“Factory in the Field”
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“How might the New Zealand creamery be developed as a compelling tourist destination, whilst enhancing the architecture of the utilitarian factory?”

Master Thesis Explanatory Document

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“The man who builds a factory builds a temple” Calvin Coolidge
ABSTRACT

The commercial Creamery is New Zealand's undervalued tourist destination, in a society where people are increasingly separated from the production and original source of food. The creamery has the potential to offer an educational and entertaining experience by heightening the appreciation for cheese, whilst enriching Auckland's tourist industry. Today's food production facility often presents us with a mundane and utilitarian typology. The current approach to the design of these factories often lacks architectural expression and neglects man's spiritual and sensory needs. This project addresses the issues mentioned above, by architecturalising the factory through an engagement with the senses, ultimately producing a more humane workplace and engaging tourist experience. This research project brings together food production with a tourist experience, offering an opportunity to reconnect people to an essential aspect of life and their association with the environment. The existing Puhoi Valley Cheese Company will be redeveloped to accommodate these vital aspects.
Figure 1.2: Puhoi Valley
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1.0 INTRODUCTION
1.1 Research Question

“How might the New Zealand creamery be developed as a compelling tourist destination, whilst enhancing the architecture of the utilitarian factory?”

1.2 Outline of Project

The creamery is New Zealand’s undervalued tourist destination, yet it has the potential to give public insight into the traditional craft and science of cheese making – a skill that was once common knowledge amongst most members of rural families. The conventional commercial creamery in New Zealand fails to enhance the appreciation and experience of its product, thus missing an opportunity to exploit the potential for tourism earnings in the way its sister production facility, the New Zealand winery does.

Our current approach to the design of commercial food production facilities has degraded the experience of the consumer and increased human separation from natural elements. Unfortunately, the industrial factory has had a long history of being perceived as a place of production and a home for the machine, rather than a place for people. The factory provides an ideal mechanical environment with perfect conditions for mechanisation which is assumed to be suitable for human operation, however this neglects to accommodate basic human spiritual needs. Modern factories often utilize cheap transparent materials, such as polycarbonate roofing, as an attempt to provide more humane environments, however this design approach tends to lack any architectural expression. Today the factory is no longer given the attention that it once received by architects and engineers in the twentieth century, where importance was placed on improving the factory environment and it’s aesthetic.

This project focuses on architecturalising the modern day commercial creamery to be a compelling and educational tourist destination, whilst providing a more humane and sensuous work environment for factory workers. In a society where people are distanced from the process of food production, bringing together the factory with a tourist experience offers an opportunity to reconnect people to an essential aspect of life and their association with the natural environment.

1.3 Aims and Objectives

The aim of this project is to develop a cheese production facility as an agri-tourism destination. It attempts to engage spectators in the process of cheese-making by enabling them to experience the ancient art of cheese making.

Figure 1.3: A print of the Iron Works at Coalbrooke Dale, England produced 1776.
1.4 Scope and Limitations

Although it is fairly common for factories to incorporate sustainable features, it is not the focus of this project and because of the demanding programmatic requirements, which provide ample complexity, sustainability is not addressed as thoroughly as it could be.

For future reference, the earliest factories were referred to as mills, not factories. Ultimately, the use of the word developed and was used synonymously with the word machine or mill. The legal definition of the word dates from 1844:

“The word factory... shall be taken to mean all buildings and premises... where-in or within the close or curtilage of which steam or any other mechanical power shall be used to move or work any machinery employed in preparing, manufacturing, or finishing.”

Furthermore, the use of the word creamery can refer to both butter and cheese factories, however it is used throughout this project to refer to only the ‘cheese factory’. However, traditionally cheese making took place in dairy factories so reference to dairies may be discussed.

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2.0 RESEARCH FOR DESIGN
2.1 Literature Survey

2.1.1 The Factory

The complex history of the industrial revolution and birth of the factory is rather large and partly unexplored. The following historical dialogue attempts to explain the main developments of the factory leading up to and after the revolution. The factory has gone through an extensive reform due to a number of economic, social and technological developments that have had a profound effect on the architecture and social organization of the modern factory model today.

A number of the first manufactories of north-western Europe were housed in castles, churches and monasteries that had been seized during the French Revolution or under Austrian rule. The earliest factories were founded by sovereign rulers or royals to process raw materials and produce essentials for the state. Signs of the modern factory system were present in France as early as the reign of Louis XIV (1643 – 1715). The French crown played a part in the development of the factory system by describing the "industrial legislation, the system of supervision and inspection of trades" and methods of administration intervention. Industrial establishments were classified into three classes.

The first model, 'Manufacture Royale des Meubles de la Couronne', was state owned producing goods mostly for the King and his palaces. Hundreds of international and local artisans and artists were employed to work in the tapestry, 'Gobelins Manufactury'(1662) and in other manufactories to produce furniture, silverware and other lavish goods for Versailles Palace(1682). This model class was divorced from the possibility of economic life: there was no pursuit of competition or profit. The second class of factories, 'Manufactures Royales', belonged to individuals and produced goods for public consumption. These factories were still under the complete control of the crown, and royal ministers often sought out expert artisans from all over Europe to produce the finest goods. This model type received exemption from the heaviest taxes, and was given interest free loans and was superior to the laws of state. Van Robais of Abbeville, a fine cloth factory employing up to 2,500 people at its peak in 1665, is an example of this model type. Lastly, the third model, 'Manufactures Privilegiees', received superior treatment over royal manufacturers. The crown gave them the sole right of producing and selling certain products, which basically gave them freedom to be as fraudulent as they liked.

The royal manufactories in the seventeenth century can be described as artificial, and only survived through the support and subsidy of the French Crown. In little way did they help to contribute to the industrialization of France. The artisanal collectives did,
However, display characteristic signs of the organization of the modern factory system – the organization of specialist production, large employment quantities, and importance of undertakings where companies were regulated and under contractual obligation to produce fine quality goods. It is suggested that the organization of French manufactories may have had a profound effect on the organization of the early factory models.

The rise of the Industrial Revolution in the 18th Century brought with it the birth of factory production, an entirely independent natural evolution that rose in England between the years 1760 – 1800. The move to factory production resulted in the conversion of many industries moving from hand-craft to mechanical production. The change in manufacturing methods resulted in the substitution of human labour and craftsmanship with the machine. The Revolution marked an important change in history; new manufacturing processes gave new hope to society and improved daily life. The machine enabled products to be made more cheaply and at an unprecedented scale compared to former hand-craft. As a result of early capitalism, average income and living standards were improved; the difference between agricultural and industrial wages became notable, this growth encouraged the move to industry.

Large manufacturing premises evolved from the pre-industrial English cottage (1740), a precursor of the factory, quite literally the worker’s cottage or ‘glorified workshop’ used to manufacture hand-crafted goods. A majority of cottage workers were from rural settlements engaged in agricultural industry. During the winter months, people were involved in craftwork such as sewing, lacemaking, and weaving when there was little farming work to be done. The cottage workshops proved to be in an unsuitable location for water-powered machinery and larger

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5 Ibid.
premises were needed to contain mass machinery and produced goods. Large steam-driven factories eventually replaced grain, paper, weaving and other types of mills that relied solely upon wind or water for energy.

