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Concrete Complexities: Reinforced Concrete in the Architecture of Auckland's Town Hall, Chief Post Office and Ferry Building

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Abstract

Economic prosperity and the changed political circumstances resulted in increased building activity in the pre-First World War New Zealand. Auckland, the country's largest city, was not an exemption. Queen Street, the main civic and mercantile axis of New Zealand's capital of commerce, acquired three new landmark buildings, constructed simultaneously between the years 1909 and 1912. The three buildings – Auckland's Town Hall, Chief Post Office, and Ferry Building – still remain important historic monuments of Central Auckland. Focusing on the materiality of the three buildings, this paper contributes to the study of early history of reinforced concrete in New Zealand. The relations between the innovative structural material and historicist architectural language of the three Queen Street buildings are discussed in context of the early 20th century socio-political and cultural circumstances. The paper demonstrates that there was no tension between the use of cutting edge construction technology for the structure and the Edwardian Baroque for the architectural envelopes of the three buildings. In fact, both the materiality and the architectural language were considered to be indicative of the development the city and the country were undergoing.

Introduction

The early 20th century marked a golden period in New Zealand history. The country's economy was recovering from the 1880s and 1890s depression; the socio-cultural matrix was transforming as the old towns were growing; the transition of New Zealand from a colony into a dominion altered the political climate. Auckland, New Zealand's Queen City, was not untouched by the changes. "Progress", "development", and "prosperity" were the period's leitmotifs, colouring every aspect of the city life. A stronger economy, the development of public institutions, and an increased population influenced growth in the construction industry.

The erection of numerous buildings transformed central Auckland into a large construction site in the first two decades of the 20th century. The majority of the new structures were constructed of stone and brick, with limited use of reinforced concrete. Though at the first decades of the

20th century reinforced concrete was used only partially – mostly in the construction of foundations, floors and stairs – the innovative material was a popular topic, widely discussed in lay and professional circles. The early employment of reinforced concrete was well documented by the press and interpreted as a sign of progress and prosperity. However, in spite of the increased interest in new building technologies, the architectural language of the newly erected structures remained confined to the 19th century practices of historicism. Combinations of past architectural styles continued to dominate the urban scenery of Auckland.

Queen Street, Auckland's commercial throughway, acquired three landmark buildings between the years 1909 and 1912. The Town Hall, the Chief Post Office and the Ferry Building to this day remain historic landmarks of the city centre, and can be seen as examples of broader early 20th century construction practices. The large-scale construction projects in Auckland attracted extensive press coverage in the first decades of the 20th century. The Town Hall and the Ferry Building were celebrated as symbols of civic pride, and the Chief Post Office as a testimony to national progress.¹ Henry L. Wade, the president of the Auckland district branch of the New Zealand Institute of Architects, noted the significance of the three buildings and of reinforced concrete, in an interview in 1911:

It is pleasing to note that the Government and the municipal authorities are waking up to the fact that it is high time more importance and character were attached to design, and the materials used in the construction of our public buildings... Of such structures, three buildings now nearing completion in Auckland might be mentioned, the new Chief Post Office, the Town Hall, and the Harbour Board's new Ferry buildings, all of which are constructed of stone, brick, and reinforced concrete. The latter material will doubtless play an important part in our building programme of the future...²

Conservation and renovation projects, conducted since the 1980s, classified the three structures as unreinforced masonry buildings.³ In contrast, the early 20th century press advertised them as both earthquake- and fire-proof edifices, due to the structural application of ferro-concrete. This paper explores the extent to which reinforced concrete was used in each of the three edifices. How did period commentators align the historicist architectural language of the buildings and the introduction of the technologically advanced new material? The paper shows that in fact both the language and the materiality were associated with the confidence and progress of the Edwardian period.

Edwardian Landmarks of “Progressive Auckland”: Architectural Style as an Expression of Contemporary Circumstances

Distinctive features of Auckland’s central cityscape and valuable historic monuments, the Town Hall, the Chief Post Office, and the Ferry Building have been well documented in New Zealand architectural historiography.⁴ Prevalently focused on their stylistic qualities, the researchers placed the buildings amongst the country’s most successful achievements of Imperial Baroque architecture. Unlike these earlier texts, this paper is focused on the materiality of the three Queen Street structures. The relations between the new structural material and architectural language of the buildings are discussed in the context of broader historic conditions. Furthermore, based on the study of period sources, the paper proposes that the three buildings should be considered together. Documenting the general attitude that public buildings were a suitable expression of socio-economic and political conditions, the early 20th century press singled the three edifices out as the three most significant construction projects in Auckland.

