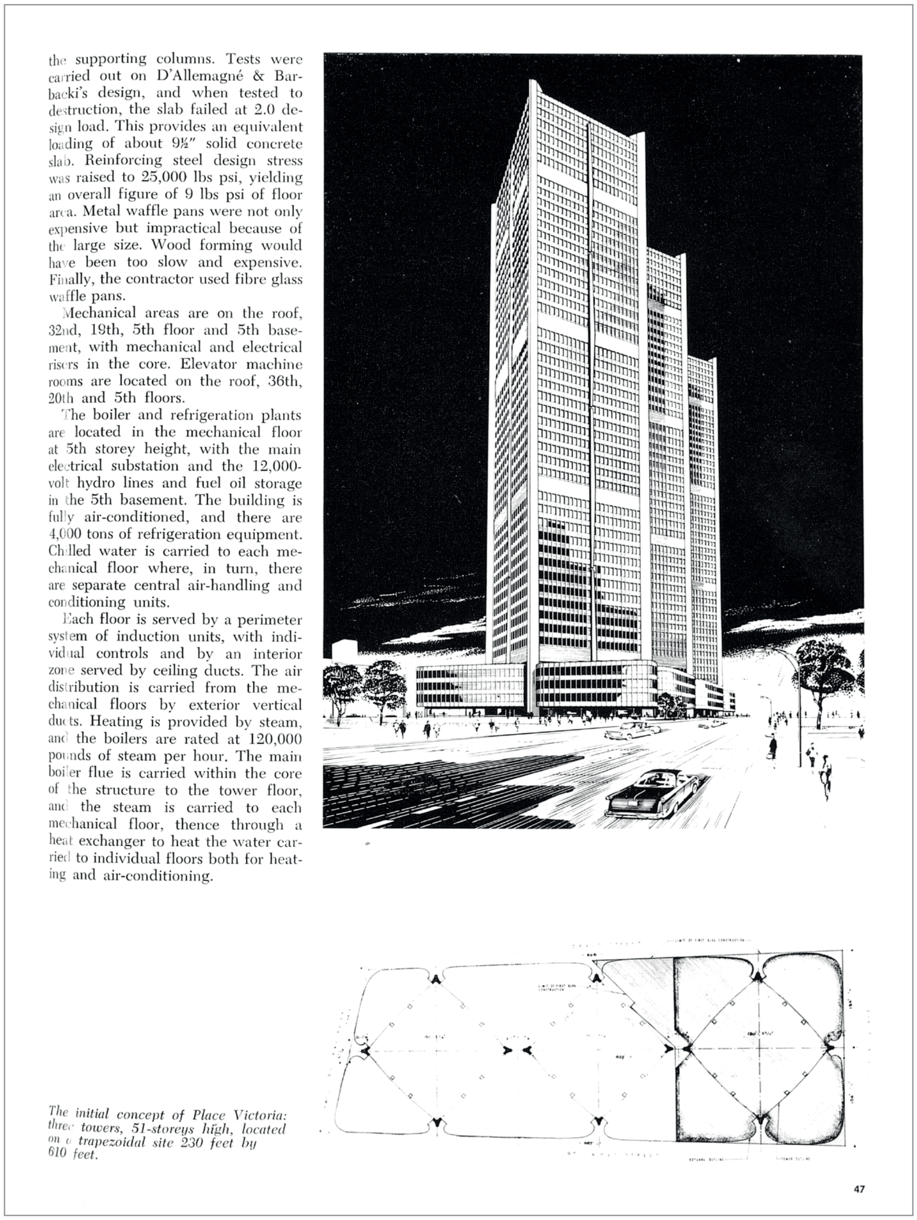
FIGS. 2-3. A STAGE IN THE CONSTRUCTION OF THE PIRELLI CENTRE: COMPLETION OF THE 17TH FLOOR. "PIRELLI FOR THE SEA" ADVERTISING INSTALLATION DESIGNED BY ROBERTO MENGHI AND ALBE STEINER, 1957 (LEFT) AND TYPICAL FLOOR PLANS (ABOVE), FROM A HIGHER FLOOR TO A LOWER FLOOR (TOP TO BOTTOM). | *CAMERA-COLOR MILANO,* COURTESY OF FONDAZIONE PIRELLI (LEFT), PLANS RETRACED BY KATIE FILEK (ABOVE).