Like the establishment of Albion Mill in London 1786, many factories built in this period resembled a familiar Palladian styled country manor or town hall rather than a major industrial complex. Behind its classical heavy façade, the factory relied heavily on load bearing walls, columns and piled foundations to withstand the heavy weight of engine beams. The Albion Mill was emblematic of the new industrial world and, its opponents perceived the Albion Mill as an evil that destroyed nature and human relationships. These factories or mills were often located in idyllic landscapes close to water sources for water or steam driven power and for water transportation of goods. These large classical buildings reflected the power of industrialists and its elegance compensated for intruding on some of the most attractive pastoral landscapes in England. It is important to note that the earliest factory models of England were adopted by other nations.

Architect Claude Nicholas Ledoux was one of the first industrial reformers to design a Utopian scheme that attempted to not only improve work environments, but to improve and control living conditions also. Ledoux’s design for the Royal Saltworks (1779) in Eastern France was beyond an ordinary factory, his proposal for a semi-circular plan separated combustible and dirty operations of the salt plant from workers’ housing. The idealistic scheme was arranged according to a rational geometry and hierarchical order between parts and the plan. The scheme included everything from workers’ accommodation, workers’ gardens and chapel to courtroom. The master plan had a grand and formal aesthetic language, including columned porticos that defined the main entry to the estate and entrance of the director’s house. Walls featured ornamented stone water barrels that expressed the process of salt solidification. Overall the factory was radical for its time and

Figure 2.4: Albion Mill built 1786

Figure 2.5: Bates Cotton Mill taken 1908.
may have been perceived by social reformers as successful and somewhat influential. However the reality was, the two-hundred workers preferred to live independently of their work place, rather than be confined in the guarded grounds, completely cut off from society and the outside world\(^\text{10}\). Idealistic factory models of this period often attempted to exert undue social and behavioural control over workers.

After leaving the cotton mills of Manchester and entering into business partnership, social reformer Robert Owen came up with radical ways of reforming the organization of the factory by proposing government intervention with private industry. The acts introduced by Owen forbade child labour under the age of 9 and restricted the working hours of older children. Other acts introduced restricted night working hours all together, so workers could pursue an education or other leisurely activities after work hours. He purchased the land and buildings for a new town renamed New Harmony (1825-1827), Owen’s ideas of social reform were drivers in the model community and he believed prosperity could be generated through education, happiness, and communal living. The scheme was an attempt to create a superior intellectual, social and physical environment. As a social experiment the community was an economic failure. Owen placed part of the blame on a number of freeloaders attracted to the community\(^\text{11}\). Although Owen’s Utopian scheme failed, his intervention with factory legislation made a positive impact on the factory system today.

Philanthropic employers from the eighteenth to twentieth century were generally concerned with how their buildings would affect employees’ mental attitude, and many put emphasis upon the importance of health, wellbeing, sobriety and literacy. It was believed that attractive buildings

\(^{10}\) Ibid.

\(^{11}\) Ibid.
and a comfortable worker produced better work.\textsuperscript{12} This idea was widely received leading up to World War 1 in 1914.

“For psychological reasons it is desirable that the building presents a pleasing appearance rather than that of an ugly monster or prison (Diemer, 1921, p. 107)”\textsuperscript{13}

“It is only where high spirits and enthusiasm enter the human machine that, like a well-oiled engine, all parts work smoothly and produce the greatest effect with the least friction. (Meakin, 1905, p. 203)”\textsuperscript{14}

It wasn’t long before the romantic imagery of the first and second industries quickly vanished, and the aesthetic and efficiency of the factory continued to be challenged by socialists and industrial reformers. European and American enlightened industrialists continued to provide variants of factory models and social experiments, such as the workers cottages at Bournville set up by Cadbury (1880), and Ebenezer Howard’s master plan for a garden city (1902) as an attempt to zone residences, industry and agriculture surrounded by a green belt.

The first generation of factories, or mills as they were once referred to, often encountered outbreaks of fire. William Strut was an engineer and pioneer of iron construction who pushed for an alternative construction method to alleviate the issue. His Derby Mill built in 1793 replaced wooden columns with cast-iron (which had already been used in the construction of churches), and timber beams that were plastered to give fire resistance. The transition to iron construction occurred in the period 1750 – 1850, commonly referred to as the ‘Iron Revolution’\textsuperscript{15}. Prior to the invention of electric light, factories relied on gas lighting to illuminate workplaces. Production had to be conducted on multiple floors as natural light restricted the width of buildings, this interrupted the sequence of production resulting in an inefficient factory. Factories of this period were also limited in design due to structural limitations; specifically timber joists were limited in spanning capacities


\textsuperscript{13} Ibid., 17

\textsuperscript{14} Ibid., 23

\textsuperscript{15} Mantoux, \textit{The Industrial Revolution in the Eighteenth Century: An Outline of the Beginning of the Modern Factory System in England}
so this dictated building dimensions as well as the limitations on penetration by natural light. Heavy external walls and rows of columns were often relied on to carry the heavy roof and floor loads of the building. The second revolution in the years of 1840 – 1870 brought economic, scientific and technological advancements characterized by railway-building, large-scale steel production, use of electricity and the wide acceptance of machinery in production facilities\textsuperscript{16}. The introduction of electricity and the internal combustible engine had a profound effect on the architecture of factories, encouraging new models to replace the dark mills and faux-palaces of the nineteenth century. The introduction of electric light removed the limits on the width of buildings, however it also removed the need for natural light, which inevitably would have had a negative impact on work environments.

The reliance on artificial light in factories was still an issue leading up to 1903 until Architect Albert Kahn and his brother and engineer, Julius Kahn, introduced a new structural system which became the standard throughout industry and influenced the work of modernist architects. Kahn revolutionized the health and safety of early twentieth century factories which were at the time dark, cramped, gritty and a fire-hazard because of oil soaked wooden floors. He pioneered the use of reinforced concrete, nonintrusive steel structures, natural ventilation and glass building skins to respond to the changing factory needs. His Company offered a range of standardized prefabricated concrete and light steel roof, wall and beam products, making it easier to provide natural light through external walls and the roof. This enabled buildings to be stronger, lighter, standardized and therefore economical. Furthermore elevations were no longer restrained and could consist of expanses of glass rather than masonry. Their new lighting and ventilation solution was known as the ‘Kahn Daylight System’, as seen by the Ford Motor Company at Highland Park in Detroit designed by Albert Kahn, this evidently became the new prototype for ‘the factory model’. The building consisted of multiple floors overlooking a naturally lit central atrium and was the largest manufacturing plant in the world and the first to implement a continuous assembly line at the time of its construction in 1910. This new production process improved production time and enabled cars to be purchased more affordably. Ford’s multi-storey ‘daylight
'The factory' was highly influential, and attracted industrialists from all over the world, becoming a model for future factories. Moritz Kahn, another Kahn brother identified three factory models in his book, 'The design and construction of industrial buildings (1917)', one which included the single story roof-lit factory using a saw tooth roof (this model was used for the Bates Mill #5 in Lewiston, designed by Albert Kahn). The second, a long-span trussed roof which included an overhead crane, and third a multi-storey factory which was the cheapest model option for lightweight production. Moritz stressed the importance of quality factory lighting, both 'physiologically and psychologically'. Just as Mathew Boulton had considered whitewashing the walls of Albion Mill to alleviate the roughness of the interior and to reflect more light, Albert Kahn had implemented both translucent and clear glass panes to help diffuse light and alleviate the visual strain of looking at manufactured goods.