The future direction of New Zealand towns and cities rapidly gained traction at the turn of the century. The development of Auckland was closely related to the concurrent building programme, described by the press as a “practical illustration of the steady progress” the city was making.⁵ “Building reports” on the new structures erected across the city were published regularly. The “handsome shapes” and the structural qualities of the new buildings were widely discussed. These articles traced the latest architectural stylistic trends and the use of innovative building technologies, perceiving them as an expression of up-to-date quality and progress.⁶ The new buildings were interpreted as symbols of the city’s bright future and were a matter of great public interest. They were considered to be a reflection, or better yet, proof of the betterment the city – and the country – were experiencing. The buildings’ patrons – the Auckland municipal authorities in the cases of the Town Hall and the Ferry Building; the New Zealand Government for the Chief Post Office – were determined to create durable architectural pieces, expressive of contemporary circumstances, and suitable for generations to come. To do so, two strategies were implemented.

First, the architectural language found to be the most suitable for the patron’s intentions was chosen. Period sources documented the importance placed on the fact that the three buildings were shaped in the latest fashion – the style often referred to as the “English”, “modern” or “free interpretation” of the Renaissance. Popular throughout the British Empire and based on the long line of culturally legitimised precedents, Edwardian Baroque was considered as the most appropriate style for important public buildings. Furthermore, prominent overseas architectural solutions were used as a source of formal inspiration.

The New Zealand Governor himself, the Right Honourable Lord Islington, noted at the opening ceremony of the Auckland's Town Hall in 1911 that "an adequate and appropriate building should be provided for those who are selected by their fellow citizens to control and administer that service."⁷ The Governor's opinion was that such a building should be central in situation, spacious in dimensions, and dignified in appearance. John and Edward Clark, the Melbourne architects who won the design competition for the new Auckland Town Hall, aspired to those architectural qualities.⁸ Though their solution was not unanimously welcomed by the Auckland public and a few loud voices rose against it,⁹ it was generally agreed that the building was a "true sign and symbol of Auckland's arrival at full municipal maturity."¹⁰ On the other hand, a connection to Britain was made obvious by the similarity to the Lambeth Town Hall, built in London in 1908. Both buildings were constructed on a triangular site, in the style of Edwardian Baroque. Facades of Auckland Town Hall were modelled unpretentiously, with a moderate application of architectural ornament. Slender Ionic pilasters and columns create the rhythm of the long horizontal facades. The building's corner is accentuated with an elliptical apex. Radiating institutional significance of the structure, the apex is surmounted by a tall clock tower – a traditional symbol of civic prosperity, capped with a cupola. Combining council administration and public entertainment, the building's interior was divided between offices at the front, and two large public halls at the rear.