The story of concrete in Italy continues: in the period following World War II, as large-scale reconstruction began in the country, concrete again entered into widespread use as the primary building material in a booming construction industry. Italian architects meanwhile experimented with both the historicity and the plasticity of concrete in the postwar period, as demonstrated by a series of towers constructed across Northern Italy in the 1950s and 1960s.[24] This includes the tower at 2-4 Corso Francia in Turin (1959), designed by the Milanese firm BBPR with a mix of concrete frame and brick infill, or the historically attuned Torre Velasca in Milan (1950-1958) by the same firm—the latter notably backed by SGI, the developer behind the Place Victoria project. In that same period, Nervi collaborated with the architect Gio Ponti on the Pirelli Tower in Milan (1955-1961) (figs. 2, 3). In the project, a 32-storey reinforced concrete tower designed as headquarters for the Pirelli company, Nervi and Ponti employed a concrete structure anchored in two vertical shear walls on either end, minimizing the distribution of structural columns throughout.[25] The tower would serve as an important structural and formal precedent for Place Victoria, as a testing site for Nervi's theories of structural optimization and material efficiency in a high-rise concrete tower. The structures of the Pirelli Tower and the Torre Velasca were meanwhile tested at the Istituto Sperimentale Modelli e Strutture in Bergamo, or ISMES, a facility founded in 1951 for the testing of major concrete building projects—the same facility where the Stock Exchange Tower's concrete structure would soon also be tested.

TRANSLATING EXPERTISE IN MONTREAL

By the time the offices of Nervi and Moretti joined the Place Victoria project, they were thus able to draw on a rich legacy of knowledge in reinforced concrete construction, developed in Italy over the span of half a century. This accompanied Nervi's own particular experience and expertise with the material. It is at this point, now travelling back to the Canadian context, that the true story of translations in concrete begins. Developed across Italo-Canadian networks and attuned to local effects of climate, political economies, and material availability, the Place Victoria project not only drew on conditions on the ground in Montreal but *depended* on them, was made possible by them: as a transnational collaboration in concrete, feasibility lay on both sides.

The history of concrete in Canada speaks to situated frictions around its use: reinforced concrete has historically been a site of tensions between the global and local, a collision of the hypothetical global availability of its basic components and local specificities of aggregates, labour, and steel.[26] Although the domestic manufacture of Portland cement commenced outside of Montreal in the late nineteenth century, and although reinforced concrete was used extensively in agricultural applications in Canada's grain silos in the early twentieth century,[27] labour costs and a lack of skilled workers in Canada prohibited the materials' widespread use even as it dominated the European market. It was only in the period following World War II that concrete was adopted at a large scale for construction in Canada, in a trend often attributed to technological advances and new methods of prefabrication, decreased construction costs, and an influx of skilled European immigrants who brought their expertise and preferences.[28] Waves of immigration meanwhile increased the availability of unskilled construction labourers in urban centres.[29]



the supporting columns. Tests were carried out on D'Allemagné & Barbacki's design, and when tested to destruction, the slab failed at 2.0 design load. This provides an equivalent loading of about 9½" solid concrete slab. Reinforcing steel design stress was raised to 25,000 lbs psi, yielding an overall figure of 9 lbs psi of floor area. Metal waffle pans were not only expensive but impractical because of the large size. Wood forming would have been too slow and expensive. Finally, the contractor used fibre glass waffle pans.

Mechanical areas are on the roof, 32nd, 19th, 5th floor and 5th basement, with mechanical and electrical risers in the core. Elevator machine rooms are located on the roof, 36th, 20th and 5th floors.