Since the beginning of the factory typology it was common knowledge that poor lighting contributed to accidents occurring in the factory. The late nineteenth century saw various glazing options, and roof forms such as butterfly roofs, saw tooth roofs and standard roof profiles. Technological advancements saw the quick development of factory construction and introduction of iron multi-storey framed buildings. The Boat Store at Naval Dockyard in Kent...
by architect Godfrey Greene utilized a light cast and wrought iron structure with light iron corrugated infill panels\textsuperscript{18}, compared to conventional factories at the time of its completion in 1860, it was extremely light and economical.

Introducing natural light and minimizing solar heat gain was an issue in twentieth century factory design and still is a common issue in factory design today. Walter Gropius’s Faguswerk factory (1914) quickly introduced blinds and opaque paint to stop heat gain through its expansive windows\textsuperscript{19}. Factory design in the early twentieth century saw more expressionist, innovative, and complex forms. Expressionist Erich Mendelsohn’s design for a Hat factory built in 1923 in Brandenburg was seen by critics as a mechanism itself. Mendelsohn’s form for the factory was found by paying close attention to the hat manufacturing process, and the need to provide large vents to exhaust noxious gases. An abnormally steep roof provided a chimney effect to exhaust gas and heat.

Engineer Pier Luigi Nervi pushed the boundaries with pre-stressed in-situ and precast concrete in industrial and public building design\textsuperscript{20}. He was a master at creating beautifully complex forms, creating parabolas, plunging vaults and other complex forms. His structures were relatively crude. The form-work was not fussy allowing a raw industrial quality in his buildings. The Gatti Wool Mill in Rome, built 1951 revealed exposed ribs that expressed the flow of forces of the floor slab to the column. Throughout his designs he took advantage of necessary structural elements, using it as ‘decoration’ to

\begin{flushleft}
\textsuperscript{18} Ibid.
\textsuperscript{19} Ibid.
\textsuperscript{20} Ibid.
\end{flushleft}
Figure 2.18: Boat Store, Sheerness Dockyard, Kent.

Figure 2.19: Boat Store.

Figure 2.20: Boat Store by Albert Kahn.
create visual interest for occupants. The presence of wooden boards used to form his handcrafted concrete structures, are noticeable in crudely formed concrete. The strong hint of craftsmanship and visual interest expresses a building marked by human occupation. Nervi’s Hanger building in Orvieto 1935 broke the rigid orthogonal system expected of large-span buildings, a series of perpendicular curved beams span (width of 36m) the interior of a single barrel vault. The list of innovative factories in the twentieth century is endless; Frank Lloyd Wright’s Johnston Wax Factory 1939, Ralph Erskine’s Cardboard Factory in Ostenfors 1950, and Nervi’s Hanger building in Orvieto 1935 all proved that form was no
Form was left to be expressed as freely as the architect or engineer wished. Unfortunately this attention once given to the architecture of the factory has diminished. Instead the factory is now often perceived as no more than a utilitarian facility, to house machinery used to produce goods sold for capital gain. The factory was previously used architecturally in the past as an effective metaphor, or created an identity for a company and its product.

Design priority in the twenty-first century privileges an ideal machine environment that is clean as well as temperature and humidity controlled, which may appear on the surface as the perfect operative human environment. Whilst many food production factories must provide necessary sanitation and machine friendly environments they often ignore or misinterpret basic human needs. Humans are greatly affected by the shape, colour and aesthetics of an environment, whilst machines are entirely unaffected. Architects of the past have gone to great extents to introduce natural light to enliven the workplace. Unfortunately modern facilities are totally integrated with artificial lighting, or provide the absolute bare-minimum of natural lighting through polycarbonate roof sheets. Sadly this is now the modern solution of providing factory workers with a 'connection to the natural world'.

The factory requires a work and visitor environment that meets man’s spiritual and sensory needs, an environment that takes account of aesthetic, visual, sonic and thermal needs. In an environment where workers inevitably spend a large portion of their days inside cut off from the natural world, the need for a more humanised factory is called for. The factory needs to be rejuvenated and made significant again to take
advantage of the potential attraction it can convey. Furthermore, by utilizing and enhancing form to reflect a particular manufacturing process, the factory may have a better chance at standing out from other production facilities, and may prosper from a new identity.

2.1.2.1 The Cheese Factory or Creamery

History of Cheese

Cheese is commonly perceived as a product that belongs to the French, Swiss or Italians; however it dates back to the biblical period and is “as old as the Egyptian pyramids...remnants were found in the tombs of important Egyptians dating back to 3000B.C.”. The earliest signs of cheese originated from southern-Iraq in a Sumerian settlement, a frieze discovered with pictograms presented the practice of intense year-round agriculture which included cheese making. Furthermore, a clay tablet with inscribed pictograms recorded a farmer’s harvest, also including cheese.

In New Zealand, early dairy farming was an activity that was often family operated and it was common for most families to own a couple of dairy cows. Generally speaking, women and children had the task of milking, to provide for the family’s dairy needs. Milk was collected to produce butter, cream, and cheese on a small domestic scale.

In the early 1880s there were about twenty dairy factories that produced both cheese and butter. From the early 1880s onwards, the export of dairy products was made possible with the invention of commercial shipping refrigeration. By 1884 twenty creameries had been built, first utilizing traditional farmhouse methods and then gradually taking advantage of large steam-driven technology. The dairy industry was a huge driver for New Zealand’s economy and still is today. During World War II farmers turned to

22 Ibid.
cheese production because of its longevity as a commercial product. The creamery was a social place for local farmers, meetings occurred every morning after dropping off barrels of milk by horse and cart. By the 1920s, the number of dairy factories peaked at around 600 and most were cooperatively owned. This changed significantly around the 1990s when cooperatives merged into four companies which remain today: The New Zealand Dairy Group, Kiwi Co-operative Dairies, Tatua Co-operative Dairy Company and Westland Milk Products. Soon after, several co-operatives merged to become the Fonterra Co-operative group, who is now responsible for supplying all commercial cheese factories with milk from their numerous dairy farms around New Zealand.

In recent times, New Zealand has experienced a back-lash against mass-produced standardised products and many entrepreneurs have emerged over the last decade, pushing for the reincarnation of crafted and specialty products, particularly craft beer and cheese. A huge number of specialty and boutique creameries have emerged from a market which previously restrained and conservative.

25 Scrimgeour, "Dairying and Dairy Products".
26 Springford, "Craft Cheese Industry Reincarnated".

Figure 2.30: Milking scenes from the temple of Ninhursag.

Figure 2.31: Milling curds at Taungatara Factory 1920s.

Figure 2.32: Cheese ready to be exported from Waihi Cheese Factory.
Fundamental Elements

The commercial creamery involves a very controlled process in a highly moderated internal environment. Factory spectators are often kept behind glass screens or kept at a distance to avoid any contamination. Furthermore, factory employees go through a thorough dressing procedure each day, which involves scrubbing and boot and clothing exchange to help maintain a sterile environment. The main sources of listeria monocytogenes in cheese contamination are due to raw materials, processing equipment and environment, and the handling and hygiene practices of workers.