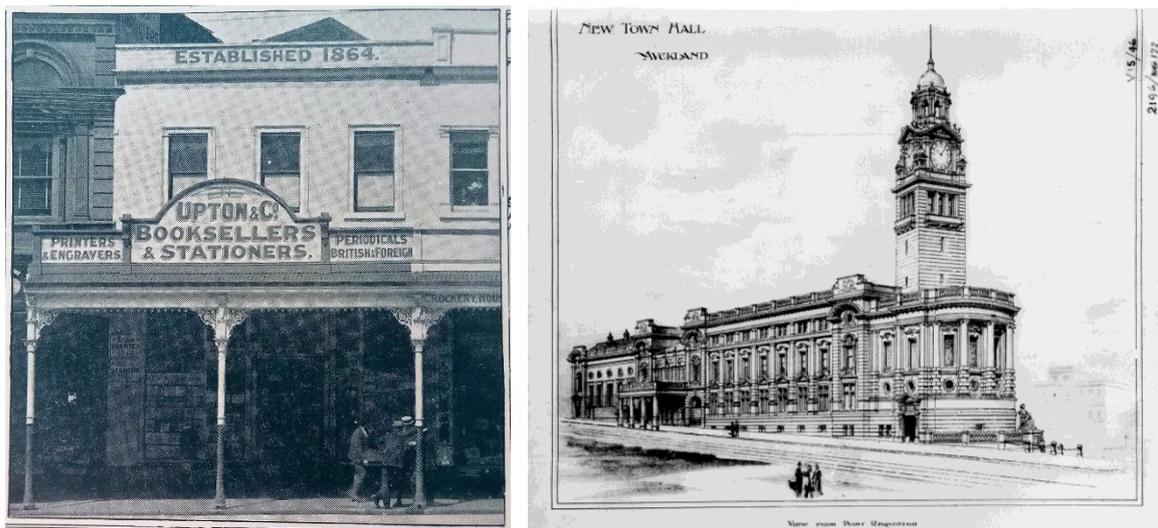


Figure 1. Left: The First Municipal Offices in Upton & Coy's Shop, Queen Street (Auckland Council Archives, ACC 398 Publications 1903-1908, Record No. 400048); Right: New Town Hall (Auckland Council Archives, AKC 033 City Engineers Work Plans Aperture Cards 1872-1993, Record. No. 2196-172).

Another landmark of civic pride and Auckland's self-confidence, the Ferry Building was the first major historic structure a visitor would notice approaching Auckland by sea.¹¹ One of the

most imposing port buildings in New Zealand, it was designed by the architect Alexander Wiseman, and built between 1909 and 1912.¹² Celebrating Auckland's status as the country's biggest and busiest port, the ornate Imperial Baroque structure was erected by the city's Harbour Board, as a part of the costly reorganisation of the docks. Highlighting that "at no point is the progress of Auckland more in evidence than along the waterfront," an article published in 1911, maintained that the Ferry Building was one of its "most striking improvements."¹³ The monumental design was a testimony of the city's aspirations to become one of the leading Southern Hemisphere ports. The warm colour palette remains an appealing design feature, uncharacteristic for other Edwardian buildings of the period constructed in Auckland.

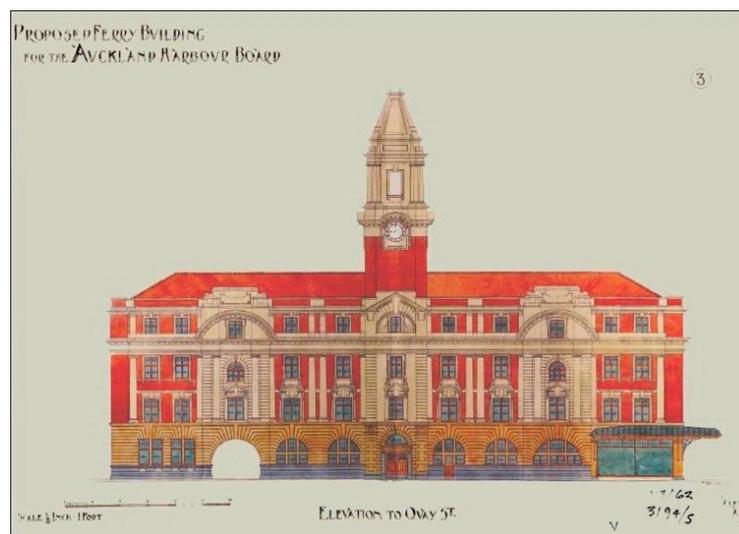


Figure 2. Proposed Ferry Building for the Auckland Harbour Board (Auckland Council Archives, ACC 015, Record No. 3194-5).

Contributing to the hub of the city's transport and communication systems, Auckland Chief Post Office was built in close proximity to the Ferry Building, at the foot of Queen Street. Designed by the Government architect John Campbell, and Claude Paton, it was constructed 1909-1912.¹⁴ The imposing Edwardian Baroque edifice reflected the significance of the postal service as a Government network for public welfare. Described as "a milestone in the progress of the city,"¹⁵ the Chief Post Office was a sister building with the one constructed concurrently in Wellington. Both buildings were stylistically, as well as structurally, related to Sir Henry Tanner's General Post Office in London.¹⁶ The similarities with the London example were proudly acknowledged at the opening ceremony of the Auckland Post Office.¹⁷



Figure 3. General Post Office, 1912. (Auckland Star: Negatives. Ref: 1/1-002894-G. Alexander Turnbull Library, Wellington, New Zealand. [/records/23210653](#)).

