POURING ECCLESIASTICAL TRADITION INTO A MODERN MOULD
Reinforced Concrete Churches in Canada

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FIG. 1. VIEW OF WEST FAÇADE OF THE FIRST CHURCH IN CANADA FABRICATED FROM REINFORCED CONCRETE. ST. PATRICK'S ROMAN CATHOLIC CHURCH, MEDICINE HAT, ALTA. (1912-1914). ARCHITECT: MANLY N. CUTTER. | BARRY MAGRILL.

The expediency of modern architectural planning and execution overlapped the long period of the Gothic Revival's diminution into the early decades of the twentieth century.[1] European clientele readily accepted the rapid succession of new architectural vocabularies while their North American, and particularly Canadian, counterparts were pragmatic when venturing into new territory. Newness tended to be introduced in architectural circles in terms of the application and aesthetic charm of innovative construction materials; and, in looking at discourse generated around the ensuing debate, a locus of identification can be found in the manner reinforced concrete was both resisted and normalized in Canada prior to World War I. A particularly fruitful and overlooked subject is the assemblage of religious monuments in Canada using reinforced concrete. One of the earliest examples of reinforced concrete in a religious context comes, not as one might expect from a progressive branch of the Christian Church, but from the Roman Catholic Church of St. Patrick, Medicine Hat, Alberta (1912-1914) (fig. 1). Further complicating matters is the fact that Medicine Hat was a rural farming community where one might expect to find resistance to the sort of cosmopolitan ideas that reinforced concrete expressed outside of industrial usages. In fact, the building represents a brief moment in Canadian history when the legitimacy of new materials was tested alongside its structural validity, when a variety of print media grappled for a piece of the changing fortunes for reinforced concrete writ large as the Modern Age.

FIG. 2. DETAIL OF THE INTERIOR OF THE CHURCH TOWER REVEALING THE FORMWORK IMPRINTS LEFT BEHIND AS THE METHOD OF CONSTRUCTION. ST. PATRICK'S ROMAN CATHOLIC CHURCH, MEDICINE HAT, ALTA. (1912-1914). | BARRY MAGRILL.

During this brief moment as the second decade of the twentieth century opened, the benefits of innovative construction materials and processes inexplicably outweighed the traditionalist's view that the avant-garde was a danger to Roman Catholic ideology.

On the one hand, the client of religious architecture in Canada cautiously flirted with the idea of legitimizing the use of reinforced concrete in a religious setting. The adoption of new building materials and technical processes in religious contexts was delayed in its full implementation by church builders reluctant to appear allied with innovation and achievement in modern secular architecture and industrial engineering. Anti-modern sensibilities among the clientele for religious monuments rejected the cool simplicity of modern aesthetics typical of reinforced concrete on the grounds that it ventured into a cult of form. To them, concrete represented a material form bereft of meaning applicable to theological enterprise. On the other hand, the challenge for progressive architects, intent upon updating the tastes of their clientele of clergymen and church building committees, was to find an acceptable way to reconcile historical vocabulary with the reduced geometry and structural expression delivered by poured concrete. They were assisted by changes in the public's attitudes toward cost-saving measures, a social phenomenon attached to the increase of corporate influence in the social terrain. These shifts in attitude were accompanied by clashes between historicist and progressive factions, each of them intent upon controlling architectural output on a regional and national scale with St. Patrick's Medicine Hat acting as a quasi-focal point.

Concrete re-conceptualized a new space for architecture, and in the case of religious enterprise, it fashioned a homogeneous building poured from a uniform mould (fig. 2). This paper introduces the interplay of new technique and historicist architectural vocabulary, demonstrating how the marketing of new materials for construction was cloaked in a Gothic language palatable to Roman Catholic ecclesiastics. The primary focus of analysis is the social and aesthetic conditions that functioned to empower the use of reinforced concrete as an appropriate, if short-lived, expression of religious fortitude. From there, the investigation illustrates possible British design models and transatlantic precedents for the use of concrete technology in churches. Rather than contrast nineteenth- and twentieth-century modes of thought about religious architecture, my aim is to look for a meaningful transition between the distinct modes of Victorian and modern expression. This transition was global in scope but local in effect. Adopting a Canadian bias, this paper deliberately explores the regional and local impact of reinforced concrete on the construction of churches built in Canada, west of Manitoba.

SOMETHING/NOTHING NEW IN REINFORCED CONCRETE

To the builders of churches in the early decades of the twentieth century, the process of encasing metal bars inside Portland Cement (fig. 3) represented a technological intervention that clashed with the accepted expressions of religious symbolism. Christian symbolism had been primarily a Gothic architectural enterprise since Augustus Welby Northmore Pugin (1812-1852), John Ruskin (1819-1900), and the ecclesiologists (publishing *The Ecclesiologist* journal between 1841 and 1868) had equated truth with religious worship in the mid-1800s. They set in motion a powerful wave of the Gothic Revival that persisted in various strains until the 1930s, only a few years after twenty-four architects attempted to codify the principles of the Modern Movement and emphasize standardization over style at La Sarraz, Switzerland, during the 1928 Congrès international d'architecture moderne (CIAM).[2] As successive waves of the Gothic Revival spread out, over time and space, from the initial core beliefs, its principles dissipated and the movement lacked any coherent appearance. The Revival is imagined as an initially powerful wave cresting the high coast of Newfoundland, then losing momentum over fields of yellow Prairie wheat and finally flooding thinly up to the steps at St. Patrick's Medicine Hat where it appeared as a marriage of reinforced concrete and historical style.