Creamery Form and Experience

The aesthetic of first generation dairy factories in New Zealand consisted of basic orthogonal wooden sheds that required an enormous amount of timber for interior lining and even cheese making machinery. These were soon replaced by a number of reinforced concrete built dairies that became the following trend for dairies after 1920. John A. Duffill was a pioneer in reinforced concrete constructed dairies around the Taranaki region, designing around sixty during his career, including the 1922 Waharoa Butter factory which was highly influential in following dairy designs and has since been replicated to house the Kaimai Cheese Company. Waharoa butter factory had a number of changes over the years; early wooden churns were replaced by stainless steel churns and then again by automatic butter churners in the early 1980s. At the time of its construction it was said to be the largest butter making factory in the world. The Kaimai Cheese factory built in 2007 by Stiles&Hooker, reflects and emulates the traditional forms of 1950 dairy factories, even reusing truss and roof vents from the old Waharoa factory which was later demolished in 2005. The design


incorporates a series of gable roofs with roof vents, enabling light to enter central to the building. It is assumed that the various roof vents were once utilized to exhaust steam from the production room, however this has since changed as the production room appears to have been altered to accommodate mechanical air conditioning.

Factory buildings often focused design attention to the roof element as they were generally large plan spaces, where light entry through the windows only was not adequate. The gable roof form was a familiar feature for first generation dairies, as this mirrored a conventional linear production line generally used. Internally roof framing was left exposed, allowing machinery and services to be suspended below and expressed a well-proportioned volume. The gable roof form works sufficiently for small production facilities, however this has proven to be difficult when used for large-scale factories, as seen at Puhoi Cheese Factory. The gable roof form rejects the possibility of defusing light into workspaces and is inflexible with additions. Lean-to roofs are utilized in addition to gable roofs to maintain necessary ceiling heights, however these additions are awkward and aesthetically unpleasing.

The semi-circle and the cylinder are important forms in cheese making, a wheel shaped mold is often used to maintain cheese consistency when salting and ripening. Traditionally, it was common practice to use barrel vaulted ceilings in the formation of cheese cellars to prevent any moisture on the ceiling from dripping on maturing cheese. Examples of these forms are often still used in modern creameries, such as Jasper Hill Cellars which utilize barrel vaults in their cheese cellar and implement cave-like features such as porous pebble floor coverings which help to hold internal moisture, necessary to prevent cheese from drying out.
Figure 2.38: Mataura dairy Factory 1930.

Figure 2.39: Patea Cheese making factory.

Figure 2.40: Cutting cheese curds, Patea Cheese Factory.
Figure 2.40: Cutting cheese curds, Patea Cheese Factory.

Figure 2.41

Figure 2.42: Making cheese in 1910 New Zealand.
The following creameries are compared on a sensory and touristic experience or analysed in terms of form. The house of Gruyere (1969), Switzerland is one of the few creameries that attempt to engage the visitor on a multisensory level and provides an informative tour that demonstrates the knowledge involved in cheese making. The tour engages all five senses, whilst audio provides an explanation of the cheese making process and the sounds of streams that run down the mountain side. Visitors are exposed to aromas of flora and hay, which can infiltrate deep into the subconscious. Furthermore, traditional cheese making equipment is on offer for engagement. The tour takes the visitor on a 180 degree journey around the active production facility which produces forty-eight wheels of Gruyere cheese throughout the day. Dim lighting allows the visitor to view the production area without seeing
uncomfortable reflections. Similar to the Parmigiano cheese cellar, the vast scale of space and quantity of cheese in the Gruyere cellar allows the consumer to be immersed in a space, rich with drama. Despite the cool conditions of the cheese cellar, the hues of timber and cheese rinds create a warm aesthetic which counteracts the cold climate of the cellar and appears more inviting. Rows of stacked cheese act as an architectural wall element, which enlivens the ordinary cellar.
The Parmigiano cheese factory in northern Italy successfully provides visitors with a multisensory experience. The visitor enters slightly elevated, above the production room and literally side-by-side the main production line. This gives a greater sense of engagement as visitors enter abruptly into a noisy and steamy environment where they experience the process up close. The use of ceramic and terracotta tiles are a great response to the sterile environment, providing detail and visual interest to the room.
Figure 2.50: Brine soaking.

Figure 2.51: Fromager’s checking cheese quality

Figure 2.52: Cheese turning and washing
Sutherland Hussy architect’s award winning Lynher Dairy is a small boutique facility for Cornish Yarg cheese. The industrial facility is disguised as a traditional domestic form, whilst utilizing industrial materials and components in an elegant way. Intricate detail on the facade reflects the craftsmanship demonstrated by the companies approach to cheese making, and the use of domestic timber material reflects the small boutique brand. Part of the roof form has been elevated to accommodate the dairies services which are located in the upper roof void.

Comtè Fort St. Antoine, the “Cathedral of Comtè Cheese” is an old military fort in the French Jura Mountains which was converted in the early sixties. The cellar houses over 100,000 wheels of Comte cheese, which is produced locally in several dairy factories. This cellar benefits from 5000 square meters of existing barracks which was built to house 420 army men. The facility included an underground water tank used to harvest rainwater, air shafts that provide consistent air ventilation and is naturally insulated from the ground above, all which contribute to cheese maturation. The conversion to a cheese cellar required the installation of vaulted stone in the ceiling and walls and 3km of timber shelving, which adds to the aroma and taste of the cheese. The sheer scale of the cheese cellar establishes a strong sense of monumentality, leaving the visitor exhilarated and feeling overwhelmed in a positive sense.
Figure 2.57: Comte Fort Cheese cellar.

Figure 2.58: Cross Section through Comte cheese

Figure 2.59: Comte Cheese Cellar

Figure 2.60: Comte Cheese Cellar
2.1.2.2 Creamery Precedents

The following creameries are notable for the following reasons: Roquefort allows an engaging visitor experience in an environment that is tends to be highly controlled and sanitized; whilst Fifth Town is notable for its efficient layout. The creamery must coordinate the circulation of staff, visitors, raw and finished product and vehicles in an order that does not cause product contamination, or disrupt the sequence of production or cause danger to employees and visitors.

Precedent: Roquefort Cheese, France

Roquefort is one of the most beautiful industrial sites in France, still in operation today. The town of Roquefort is a popular tourist destination for those fascinated by the natural Combalou Caves of Roquefort-sur-Soulzon and Roquefort cheese. A visit to the Roquefort caves consists of exploring an underground labyrinth of natural caves formed after the collapse of a nearby mountain. The caves are organised into a number of vaulted cellars which hold the production, maturation, and packing of Roquefort cheese. Some of the caves are left in their natural state, consisting of jagged walls of limestone, whilst others have been widened and clad in stone.

Fleurines or long faults formed in the rock enable air to circulate underground maintaining a humidity of 95% and a consistent underground temperature of around ten degrees celcius, an environment perfect for the cultivation of blue cheese.