Innovative Building Technologies in the Service of Progress: Reinforced Concrete in the Auckland Town Hall, the Chief Post Office, and the Ferry Building in Auckland

The second strategy used in “building for the future” – the construction of important public architectural monuments – was the employment of cutting-edge building technologies, and making certain the public was well informed about this effort. At this stage, in the years before the First World War, the use of reinforced concrete was not yet as developed as it would be in the years to come. It was partly applied in the construction of buildings, mostly for the foundations, floors and stairs. However, its employment was always publicly advertised, and directly associated with the notion of progressive and prosperous Auckland.

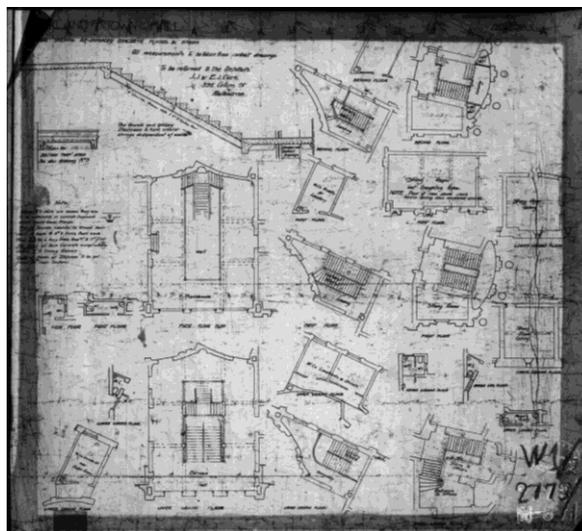


Figure 4. Auckland Town Hall: Drawing Showing Reinforced Concrete Floors and Stairs. Detail No. 9 (Auckland Council Archives, AKC 033 City Engineers Works Plans Aperture Cards 1782-1993, Record No. 2773-1).

The structure of the three Queen Street landmarks attracted a great deal of public attention in the early 20th century. However, though the period sources stressed the structural use of reinforced concrete, the Auckland City Town Hall, the Chief Post Office, and the Ferry Building were mostly constructed of unreinforced masonry. In fact, in the structure of the Town Hall building, reinforced concrete was used only in the construction of the Queen Street retaining wall, the floors and the stairs.¹⁸ In contrast, an article published after the winning design was selected highlighted that “a fine structure was proposed,” with fireproof elements of reinforced concrete.¹⁹ Both the lengthy study of the new Town Hall building, published in the May 1909 issue of *Progress*, as well as the booklet published two years later for the opening ceremony, praised the arrangement of the building’s reinforced concrete foundations. They described this as a special feature of the construction, and stressed that the method of piers and beams, reinforced with Kahn steel bars, had previously been used by the architects in several important buildings in Australia.²⁰ Similarly, a report on “buildings in progress” noted that the Ferry Building stood on a foundation of ferro-concrete piles and that all the floors were laid down in the same material, “rendering the building practically fireproof.”²¹ The Chief Post Office in Auckland was built upon 260 reinforced concrete piles. The material was also used for the floor of the ground floor and for the roof structure. A period source concluded that “the building will thereby be greatly strengthened, and rendered immune from the threat of fire from either the basement or the floor.”²²

Encapsulating the extent of public interest in the matter, a period source noted that, ever since the use of reinforced concrete was first proposed by engineers for the construction of Auckland wharves, “it is improbable that any other subject has been more generally a topic for discussion and controversy on the part for both press and public.”²³ Why was reinforced concrete such a popular topic in the early 20th century New Zealand?

In his major and so far unsurpassed study, Geoffrey Thornton demonstrates the long history of concrete construction in New Zealand.²⁴ Earlier positive experiences with unreinforced concrete set the stage for the introduction and acceptance of reinforcing. Cultural, socio-economic and political circumstances of the period also played an important role in the acceptance of the new material. In the atmosphere of the growing self-confidence and national pride, the impetus to look forward, to celebrate the future, permeated everyday experience. New Zealanders heeded the raucous call of the Machine Age. Latest inventions remained a popular topic in the first decades of the 20th century; new technologies were eagerly employed

and broadly advertised. Ferro-concrete was praised for its innovativeness, advertised as “the modern *iron-stone* – a material which promises a revolution in building schemes.”²⁵ An article from 1908, published in the *Auckland Star* newspapers, proclaimed that “wood, like the stone axe, has had its day, and as far as huge constructions are concerned, we are largely entering into the cement age.”²⁶

