EARLY CORRUGATED IRON CONSTRUCTION IN SOUTH AFRICA 1820-1920

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D E C L A R A T I O N

E A R L Y C O R R U G A T E D I R O N C O N S T R U C T I O N I N S O U T H A F R I C A : 1 8 2 0 - 1 9 2 0

I declare that this dissertation is my own unaided work. It is being submitted in fulfilment of the requirements for the Degree of Master of Architecture (Conservation) in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University, nor has it been prepared under the aegis or with the assistance of any body or organization or person outside the University of the Witwatersrand, Johannesburg.

SIGNED: ....

DOUGLAS HARVEY RODD

The 13th day of November, 1989

ABSTRACT

The main purpose of this study was to focus attention on an historically important, but somewhat neglected and overlooked, building material and system of construction which dominated the urban and suburban scene in South Africa at the turn of the nineteenth century, namely, corrugated iron and the so-called wood and iron form of construction.

The somewhat limited literature on the subject was reviewed and a summary of the historical background and history of the manufacture and use of corrugated iron, and the various systems of construction that it spawned, was compiled. Some attention was given to the occurrence and distribution of the forms of corrugated iron construction in the historical context, and a sample survey of extant examples of buildings in some of the well known, and lesser known, areas of concentration was carried out.

The historical, technological, development of the various systems of construction using corrugated iron was analysed, and some case studies illustrating the findings in this respect were reviewed.

The study revealed that the subject of corrugated iron construction in South Africa was indeed a vast one, and one that had received scant attention from architectural historians, or chroniclers of building construction, up to this time. It also revealed that there is still a reasonbly good sized stock of iron buildings of varying types in the country today, many of which may be worthy of preservation for their historical and architectural interest and significance.

However, the lack of knowledge and records of early corrugated iron construction in South Africa, as well as the virtual absence of any systemmatic records and evaluations of extant examples of buildings in this respect, appear to make the formulation of a relevant conservation policy, difficult, if not impossible at this stage.

It was concluded, therefore, that a survey of the existing stock of corrugated iron buildings in this country, leading to the preparation of a conservation study and policy related specifically to this type of building, was of first priority.

It became apparent that the corrugated iron tradition in South Africa was of great historical and architectural interest and significance and needed to be studied in greater detail than was possible within the scope of this present study.

In conclusion, some thoughts on the possibility of reassessing the humble and much maligned material, corrugated iron, in the future, were submitted.

PREFACE

Information for this study was drawn from sources including surviving buildings, records of early works, libraries, museums and archives. Invaluable help has been supplied by the personnel of the institutions and local museums visited, such as at Simonstown and Barberton. In particular, I am grateful for the assistance given by Alison Bornman, of the latter museum, who provided me with some useful background material on the history of the buildings involved. I am also particularly indebted to Andrew Hall of the Transvaal Museum Services for his valuable comments on corrugated iron structures, and for a copy of his thesis on the history of American Galvanized Iron Roofing and Cladding from the 1870's to the 1920's.

Thanks are due to Mr John Rennie and Mr Brian Kearney, who during the course of my survey of existing buildings, helped to put me on the right trails in Cape Town and Durban, respectively. In this connexion, I am particularly grateful to my wife, who patiently acted as navigator, while I searched among the not always so reliably mapped labyrinth of streets in the various parts of the country involved, for the elusive examples of corrugated iron buildings involved. I am also indebted to my daughter-in-law and son who helped with some of the last minute typing, collating and binding chores involved in the completion of the project. Without the stimulation and encouragement provided by Prof. D. Radford in the supervision of this study it might never have been completed.

All present day photographs are my own, and photographs, reproductions of old drawings and other documents, have been specifically acknowledged.

C O N T E N T S

LIST OF ILLUSTRATIONS

CHAPTER 1

HISTORICAL BACKGROUND

Attention will be focussed in this study on an one hundred year period of development of corrugated iron and associated forms of building construction spanning the nineteenth and early twentieth centuries.

Before doing this it is necessary to place this period of development in its broader historical perspective, particularly in the context of South Africa as a colony of the time. In order to do this the angle of focus will have to be quite considerably widened to view the subject against the background of political, social and economic development in Europe and its colonies during the preceding two centuries. These two centuries, ie. the seventeenth and eighteenth, also happen to coincide with the early historical life span of South Africa itself.

In the narrower vision of the nineteenth and early twentieth centuries the history of corrugated iron construction can be seen as being inextricably interwoven with the social and economic history of Victorian Britain and its Empire. In the broader vision of the middle fifteenth to the early twentieth centuries it can be seen as being part of an ongoing and accelerating process of political, social, religious and intellectual change and development on a world-wide scale.

In this chapter the subject, ie. early corrugated iron construction in South Africa, will be reviewed in the context of this broader historical vision.

Although the heyday of the wood and iron tradition in South Africa could loosely be called the period from 1890 to 1920 (1), corrugated iron structures have been recorded as having been sent out to the country as early as 1846 (2). In any event the significance of the "tin tradition" in South Africa can only be appreciated against the historical background of the full hundred year period of its development in Europe and the colonies, that is, from the 1820s to the 1920s. In order to see this period in its true perspective it is also necessary to consider the economic developments which had taken place in the mother countries of Holland and England and in their fledgeling colony South Africa, during the preceding two hundred years.