Roquefort cheese is mentioned in literature as far back as AD 79. Legend has it that the cheese was first produced by accident when a young man, eating his lunch of bread and sheeps milk cheese, saw a beautiful girl in the distance. Forgetting about his lunch, he left the cave to meet the girl, returning several months later to find mold (penicillium roqueforti – a microorganism found only in this cave) had transformed his plain cheese into what is known today as Roquefort blue cheese.30

The Roquefort cheese tour engages the visitor on a number of different levels. The journey through the caves offers a sense of mystery, whilst the use of materiality and natural rock allows the visitor to feel connected to the geology and landscape of the region, allowing the visitor to physically feel the damp, airy conditions that cheese is aged in. The tour can be broken down into ten different stages and has the following sequence:

1. A display of an animated landscape model that explains the geological forces that formed the unique caves.

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2. On the way to the film room the visitor discovers the natural fleurines in the cave walls
3. A film that shows the history of Roquefort, where the milk comes from and how the cheese is produced.
4. A light show that depicts the famous legend of the sheppard who left his curds in the cave to later discover that it had gone mouldy.
5. The greeny-blue mould penicilium roqueforti flourished naturally in the caves, today it is cultivated in a lab from extracts of mould from rye bread.
6. A glimpse of the cheese maturation caves, each with a different micro-climate that allows different cheeses to attain a particular taste and texture.
7. A museum displaying information about the characters that played an important role in the history of roquefort cheese.
8. Tasting room displaying the three different types of roquefort cheese.
9. An exhibition displaying the history of marketing and the famous societe roquefort.
10. Gift shop

Figure 2.62: Roquefort, France
Figure 2.63: Roquefort passageways.
Figure 2.64: Roquefort, France.
Figure 2.65: Roquefort Cellar cross section

Ibid.
Precedent: Fifth Town Creamery, Canada

Fifth Town Creamery, designed by Lapointe Architects, is a boutique artisan creamery located in a region selected for its fast growing agri-tourism. The Canada region has attracted wineries, fine restaurants, and bed and breakfasts. Using the winery as a model, the design of Fifth Town allowed their grounds to be opened to the public, not only for retail and cheese tasting but for educational purposes also. The facility effectively educates the public on how artisanal cheese is produced and teaches them about sustainable architecture and what it involves. Fifth town creamery demonstrates an efficient layout, as the design clearly distinguishes and coordinates raw and finished product, visitors, staff and waste.

Conventionally, an unrelentingly linear form was employed to avoid the cross contamination of pasteurized milk by raw milk. The bold decision, to change venture away from this traditional form was to fulfil an “educational mandate of ensuring that all aspects of cheese making are visible to the public”\(^\text{32}\). Lapointe Architects produced an effective design that resolved the issue of visibility, by continuing the production line in a circuit then ‘folding’ back again. This created a compact production line that is visible from the shop at the front, and through the cave window outside. The distinction between visitors, production line and commercial vehicles is clear and establishes a safe work environment. The facility is equipped with a staff room located on the upper floor, where staff are able to disconnect themselves from the factory floor, allowing a sense of separation from work spaces.

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2.1.2.3 The Cheese Making Process

The typical process of making cheese involves some straightforward steps and varies according to the type of cheese, tradition and provenance. Cheese is simply made of nature’s ingredients, and like wine, it is a product that depends largely on its terroir. To name a few, it varies according to the type of animal milk, the quality of soil, the environment it has been aged in and the experience of the cheese maker.

For some mammals, milk is almost a complete food. It is a nourishing product that contains the necessary nutrients to develop a healthy immune system and strong bones. Milk is mostly made up of water but includes enzymes, fat, sugars, vitamins, hormones and minerals. Cheese
is ultimately a preservation of milk, and a product that now has over 500 varieties worldwide. Generally speaking, cheeses that are acid or heat/acid coagulated are typically consumed fresh and consist of a shorter process (for example, feta), while rennet coagulated cheeses are required to be matured before being consumed.\(^{34}\)

Although the process of cheese making varies according to the type of cheese, the general process of making rennet coagulated cheese may be categorized into the following steps:

1. **Standardization and clarification** – After the reception of raw milk it goes through a screening process to filtrate any unwanted elements.

2. **Pasteurization** – involves heating milk to kill any bacteria. Some European cheeses skip this process.

3. **Acidification** – Milk is transferred into large vats where starter cultures are added, this is the good bacteria that gives cheese its certain characteristics. Starter bacteria cause the sugars in milk to convert to lactic acid.

4. **Coagulation** – usually a vegetarian rennet enzyme is added, this is a clotting enzyme, together with the starter cultures, milk ferments and solidifies into curd.

5. **Curds and whey separation** - the coagulation process leaves a solid curd (cheese) and a liquid whey product which is disposed of. Depending on the type of cheese it may be milled into pieces (cheddar for example) or carefully removed from the vats (brie and camembert for example).

6. **Cooking** – the curds are cooked and sometimes salted at this stage (cheddar for example) to prevent the cheese from spoiling during the maturation process.

7. **Draining and pressing** – Curds are transferred to hoops where they are left to drain for a period of time. The hooping process is typical for cheeses such as Camembert and Brie.

8. **Salting** – To slow down the growth of bacteria and give the cheese flavour, cheese wheels are either salted externally or left to absorb in salted brine baths. At this stage cheeses such as Brie and camembert are sprayed with fungi or left in a fungal wash during the maturation stage to give the cheese a fluffy coated crust. The application of fungi allows the cheese to mature externally.

9. **Maturation** – the ripening process can be anywhere between two weeks to two years. This may take place in a controlled refrigerator or in a natural cool environment, where the cheese can develop textures, flavours and generate authenticity as they take on a terroir of a specific place.

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Figure 2.70: Process diagram for rennet coagulated cheese.
2.1.2.4 Architectural Implications of the Creamery:

The commercial creamery involves a very controlled process in a highly moderated internal environment; factory spectators are often kept behind glass screens or kept at a distance to avoid contamination. Furthermore, factory employees go through a thorough dress procedure each day, this involves scrubbing, boot and clothing exchange to help maintain a sterile environment. The main sources of listeria monocytogenes in cheese contamination are due to raw materials, processing equipment and environment, and the handling and hygiene practices of workers. Poor personal hygiene is one of the most common errors leading to illness outbreaks. Therefore, selection of materials needs to address the issue of sterility, and the design of spaces should take contamination and outdoor pests into account.

Depending on the scale of the factory, the cheese making and draining process typically takes place in one room, the cheese vats produce a considerable amount of heat, usually around 25 degrees Celsius which is often maintained in the space to prevent the cheese from drying out. This is contrasted with the maturation and packing spaces that need to be a cooler temperature, around 10-15 degrees.

The underground cellar or cave is a much more energy efficient model than the conventional walk in cooler. Underground conditions provide the perfect environment for the cultivation of cheese at a consistent all year round temperature of ten degrees Celsius.

Overall, a majority of factory spaces need to be thermally insulated to maintain the necessary temperature and humidity level. Most importantly, the maturation cave or cellar needs to maintain a humidity of 95% and will naturally provide a consistent temperature of ten degrees Celsius for ripening cheese. The factory environment also requires consistent illumination for tasks to be taken out efficiently and safely.

2.1.3 Agriculture Tourism

Although the definition of agri-tourism varies, the general idea is to provide visitors and potential entrepreneurs with information about existing agri-tourism locations. It involves introducing urban residents to rural areas for leisurely spending and travel. In a progressively mechanized world, people have lost touch with how food is produced and where food originates from. Agri-tourism offers tourists a chance to reconnect with the land and learn about food production. Agri-tourism activities range from: fruit and vegetable picking; tending to bee farms; milking farm animals; sampling and learning about wine and cheese. A number of agri-tourism destinations, such as wineries, are key precedents for this project. Like the creamery, the winery is a place of production and storage, where tradition and provenance have continued in some parts of the world for centuries. Tourism now plays a huge role in the design of new wineries, to the point where the location for a new winery may be chosen for its close proximity to other tourist attractions as well as for the quality of soil and growing conditions.35

Many new and existing vintners have employed big name architects or firms such as Frank Gehry, and Rafel Moneo, Zaha Hadid, to design their wineries, for the reason known as the ‘Bilbao effect’. The winery tour and the marketing advantage of brand-name designer architecture have revolutionized the wine industry by using these two elements to pull new and existing customers. Southern parts of New Zealand and Australia have seen a rapid growth of new wineries and are considered the new ‘hot spots’ for

the wine tourism industry. High-profile practices in Australia and New Zealand have been
approached to design wineries to foster public interest in winemaking and evidently to
purchase the wine.