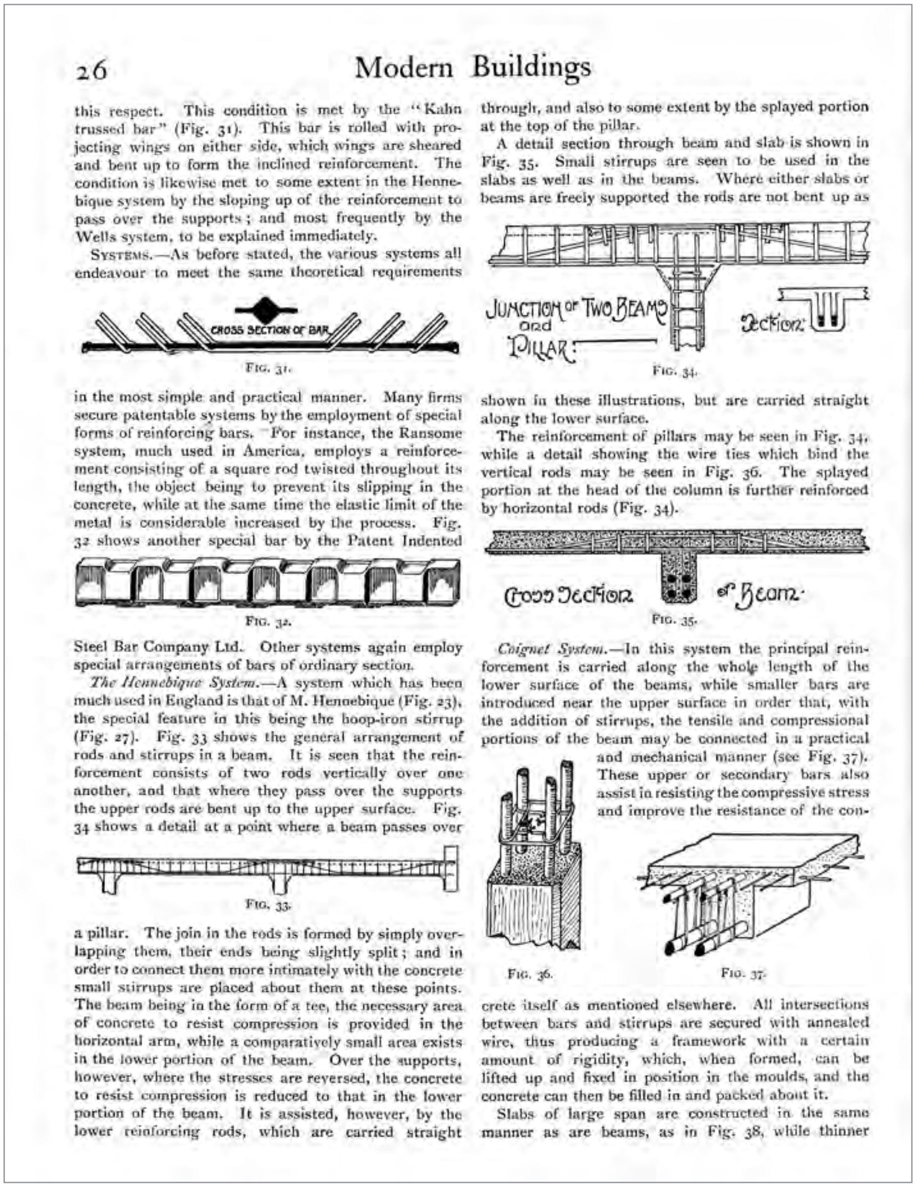
Might it also be possible that clergymen were channelling anxieties emanating from a general public distrust of reinforced concrete used in the industrial sector? The public's distrust of innovation and its fear of industrial accidents appeared to have weighed heavily against the opportunity of using reinforced concrete in churches. The collapse in a windstorm of a one-hundred-and-fifty-foot tall chimney owned by the C & J Michel Brewing Company at Las Crosse, Wisconsin, as reported in the *Canadian Architect and Builder*, appeared to be a relatively common catastrophe.[3] In Philadelphia, a three-storey office building built with reinforced concrete collapsed during construction in 1905, killing two workers and injuring thirty others.[4] It mattered not that the cause was human error; the public's anxiety was directed toward the new technical processes. This mishap clearly called into question the viability of church towers composed of steel bars encased in concrete. The process of poured concrete adhering to steel rebar must have appeared akin to alchemy to some religious authorities. At least it was clear that the ignorance about the material's composition underplayed public suspicion of reinforced concrete.

FIG. 3. DETAIL OF EXPOSE REBAR IN WALLING LOCATED INSIDE THE SPIRE. ST. PATRICK'S ROMAN CATHOLIC CHURCH, MEDICINE HAT, ALTA. (1912-1914). | BARRY MAGRILL.

To counterbalance the lack of public awareness about the efficacy of reinforced concrete, and because significant profits for the burgeoning construction industry were at stake, advocates worked diligently to achieve greater public acceptance of the composite product. To overcome Canadians' apprehensions of concrete, print media was engaged to broadcast a series of public service announcements about the safety and economic viability of reinforced concrete. The campaign to lift suspicions about reinforced concrete was directed chiefly toward industrial and commercial projects, including railway, roadway, bridge, and seaway expansions. One remark in this context was presented in a lecture to the Northwest Railway Club delivered by the principal of the Brayton Engineering Co. of St. Paul, Minnesota.[5] In it, Louis B. Brayton drew attention to the combined tensile and compressive possibilities, noting the inevitability of surface cracks. His position as both engineering professional and businessman illustrated the close relationship between economy and technology in the new game of publicity.

CONCRETE'S INDUSTRIAL GENESIS

Books and magazines in North America published a variety of formulas and opinions that originated with engineers, technicians, and labourers familiar with the history of poured concrete in European countries. Commentary in the twentieth century had its roots in hands-on knowledge of the technical processes since the late eighteenth century. In Britain, the civil engineer John Smeaton's experiments with hydraulic concrete in 1774 for the base of the Eddystone Lighthouse, Devon (England), advanced the technology in other European countries. In France, the inventor Joseph Monier's important patents for reinforced concrete, taken out in 1867, were subsequently sold to a series of larger architectural and engineering concerns. A.G. Wayss took over Monier's holdings, and in partnership with Rudolph Schuster he published the technological process in 1887 as *Bauten und Konstruktionen aus Zement und Eisen nach dem patentierten System J. Monier* [Building and Construction in Patented Reinforced Concrete Systems]. Wayss later joined with Conrad Freytag in 1892 and employed Emil Mörsch as engineering director, a figure who played a significant role in the developing science of reinforced concrete.[6] A multitude of technical processes were tried though only a few were fully adopted in construction, notably Visintini's prefabricated beam, Möller's T-beam, and Hennebique's T-beam system (fig. 4). François Hennebique succeeded in



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this respect. This condition is met by the "Kahn trussed bar" (Fig. 31). This bar is rolled with projecting wings on either side, which wings are sheared and bent up to form the inclined reinforcement. The condition is likewise met to some extent in the Hennebique system by the sloping up of the reinforcement to pass over the supports; and most frequently by the Wells system, to be explained immediately.

Systems.—As before stated, the various systems all endeavour to meet the same theoretical requirements

CROSS SECTION OF BAR

Fig. 31.

in the most simple and practical manner. Many firms secure patentable systems by the employment of special forms of reinforcing bars. For instance, the Ransome system, much used in America, employs a reinforcement consisting of a square rod twisted throughout its length, the object being to prevent its slipping in the concrete, while at the same time the elastic limit of the metal is considerable increased by the process. Fig. 32 shows another special bar by the Patent Indented

Fig. 32.

Steel Bar Company Ltd. Other systems again employ special arrangements of bars of ordinary section.