Furthermore, New Zealand prosperity and civic and national pride needed to be plastically expressed. And what better way to do so than to build? Grand public buildings were erected prior to the First World War, giving the historical circumstances empirically observable forms. However, all that building activity came at a price. In the good Protestant tradition of frugality, employing a cost-effective, earthquake- and fire-proof, durable material was the most obvious choice. Furthermore, the international context was relevant for the development of New Zealand national identity. Reinforced concrete was promoted through its association with state of the art construction overseas. Pride was taken in the fact that, remote as it was, New Zealand kept pace with the world.²⁷ On the other hand, connections with Imperialism and another important precondition of political legitimacy – the civilizational demand for longevity – were expressed through frequent comparisons with the building practice of Ancient Rome. For instance, the Wellington architect, James O’Dea, maintained that reinforced concrete will soon supersede all other building materials, “for not alone is it fireproof and earthquake-proof, but its age is as unlimited as that of the aqueducts and bridges built by Rome when she was mistress of the world.”²⁸

The media actively contributed to the wider popularisation of the new material. An article published in 1907 informed the public that ferro-concrete, reinforced, or armoured concrete, “which are one and the same thing under different appellations, has come to take its place amongst the leading methods and materials adopted in structural works in New Zealand.”²⁹ The information was sometimes articulated in terms that would be easily understood by any lay person. For example, the structure of reinforced concrete was explained as a “happy combination” that “may be compared to a marriage of two dissimilar but complementary natures, like our old friend Jack Sprat and his wife.”³⁰ Similarly, a report on the first annual dinner of the Ferro-concrete Company of Australasia was spiced with trivia: “the cartes du menu were whimsically designed to represent a skeleton ferro erection, enclosing a list of courses whose names, in conformity with the general concept, were... ‘Fillet du Schnapper au Sauce Ciment,’ and ‘Beton Arme Electricite Frites’.”³¹ Mainly employing the Hennebique system, the Ferro-Concrete Company of Australasia was the first to comprehensively undertake the construction of reinforced concrete structures in the Dominion.³² The article on the first annual dinner advertised the Ferro-concrete company of Australasia as a skilled

medium between the innovative building material and the consumer.³³ Its promotional materials stressed that reinforced concrete was a material understood by comparatively few people: “it was not... made by just putting a few pieces of steel or wire into concrete.”³⁴ The reinforcing required skill, knowledge, care, and conscientiousness – all of which were guaranteed by the company.

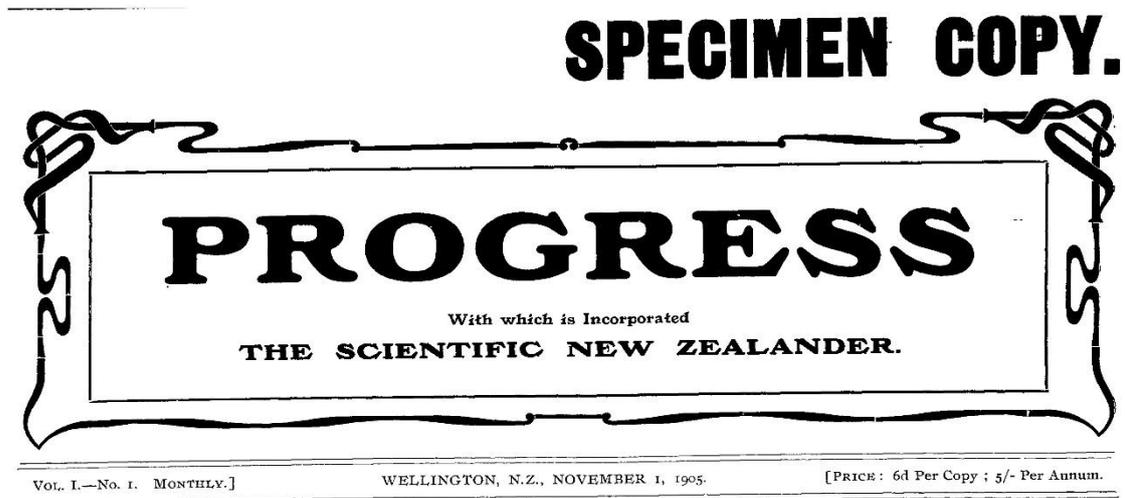


Figure 5. Progress with which is Incorporated the Scientific New Zealander (*Progress* 1, No.1 (November 1, 1905): 5).