South Africa came into existence at a time when Europe was experiencing an acceleration in development in all spheres of life. This was a result to a great degree to the accumulative effect of developments in science and technology and the growing complexity of life (3). Political, social, religious and intellectual changes had been taking place from as early as 1450, and were to continue at an ever increasing pace until the present time. Capitalism was in the process of developing. Part of the process of change was the rise of national states which together with the rise of capitalism and expansion overseas led to the development by the new nations of the economic policies, theories and practices which have come to be called "mercantilism"(4). "Mercantilism" is a term used to cover the efforts of the various European countries to make themselves powerful, wealthy and united. These efforts gave rise to the urge to colonize and led among other things to the foundation of great trading companies. The various powers of the time established special organizations to control their colonization activities. These were the various East India trading companies formed by the Dutch, British and French.

South Africa was a product of this urge to explore and colonize as well as to find new trading routes and sources of raw materials and imports for the mother countries. Not long after van Riebeeck landed in 1652 to found a refreshment station, a half-way house to India, South Africa was to come under the jurisdiction of one of the trading companies, ie. the powerful Dutch East India Company(5) and begin to feel the effects of the mercantilist policies of the time.

As well as other factors peculiar to the South African scene (6), these mercantilist policies of the Dutch and in later years of the

English mother countries were to make South Africa almost completely dependent on the importation of processed goods from the parent states. In particular, the growth of processing industries was discouraged by the policies of mercantilism. Thus, the colonizing powers in their pursuit of increased strength and wealth, regarded anything which tended to make the colonies more indedendant as evil and dangerous. The growth of processing industries was therefore strenuously opposed. The colonies were developed with two main objects in mind, namely, to provide the mother country with raw materials which she herself could not produce and which had therefore to be imported from other countries, and to serve as outlets for the processed commodities of the mother country (7). And so it was that, although Europe had reached a very advanced stage of industrialization by the second half of the nineteenth century, South Africa had remained a predominantly rural economy. Small local industries, such as brick-making, hand-sawn timber production, hand-made furniture and small-scale mills for grinding wheat and maize, had sprung up at an early date throughout the country. But, in the development of industry in the sense of modern manufacturing industry, South Africa was to lag almost a century behind the Industrial Revolution in England (8).

The material and techniques of corrugated iron construction could be said to be a product of the so-called Industrial Revolution. By the time that a peak had been reached in industrial development in England, ie. in the 1850s, South Africa had been firmly cast in the characteristically dependent mould of a mercantilist colony and had become virtually a captive market for the manufactured products of the mother country, such as corrugated iron.

It is ironic to note that by the time that diamonds were discovered and intensive gold mining developments were taking place in South Africa, the restrictive policies of the early colonists had already given way to the more relaxed concepts of "laissez-faire", but South Africa was not able to take advantage of this. The mining developments during the latter part of the nineteenth century were in themselves so rapid that they absorbed all available capital, skilled manpower and entrepreneurship that they generated, and factory production on any significant scale could still not take place. Indeed it was not until the Act of Union in 1910 and the emergence of other forces and factors during and after the first world war that South Africa began to come into its own as an industrialized nation. In fact it was not until The South African Iron and Steel Corporation (Iscor) was established in 1928 that South Africa became capable of manufacturing such materials as sheet steel.

The same forces of colonization and expansion of overseas trade that were to provide the incentive for the acceleration in technological invention in England at the time of the Industrial Revolution of 1760-1820 were to make South Africa an ideal captive market for the products of this period and the years to follow. Corrugated iron was one such product.

These forces gave rise to unusual circumstances such as "the settlement of a new colony, the finding of gold and diamonds and the waging of a far-off campaign". In turn these circumstances generated a local demand for a variety of building types which, for the reasons outlined above, exceeded the local capacity to supply. Victorian Britain on the other hand, possessed the ability to respond to this demand in the shape of its characteristic technological competence and industrial capability. In the field of building this demand was met by the development of prefabricating techniques and materials such as corrugated iron . The history of prefabrication and the development of corrugated iron in the early days is largely that of the successful response of a highly industrialized and technologically competent Victorian mother country to the demands of its underdeveloped and less capable colonies such as South Africa. (9). In the following chapter the history of the technological development of galvanized corrugated iron will be considered in the narrower vision of the nineteenth and early twentieth centuries.

REFERENCES AND NOTES CHAPTER 1

1 Prof. Dennis Radford, in an article: "The Wood and Iron House: A Study of its Occurrence and Distribution in Southern Africa".

2 Gilbert Herbert, "Pioneers of Prefabrication", The John Hopkins University Press, Baltimore, 1978, p. 48 and 56.

3 S B Clough and C W Cole, "Economic History of Europe", D C Heath and Company, Boston, Third Edition, 1946, p. 97 et seq.

4 Ibid, p. 197

5 The Dutch East India Company was established in 1602; see also "Encyclopaedia of Southern Africa", compiled and edited by Eric Rosenthal, Frederick Warne & Co. Ltd., London and New York, Second Edition, 1964, p. 152.