The Hennebique System.—A system which has been much used in England is that of M. Hennebique (Fig. 23), the special feature in this being the hoop-iron stirrup (Fig. 27). Fig. 33 shows the general arrangement of rods and stirrups in a beam. It is seen that the reinforcement consists of two rods vertically over one another, and that where they pass over the supports the upper rods are bent up to the upper surface. Fig. 34 shows a detail at a point where a beam passes over

Fig. 33.

a pillar. The join in the rods is formed by simply overlapping them, their ends being slightly split; and in order to connect them more intimately with the concrete small stirrups are placed about them at these points. The beam being in the form of a tee, the necessary area of concrete to resist compression is provided in the horizontal arm, while a comparatively small area exists in the lower portion of the beam. Over the supports, however, where the stresses are reversed, the concrete to resist compression is reduced to that in the lower portion of the beam. It is assisted, however, by the lower reinforcing rods, which are carried straight through, and also to some extent by the splayed portion at the top of the pillar.

A detail section through beam and slab is shown in Fig. 35. Small stirrups are seen to be used in the slabs as well as in the beams. Where either slabs or beams are freely supported the rods are not bent up as

Junction of Two Beams and Pillar:

Section:

Fig. 34.

shown in these illustrations, but are carried straight along the lower surface.

The reinforcement of pillars may be seen in Fig. 34, while a detail showing the wire ties which bind the vertical rods may be seen in Fig. 36. The splayed portion at the head of the column is further reinforced by horizontal rods (Fig. 34).

Cross Section of Beam.

Fig. 35.

Coignet System.—In this system the principal reinforcement is carried along the whole length of the lower surface of the beams, while smaller bars are introduced near the upper surface in order that, with the addition of stirrups, the tensile and compressional portions of the beam may be connected in a practical and mechanical manner (see Fig. 37). These upper or secondary bars also assist in resisting the compressive stress and improve the resistance of the con-

Fig. 36. Fig. 37.

crete itself as mentioned elsewhere. All intersections between bars and stirrups are secured with annealed wire, thus producing a framework with a certain amount of rigidity, which, when formed, can be lifted up and fixed in position in the moulds, and the concrete can then be filled in and packed about it.

Slabs of large span are constructed in the same manner as are beams, as in Fig. 38, while thinner

FIG. 4. ILLUSTRATION OF COMPETING REINFORCED CONCRETE SYSTEMS USED IN CONSTRUCTION. | *MIDDLETON, MODERN BUILDINGS: THEIR PLANNING, CONSTRUCTION AND EQUIPMENT,* VOL. 5, P. 26.

accelerating public opinion about reinforced concrete by showcasing his solution for the monolithic joint at the Paris Exposition of 1900 and publishing the technology in his corporate magazine *Le Béton armé* (Reinforced Concrete). Two years after Hennebique's participation in the Paris Exposition, his company was taking on international contracts.

In Canada, it was without surprise that considerable interest in reinforced concrete was directed toward the efficiency of industrial projects. In 1905, in the Strathcona area of Calgary, a reinforced concrete grain elevator was planned to accommodate a staggering holding capacity of one hundred thousand bushels.[7] A suite of roadbeds, bridges, and retaining seawall projects came to public attention, shedding light on the technical advantages of reinforced concrete. The Herculean nature of projects backed unofficially with civic and nationalizing intent involved political economy in a game of construction speed and cost management. These projects tapped into an unskilled labour pool arriving regularly from European countries, demonstrating modern processes called into the service of immigration. The application of reinforced concrete did not require skilled masons, only a knowledgeable and responsible foreman. With less reliance on craftsmen and masons, the new technical process in building had the potential to arrest craftsmanship at the same time as Canada was imagining itself into a nationalized and commercialized entity.

CRACKS IN THE SURFACE

Engineers disagreed about the formula that produced optimal adhesion between concrete and metal reinforcements. The public interpreted the absence of a unified voice in the industry as weakness that became attached to public reception of the product as a whole. The technique of mixing concrete appeared complex. Precise calculations were required in the proportions of the water, sand, cement, and stone. Adding to the confusion was the fact that there were several adequate recipes without there being a definitive one. Each new printed recipe claimed to have a superior mixture.[8] One professional noted that reinforced concrete was poured incorrectly in Canada, a country that did not use mixing machines, because lackadaisical workers allowed the mixture to cure in place for over an hour before pouring. They compounded their mistake by subsequently adding water, inviting disaster.[9] The complexity of mixing concrete required increased supervision on the construction site and

Canada may have lacked the necessary management expertise. More serious, still, was that the quality of reinforced concrete could not be verified until after it was dried. By then, it would be too late to make adjustments without seriously damaging the cost effectiveness of the process. Indeed, in the era of early reinforced concrete, an efficient and cost-effective method of demolishing ferroconcrete was not fully formed. Thus, the public's negative interpretation of this discord resulted in a distrust of the material's ability to permanently adhere to metal bars. In 1907, an article appearing in *The British Colonist* warned of the limited capabilities of reinforced concrete, claiming that the material had not surpassed minimal shear stresses. Its author advised readers to beware of cracks in reinforced concrete.[10] A month later, an untitled and anonymous article appeared in the same newspaper claiming that Portland Cement cracked after only six days because of flaws in the adhesion between concrete and metal.[11]

Tall buildings composed of reinforced concrete appeared particularly at risk. Highlighting the looming conflict, the *Canadian Architect and Builder* proclaimed the adoption of new building codes in Cleveland, Ohio, that placed a seven-year moratorium on reinforced concrete buildings exceeding six storeys until the claims about the material could be tested in practice.[12] Undeterred, the city of Calgary boasted the completion of its first reinforced concrete "skyscraper" office tower reaching eleven flights.[13] Any implication that U.S. building codes ought to be adopted in Canada clearly had little effect among the religious authorities in Medicine Hat, where the towers of St. Patrick's Roman Catholic Church rose to the impressive height of one hundred and fifty feet. It had begun to appear as though a building's height related directly to its marketability. The thinness of reinforced concrete walls promised to achieve unprecedented heights at economical expense. The local authorities in Medicine Hat appeared to have become more or less caught up in the idea of achieving great height at minimal cost.