The earthquake and fire-proof qualities of reinforced concrete also attracted a lot of interest. Clearly, earthquakes were, and still remain, a constant threat to New Zealand's construction, while fire presents a danger for any urban environment. In fact, the earthquake and fire-proof potentials were in focus when *Progress* first mentioned reinforced concrete, in 1905 – the same year the publication itself was founded. *Progress* remained the country's most important specialist magazine reporting on international and local technological advances and issues for years. Discussing “earthquakes and their relation to building construction in New Zealand,” Frederick de Jersey Clere passingly mentioned that, one of the possible solutions for the construction of earthquake resistant buildings would be “iron construction protected by concrete.”³⁵ New Zealanders had been attentively following the earthquake and fire-proof tests conducted in the US.³⁶ Comparing the system used in the construction of the Auckland wharves with the American one, Samuel Brown described the New York experiments, and concluded that reinforced concrete was “the most fire and earthquake proof mode of construction at present known to engineering science.”³⁷

As with any popular topic, reinforced concrete also attracted critics. However, it appears that the New Zealanders were eager to experiment – there were not many negative views of the innovative material. Caution with the application of reinforced concrete was advised in an

article published in the May 1906 issue of *Progress*.³⁸ Similarly, the *Auckland Star* published an article that, though praising the Auckland Harbour Board for “being up-to-date in its operations, and placing the port of Auckland in the van of the harbours of the world,” wondered if it might be wiser to have kept some of the existing wooden structures in the construction of the wharves – at least until wider experience with reinforced concrete had been acquired.³⁹ I could find only one entirely negative reading of reinforced concrete.⁴⁰ G. A. Lewis discussed “many and formidable” failures of reinforced concrete. He maintained that, though the subject of reinforced concrete was fascinating to theorise about, being in an experimental stage, it was mostly attractive to young engineers and architects. The experienced professionals, however, should not accept the material uncritically, he asserted, bearing in mind the disasters leading to the collapse of ferro-concrete buildings. The article instantly provoked two responses, both dismissing Lewis’ opinion as a misinterpretation.⁴¹

Conclusion

The early 20th century economic prosperity and the change of New Zealand’s political status resulted in increased construction activity in this period. The developing nation and its growing cities needed buildings suitable for housing their administrative and governing apparatus. The building activity in pre-First World War Auckland was interpreted as the verification of the city’s development. The Auckland Town Hall, the Chief Post Office, and the Ferry Building were the city’s most significant early 20th century public structures. Closely monitored by the press, the buildings were ultimately interpreted as symbols of national pride and the prosperity of Auckland.

Period sources clearly documented the importance the general public placed on the use of reinforced concrete in the first decades of the 20th century. Reinforced concrete was abundant in both technical and symbolical qualities. It was economical, structurally durable, earthquake-resistant, and fire-proof. Furthermore, it had a long tradition with imperial connotations, was used internationally, and was widely popularised. In sum, originating in the imperial times of the great Roman engineers, developed by the modern innovators for the sake of progress and bright future, reinforced concrete was suitable for the construction of both public buildings and the national identity.

Early 20th century Aucklanders did not think that the use of the innovative structural material demanded a particularly innovative architectural language. On the contrary – the Auckland Town Hall, the Chief Post Office, and the Ferry Building, as well as the majority of contemporaneous construction, combined the cutting-edge technology with the historicist architectural forms of Edwardian Baroque. Within their architecture the “progressive” merged

with the “traditional”. Both were perceived as signs of progress and advertised as the symbols of Auckland’s modernity, development and prosperity. The early 20th century press clearly documented that – as far as the function, the architectural style, and the materials used were concerned – the three buildings were genuine landmarks of “to-day”, and a valuable public legacy for the generations to come.

¹ For example, one amongst many, the article announcing the future Chief Post Office, Ferry, and Town Hall buildings as splendid symbols of the city’s prosperity: “Review of the Year,” *New Zealand Herald* 45, No. 13946 (December 31 1908): 7

² “Land and Buildings,” *New Zealand Herald* 48, No. 14801 (October 3, 1911): 9.