The boiler and refrigeration plants are located in the mechanical floor at 5th storey height, with the main electrical substation and the 12,000-volt hydro lines and fuel oil storage in the 5th basement. The building is fully air-conditioned, and there are 4,000 tons of refrigeration equipment. Chilled water is carried to each mechanical floor where, in turn, there are separate central air-handling and conditioning units.

Each floor is served by a perimeter system of induction units, with individual controls and by an interior zone served by ceiling ducts. The air distribution is carried from the mechanical floors by exterior vertical ducts. Heating is provided by steam, and the boilers are rated at 120,000 pounds of steam per hour. The main boiler flue is carried within the core of the structure to the tower floor, and the steam is carried to each mechanical floor, thence through a heat exchanger to heat the water carried to individual floors both for heating and air-conditioning.

The initial concept of Place Victoria: three towers, 51-storeys high, located on a trapezoidal site 230 feet by 610 feet.

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FIG. 4. THE INITIAL DESIGN FOR THREE 51-STOREY TOWERS PROPOSED BY NERVI AND MORETTI IN 1961, AS PUBLISHED IN *THE CANADIAN ARCHITECT* IN 1965. THE FLOOR PLANS FOR THE GROUND FLOOR OF THE PROPOSED COMPLEX SHOW THE MONOLITHIC CORNER COLUMNS, SIMILAR TO THE EVENTUAL PROFILE OF THE PRE-CAST CASINGS. | *THE CANADIAN ARCHITECT*, 1965, VOL. 10, NO. 7, P. 47.

The project proposed by Pier Luigi Nervi and Luigi Moretti fit within these initial conditions of material feasibility. The project in early 1961 consisted of three towers with reinforced concrete structures, each 51 storeys in height and spanned by an aluminum-glass curtain wall (fig. 4). Similar to Nervi's design for the Pirelli tower in Milan, the proposal concentrated structural elements into a central core and massive columns, leaving much of the floor space flexible. Nervi favoured this solution over steel-framed structures, in which vertical loads were carried by smaller yet more frequent steel columns characterized by intermediate and perimeter supports.[30] In the case of the Stock Exchange Tower, this floor space had to remain competitive as rentable commercial space in Montreal's new business district (while in Milan, the office space had belonged to the Pirelli company). In a first translation, following two reports carried out by Montreal consultants in 1961—one that evaluated real-estate values and economic feasibility, another that studied the project's urban context and connection to the city[31]—the design was modified into a set of two towers (only one of which was ultimately built, due to changing finances) with higher ratios of rentable floor area to structural core and a lower podium building of five storeys (fig. 5). The proposed concrete structure would not only provide competitive flexible floorspace and draw on the increased regional manufacturing capacity of cement and availability of labour but would also fulfil requirements of speed and affordability.

FIG. 5. THE STOCK EXCHANGE TOWER AS PHOTOGRAPHED IN 1965. THE IMAGE SHOWS THE TOWER'S HEIGHT AND POSITION IN DOWNTOWN MONTREAL, IN PARTICULAR IN RELATION TO THE SAINT LAWRENCE RIVER AND THE CITY'S HISTORIC PORT, ALONG WITH THE BUILDING'S TAPERED FORM AND MASSIVE CORNER COLUMNS. | *THE CANADIAN ARCHITECT*, 1965, VOL. 10, NO. 7, P. 45.