The expense associated with attaining unprecedented height attracted the attention of the financial world, which took note of the cost effectiveness of reinforced concrete. Claims that the new material could support an economic recovery from the disastrous 1893 depression were evident, for instance, in a massive fish-freezing plant constructed of reinforced concrete by the Canadian Fish and Cold Storage Co. The plant boasted its reinforced concrete walling could withstand three hundred and fifty pounds per square inch of compression.[14] The problem unrecognized as such at the time was that cost savings were typically reserved for contractors and building owners. Thus, there was created an unresolved public anxiety directed at the speed of construction projects where reinforced concrete was concerned. This anxiety was manifested around the belief that contractors, sometimes lacking credibility as the middlemen of the construction world, might place cost savings and deadlines ahead of safety. The financial companies also built new branch offices using reinforced concrete. In 1910, the Bank of Montreal announced its intention to construct a service branch of reinforced concrete in the British Columbia town of Enderby.[15] The expansion of the economy in British Columbia's Lower Mainland, spurred ahead by agriculture, impacted the enlargement of the Vancouver Portland Cement Co., in 1907, increasing the demand for barrels of poured concrete beyond previous limits. People may not have understood the technical jargon associated with reinforced concrete but they easily grasped the concept of economic growth and the promise of wealth trickling down to the middle classes.

Advocates of reinforced concrete worked diligently to promote the material's usefulness as a way of combating public resistance.[16] They listed its qualities: cost effectiveness, resilience to time and weather, little skilled labour requirement, and most of all, fireproof factor. Protecting the public safety had already become a lucrative endeavour in a public sphere where new dangers were identified with remarkable regularity. Urban densification and fire had been a longstanding problem, now vigorously renewed in tandem with the growth of print media. Fires became one of the single most reported local incidents in newspapers, more frequent than mundane robberies, tragic murders, and shocking railway accidents. Eight years after the Paris Exposition, *The British Colonist* newspaper in Victoria, British Columbia, celebrated the "Approach of the Cement Age" by noting the importance of fireproof buildings. Reading into and out of the article, it became apparent that the increasing value of children as a family commodity coincided with efforts to ensure the safety of school houses. An illustration for a model school in plan and cross-section accompanied the article. It showed a multi-storey building with a central section linked by staircases called the "citadel of refuge." Putting reinforced concrete to its fullest use, the central hall became an internal "fire escape," allowing students to safely exit a burning building under the spray of water from a centrally located standpipe. Reinforced concrete was marketed as a superior fireproof material because it was thought to be capable of handling the extremes of heat and cold water without disintegrating. That is, the combination of metal encased in concrete was more than simply fire resistant, it was touted as the superior building material of the modern era.[17] Thus, one imagines children emerging safely from a devastating school fire, gleeful to leave their lessons and books behind them to fuel the flames.

Engineering and architectural textbooks describing construction methods were called upon to supplement the profession and enhance public acceptance of new materials. Painstaking detail was used in the textbook *Modern Buildings: Their Planning, Construction and Equipment* (1921) to show the physical properties of reinforced concrete using scientific methods of measurement. It listed the superior compression strength of reinforced concrete as four hundred pounds per square inch. Mathematical computation determined its tensile strength to be forty pounds per square inch, highlighting the potential weakness of beams only under careless or misguided design.[18] "Armoured concrete" was listed as twenty percent cheaper to construct than steel, it guarded against corrosion, and was adaptable to any required design. Science became a focal point used to alleviate the public apprehension about the accelerated pace of the modern age, including rail travel's ability to compress time and space. In 1906, the *Canadian Architect and Builder* described a "New Construction Company" that made a "specialty of speed in construction" and noted, the following year, that the prejudices of many engineers were changing because of the availability of reliable data.[19]

Despite claims to benefit the majority of citizens, reinforced concrete was generally restricted to large-scale industrial projects. With claims of superior efficiency, the Dominion Engineering and Construction Company, Limited (Montreal) guaranteed the completion of mining and industrial complexes. Dominion Engineering had formed precisely to capitalize on megaprojects recognizing the lucrative nature of the industrial market. Industrial buildings represented the lucrative commissions of the modern age that religious buildings had been up to the nineteenth century. The modern architectural office, teeming with draftsmen and project managers working on an agency model of high productivity, tended not to offer the intimate architect/client relationship of the nineteenth century. On a cost-effective basis, a large firm of architects, engineers, and businessmen succeeded financially using the "Gilbreth cost-plus-a-fixed-sum system."[20] The adoption of such a system coincided with the transition of architecture partnerships into large managerial efforts in which architects supervised the process of construction; artistry was left to draftsmen. The modern managerial office of architect partnerships benefited from the manufacture of new products such as the "Re-inforced Cement Block Company" of Vancouver, British Columbia. The company introduced, in 1906, "a new style of cement block [...] being composed of two sections held together by malleable steel braces, leaving a clear air-space of several inches to insure a completely dry wall under any conditions."[21] The existence of no less than two hundred manufacturers of concrete blocks was estimated around 1905, mostly producing cement blocks aesthetically disguised as richer materials.[22] One monumental church project in Western Canada took advantage of the speed of production associated with concrete block construction typically reserved for industrial complexes. Christ Church Anglican Cathedral in Victoria, British Columbia, selected concrete blocks for the load-bearing walls. The architect John Charles Malcolm (J.C.M.) Keith had won the competition to design the church in 1891, but financial difficulties delayed construction until the late 1920s, more than a decade after the arrival in force of concrete block manufacture. The authorities at Christ Church Cathedral must have been uncomfortable with the idea of using reinforced concrete, considering its free-form capabilities anathema to the truthful expression of historical styles. Only the foundation beneath the bell tower, installed in the 1950s, was reinforced concrete owing to the concern that the heavy bells would initiate collapse.

Discourse about the technical nature of reinforced concrete filtered into the public domain through magazines and builders' trade journals. In these periodicals, the reader was continually bombarded with messages about concrete's economical and structural benefits. Reinforced concrete trusses were installed to support the poorly assembled concrete floor, sagging and threatening to collapse above the chapel in the Maternity Hospital of Montreal.[23] Aesthetically the trusses presented no visual obstruction in the chapel as opposed to heavy pillars. Reinforced concrete's earliest extensive application in Montreal was believed to be the external walls of the American Tobacco Company on St. Anthony Street built by the Dominion Construction & Engineering Company.[24]

Many of these messages were laced with caveats. The architect Frank Gilbreth of New York wrote that reinforced concrete was suitable for architecture projects provided that air bubbles were not allowed to form in the poured mixture.[25] The conflicted discourses about reinforced concrete opened space up for various publications to proclaim to have superior knowledge. The London publisher Archibald Constable asserted that its pamphlet *Marsh's Reinforced Concrete* (1905) was "an event [that] gives a comprehensive account of what is known about the material," a claim giving itself credence by stating that "the use of reinforced concrete at present has the disadvantage of want of exact knowledge."[26] C.F. Marsh claimed to fill that void. In his book, Marsh alleged his own advantage by calling the Gothic design for Saint Jean de Montmartre, Paris (1897-1905), by Anatole de Baudot (star pupil of Eugène Viollet-le-Duc), "the folly of the century."