³ For example, writing about the strengthening of Auckland Town Hall, Trevor Robertson said that the building was mostly constructed of unreinforced masonry: Trevor Robertson, “The Strengthening of the Town Hall,” in *Proceedings of the 12th World Conference on Earthquake Engineering* (2000), accessed January 4, 2018, <http://www.iitk.ac.in/nicee/wcee/article/1155.pdf>

⁴ Extensive information on the individual buildings is available at the Heritage New Zealand website. See also: John Stacpoole and Peter Beaven, *Architecture 1820-1970* (Wellington: A.H. & A. W. Reed, 1972): 44, 68; John Wilson, *AA Book of New Zealand Historic Places* (Auckland: Lansdowne Press, 1984): 38-41; David Johnson, *The Auckland Ferry Building* (Auckland: Auckland Maritime Museum, 1988); Peter Richardson, “An Architecture of Empire: The Government Buildings of John Campbell in New Zealand,” MA diss. University of Canterbury, 1988: 165-169; Terence Hodgson, *Looking at the Architecture of New Zealand* (Wellington: Grantham House, 1990): 36-37; Peter Shaw, *A History of New Zealand Architecture* (Auckland: Hodder Moa Beckett, 2003): 67-70; Lewis E. Martin, *Built for Us: The Work of Government and Colonial Architects 1860s to 1960s* (Dunedin: University of Otago Press, 2004): 96-97.

⁵ “The Prosperity of Auckland,” *New Zealand Herald* 43, No. 13250 (August 8, 1906): 4.

⁶ For example, praising the “wonderful activity in the building trade,” an article highlighted that “in the business area ferro-concrete buildings from five to eight storeys high are in course of construction...:” “The Closing Year: Record of Progress,” *New Zealand Herald* 44, No. 13633 (December 30, 1907): 6.

⁷ “Auckland’s Town Hall,” *Auckland Star* 42, No. 297 (December 14, 1911): 7.

⁸ A lengthy report on the results of the competition: “Auckland’s Town Hall: Three Designs Selected. Fine Structure Proposed,” *New Zealand Herald* 44, No. 13435 (March 13, 1907): 8.

⁹ The design solution and the chosen location were heavily critiqued in a 1907 article: P. A. Vaile, “The Auckland Flat Iron,” *Auckland Star* 38, No. 121 (May 22, 1907): 8.

¹⁰ “Auckland’s Town Hall,” *Auckland Star* 42, No. 297 (December 14, 1911): 4

¹¹ Extensive and, so far, unsurpassed study of the Ferry Building: Johnson, *The Auckland Ferry Building*.

¹² “The Ferry Building, Auckland,” *Progress* 5, No. 3 (January 1, 1910), 99.

¹³ “Improving the Waterfront: The New Ferry Office,” *New Zealand Herald* 48, No. 14622 (March 7, 1911): 7.

¹⁴ For more information see: Richardson, “An Architecture of Empire,” 165-169

¹⁵ “New Post Office: The Opening Ceremony,” *New Zealand Herald* 49, No. 15156 (November 21, 1912): 8

¹⁶ Peter Richardson, “An Architecture of Empire,” 166.

¹⁷ “New Post Office: The Opening Ceremony,” 8.