In addition to the Italian-led project management group established by SGI, Ediltecno (Canada) Ltd., which acted as a liaison between Italian and Canadian design groups, an extensive team of local actors and companies was brought into the project starting in 1961. These included associate architects Greenspoon, Freedlander & Dunne, consulting architect Jacques Morin, structural engineers D'Allemagne & Barbacki, consulting engineers Letendre and Monti, and mechanical and electrical engineers James P. Keith Associates along with the Montreal-based construction company E.G.M. Cape & Co., hired as the project's general contractor.[32] A separate construction company, Janin Construction Ltée, was responsible for the reinforced concrete. Although the project's original design was drawn out in Roman offices, fundamental aspects of the project's structure and design elements were worked out upon its arrival in Canada. The structure proposed by Nervi and Moretti consisted of a central core of diagonal shear walls and four large exposed concrete corner columns, connected by double height, x-shaped concrete trusses on three mechanical levels (on the 5th, 19th, and 32nd floors).[33] This primary structural system would carry the building's horizontal loads, designed to meet seismic requirements in Montreal's high-risk Zone 3 earthquake zone, as dictated by Canada's National Building Code. A secondary system of peripheral columns on each side of the tower would carry vertical loads. This dual structure—described by Nervi as an "outrigger" system, or like a skier with outstretched arms supported by poles—was structurally innovative and was subsequently widely adopted as a model for concrete construction.[34] Pushed by the economic feasibility report of 1961, a typical tower floor was designed to measure 45 metres on each side, with elevators and services concentrated into a central core. One tower would house one million square feet of floor space (fig. 6).