Moreover, aesthetic considerations were closely tied to theology and liturgy amongst conservative branches of Christianity. Anglicans' rejection of reinforced concrete was based on the objection to reducing architectural style to a series of constructional elements: beams, arches, walls, and foundations. They believed that pouring concrete into the formwork of a church removed artistry from the architect. The architecture of Anglican churches had relied upon the notion of taste and art since A.W.N. Pugin wrote his seminal text on "pointed" or Neo-Gothic architecture, *Contrasts: or, the Parallels Between the Noble Edifices of the Middle Ages and Those of the Present Day, Showing the Present Decay of Taste* (1836). Even though Pugin's views on archaeological precedent and the truthful use of materials reflecting theological truths had consistently been challenged by architects working for non-Conformist Christians and Roman Catholics, reinforced concrete represented a greater leap that was not immediately accepted into the lexicon of religious symbolism.

Much of this debate was rendered moot, when in 1908 a devastating earthquake struck Kingston, Jamaica, instilling the idea in the imperial consciousness that reinforced concrete buildings would be able to withstand such tremors.[27] Jamaican civic officials agreed that places attracting large groups of people, such as churches, needed to be constructed of reinforced concrete. However, the practical solution did not address the significant aesthetic concerns of religious authorities. At issue was the idea of reconciling modern technology, no less than political economy, with a historicist architectural language acceptable to a wide variety of Christian churches since before the Middle Ages. Clearly, a new visual language was required for modern churches. "Modern Gothic" was an early expression of the transitory phase where ornament reduced to basic linear qualities and smooth surface suited a technocratic society in which "engineers" dominated politics.

It remains to examine the architectural origins for adapting reinforced concrete in a religious context in Medicine Hat, Alberta. The monumentality of the church makes it clear that new technology was adopted to provide for grandeur and serviceability at a lower cost. Construction was completed in a fraction of the time it would have taken to erect load-bearing walls. But, still there was the question of achieving a convincing Neo-gothic aesthetic (since that was still the accepted language of church architecture) using poured concrete. Modern Gothic made its first brief appearance in Canada because a relatively small congregation of Roman Catholic parishioners identified with the grand edifices of medieval Europe but were unable to afford the cost of constructing a monumental stone building.

BRITISH MODELS FOR REINFORCED CONCRETE IN CHURCHES

European pioneers of reinforced concrete were awarded significant commissions for religious buildings that advanced the position of the new material. The architect Louis-Charles Boileau's Gothic design for the parish church in the garden city of the Le Vésinet Company (1864) received full honours above other historicist submissions. Against Boileau's wishes, the building contractor Francois Coignet opted to build the exterior shell of the church in reinforced concrete as a separate system of structural support from vaulted ironwork interior. With accidental daring he fabricated one of the first building envelopes. However, Boileau was incensed. He had wanted a subtler marriage of concrete and the completely cast-iron interior.[28] He invoked the legitimacy of tradition by asserting that his father, the architect Jouis-Auguste Boileau, had used a similar system to vault the church of Notre-Dame-de-France, London, in 1868.

The supportive role of vaults and arches tended to receive attention from architects and engineers searching for economical, virtually patentable, solutions. The architect and conservationist William R. Lethaby (1857-1931) used concrete slabs in the pointed tunnel vaults at the church of All Saints, Brockhampton-by-Ross, Herefordshire (built 1901-1903).[29] At St. Andrew's Roker, County Durham (1906-1907), the architects Edward S. Prior and A. Randall Wells constructed walls and parabolic arches of reinforced concrete cased in stone.[30] These new advances were not only a matter of expediency and efficiency but were also steps toward a lucrative architectural office, having cornered the market on a new and potentially indispensible structural system. As it were, the Holy Grail of modern

FIG. 5. VIEW OF INTERIOR OF SPIRE LOOKING UP. ST. PATRICK'S ROMAN CATHOLIC CHURCH, MEDICINE HAT, ALTA. (1912-1914). | BARRY MAGRILL.

FIG. 6. VIEW OF NAVE LOOKING EAST AND INTO THE AISLE THAT SHOWS THE SIMPLE PIERFORM MOULDING. ST. PATRICK'S ROMAN CATHOLIC CHURCH, MEDICINE HAT, ALTA. (1912-1914). | BARRY MAGRILL.

architectural practice was the invention of a new system that promised to change building processes and make its inventor rich in the due course. Lacking the key to reverse engineering, the inventor was the only man living who understood the nature of his creation, in a manner not dissimilar (though genders reversed) to the fabrication of Mary Shelley's monster. Through Shelley, Victor von Frankenstein truly apprehended the creation's soul, its merits and faults.

Reinforced concrete was advertised to withstand crises of a seismic nature in order to bring an end to the uncertainty of monumental building. Achieving a superior supportive structure was imperative in Guyana, well known for its earthquakes. The architect Leonard Stokes brought reinforced concrete to bear on an unstable site in the earthquake-prone country without sacrificing the strong Gothic silhouette. The composite material also bridged the void in skilled labour in Guyana as well as the lack of acceptable stone for load-bearing walls. The architect provided monumentality, maximum light penetration, massive fenestration, thin walls, and a solid envelope at Georgetown Catholic Cathedral of the Immaculate Conception (*c.* 1914) by calling upon reinforced concrete.[31]

Materials other than concrete were tried, most of them leading to dead ends. When, in 1905, the contract for the Methodist church of St. Sidwell in Exeter, Devon, was tendered to the French engineer Paul Cottacin, a method of threaded hollow red bricks tied with steel wires was attempted.[32] The architect Frederick Commin approved of the scheme, imagining it as structurally sound as representative of the future of architecture. One presumes the wires were supposed to provide the walling with flexibility unheard of in brick acting on its own, except that the laborious process of tying bricks together did not represent the rational system the profession was searching for. One problem was that the public were still wedded to bricks and mortar. A major part of the devotion to brick was aesthetic since the colour and texture of brick, as well as its local availability, had become intimately associated with urban life since the mid-nineteenth century. Brick was able to replicate almost any architectural style and the local availability of good clay in many urban centres made brick a desirable local material. A Lombardic effect was produced by Professor C.H. Reilly at St. Barnabus's Church, Shaklewell, North-East London (1910), where reinforced concrete and brick were employed. Reilly chose brick, wishing to eliminate any possibility for a bright future for reinforced concrete in any use except engineering works. He built his argument around the notion that the American skyscraper was tasked with advancing the terms of architectural expression rather than the efficacy of materials. But, only a year after Reilly dismissed the use of concrete, architect Edwin Lutyens produced the Free Independent Church, Hampstead Garden Suburb, Barnet (London), where reinforced concrete columns were used to uphold the concrete inner dome.[33] The weight of the dome seemed capable of putting the material to the test in the public domain.