6 Eg. factors such as lack of markets, widely dispersed population and meagre and expensive transport facilities.

7 Clough and Cole, Op. Cit. See Chapter 7 for an exposition on the nature of mercantilism in Europe, 1500-1640.

8 D Hobart Houghton, "The South African Economy", Oxford University Press, Cape Town, Fourth Edition, 1976, p. 119.

9 Gilbert Herbert, Op. Cit., p. 2.

CHAPTER 2

HISTORY OF THE TECHNOLOGICAL DEVELOPMENT OF CORRUGATED IRON

In the previous chapter early corrugated iron construction in South Africa was looked at in the context of a broader historical vision covering a period of some four centuries of development in Europe and the Colonies. In this chapter some aspects of the subject will be discussed in the narrower vision of the one hundred year period of development of corrugated iron from about 1820 to 1920.

Corrugated iron will be defined; the history of the manufacture and use of the material, including the development of the process of galvanizing, will then be outlined; and some of the principal merits and demerits of the material will be discussed.

i DEFINITION

Corrugated iron may be defined as sheet iron formed into a series of rounded, parallel ridges and hollows (1). The term galvanized corrugated iron is in a sense misleading, because since the latter half of the nineteenth century the metal used became predominantly steel rather than iron and the material was zinc-dipped rather than "galvanized".

ii OUTLINE HISTORY OF MANUFACTURE AND USE OF CORRUGATED IRON

The corrugated iron tradition was born in England in the early 1820s against the historical background sketched in Chapter 1. The Victorian era in Britain was about to be ushered in with the accession of Queen Victoria to the throne in Britain in 1837. In South Africa sovereignty over the Cape had recently been acquired by Britain, ie. in 1814; 5000 British immigrants who had arrived in

Port Elizabeth in 1820, the so-called 1820 settlers, were experiencing the rigours of settlement in an unfamiliar and hostile environment; and the Great Boer Trek from the Cape Colony was about to begin.

The period from 1776 to 1850 has been referred to by economic historians as the adolescent period of industrial development in Europe and the period from 1850 to 1914 as the period of maturity. Technologically, the development of corrugated iron and the process of galvanizing of the material could be said to have reached its peak in the 1850s (2). According to Gilbert Herbert in his book "Pioneers of Prefabrication", the period from about 1860 until the turn of the century was not marked by radical technological innovation or by finesse in use, but rather by the consolidation of the market and expansion of production of corrugated iron (3).

For the purposes of this study the history of the development of corrugated iron has been divided into four broad phases roughly corresponding with the periods of industrial development in Europe and the periods of development of corrugated iron identified by Herbert as outlined above, namely:

Phase 1: The pre-development period prior to 1820;

Phase 2: The heyday of the development of prefabrication in building and the manufacture of corrugated iron from 1820 to 1860;

Phase 3: The period of consolidation of the market and expansion of production and distribution of corrugated iron and steel from 1860 to 1890;

Phase 4: The heyday of wood and iron construction in South Africa from 1890 to 1920.

The history of the development of the material and techniques of corrugated iron has been well documented by Herbert, particularly in the field of prefabrication(4). Much of the material contained in this chapter has been gleaned from his book on the subject. Notable events in the technological development and distribution of the material is summarized in chronological order below:

PHASE 1: BEFORE 1820

In 1783 Cort introduced the use of rollers instead of hammers in the production of iron plates making the manufacture of sheet metal a feasible proposition.

Before 1820 the principle of enhancing the rigidity of a sheet of iron by fluting, grooving or corrugating had long been known; practical problems of manufacture had inhibited its development. Only a laborious method of production, one groove at a time, was possible.

PHASE 2: 1820 TO 1860

In 1829 the first patent using the term "corrugation" was granted to Henry R Palmer, a London civil engineer;

corrugated iron was first produced on a commercial basis by passing sheet iron through fluted rollers when in a red hot state;

the firm of Richard Walker, "Carpenter and Builder and Manufacturer of Patent Corrugated Iron" was founded after acquiring the patent from Palmer by purchase.

In the early 1830s a drawback was experienced in the use of corrugated iron for roofs; unless painted regularly it was highly vulnerable to corrosion.

By 1832 Walker had experienced considerable experience in the manufacture and application of corrugated iron.

In 1837 the drawback experienced in the use of corrugated iron was to be overcome with the development of the process of hot-dip galvanizing;

the first British patent for the process of hot-dip galvanizing was awarded to Craufurd;

a similar patent was awarded to Sorel in France.

From 1832 to 1845 an important part was played by Richard Walker in the use of corrugated iron for building purposes. He foresaw the potential of corrugated iron as a building material for prefabrication or portable buildings in

1832, anticipating most of his competitors by at least a decade.

In 1841 a British patent was awarded to Edward Morewood for "preserving iron and other metals from oxidation and rust".

In 1843 the first application of galvanized corrugated iron to roofing in Britain was claimed to have been made by John Porter of Southwark.

From 1843 onwards further patents in the name of Morewood and Rodgers were awarded.

In 1845 a British patent was awarded to Morewood and Rodgers for corrugated iron covered with zinc.

Up to 1845 Walker's process of manufacturing corrugated iron was cumbersome and expensive.

In 1845 a key development took place in the manufacture of corrugated iron:

John Spenser, an agent for Thomas Edington and Sons of the Phoenix Iron Works, Glasgow, was granted a British patent for producing corrugated iron using either a hot or cold process by passing it through rollers. This process made corrugated iron available in much greater quantities and at a reduced cost.

In the 1840s and 1850s iron buildings for exportation made their appearance in Britain as exciting new phenomenon accompanied with much publicity and celebration. From the 1860s onwards, however, they were to come onto the scene unheralded and as an accepted fact of life.