Frank Gehry’s ‘Marques De Riscal’ in Elciego, Spain, is an example of intentionally imple-
menting the Bilbao sales technique by locating the winery close to the major wine centre
Bilbao, in hope that it will be a magnet for visitors visiting the area. The new millennium
stands for an age of brand conscious consumers that are not overly concerned with tradi-
tion or provenance. Instead, they are concerned with the quality of the wine and the expe-
rience of architecture that houses it, often located in pristine pastoral locations.\textsuperscript{36}

The modern winery is an ideal model for a tourist attraction and production facility. New
modern wineries offer an architectural hybrid, consisting of a cross between production
and distribution facility, education facility, retail outlet, café and a venue for weddings or
other occasional functions. These new facilities add to the attraction of the wineries and
generate an additional income for vintners. In an industry of 613 wineries that received
an annual tourist expenditure of $907 million in 2008 from an overall winemaking profit
of 1.22 billion\textsuperscript{37}, the New Zealand winery has good reason to strive for national and inter-
national recognition, using architecture as a sale and marketing tool. Likewise, these ideas
can be applied to the cheese factory to lure the potential visitor.

With a cattle population of over 6.6 million, New Zealand is renowned for livestock num-
bers exceeding the overall human population and for the country’s dairy industry. Con-
tributing $5 billion to the gross domestic product (about ten times more than the wine
sector), the dairy industry makes a significant contribution to New Zealand’s economy.
The government’s ambitious plan to further boost the economy by promoting Auckland
tourism and attracting international investment, suggests an opportunity to promote the
image of the creamery as insight into New Zealand’s dairy industry. Companies such as
Puhoi Valley Cheese which currently accounts for 26 percent share of a 29.8 million spe-

\textsuperscript{36} Ibid.
\textsuperscript{37} John Ballingall and Chris Schilling, “Economic Impact of the New Zealand Wine Industry: An Nzier Report to New Zealand Wine-
growers,” nzier authoritative analysis, Economic Impact of the New Zealand Wine Industry: An Nzier Report to New Zealand Winegrowers,
cialty cheese market\textsuperscript{38}, have the potential to gain a better national and international market through the agri-tourism sales and marketing approach. The New Zealand creamery could heighten the appreciation of their product through the use of architecture, where a compelling design would enhance the tourist experience and reflect the nature of New Zealand’s commercial dairy industry.

2.1.3.2 Winery Precedent

Precedent: Peregrine Winery, Central Otago

The Peregrine winery stands out as a magnificent object in a beautiful landscape, yet allows the visitor to experience an internalized journey, focused solely on the production of wine. The vintners of Peregrine Winery didn’t want their winery to be reduced to a tourist attraction. The design respects the winery as both a workplace and an attraction, overcoming the issue by dividing the two functions spatially, while still allowing visual connections into some work areas. The journey allows the visitor to move through a series of contrasting spaces, which are separated by the occasional ‘break’ space; this break space allows the visitor to be exposed to the beautiful surroundings and the specific terroir of wine.

An array of different functions are unified under one roof, a canopy that is interpreted as the wing of a Peregrine Falcon – a bird which the vintner breeds. The architects were aware that the building needed to reflect and establish the Peregrine Winery brand and designed the building accordingly. The use of utilitarian materials: concrete and steel, reflect the raw industrial nature of the winery whilst responding to the necessary sterility of the work environment. The warm atmosphere of the wine barrel rooms, counteracts the cool conditions of the cellar, whilst the production rooms express a cool work environment.


Figure 2.74: Peregrine Winery, Otago.
Figure 2.75: Peregrine Winery Entrance, Otago

Figure 2.76: Open services floor with saw tooth roof overhead.

Figure 2.77: Front of house showing steam from production behind.

Figure 2.78: Long Section through Peregrine Winery
2.1.3.3. Factory Precedents

Indian Architect Anant Raje, the Protégé of Louis Kahn and Le Corbusier, has designed a number of notable dairy factories in India. Although Raje generated his own design principles, Kahn’s influence is prominent in the design of his buildings. The use of strong geometrical forms, voids and arches are clearly influenced by Kahn. However, the organization of his buildings reveals his fascination with ancient ruins and he continuously returns to the “theme of a shaded court surrounded by transitional spaces, rather like the streets and squares of a traditional city.”

Raje is among the few architects who attempt to architecturalise the dairy factory. His use of bold forms is repetitive and often arranged along a dominant axis. Raje breaks the programme down to identify and define spaces to formulate an order and hierarchy. Volumes are arranged hierarchically according to the importance of each space, these volumes together combine fabricated layers of structure and spatial complexity. Parts of the building respond to one another and make up the building as a whole. His Mafco Dairy in Bombay 1977, repetitively uses lights wells centrally in his plan, in an attempt to frame various vistas, whilst minimizing direct light and internal heat gain. Undesirable heat gain has inevitably determined the use of heavy buffer facades which filtrate light and air via a breeze way, this is necessary in a hot tropical climate that receives wet but mostly dry spells. His close and compact plans were a solution to a hot and dry climate, as well as generating an economic design. Raje claimed the importance of structural elements and their role in his projects, which determine the type of material to be used, either by choice or by the demands of a particular space. He often manipulated structural roof elements to provoke a sense of space and reinforced its crucial purpose of bringing natural light into spaces within his buildings. Overall, his designs evoked and reinforced the relationship of ground to sky, light and shade, and gave the elemental sense of shelter.

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3.0 RESEARCH BY DESIGN
3.1 Project Development

3.1.1 Site Analysis

3.1.1.1. Criteria

For the purpose of this project, Puhoi Valley Cheese Company will be used as a model for what types and sizes of spaces are required and to determine the amount of workers required for production. The scale of its production line is significant and this quality is something that is worth exposing visitors to as it is important that people understand the real origins of their food sources. To make

an improvement to the work environment of the factory, the number of employees working for the company is also significant. In this case Puhoi Valley Cheese has approximately 65 employees working on site.

The current site of the Puhoi Valley Cheese Company will be used for a number of reasons. The site is in close proximity to Northland dairy farms, enabling fresh milk to be delivered to the facility within a short distance and free of Auckland’s city traffic.

Furthermore, its small town success can be given to its location, as it appeals to visitors for its strong history and idyllic pastoral landscape. Where traffic may be an issue, the location is ideal for commuting staff currently living in the Puhoi region or on the north shore of Auckland. The town of Puhoi has a strong reputation for providing boutique or artisan goods, therefore the programme of a creamery is well suited in the Puhoi community.
3.1.1.2 Location and History

Puhoi is an attractive historic village just 45 minutes north of Auckland’s CBD. The town of Puhoi Valley can be accessed just less than five kilometres from the Puhoi Valley turn off, situated off the main northern route, State Highway One. The journey to the site consists of a winding drive following the contour of the Puhoi River, which is situated across the road from the site. The site is located at 275 Ahuroa Road which is wedged between two hills, at the bottom of the valley. The Maori word, Puhoi, translates as “slow water”, a name that refers to the slow pace of the town’s river. The Maori word for
Pūhoi literally means “be slow, sluggish, unhurried.” An appropriate word used to describe the traditional and modern state of the ‘slow-paced’ town, a popular town for Aucklanders wanting to escape the busy city life.