With so many architects applying reinforced concrete to the task of redefining how churches should look in Britain and Europe, it is surprising that the same thing did not occur in Canada. This is especially interesting given the desire of Canadian practitioners to remain current with transatlantic developments in architecture. Do the circumstances around the construction of St. Patrick's in Medicine Hat shed some light on the potential reasons for reinforced concrete's delay in a religious context in Canada?

MODERNITY POURED INTO A NEO-GOTHIC MOULD

The Gothic Revival did not extend into the early part of the twentieth century as a coherent movement. A variety of positions taken on the criteria for Gothic design contributed to the fragmentation; some voices still decried Classicism, some insisted on the legitimacy of historicism, and others pushed for a vibrant response to modernity. The competition opened an opportunity for a few prominent architects to try their hand at whatever historical architectural style suited the projects awarded to them. Prominent among these men was the American architect Ralph Adams Cram, who daringly reasserted the Gothic Revival as a foil to the popular Richardsonian Romanesque style. He imagined that the restoration of the Gothic Revival was metaphoric of the restitution of "half the consecrated treasure [*sic*] torn from the Church and poured into the greedy laps of thieves and sychophants."[34] Over several decades, Cram's architectural practice and authorship worked out a type of "Modern Gothic" for religious buildings that claimed to understand functional and aesthetic problems of the modern era while holding in the highest esteem the religious character of the ancient past. However, Cram was in a camp all to himself. He neither associated with modernist ideals nor with the architectural application of reinforced concrete, preferring load-bearing masonry walls and brick-clad exteriors in religious buildings. His mention is integral, in this instance, however, because he advocated with such fervour on behalf of the Roman Catholic Church and he wrote proscriptively about religious architecture in the modern era. His rhetoric increased to a fevered pitch when on the subject of the symbolic power of cathedrals, a building type he noted was alone in its legitimate growth through the additions of chapels, altars, and major components. The cathedral, like the congregation, grew through faith. He believed that the failing of modern church buildings was the failure of modern technocratic and materialistic society. He abhorred the pretentiousness of the New York Cathedral but admired Albany, whose plan he thought exhibited the appropriate grandeur and sublimity.[35] But, Cram's assertions were not without reprisals.

The Canadian Architect and Builder published some acerbic responses to Cram's self-proclaimed "Modern Gothic," deriding it as a "display of function" rather than an "expression" of it.[36] This may seem a rather small point of contention but in fact it reached into the heart of Cram's "Modern Gothic" and marketable theory of architecture. The critic accused Cram of creating a thin veneer of surface ideas about Gothic rather than producing the true substance of architectural thought. Cram seemed deliberately resistant to addressing the problem of modern building materials. Reinforced concrete was found at the axis of the critique of Cram's so-called Gothic "display," no less than in the overthrow of tradition, as follows:

> One cannot affirm with certainty how the problem of concealed construction is to be treated. Invention is at work in building material, in great part in order to meet these very conditions of modern life—the employment of iron on construction and the desire to build fire-proof. We may conceive of our church designed in some casing material [...] We may think of reinforced concrete, with an exposed construction not at all (in bridges that have been built of this material) unsuggestive of a sort of work that would follow on well from the last stage of Gothic architecture in England.[37]

The "architecture of modern life" corresponded to a structural language, speaking of, and for, modernity. That language in church building was no longer legitimately described in stylistic terms—Neo-gothic, Neo-Grec, neoclassical—but in the expression of verticality, itself. "A question of vertical pressure on vertical walls, and any structural form into which the walling is cast will be designed not to enable the wall to carry its load the better but to express better the fact that it carries it."[38] Structural merits played a critical role in establishing a reservoir of cultural expression. With apparent normalcy, the awakening of modern society

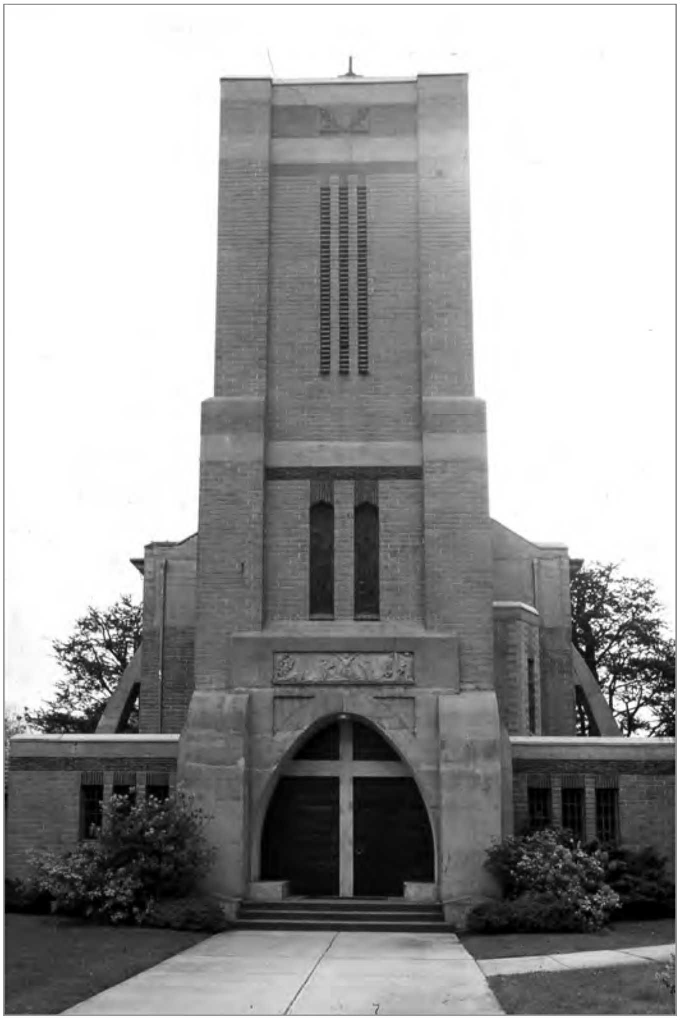

FIG. 7. VIEW OF THE WEST FAÇADE OF ST. JOHN'S ANGLICAN CHURCH, SHAUGHNESSY, VANCOUVER, B.C. (1949). | BARRY MAGRILL.

FIG. 8. DETAIL OF BUTTRESS, VIEW OF THE SOUTH SIDE OF ST. JOHN'S ANGLICAN CHURCH, SHAUGHNESSY, VANCOUVER, B.C. (1949), SHOWING THE TRAJECTORY OF THE REINFORCED CONCRETE BUTTRESSES. | BARRY MAGRILL.

occurred in tandem with the quest for height. With high-rises in Chicago and New York overtaking churches as the tallest edifices, and by implication the most compellingly modern, serious reflection upon the merits of reinforced concrete's ability to reach the heavens had to be re-evaluated.