In 1846 an iron cottage and a warehouse were sent out from England by John Porter for a merchant emigrating to the Cape of Good Hope.

In 1848 John Porter patented various designs for using corrugated iron structurally in beams, floors, etc.

In the 1850s several iron buildings were sent out to Port Natal.

In 1850 Walker contracted to ship a spacious corrugated iron Hotel to Port Natal.

In 1852 John Henderson Porter, one of the pioneers of corrugated iron in the 1840s, patented a system of fixing iron sheets to timber framing.

In 1853 Edward T Bellhouse described a method of using corrugated iron horizontally between exposed iron columns;

Bellhouse was awarded a British patent for a special column to overcome the complication of horizontal sheathing between exposed iron columns.

In the 1850s an excellent quality of corrugated iron with a "larger size" corrugation was used in Durban.

In 1851 there was a gold strike in Victoria, Australia, which created a demand for housing in that country.

In 1853 John Walker, apparently aware of the demand, advertized in the Australian press.

By May 1853 John Walker had thirty six houses in course of construction for residences of emigrants to be sent out by the Government to Australia; and Walker claimed to have erected "many hundreds of houses".

In 1853 and 1854 there was a considerable trade in iron prefabricated buildings for Australia, which was to decline in 1855.

PHASE 3: 1860 TO 1890

After 1860 the steel making process became a commercial proposition and steel sheets were produced in the heavier gauges.

After1867 when diamonds were discovered in Kimberley large quantities of galvanized iron were sent out to South Africa.

By 1870 coastal dealers were advertizing corrugated iron and sheet iron at Port Elizabeth prices.

By 1872 local merchants were handling considerable stocks of galvanized corrugated iron.

In 1888 corrugated iron received some form of official recognition in Britain in the Model Bye-Laws governing temporary iron buildings.

In 1889 the shortcomings of corrugated iron were expressed in an article in the "Building News", August 1889. The Victorian attitude to the material as expressed in this article is discussed more fully below.

From the 1870s to the 1890s a large number of corrugated iron buildings were built in the South African mining areas and towns such as the Vaal diggings, Kimberley in the Cape, Pilgrims Rest and Barberton in the Eastern Transvaal and the Johannesburg and Witwatersrand areas.

PHASE 4: 1890 TO 1920

This period, 1890 to 1920, has been called the heyday of the wood and iron system of construction in South Africa. During this period a vast number of wood and iron buildings, mainly houses, were built particularly in the Johannesburg and Witwatersrand mining areas; many of these buildings being of the brick lined variety. This method of construction will be discussed more fully in a later chapter.

After 1890 steel sheets were successfully made in the lighter gauges; the output per shift was so much larger and the cost so much lower than iron, that steel very quickly ousted the old-fashioned wrought iron sheets.

From 1900 onwards, during the Anglo Boer War, corrugated iron was used in the provision of military buildings for the British army of occupation; for example, at Middelburg and Barberton in the Transvaal.

By 1901 there was a demand for the provision of blockhouses for the British forces in dealing with the problems of geurilla warfare; this demand was met by the construction of an unique form of wood and iron building which will be described and illustrated in a later chapter.

iii HISTORY OF THE MANUFACTURING PROCESS OF CORRUGATED IRON

The manufacturing process of corrugated iron was perfected during the first half of the nineteenth century as outlined above. The history of this process is discussed in more detail below.

Three methods of forming corrugations in sheet iron have been identified: Firstly, a laborious method of production by casting or pressing one groove at a time. Secondly, a more mechanized method of production by passing sheet iron through fluted rollers when in a red hot state; this method proved to be a commercial proposition but somewhat cumbersome and expensive.(5) Finally, a method of production using either a hot or cold process by passing the sheet iron through rollers; this process made it possible to produce corrugated iron in greater quantities and at a reduced cost.

Up to about 1860 the sheets were made from wrought or puddled iron, not steel, and corrugated in the black before being galvanized by dipping in an open bath of molten zinc. After the steel making process became a commercial proposition about 1860, steel sheets began to oust the iron sheets (6). At first the steel sheets were produced in the heavier gauges and it was not until about 1890 that they were made successfully in the lighter gauges. The output of the sheets then became so much larger that steel virtually replaced iron as a medium for making corrugated sheeting. The stiffening effect of corrugated profiling also made the use of lighter gauges possible.

It has been contended that the life of ordinary quality galvanized corrugated steel sheets is only 25% of the original iron sheets. For this reason iron sheets of higher purity than ever were still made at the time for those who were prepared to pay a higher price for an article of longer life. These superior quality iron sheets were apparently still being made in Great Britain and on the continent and in America as late as 1927 (7).