Puhoi Valley historic village was established by Bohemian immigrants, who originally came to New Zealand in 1863 at the offer of free ‘waste land’. The land was originally covered in dense native bush that was difficult to access, the only entrance was through the Puhoi River which was used as their main route to transport timber logs and other goods. The Bohemians survived off the bush, producing kauri gum, logs, shingles, sawn timber and anything else that could generate income. From 1881 parts of the bush were cleared and used for farming. However, the land was steep and was difficult to farm. The Bohemians established a small community which still remains today, attracting local and international visitors.40

Puhoi Valley Cheese Company owned by Australasian food giant Goodman Fielder, was founded by Lloyd Darroch in 1983. The company started with a small manufacturing plant in Puhoi Valley which produced Camembert and ice cream from goats’ milk, from the goats that were located on site. Their factory eventually increased to more than four thousand square meters and switched to cows’ milk from local farms to produce a number of specialty cheeses including Camembert, Brie, Feta, Blue cheese, Ricotta, double and triple cream.41


Figure 3.04: Site sketch, north elevation
The site now consists of an office and staff block, two separate factories, café and utility buildings which are sprawled over the site.

In 2011, the company revamped and expanded their café in an attempt to show off their premium hand crafted cheese and to become a significant food tourism destination for visitors from around the country and the world. Additional aesthetic touches were added to the café, such as exterior stonework and timber interior lining. It is fair to say that the current tourist experience is negligible and uninformative, as the complex process of cheese making is not easily informed through the visual sense alone and it is the visual sense that


the current building relies on. Visitors view a small portion of the blue cheese production room, through two awkwardly placed windows in their café. The café and blue production room are isolated and hidden from the bulk of the factory, this gives the visitor a misleading sense of scale leading the visitor to perceive the company as a small boutique. A large commercially operated creamery has the advantage of heightening the appreciation of cheese by immersing the visitor and creating a journey through the many spaces utilized for cheese production, which often go unseen.

Puhoi is one of the largest artisan creameries in New Zealand, unlike large companies like Fonterra, they are still reasonably hands-on and the cheese making process is not completely automated by machinery. Machinery takes over the packing of small cheese wheels, whilst
the large rounds are packed and handled by staff. The company utilizes traditional techniques such as cheese turning during the ageing process, hooping (molding), and manual salting and washing of brine. The factory receives a tank of 25,000 litres of milk a day and is used the same day or held in the milk silos for the following day’s production. The milk is processed to produce around 2.5 tonnes of cheese a day. The milk for this is sourced from roughly 1000 cows from northland farms.

3.1.1.3 Site Analysis

The site is located several kilometres from the Puhoi Valley township.

A large majority of the site can be described as having a gentle to moderate topography that graduates into a steep bush-clad hill, densely covered in mature pine and eucalyptus trees. The site is tucked into the side of a hill, facing north towards Ahuroa road and Puhoi River it is an attractive and sheltered spot nestled in a sunny valley. There are two ponds on site, one which is currently used for the disposal of waste water. There are expansive vistas all around, however the larger pond toward the front of the road is an attractive feature of the site and will remain so in the design of this project.

Figure 3.06: Photo of site pond
Figure 3.07: Section through selected site.
Figure 3.08: Selected site at Puhoi Valley.

Figure 3.09: Puhoi Valley Church built 1800s
3.2 Programme

3.2.1 Brief

The design will provide the following spaces which will need to address the presence two different social groups:

1. A cheese production facility operated by employees and viewed by visitors
2. A café, events room, shop, and cheese tasting room
3. A cheese maturation cave operated by staff and viewed by visitors

3.2.2 Spatial Requirements

Cheese production room: (Mostly wet area spaces)
- Self-cleaning milk silos (raw milk)
- Whey holding tanks
- Water tanks for washing production room
- Room for pasteurization equipment
- Hand-washing area
- Vat area (coagulation process)

Factory offices/other
- Separate lab for antibiotic testing (not in wet room)
- Small office for paperwork and inspector
- Screened chemical area

Cheese cellar/cave
- Cheese cellar for maturation (must be able to hold humidity and temperature)
- Rind washing room/area in cheese caves

Packing and distribution space
- Inward goods truck loading bay
- Outward goods truck loading bay
- Packaging space
- Refrigeration rooms

Factory staff spaces:
- Changing room (private lockers and showers)
- Bathrooms
- Staff room with kitchen

Café and other public spaces:
- Café kitchen
- Café counter
- Cheese shop/chapel + tasting room
- Cafe seating indoor/outdoor
- Function/events room
- Public bathroom for events room + cafe

Other Spaces:
- Parking spaces for visitor and staff cars/tour bus
- Parking and turning space for milk tankers
3.3. Development of Sensory and Spatial Experiences:

3.3.2 Form

Cheese process diagram:

Initially the cheese making process was explored in an attempt to generate form or find a common pattern. The practice of piercing, dicing, cutting, molding, stacking, pressing and aging were all processes taken into account in the preliminary design of the factory. Subtle hints of these patterns and forms are implemented in the design.

Figure 3.10: Patterns and forms in cheese making
Formal roof exploration:

Creameries in the past have been seen to be internally focused, and current issues related to the factory tend to be about natural light in the workspace. This initially suggested an exploration with the roof. Various roof forms were explored to try and achieve a form that would defuse natural light beautifully into the factory, whilst also retaining some connection to the production of cheese. Initially, the traditional factory sawtooth roof was explored and altered to achieve a more dramatic internal effect. The curved roof form was then explored to express the importance of the cylinder or circle in cheese making, an element that continuously arises in cheese making, from cylinder shaped silos to cheese wheels and barrel vaulted ceilings. It is a traditional element that has a practical purpose but allows a poetic play.

Figure 3.11: Roof Exploration
Nature, form + light exploration 1:

The following sketches explore visual connections to the surrounding landscape and the sky, whilst avoiding solar heat gain. Using an abstracted saw-tooth roof form, a repetitive motion is created responding to the progression of cheese making processes happening below.

Nature, form and light exploration 2:

The cheese making process of cheddaring (a process where cheese curd is sliced into layers and stacked) was referenced, to generate a segmented form that would enable visual access into the production spaces, in addition to providing a visual connection outdoors for workers. The undulating form of the roof, as seen in some sketches, responded to the inclining nature of the site and the attempt to ground the structure and reinforce the importance of nature’s role in the creation of cheese.

Figure 3.12: Form and nature exploration
Figure 3.13: Form and nature exploration
Figure 3.14: Eastern morning

Figure: Western late evening sun
Roof exploration and light:

The following model explores light qualities using the curved saw-tooth roof. The repetitive motion of the curved roof follows the direction of the cheese making process, reinforcing the sequence. It was decided that the unified beam and column structure gave a classical impression, therefore was decided against.
Figure 3.17: Roof and light exploration

Figure 3.18: Roof and light exploration
Roof exploration and light:

The following images demonstrate some of the conceptual roof forms and the quality of light. Where solar heat gain is an issue in the factory, all roof elements are oriented towards south or are exposed to early morning sun. The dramatic play and influx of light into the factory alleviates factory workers from the somewhat mundane tasks of production and enlivens their spirits by reconnecting them with natural elements. As already discussed, the curved roof form follows the direction of the cheese making process, implying a visual sense of moment. This helps visitors to understand the sequence of cheese making which will be organized in an uninterrupted order.
### 3.3.4 Circulation

Conceptual circulation diagrams:

After researching the cheese making process and analysing Fifth Town Creamery, it was made clear that an efficient creamery carefully distinguished and coordinated raw and finished product, visitors, staff and waste. However, the tourist experience and visual connection to site was just as important in the planning of spaces.