Reaching for impressive heights, the spires of St. Patrick's Church brought to bear advanced technology to achieve a unique structural showcase (fig. 5). The shell of reinforced concrete poured into a historicist mould demonstrated that the Roman Catholic population of Medicine Hat was willing to push the envelope of architectural materials.[39] The Neo-gothic design by the New York architect Manly N. Cutter was not speaking the same sort of language as Cram's Gothic. The building was huge on a Canadian scale, but its single building phase limited its monumentality, in Cram's sense of things. St. Patrick's is a historicist version of the Gothic Revival twenty or thirty years past its prime, almost encased in concrete as though an immense container of the material had been poured over a Victorian building and dried that way. Cutter's design included a double western tower, short transept arms, and semi-circular east end modeled chiefly on St. Patrick's Roman Catholic Cathedral in New York (1878). Cutter knew that building well since he had practiced in New York as of 1880, later taking a job as staff architect for the New York Building Plan Company from 1886 to 1892 where

FIG. 9. EXTERIOR VIEW OF ST. JAMES ANGLO-CATHOLIC CATHEDRAL, VANCOUVER, B.C. (1935). | BARRY MAGRILL.

FIG. 10. POSTCARD OF GOLDER'S GREEN CHURCH, LONDON (1925). | ARCHIVES OF ST. JAMES ANGLO-CATHOLIC CATHEDRAL, VANCOUVER, B.C.

he produced their pattern book entitled *The New York Building Plan Co. Illustrated Catalogue of Examples of Buildings* (1887). With the publication of this book, the youthful Cutter must have felt as though his future in architecture was secure. However, important commissions were not forthcoming. By 1909 he had moved from New York to settle in Monclair, New Jersey, where he was listed as a solo practitioner. He must have struggled in New Jersey as well because the commission of the church in Medicine Hat was one of his largest awards. He had amassed the varied portfolio of a second-rate architect competing for work, expanding into interior design and decoration to make a living. He designed a "snoring room" for a wealthy client.[40] Then, he provided Anglo-Japanese wall decorations for the home of Henry G. Marquand, president of the Metropolitan Museum of Art in New York.[41] Lacking experience, it is no surprise that Cutter leaned so heavily on the Roman Catholic Cathedral in New York for the Medicine Hat design.

At Medicine Hat, the program of ornamentation was reduced to a simple format without completely pursuing the pure geometric expression of European modernism. Clearly, there was a lack of technical expertise to form Gothic details in concrete moulds. A kind of artificial Gothic resulted in an edifice that appeared monolithic. The crisp lines of the buttresses that extend upward to form conical turrets and the simplified tracery in the towers create the impression that the shell was produced from a single mould (fig. 6). Its smooth wall surface emits a kind of cool, clean sterility. The mouldings articulating the multiple orders of the west entrance and above the gables appear counterfeit. That is, the poured concrete showed no joints, as would have existed had stone been used. Consequently, the viewer's eye recorded a homogeneous structure. This was not a favourable aesthetic. Cutter circumvented the type of advice given by the Boston architect C. Howard Walker at the 1908 American Institute of Architects convention. "A reinforced building is very apt to express itself tolerably well if none of the architectural detail applied to it is in imitation of stone, brick, or wood forms."[42] The character of St. Patrick's Church appeared contrary to the lightness of its construction. Indeed, its monumentality seemed derived from two things: the stability of its materials and the monophonic reproduction of medieval Gothic. From a distance it has the appearance of a great grey piggybank lacking the coin slot.

How might this all have come about? The introduction of reinforced concrete in a religious context at St. Patrick's relied upon a historicist treatment of the new production technique. What transpired was a "perfect storm" of circumstances. First, the Roman Catholic Church, which commissioned the building, rarely objected to the opportunistic use of building materials provided they were upgraded in appearance. St. Patrick's exterior looks like stone; its ornamentation opposes the customary modernistic geometric abstraction typical of Le Corbusier or Alvar Aalto. Furthermore there were no recorded objections to the link between the fabricated materials hiding the rebar inside of the concrete. The Roman Catholic authorities and the general public appear to have approved of concrete provided a historical style was chosen, at least in the absence of particular discourse to the contrary.

Second, Medicine Hat was located in an agricultural cum industrial region, so residents were accustomed to large concrete structures. The monumental scale of St. Patrick's was a matter of civic pride, especially since its use of technology symbolized the town's advanced position within modernity. Third, a local contractor was capable of pouring concrete to the required specifications. These factors combined to make possible the introduction of reinforced concrete in a rural place and where the material was tested for the first time in a religious setting in Canada. Ultimately, Cutter's historicism emulated, but could not live up to, the precision demonstrated by Auguste Perret at the Théâtre des Champs-Élysées in Paris (1912-1913).

In Vancouver, British Columbia, two other churches built of reinforced concrete illustrate how the technology developed subsequent to its initial use on the Prairies. At St. John's Anglican parish Church, Shaughnessy, Vancouver (1949) (fig. 7), the structural rationale of reinforced concrete was chiefly concealed but visible in the curvature of the buttresses (fig. 8). On a longitudinal axis, the building was comprised of nave, side aisles, and eastern apse with the whole lit by clerestory windows. All of this, including a western tower integrated into the main body of the building expressed a historical theme. The reinforced concrete construction was concealed behind a brick veneer and the aggregate material, on the tower, was scored to resemble masonry. Only the arched trajectory of the buttresses suggests reinforced concrete application and introduces the modern Gothic interior space. Above the nave interior, a quasi-barrel vault veneered in wood is supported by a system of transverse arches projecting deeply into the interior. The unadorned chancel arch follows the same parabolic trajectory as the buttresses. The transverse arches communicate with the curved form of the unique buttresses.

A deeper commitment to modernist sensibilities transpired at St. James Anglo-Catholic Church, Vancouver, British Columbia (1935) (fig. 9) constructed to replace a decayed timber edifice of the late nineteenth century. The site was problematic, sandwiched between the church hall and the clergy house, leaving an irregular plot. Father Wilberforce Cooper, and his cohort in England, Father Harker, consulted Giles Gilbert Scott, grandson to the famous British architect Sir George Gilbert Scott. Giles, who claimed to be unavailable, recommended them to his brother Adrian Gilbert Scott, an architect known primarily for post World War II housing reconstructions and an Anglican church in Egypt. The brothers operated out of the same offices. For St. James, Adrian devised a means of bringing the entrance to the street corner, using the maximum footage available on site, and maximizing seating for five hundred. He used an octagonal shaped worship space elongated to the west with a gallery above. The interior was broad, open, and dynamic.