It seems that a great variety of shapes and patterns of corrugated sheets have been manufactured and that different standard sizes were produced in Britain and America. Widths or pitches of corrugations ranged from as large as 127mm (5 inches) to as small as 16mm (5/8 inch). Depths of corrugations ranged from 50mm (2 inches) to a mere 3mm (1/8 inch). ILL 1 shows some of the shapes and sizes manufactured in Britain and America.The most commonly used corrugation width in Britain was probably three inches while the most popular width in America seems to have been the two and a half inch (8). Although the larger five inch corrugation must have imparted the greatest strength to the sheet the three and two and a half inch widths were more popular possibly because they were cheaper or because the smaller corrugation was thought to have a more pleasing appearance. The latter widths were also probably the smallest practical sizes from a structural strength point of view. The smaller sizes of corrugation were apparently used for ceilings and for decorative purposes in America(9). ILL 1

Corrugated iron was also manufactured in a great variety of gauges ranging from 13 to 30 (10). 18 gauge which was used for earlier iron was considered to be a very heavy gauge (11). By the 1860s the thickness of sheets was down to 24 to 26 gauge and in 1870 a 28 gauge sheet named "Buffalo Brand" was introduced, ostensibly to take advantage of the potential market at the diamond diggings (12). ILL 8

The question arises whether these thinner gauges were in fact of steel rather than wrought iron. It is difficult to distinguish whether the material commonly referred to as "corrugated iron" in trade literature of the time is wrought iron or steel. For example, Holland & Vardy's price list of 1897 refers to galvanized corrugated "iron", as does Boustred's catalogue of the 1940s. By both of these dates steel had probably replaced iron as the sheet metal used for so-called corrugated "iron"(13). Perhaps the answer to the dilemma is to ignore the difference between iron and steel as such and adopt the common parlance of referring to both varieties as "corrugated iron". Eventually the most common gauge used seems to have been 24.

iv HISTORY OF THE PROCESS OF GALVANIZING

The main drawback to the use of corrugated iron in the 1830s has been mentioned, ie. its vulnerability to corrosion unless painted regularly. In order to overcome this drawback methods of coating the iron with zinc were devised. Proper coating of the sheet could add considerably to its life. This process of zinc-tinning of iron was called "galvanizing" which seems to imply some galvanic action in the coating of the metal.(14) It is not known why the term "galvanize" was chosen in the 1830s as no particular galvanic action takes place in the process other than that which is common to all forms of chemical reaction (15). Some galvanic or electrolytic action does apparently come into operation, however, when the coated iron is exposed to the atmosphere. This action results in the eventual protection of the metal.

Be that as it may, early iron - not steel - sheets were corrugated in the black, then galvanized by hand dipping in an open bath of molten zinc. The output was small and the cost high, but the quality was excellent (16). With the use of machinery outputs were increased considerably and costs lowered.

This was not brought about without some sacrifice in quality. In response to a growing demand for cheaper goods the zinc coating, which could now be easily regulated by mechanical rollers, was brought down to dangerously low limits(17). The life of a galvanized sheet depends on the thickness of the zinc coating to the extent that an imperfectly or insufficiently coated sheet is thought to be worse than a black or ungalvanized sheet.

Just what constitutes an adequately coated sheet is not clear. Some comparative galvanizing specifications ranging from 0.82 ozs/ft^2 (250 gms/m^2) to 2.50 ozs/ft^2 (762 gms/m^2) are given in ILL 2. It is interesting to note that in 1927 a coating of from 2.0 to 2.5 ozs/ft^2 was considered desirable although this was considerably higher than ordinary merchant quality. At the present time a coating of 0.90 ozs/ft^2 (275 gms/m^2) is considered by the Department of Public Works to be adequate for roofing purposes. ILL 2

A brief description of the processes of galvanizing and corrugating of metal sheets, as they were carried out in 1927, is contained in ILL 3. The early method of galvanizing of sheets already corrugated ILL 5 was apparently replaced by the mechanized process of galvanizing of the flat sheets before corrugating.

v MERITS AND DEMERITS OF CORRUGATED IRON

The development of corrugated iron in the late 1820s was particularly well timed. It provided an important new building element for the designer and manufacturer of prefabricated buildings of the time. s development also resulted in a system of construction which was be particularly suited to the pressing needs of a rapidly expanding European and Colonial economy of the latter half of the nineteenth century.

The importance of corrugated iron in the context of prefabrication is summed up by Herbert as follows: (18)

> ....And now, in addition to the familiar castings of building components from staircases to spires, in addition to the repertoire of cast- and wrought-iron structural elements, in addition to the new techniques of iron roof construction, he (the British designer or manufacturer of prefabricated iron buildings) had readily available, for the first time, a large-scale, relatively lightweight building element suitable for roofing and wall-cladding: the galvanized , corrugated iron sheet......When considering the development of prefabrication in the 1840s and '50s, one can hardly overstate the importance of corrugated iron. While the iron frame was a structural system especially important for large-scale buildings of many stories, and the iron truss was related to the problem of the wide span, the development of corrugated iron resulted in a system of construction, a quick and inexpensive means of enclosure that was relevant to all buildings, both large and small. Corrugated iron was considered a material whose strength, portability, impermeability to water, invulnerability to termites, and presumed resistance to fire, gave promise of a sheathing and roofing system infinitely superior to wood. It was a material, moreover, entirely consonant with the spirit of the times, for if it lacked the fruity richness of cast iron, it nevertheless reflected that other attribute of the Victorian era, the quality of stern utility.

Herbert's summary encapsulates virtually all of the many attributes of corrugated iron. His reference to its quality of "stern" utility, however, touches lightly on one of its main drawbacks, namely, its somewhat austere and severe character.

Towards the middle of the nineteenth century corrugated galvanized iron became readily available in the required quantities to meet the rapidly increasing demand of the prefabricated building fraternity of the time. It was light and easy to handle, yet possessed a rigidity and strength far in excess of its unformed shape and dimensions; a property which was to result in a system of construction of almost universal application, ie. the so-called wood and iron form of construction. More will be said of this form of construction and its versatile character in a later chapter (19). The element of urgency, which was characteristic of the times, could be met both quickly and inexpensively by this new material and the systems of construction which it spawned.