- ¹⁸ Trevor Robertson, "The Strengthening of the Town Hall," in *Proceedings of the 12th World Conference on Earthquake Engineering* (2000), accessed January 4, 2018, <http://www.iitk.ac.in/nicee/wcee/article/1155.pdf>
- ¹⁹ "Auckland's Town Hall," *New Zealand Herald* 44, No. 13435 (March 12, 1907): 8.
- ²⁰ "The Town Hall, Auckland," *Progress* 4, No. 7 (May 1, 1909): 246; *Programme of the Official Opening of the Town Hall*, 23. During the early 20th century, John and Edward Clark worked on a number of commissions, including the Melbourne City Baths (started 1902); the Ballarat offices of the National Mutual Life Assurance Association (competition, 1904); the Maitland Hospital, New South Wales (1903-05); the Women's Refuge (1907) and extensions to the Women's Hospital (1907-17) both in Carlton, Melbourne; and the new Melbourne Hospital, Lonsdale Street (begun in 1912 after a second prize awarded in 1905). However, at this stage I was not able to determine was reinforced concrete used for the construction of some of this buildings. More on life and work of John J. Clark: Andrew Dodd, *JJ Clark: Architect of the Australian Renaissance* (Sydney: UNSW Publishing, 2012).
- ²¹ "Buildings in Progress: Harbour Ferries Building," *Auckland Star* 42, No. 62 (March 14, 1911): 9.
- ²² "Building a Post Office," *New Zealand Herald* 46, No. 14109 (July 10, 1909): 6.
- ²³ "Reinforced Concrete: An Engineer's View," *Auckland Star* 34, No. 262 (November 2, 1908): 3.
- ²⁴ Geoffrey Thornton, *Cast in Concrete: Concrete Construction in New Zealand 1850-1930* (Auckland: Reed, 1996).
- ²⁵ "Revolutionary Building: An Enterprising Milling Company," *Evening Post* 72, No. 46 (August 23, 1906): 6.
- ²⁶ John Guiniven, "The Truth about Ferro-Concrete," *Auckland Star* 39, No. 237 (October 3, 1908): 7.
- ²⁷ E.g.: "Ferro-Concrete Buildings: London's Post Offices," *New Zealand Herald* 44, No. 13395 (January 25, 1907): 6; "The Architecture of Britain," *Progress* 5, No. 4 (February 1, 1910): 135-136.
- ²⁸ "Ferro-Concrete Buildings," *Evening Post* 81, No. 117 (May 19, 1911): 2.
- ²⁹ "Ferro-Concrete Construction in Auckland," *Progress* 3, No. 1 (November 1, 1907): 10.
- ³⁰ "Ferro-Concrete: A Building Revolution," *New Zealand Times* 30, No. 6406 (January 1, 1908):
- ³¹ "Ferro-Concrete Dinner: The Progress of Ferro Reinforcement," *Auckland Star* 38, No. 185 (August 5, 1907): 6.
- ³² "Ferro-Concrete Construction in Auckland": 10.
- ³³ Ferro-concrete company of Australasia was a proper *bureau d'études* as defined by Cyrille Simmonet. Simmonet argued that *bureaux d'études* developed the innovative business concepts – epitomized in the methods of Hennebique company – that were crucial for the success of reinforced concrete in the early 20th century. The unique nature of reinforced concrete – its novelty and the fact that it was not available in human's immediate surroundings, but was a principle which could not exist without the inventor – required a theoretical underpinning. Mediating between the manufacturer and the consumer, these *bureaux d'études*, the original holders of the patent rights, possessed the knowledge behind this theory. *Bureaux* prescribed the dosage, the configuration of the reinforcement, they calculated the section of the structures, and regulated the manufacturing of the raw material even before they were transformed. A particular colonizing force in itself, the *bureaux* controlled the supply chain, constantly aiming at the expansion of business, areas of influence and clientele: Cyrille Simmonet, "The origins of reinforced concrete," in: *Early Reinforced Concrete*, ed. Frank Newby (Aldershot: Ashgate c2001), 119-135.
- ³⁴ "Ferro-Concrete Dinner: The Progress of Ferro Reinforcement": 6.
- ³⁵ F. de J. Clere, "Notes on Earthquakes and Their Relation to Building Construction in New Zealand," *Progress* 1, No. 1 (November 1, 1905): 2 (Supplement).
- ³⁶ "Building in Earthquake Countries (I)," *Progress* 1, No. 7 (May, 1 1906): 201; "Building in Earthquake Countries (II)," *Progress* 1, No. 8 (June, 1 1906): 28.
- ³⁷ "Seismic and Fire Risks: Claims of Ferro-Concrete," *New Zealand Times* 27, No. 5948 (July 11, 1906): 7.
- ³⁸ "Shear and Adhesion in Reinforced Concrete," *Progress* 1, No. 7 (May 1, 1906): 170-171.
- ³⁹ "Ferro-Concrete: Mr. Napier's Observations. Report to the Harbour Board. Policy of Caution Counselling," *Auckland Star* 38, No. 31 (February 5, 1907): 3.
- ⁴⁰ "Failures of Ferro-Concrete," *Progress* 3, No. 9 (July 1, 1908): 311.
- ⁴¹ C. Fleming Macdonald, "Reinforced Concrete," *Progress* 3, No. 11 (September 1, 1908): 379-380; R. W. Lesley, "Ferro-Concrete as a Heat Resister," *Progress* 4, No 4 (February 1, 1908): 118.