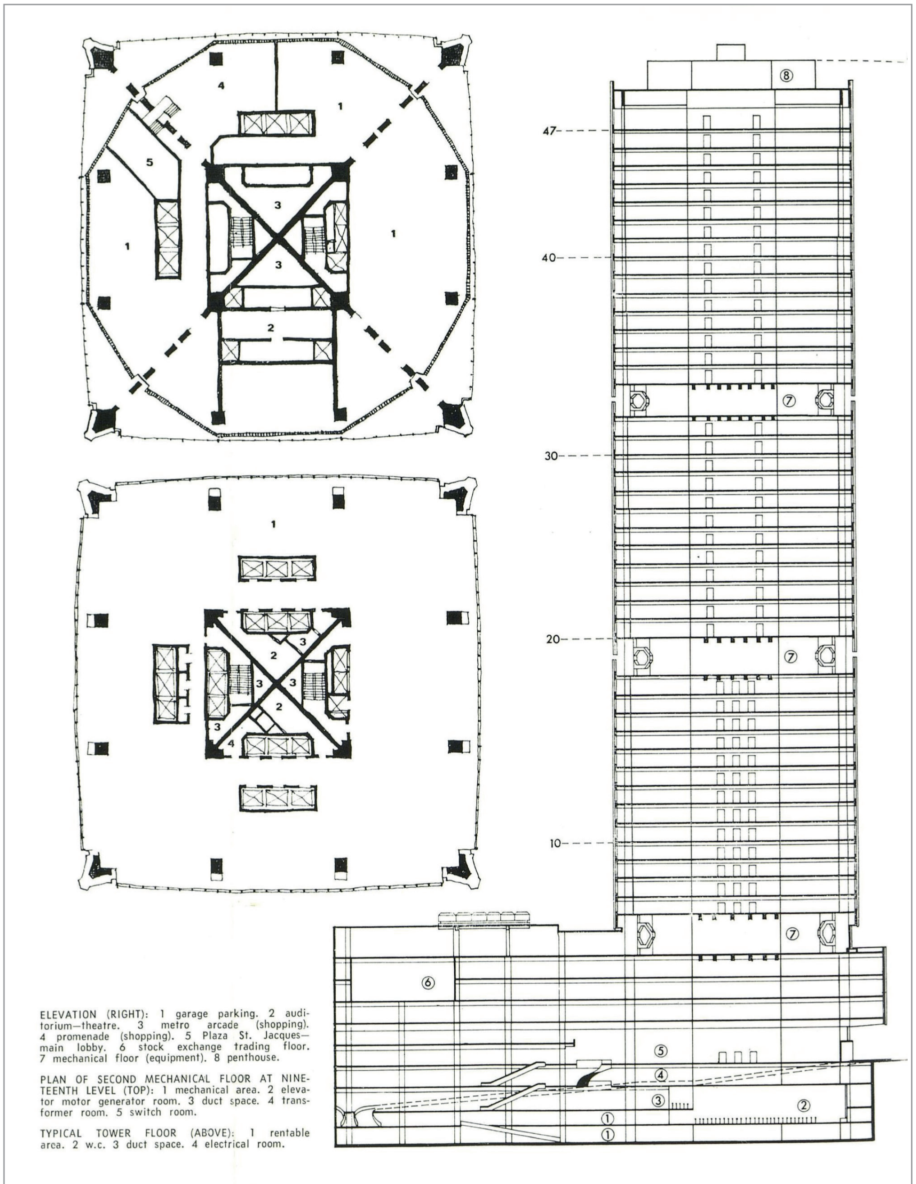

FIG. 6. THE BUILDING SECTION (RIGHT) ALONG WITH FLOOR PLANS OF A MECHANICAL FLOOR (TOP LEFT) AND OF A TYPICAL RENTABLE OFFICE FLOOR (BOTTOM LEFT) SHOW THE PRIMARY CONCRETE STRUCTURE AT THE CENTRE, THE SECONDARY STRUCTURE OF COLUMNS, CORNER COLUMNS, AND THE CURTAIN WALL. | *THE CANADIAN ARCHITECT*, 1965, VOL. 10, NO. 7, P. 44.

Despite Nervi's established expertise in reinforced concrete design, this was only the second tower his office had worked on after the Pirelli Tower. Its height would surpass the Milanese tower by 63 metres. The resolution of the innovative concrete structure relied intensively on collaboration between Italian and Canadian teams. Published accounts from the time describe the role of the Montreal engineering firm D'Allemagne & Barbacki, and in particular the engineer Jack Barbacki, in working out the details of the diagonal truss system that connected the core to the corner columns: one account in the Quebecois periodical *Architecture-Bâtiment-Construction* (*ABC*) attributes the ingenuity of the outrigger design entirely to Barbacki,[35] worked out in a design produced for the project bid. Barbacki is equally credited with the design of a two-way ribbed floor slab system that kept the concrete structure as light as possible with minimum deflection, necessary due to concrete's problematic weight and structural spans of over 14 metres, as well as a system of standardized fibreglass formwork that could be used several times and thus reduce costs (and for which Barbacki secured a patent).[36] The floor design reduced the floor slab depth to 45.7 centimetres and was chosen after being tested against a design proposed by Nervi's office in Rome. Steel reinforcement of the concrete structure was meanwhile worked out by the general contractors E.G. Cape & Company in accordance with the National Building Code, giving rise to a novel technique of splicing that allowed for the maximum reduction of column size and of the steel reinforcement required.[37]