As a sheathing corrugated iron was impermeable to water, invulnerable to termites and resistant, if not a barrier, to fire. In use as another building material, however, its efficacy in this respect still depended largely on the application of good building construction principles and reasonably good workmanship. More will be said on this point when discussing the various systems of construction used.

Although corrugated iron is in itself non-combustible, its heat conducting property when used in conjunction with wood raises doubts as to its fireproofness. More will be said on this score when the demerits of the material are discussed below. On the credit side one might mention that in the United States of America in the 1920s the fire resistant qualities of galvanized iron appear to have been regarded as its principal advantage over other materials (20). From the 1870s onwards it was promoted in that country on this basis, mainly as a roofing material in competition with the highly inflammable wooden shingle. Much was also made at the time of the part played by metal cladding in preventing the spread of fires from property to property and of its ability to hold together longer than other materials, particularly when used as a roofing material. From the turn of the nineteenth century the use of sheet metal was promoted or required by many city fire codes and endorsed by fire chiefs, insurance companies and even the Department of Agriculture in the United States of America. It was also regarded as an ideal material for the construction of such fire risk buildings as suburban garages and explosives magazines. In Japan it was prescribed for use alongside railway lines where the traditional thatch had become a constant fire hazard (21). It would appear that galvanized iron was revered in some quarters for its fire resistant qualities. On the debit side, however, one might mention that the attitude to the material on this score was distinctly negative in parts of South Africa at the turn of the nineteenth century. This point will be discussed below in the context of the local attitude to the aesthetic unacceptability of the material(22).

Another advantage claimed for the use of corrugated iron is its so-called portability". The meaning of portability as understood by Gilbert Herbert is used in this context, namely; buildings are "portable" if "they may easily be taken to pieces and reassembled or reerected elsewhere" (23). An example of the application of this principle is the well-known residence of the late General J C Smuts at the farm Doornkloof at Irene, near Pretoria in the Transvaal. An officers' mess building at Middleburg, in the Transvaal, was bought by General Smuts for £300 in 1908. It was taken down, transported by steam engine and truck to the farm and reerected there in somewhat altered form at a further cost of £1000 (24). The virtues of spaciousness and pliability of the wood and iron form of construction were referred to later by Smuts's son when he remarked that the house " was like a meccano set, for it was easy to dismantle the internal walls and alter its shape at will "(25). Many other examples of the dismantling and reerecting of corrugated iron buildings are referred to by Herbert.(26) The portability of corrugated iron buildings is enhanced by the lightness of corrugated iron and the ease with which it can be stacked and parcelled and transported to another site. Furthermore, when a corrugated iron building is demolished the sheathing material is often salvageable and has a reusable value even if the remainder of the building is scrapped.

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Durability has also been cited as a factor promoting the use of corrugated iron for buildings (27). It is not possible to generalize on the subject of durability in relation to corrugated galvanized iron because durability is a function of many other aspects of the material such as the composition of metal used, its thickness and quality of zinc coating applied. Durability can only be judged after a reasonable lapse of time and is affected by the amount of maintenance employed during the period in question. The latter point is abundantly clear from examination of extant examples of early corrugated iron buildings where the ravages of rust on areas left unpainted is palpable. On the other hand many examples of well preserved extant buildings dating back to the 1890s, with corrugated galvanized iron sheathing virtually intact, can be seen today.

The questionability of the fireproofness of corrugated iron has already been mentioned. The possible poor fireproof properties of the material is only one of the many deficiencies of corrugated iron.

Corrugated iron was a practical, flexible material admired and used extensively for its many utilitarian qualities. It was, however, an austere unspectacular material which, when used on a large-scale in a simple, almost brutal manner, resulted in a drab and mundane scene. Although there were a few special examples of some architectural merit, some of which were designed by architects, the general appearance of these predominantly utilitarian structures became to be regarded as socially unacceptable.(28)

An interesting case of the rejection of the wood and iron form of construction as a fire hazard, at the same time that opposition to it was being voiced on aesthetic grounds, can be seen in East London at the turn of the nineteenth century (29). In 1903 Building Regulations in East London placed restrictions on where wood and iron buildings could be built and required that such buildings be submitted for approval to the Medical Officer of Health. The apparent reason for placing such restrictions on wood and iron buildings was that they constituted a fire hazard. In 1905 the Mayor of East London was reported as playfully speaking of the Stone Age as being past. Commenting on this in a local newspaper the editor wrote "...Here in East London we have had a pretty long spell of the iron age and the authorities are doing their best to get the owners of property to go back to the stone age or at least to the age of good burnt brick and we are happy to say that substantial progress is being made in that direction " (30). It would appear from this statement that opposition to corrugated iron structures went further than just concern regarding its fire spreading properties, and that the latter might very well have been merely a convenient excuse for official action to be taken to restrict their use. In spite of such opposition to these buildings, wood and iron houses continued to be built in East London until well into the 1920s.