Diagram One: The idea of a 'break space' located between production areas was the main driver of this diagram. This break space allows workers to experience the natural surroundings as they move between work spaces, it also acts as buffer between contrasting hot and cold spaces. Taking advantage of the contour of the land, an underground cheese cave is buried into the site, accessed via underground tunnel. The overall layout was decided against, as the tourist journey was not sequential and required back tracking.

Diagram Two: This idea was also driven using the 'break space' concept. A linear segmented form was utilized to give an understanding of the sequence of cheese making. The form divides work and public circulation spaces, allowing visitors to enjoy the best parts of the site.
Diagram Three: This layout models the three core functions in cheese-making, allowing a circuit to be formed partly underground. Public spaces are positioned to the front of the site where visitors have full visual access of the pond.

Diagram Four: Public spaces are isolated from the bulk of the factory, however allow visual connection to the caves below. Visitors have the option of touring the factory which lines the edge of the central hub, giving close visual access to the whole production process.
Final conceptual form:

A simple curved form was utilized to reflect the contour curve in the surrounding landscape. The final diagram attempts to keep the production line continuous, while containing visitors to one part of the site where they are exposed to the best part of the site, which provides views of the valley and pond.

Figure 3.14: Final Layout option
Figure 3.15: link between main production rooms

Figure 3.16: Visitor circulation through factory
Spatial Experiences:

The vertical section was explored to discover the possible key viewpoint's experienced by the visitor. The motion of climbing gives the gesture of reaching a goal or final destination. The vast scale of the factory gives a feeling of bigness measured by the perceptual sense. The suspended level in which tourists enter through the factory allows an uplifting experience ultimately helping to heighten the product of cheese.

Figure 3.17: Spatial experience sketches
Figure 3.18: spatial experience sketches
3.3.1 The Cave

The sea cave consists of a spectacular journey of multiple routes and spaces, the layers of eroded rock and water datum lines gives evidence of season and passing time. Whilst the ground plane is consistent throughout the cave, an undulated jagged ceiling molds a series of different spaces. The cave is a rich multi-sensory environment providing heightened senses other than the visual sense. Hearing, smell, touch and temperature sensations are heightened dramatically at the decline of the visual sense, providing a stimulating spatial experience that engages the spectator with the place. Sensory receptors pick up on the sound of echoing footsteps throughout the cave, the feeling of cold damp air felt on the skin, the smell of salt water, and the sight of small shards of light in the distance. The experience of the sea cave will be a design inspiration for the cheese caves, an important part of cheese making.

Figure 3.19: West Coast New Zealand sea cave
Figure 3.20: Conceptual cave model
Roquefort Caves successfully conveys the message of nature as an important ingredient in cheese making. The notion explored here was to express the same message by playing on rough texture and weight that may express the earthiness of a natural cheese cave.
Conceptual cheese cave section:

This initial cheese cave concept demonstrates the journey from the half-submerged factory, through the caves, to the car park. After exploring other agri-tourism precedents it was made aware that it was common practice to terminate the tour with a gift shop. This influenced the overall layout of the factory and caves, as it was decided the caves would be moved to the front of the site, where a simple circuit could be formed. The cheese shop in this case, would be located in the last cave to where the tour would terminate and visitors can purchase goods before entering the car park. The caves consist of a number of linked barrel vaults, which is a traditional form in cheese making, but with a practical purpose – the rounded ceiling prevents any moisture formed from dripping on the cheese.
It was important to reflect the idea of a natural occurring process and the celebration of nature as an essential aspect of cheese making. A grounded organically formed cheese cave was utilized to provoke a strong sense of belonging and reinforce the idea of cheese as a natural product.
The curved journey in the cheese cellar reflects the natural and organic nature of the cheese aging process. This also gives the visitor a sense of discovery as numerous cheese caves are explored intermittently along the way. As discussed previously the dimly lit cave will help heighten other senses such as smell and sound, encouraging the visitor to thoroughly engage with the cheese and its natural damp environment.
Developed Concept

3.4.1 Concept 1.

This first concept explores the idea of materiality and light quality. The use of hand-formed in-situ concrete counteracts and contrasts the tons of stainless steel machinery and copper vats. With focus on an internalised journey, only the roof is open to the sky which brings light to the tasks being concentrated on by tourists and workers.
3.4.2 Concept 2.

The first floor plan attempted to compact the factory and public spaces as a solution to the sprawl seen at Puhoi Valley Cheese Company. The current layout of Puhoi Valley Cheese factory is somewhat chaotic and fails to follow any order as a result of awkward additions. The new plan suggests a simple progression of cheese making steps, which are contained in a basic form. The tour features a continuous route woven in and out of the factory, which is separated from the plane of the factory floor. Initially the tour route varied vertically, from above to below the factory floor to above again. Comments from supervisors, suggested reconsidering the underground tour route as it disrupted the flow of production.

3.4.3 Concept 3.

Similar to the previous concept, the repetition of strong geometries in Anat Raje’s Mafco dairy had a significant influence in this design. Rather than hiding the series of silo’s they were expressed and used to drive form in other aspects of the plan.
Figure: Conceptual sketch
Figure: Journey through the factory

Figure: Journey through factory
Serial Visions:

The following drawings demonstrate the touristic journey through the factory.

Figure: Journey through brine bath room
3.5 Design Outcome

Ground Floor Plan.

First Floor Plan
4.0 CONCLUSION

4.1 Summary and Appraisal

There have been many approaches to the design of factories in past years in an attempt to produce a more pleasant and productive work environment.

The shift in dairy design in New Zealand in the early 20th century was a significant move to explore the formal possibilities that concrete offered and expressed the technological achievement of concrete construction. The use of concrete or stone as seen at Kaimai creamery, Peregrine winery, Roquefort Caves and Comte fort St. Antoine, express a feeling of permanence and celebration. As an effective architectural metaphor for a company, these are important qualities to reflect as perceived by the consumer or potential business partner. The monumental permanent form of the concrete creamery reflects the idea of long-term stability and suggests celebration of the cheese product. This supports the company to be perceived as a trusted long-term brand that will attract and encourage brand-loyal consumers.

The exploration of the roof was oriented to not only producing a sensuous solution for the factory but provided a roof with metaphoric meaning. By closely relating the design of the building to the process of cheese making, a unique formal relationship was found which distinguishes the creamery from other food production facilities. As cheese is a product that is made using traditional processes, it was important to respond to the past forms or patterns utilized in traditional cheese making. The challenge lay in finding a new contemporary form that would respond to the traditional aspect of cheese making yet responded to not only the site but the modern practice of cheese making and the demands of a pleasant work space.

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Bibliography:


Franck Beaurain, Head Cheese Maker. 29 August 2014, 2014.


6.0 APPENDIX A

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7.0 APPENDIX B

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2. Staff room, kitchen, and dining
3. Staff toilets, boot exchange and lockers
4. Milk silo
5. Water tank
6. Visitors platform
7. Silo platform and entry to cave
8. Production management office

First Floor Plan
1:200
1. Silo walk
3. Production Area
4. Site Viewing Platform
5. Brine Baths
6. Cave Entrance and Viewing Platform
7. Cheese Caves
8. Cafe and Gift Shop
9. Garden Chapel
“Factory in the Field”
Jessica Malcolm