Local expertise thus built upon that of Italian engineers to produce locally viable structural solutions, fully attuned to local requirements of speed, economy, and building code. Both design and construction processes were further conditioned by Montreal's extreme climate. In the Italians' original design, the four exposed concrete corner columns were cast-in-place and monolithic, extending 190 metres from ground level to the top of the tower. Consultants in Montreal identified that distortions could occur in the columns due to temperature differentials of up to 60°C between exterior and interior in the wintertime. Further studies were carried out by the Building Division of Canada's National Research Council to quantify the potential deflection.[38] To resolve this issue of temperature differential (while maintaining the formal qualities of the columns designed by Moretti, elegantly anchoring the tower at all four corners), the architects of Greenspoon, Freedlander & Dunne proposed a solution of precast concrete panels that would encase the corner columns and create a continuous external skin with the aluminum curtain wall.[39] Working together with Nervi, a solution was reached in which the prefabricated panels were offset from the inner cast-in-place columns by 60 centimetres. This allowed conditioned ambient air from the tower's interior to circulate in the gap between the panels and columns, providing a layer of heated insulation for the cast-in-place columns. D'Allemagne & Barbacki further proposed coating the interior of the prefabricated concrete panels with a layer of polyurethane mousse to provide insulation.[40] The desired expediency of the concrete construction process, a key selling point for the commercial potential of the project, meanwhile equally came up against Montreal's winter climate. The tower's concrete structure was started in August and completed in a period of just eleven months—a quality enthusiastically promoted by the project's cement manufacturer, the Canada Cement Company, in an advertisement from August 1964 (in the Quebecois trade journal *L'Ingénieur*) (fig. 7). The advertisement shows the exposed concrete frame of the Place Victoria tower and includes an arrow showing the date certain floors were supposedly completed (the 12th floor by January 17, 1964, or the 37th floor by June 4), captioned by the slogan "*Construction ultra-rapide – en béton*." This is accompanied by a paragraph proudly stating the use of "Canada" cement.[41] The promoted timeframe was made possible through innovative construction systems that both protected on-site labourers in Montreal's cold winters and allowed the concrete to set at the required temperature. In this system, patented during the construction process, a four-storey, steel-framed cage wrapped in polyethylene was constructed, that could be moved upward one storey at a time and heated using moveable steam heaters.[42] An article from the same issue of the abovementioned *L'Ingénieur* states that a concrete floor could be built in as little as 73 hours.[43] Montreal's winter climate thus coalesced with the desire for rapid progress to push innovation in construction processes, in an assembly of political, economic, and technological forces.

FIG. 7. ADVERTISEMENT FROM THE CANADA CEMENT COMPANY IN 1965, SHOWING THE STRUCTURE OF THE STOCK EXCHANGE TOWER AND DATES AT WHICH FLOORS WERE COMPLETED. | *L'INGÉNIEUR*, 1964, VOL. 50, NO. 200, P. 2.

The project for Place Victoria was initially designed in Italian offices and worked out between Italian and Canadian design teams over the course of its execution. Technological expertise moved between countries alongside ideas and personnel: in addition to movements already mentioned, the structure was tested for earthquake resistance in the ISMES facilities in Bergamo, Italy,[44] and its foundation walls were built using a patented Italian construction system (ICOS). Yet the project was also facilitated by material networks firmly grounded in the region surrounding Montreal. Canada Cement Company used cement provided by two local manufacturers;[45] Miron Co., one of these, had established a new cement plant in the Montreal neighbourhood of Saint-Michel in 1960. This was located within the company's main limestone quarry, only eleven kilometres north-east of Place Victoria, and adjacent to other facilities of the company that included the production of ready-mixed concrete, concrete blocks, asphalt, aggregate processing, and a new kiln described at the time as the "largest dry process kiln in North America."[46] Located in Montreal's core and in close proximity to the building site, this quarry and plant likely provided the concrete for the Stock Exchange Tower's four corner columns, employing local labourers and moving concrete from quarry to building site throughout the construction process. In total, the structure of the Stock Exchange Tower used approximately 60,000 cubic metres of concrete. It used 14,000 metric tons of steel as reinforcement.[47] While the increasing standardization of reinforced concrete meant that its structural testing could be accurately carried out in Italy, to be transferred to a Canadian context, the use of concrete in Place Victoria was ultimately facilitated by changing conditions of extraction and labour in Montreal alongside growing expertise across the country. A finer analysis of this transfer in concrete formulas—with the hypothesis that Canadian technicians likely made their own alterations, following recommendations in the updated National Building Code[48]—might further reveal the role of national expertise and material translations.