Possibly the most characteristic feature of the material, corrugated iron, is the widespread revulsion which it seems to evoke. No other material appears to have aroused so much public distaste or to have suffered so much disapprobation. At first the material was accepted for its obvious utilitarian qualities. The real revulsion against it as a"cheap and nasty" material seems to have come in the early twentieth century (31). In Victorian times its applications proliferated but in the late 1880s even the Victorians looked upon it with a critical eye and spoke of it derisively(33). Aesthetically, exposed corrugated iron was considered by them to look " poor and ill-adapted for permanent buildings ". Somewhat ambivalently, however, the Victorians appreciated the material's "virtues of strength, practical convenience and low cost ".

The Victorians were also aware of the many other inherent weaknesses and faults of the material. Their colonial experience had revealed its climatic shortcomings (34). In Britain it was found that " the smoke of coal and fires is injurious to the zinc coating, and the damp atmospheres, impregnated with smoke, soon found out weak points in the metal " (35). Fortunately South Africa did not experience the same problems with industrially polluted atmospheres as the home country did.

The problems of corrosion of the material were, however, also encountered in this country. Although galvanizing went a long way towards solving the problems of corrosion, paint remained the best way of protecting corrugated iron and prolonging its life. In the 1880s the painting with oxide of iron paint at the time of erection was advocated (36). In the 1870s lead paints were thought to be best.

It was also thought that lead should be used in an oil rather than a spirit base because spirits tended to have a corrosive effect. Iron oxide and various forms of tar paint were also used to paint galvanized iron. At the turn of the century sheets were sometimes immersed in hot bitumen during manufacture (37). The bitumen apparently adhered strongly to the sheet and was effective in preventing corrosion of the steel for some time. This form of coating was, however, in itself highly inflammable and some spectacular fires, during which the bitumen burned fiercely and the sheeting collapsed, caused this type of protected sheeting to be withdrawn. Later a protective coating consisting of hot bitumen covered with a coating of asbestos felt bonded to the bitumen, which was in turn coated in bitumen, was introduced. This combination of bitumen and asbestos was apparently effective in protecting the steel sheets from corrosion and in improving thermal resistance. It also provided a fair degree of resistance to damage by fire (38).

An example of the extent to which steel coating specifications have been taken in order to ensure some durability of corrugated iron is a specification called " Paint Harling ", consisting of a thick coat of special lead paint with graded granite chips thrown on. The chips, which are previously coated with the same paint, adhere to the base to give a roughcast effect. In a post second war Building Study in Britain known as the Burt Report the method of preparing and applying this specification is described. Examples are quoted of steel houses where such a finish had lasted ten years and was still in good condition (39).

Very little was known about the effects of paint on iron up to the 1870s. Which paints should be used and what paints were better at protecting metals seemed to be a matter of experience. No testing was done. The first testing of paints for iron roofs seems to have been done in the mid-1880s when coal-tar, iron oxide and lead paints were tested on the basis of degree of deterioration after the same period of exposure in the same environment (40). It is beyond the scope of this study to trace the history of the special treatment of a zinc coated surface to ensure proper adhesion of paint. It is now known that such treatment is essential and various

Building Research Sheets covering this item have been prepared in recent years in South Africa (41). It would be interesting to find out when the necessity of such treatment first became known or when the process of allowing the zinc coated surface to weather for a time before painting was first applied.

Another disadvantage of corrugated iron as a building material is its bad thermal performance. Peter Bell, in "Timber and Iron Houses in North Queensland Mining Settlements, 1860-1920" refers to this property of corrugated iron in the context of a warm climate similar to our own on the Witwatersrand:

> ...Its thermal performance is the crucial determinant of iron's unpopularity. An unpainted iron building rises rapidly in temperature from the first minutes of insolation in the morning, and unless the building is shaded by vegetation or verandas and well ventilated, will rise to stupefying and even dangerous levels in the afternoon. There is a popular belief that iron buildings will then rapidly cool during the evening, compensating in part for their poor daytime performance. However, observations conducted by Ray Sumner show that this is not necessarily the case; unless aided by effective ventilation, the temperature remains high throughout the night. In a series of eight experiments in four North Queensland iron buildings in both winter and summer, Sumner found that in every case the interior temperature remained appreciably above that outside from noon until the following 4a.m. or later. In four of the eight cases, the interior temperature was higher for the entire twenty-four-hour period. (42)

Peter Bell, however, goes on to say that the above findings are surprisingly similar to Sumner's observations in buildings of timber and stone, suggesting that the wall's insulating properties are not an important determinant of interior temperature. He continues:

> ...Presumably shading and ventilation play a greater part. Despite the good thermal conduction of iron, only a very small part of the air mass inside the building is in contact with the walls and roof, and the remainder is self-insulating. If the air inside is still, heat-loss by conduction alone will be very slow. Thus if iron was avoided for its thermal properties, it was being unjustly maligned, for it was blamed for poor shading and ventilation, which are matters of design rather than material. Perhaps part of its poor reputation arose from its early association with small cheap structures, inadequately ventilated and shaded, whose unpleasantness for habitation had little to do with the fact they were built of iron.
>
> In any case, the insulation properties of the material are no more important than their absorption properties. and the thermal absorption of corrugated galvanized iron can be dramatically reduced by the use of white paint.

Bell's remarks regarding the unjust maligning of corrugated iron are significant. They seem to suggest that many of the technical reasons put forward for the avoidance of the use of the material in buildings in the nineteenth century were based more on a prejudice against the poor appearance of the material than on objectively observed scientific fact.