Reinforced concrete permitted a kind of animation to the elevation that nevertheless did not fully escape historical citation. The massing of the octagonal tower could be read as a reference to the fourteenth-century Octagon of Ely Cathedral. However, a closer parallel existed that originated in the offices of Giles Gilbert Scott. I would suggest that the plan and elevation of St. James in Vancouver was modeled on St. Alban's, Golders Green, London, designed in 1925 by Giles Gilbert Scott but not executed until 1933 (fig. 10). The planning and elevations are virtually identical. St. Alban's conceals its reinforced concrete core beneath a brick clad exterior. Adrian likely borrowed the design of his older and more famous brother, Giles, in the sense that he was partaking of family property. Though none of the numerous letters between Adrian and Father Cooper at Vancouver discuss architectural styles and specific models, a postcard of St. Alban's was found among the items in the St. James archives, making it highly likely that the priest knew of the connection.

St. James, Vancouver, stops just short of attempting a modernist approach. It romantically clings to the fourteenth century with hints of crenellations along the tower and grouped lancet windows and a stair turret. The execution of the design by the Gilbert Scott offices avoided ahistorical principles of composition holding the character of the church firmly within an expected modern Gothic vocabulary. The reluctance to fully reject history coupled with the anxiety over a new language that broke with the past provided contradictory impulses. St. James in Vancouver, no less than St. Patrick's in Medicine Hat, demonstrated that Canada's natural tether to Britain was stretched according to the potential of new materials. It is a good thing that reinforced concrete was so flexible. A hint of the anxiety about the acceptance of reinforced concrete in a religious context was appropriately marked by the lieutenant governor of Canada, Lord Tweedsmuir (aka John Buchan, author of *The 39 Steps*), on the occasion of the consecration of St. James in 1935. Standing on the concrete steps of the church and facing an excited crowd filling the intersection of Cordova and Gore Streets, Lord Tweedsmuir remarked:

> We moderns are committed to that material [reinforced concrete], and the sooner we get over our false modesty about it, the better for our taste and our pocket-book. To our stubborn minds, concrete

still seems naked, and we must cover it up with a costly sham of tile and brick or granite [note he is talking about concrete and not modern or free design]. It seems hard to learn that mere face-painting is bad architecture. Steel and concrete lend themselves not to petty surface decoration but to severe lines and great masses. How superb the best results are you may see in the Golden Gate Bridge at San Francisco. Like all good buildings it belongs to the age in which it was built. There is no real need for the date 1935 on its corner-stone. It belongs to these present years as certainly as a new symphony of Sibelius. But again, like all genuine art, it has behind it the impulse of a tradition. They tell me that the general style is fourteenth-century Gothic. What else would a Catholic church desire? It shows the past and present in one vast surge aloft.

NOTES

1. I am indebted to Professor Malcolm Thurlby of York University who provided the comparative materials, lists of churches, and read early drafts of the manuscript. Without his participation I can attest that this article would not have seen print.
2. A fuller discussion of CIAM may be found in Frampton, Kenneth, 2007 [4th ed.], *Modern Architecture: A Critical History*, London, Thames and Hudson, p. 122 and 269-279.
3. *Canadian Architect and Builder*, 1907, vol. 20, no. 8, p. 159.
4. *Ibid*.
5. *Canadian Architect and Builder*, 1905, vol. 18, no. 7, p. 106.
6. Kurrer, Karl-Eugen, 2008, *History and Theory of Structures: from Arch Analysis to Computational Mechanics*, Berlin, Ernst & Son, p. 513.
7. *The British Colonist*, app. May 23, 1905.
8. Middleton, George Alexander Thomas, 1907, *Modern Buildings: Their Planning, Construction and Equipment*, London, Caxton Publishing Co., vol. 5, p. 31-35.
9. *Canadian Architect and Builder*, 1904, vol. 17, no. 12, p. 202.
10. *The British Colonist*, May 12, 1907, p. 24.
11. *The British Colonist*, June 2, 1907, p. 19.
12. *The British Colonist*, April 27, 1910, p. 1.
13. *Ibid*.
14. *The British Colonist*, June 4, 1908, p. 30.
15. *The British Colonist*, April 3, 1910, p. 31.
16. American manufacturers of reinforced concrete products organized into associations for political lobbying as opposed to brick manufacturers who remained independent.
17. *The British Colonist*, June 28, 1908, p. 12.
18. Middleton : 33.
19. *Canadian Architect and Builder*, 1907, vol. 20, no. 9, p. 168.
20. *Canadian Architect and Builder*, 1906, vol. 19, no. 1, p. 6.
21. *Ibid*.
22. *Canadian Architect and Builder*, 1905, vol. 18, no. 7, p. 106.
23. *Canadian Architect and Builder*, 1904, vol. 17, no. 9, p. ix.
24. *Canadian Architect and Builder*, 1906, vol. 19, no. 9, p. 137.
25. *Canadian Architect and Builder*, 1907, vol. 20, no. 9, p. 191.
26. *Canadian Architect and Builder*, 1905, vol. 18, no. 3, p. 35.
27. *The British Colonist*, July 26, 1908, p. 30.
28. *Ibid*.
29. See Goodstein, Ethel S., 1995, "Portrait of a 'Modern' Victorian Church: W.R. Lethaby's All Saints Church, Brockhampton," *Victorian Institute Journal*, vol. 23, p. 85-107. Also, Rubens, Geoffrey, 1986, *William Richard Lethaby: His Life and Work, 1857-1931*, London: Lund Humphries, 1984.
30. A reliable source remains Garnham, Trevor, 1996, *Edward Prior, St. Andrew's Church, Roker, Sunderland, Architecture in Detail*, London, Phaidon.
31. *The Builder*, 1914, vol. 107, November 13, p. 454.
32. See [http://www.exetermemories.co.uk/em/_churches/sidwellmethodist.php].
33. Collins, Peter, 2004, *Concrete: the Vision of a New Architecture*, Montreal, McGill-Queen's University Press, p. 84.
34. Cram, Ralph Adams, 1901, *Church Building: A Study of the Principles of Architecture in Their Relation to the Church*, Boston, Small, Maynard & Co., p. 7.
35. *Id.* : 191-203.
36. *Canadian Architect and Builder*, 1905, vol. 18, no. 1, p. 9.
37. *Ibid*.
38. *Ibid*.
39. For a brief description of Manly Cutter see [http://www.dictionaryofarchitectsincanada.org/architects/view/1012].
40. *The American Architect and Building News*, 1889, vol. 26, no. 723, p. 201.
41. *New York Times*, April 16, 1905.
42. *Canadian Architect and Builder*, 1908, vol. 22, no. 2, p. 22.