CONCLUSIONS

The Stock Exchange Tower's concrete structure was completed in July 1964. The building—with its tower, five-storey podium base, and four storeys below ground that included a connection to the city's new metro system—was opened to its first tenants in December of that year. Introduced to audiences both within the nation and beyond Canadian borders as a symbol of "ultra-modernity," the project was upheld for its height and its structural ingenuity as the world's tallest reinforced concrete structure, as well as for its extensive integration of mechanical systems and electronic facilities. Much of that coverage recognized the collaborative aspect of the project through its phases of design and execution. Even Canadian critics such as Melvin Charney, however, insisted on crediting the "genius" of Nervi and Moretti for the success of the design,[49] reading the intervention of Canadian architects, engineers, and contractors as a legal necessity. Yet, while the "International Style" tower underlined increasing global connectivity in both its design and in its very function—with an electronically equipped trading floor connected to global trade networks and dependent on an abstract, international flow of capital—the examination of reinforced concrete reveals its dependence on local networks of materials and labour, including the highly specialized knowledge of local architects and engineers. The tower's design not only made use of and was altered in relation to local conditions but was made possible by them. In addition, this instance of increased postwar global connectivity, of transnational interactions of finance and technology, pushed innovation in both construction techniques and structural design not through the smooth circulation of knowledge across borders, but through an interaction of foreign expertise with the materialized friction of local regulatory bodies and climatic conditions. In the case of the Place Victoria in Montreal, this was grounded in concrete.

Today the Stock Exchange Tower occupies a quiet position in Montreal's skyline. Its interiors have been the site of tensions on multiple occasions: in February 1969, the Front de libération du Québec set off a bomb in the building's lobby, injuring 27 people. During the Quebec student strike in 2005, the same lobby was occupied by 150 students, blocking access to the elevators for two hours. The building and its primary function—even its name—clearly carry symbolic weight, rendering the tower a site of these localized frictions. By further looking at the history of its construction as a movement of knowledge and expertise (transnationally), and metabolic flows and divisions of labour (locally), we can begin to read this "International Style" tower as an intensely local, situated project. At the same time, this analysis offers a window into the broader influence of transnational collaborations on postwar Canada's built environment, and how these pushed forward technological knowledge in the Canadian context. Here, the offices of Luigi Moretti and Pier Luigi Nervi designed a concrete tower that was transmitted between Rome and Montreal, translated into locally feasible terms, and constructed in response to local climatic conditions and with local resources of labour and materials. This is an initial reading of these translations through the lens of one material; there is definitively more to read.

NOTES

1. Collins, Peter, 1966, "Stock Exchange Tower, Montreal," *The Architectural Review*, vol. 139, no. 832, p. 432-438, at p. 434.
2. *Id.*, p. 435.
3. Giedion, Siegfried, 1995, *Building in France, Building in Iron, Building in Ferroconcrete*, Santa Monica, Getty Center for the History of Art and the Humanities, p. 152.
4. Smil, Vaclav, 2014, *Making the Modern World: Materials and Dematerialization*, Chichester, John Wiley & Sons, p. 36-37.
5. The notion of concrete as a medium comes from Forty, Adrian, 2012, *Concrete and Culture: A Material History*, London, Reaktion Books.
6. While looking to these primary sources, this article also builds on previous research on the Stock Exchange Tower by scholars such as Sergio Poretti, Gianluca Capurso, Réjean Legault, and Orietta Lanzarini. The project has been most thoroughly examined by researchers based in Italy and has been published on more extensively in Italian—while this present article takes an alternate starting point and mode of analysis. See for example chapters in Reichlin, Bruno and Letizia Tedeschi (eds.), 2010, *Luigi Moretti: Razionalismo e trasgressività tra barocco e informale* [Luigi Moretti: Rationalism and Transgression Between Baroque and Informal], Fondazione Archivio del Moderno; or Lanzarini, Orietta, 2012, "Moretti e Nervi: Alcune considerazioni sul disegno della Stock Exchange Tower a Montreal (1960-1965)" [Moretti and Nervi: Some considerations on the design of the Stock Exchange Tower in Montreal (1960-1965)], in Paolo Desideri, Alessandro De Magistris, Carlo Olmo, Marco Pogacnik, and Stefano Sorace (eds.), *La concezione strutturale: Ingegneria e architettura in Italia negli anni cinquanta e sessanta* [Structural Design: Engineering and Architecture in Italy in the 1950s and 1960s], Torino, Umberto Allemandi & C., p. 89-99.
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