The use of shading devices such as verandas and hoods over windows as well as the use of white paint to improve the wall's thermal performance is important. The use of a light-coloured, or preferably a white, paint can go a long way towards alleviating the problem of heat build-up under corrugated iron roofs. Other methods of preventing heat build-up in roof spaces were roof ventilators and the placing of insulating materials on the underside of the roof, and even the running of a continuous stream of water over the roof on hot days! (43) Such spraying was apparently not very effective. The placing of insulating materials under the roof surface in hot humid climates can cause problems. Condensation may occur which may cause rusting of the underside of the corrugated iron surfaces.

Another drawback to the use of corrugated iron for roofing is the noise of rain and hail falling on the roof. The use of heat insulating materi under the roof may help to alleviate this problem.

Mention has been made of the termite resistance of corrugated iron. Used in combination with wood framing corrugated iron structures become vulnerable to termite infestation and the traditional methods of ant proofing need to be applied in the case of such buildings. Field studies have revealed that the necessary precautions were not always taken. This topic will be dealt with more fully in a later chapter when dealing with foundation walls and piers.

In spite of its many drawbacks corrugated galvanized iron continued to be used in large quantities throughout the world until well into the twentieth century. Ready availability, ease of construction and relative economy contributed to the enduring popularity of the material even although it was never admired for its aesthetic quality.(44) By 1891 the total production of corrugated iron in

Britain exceeded 200 000 tons and by 1927 the production was 1 000 000 tons. Only 25% of this production was used in Great Britain, the remaining 75% being exported to other parts of the world. British exports steadily increased from 250 287 tons in 1901 to 762 075 tons in 1913. (45)

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CHAPTER 3

HISTORY OF THE TECHNOLOGICAL DEVELOPMENT OF CORRUGATED IRON BUILDING SYSTEMS

In this chapter the evolution of the various systems of corrugated iron construction will be discussed as well as their occurrence and distribution in South Africa during the time of this study, ie. from 1820 to 1920.

I EVOLUTION OF CORRUGATED IRON SYSTEMS OF CONSTRUCTION

The advent of corrugated iron as a building material in the early 1820s was to have a profound world-wide effect on the building industry of the time. It was to give rise to an unique form of building construction which was to virtually dominate the contemporary colonial scene for a period of some one hundred years and to survive, albeit in a severely depleted form, up to the present time. This form of building construction, referred to today as wood and iron construction, came into being as a result of the remarkable alliance which formed between the continuing tradition of building in timber and the new material, corrugated iron.(1)

Although this form of construction was to play an important part in the emerging "tin tradition" of the time, corrugated iron provided a light and flexible medium suited to a variety of differing uses. It became an universal material used in conjunction with a wide variety of building methods and materials. It was used to roof masonry buildings and became an important element in the pre-fabricated structures of the 1840s and 1850s. It was also used in the construction of such ancillary items as free-standing boundary walling and in the construction of items such as water tanks and veranda roof coverings which exploited its increased strength and rigidity in curved configurations.

Corrugated iron was used both in combination with cast-iron and wooden prefabricated buildings. During the first half of the nineteenth century an iron technology had developed which was to provide the designer or manufacturer of prefabricated iron buildings with a large repertoire of cast-iron and wrought iron structural elements and techniques of iron roof construction (2). Up to about 1850 cast-iron had been dominant but the making of wooden buildings and components never ceased. Parallel with cast-iron construction the tradition of building in wood continued (3). By the middle of the nineteenth century corrugated iron in galvanized form had come into its own as a new building element available for use in combination with all forms of prefabricated structures whether of cast-iron or wood. In the latter half of the nineteenth century wood virtually ousted cast-iron as the predominant medium to be used in combination with corrugated iron.

In the South African context it is inevitable that wood and iron construction should assume greater importance in a study of early corrugated iron construction, because of its prolific application in all parts of the country. For this reason, the main emphasis in this study is now directed at an analysis of this form of construction, and some of its variations, as found in this country up to the turn of the nineteenth century.

Before embarking on such an analysis, consideration should be given to some general questions relating to the wood and iron tradition. For example:

When, how and why did the alliance between the wood and corrugated iron building elements come about?

Secondly, what part did pre- as against site- fabrication play in the development of the wood and iron system of construction, particularly in the South African context?

Thirdly, what limiting effect, if any, did the particular characteristics and properties of the individual wood and corrugated iron elements have on the design and construction of wood and iron buildings, and is there any evidence of modular planning disciplines imposed by such characteristics and properties?

In considering the above questions other related questions come to mind. For example:

Did the possibility of fabricating the wooden framework on site from readily available sawn timber pieces play a part in the prolific use of the wood and iron form of construction in South Africa during its heyday?

Also, at what time did site fabrication take over from pre-fabrication of wood and iron buildings in this country?

And, what stage of development had the saw-milling industry reached in the country at the time?

Finally, in considering a popular variation on the wood and iron theme in this country, ie. brick lined, the question which arises is:

When and why did the brick lined form of wood and iron construction come about?

These and many other practical questions relating to the materials and techniques involved need to be addressed, if not answered, in dealing with the technology of early corrugated iron construction in this country.

Not all of the above questions can be answered within the scope and resources of the present study. Some of them have already been addressed in literature on the subject while others may have to be left to further researchers to answer.

At this stage it is proposed to deal briefly and in general terms with some of the above questions and to leave a more detailed examination of the questions, more relevant to this study, when the technology of corrugated iron construction is discussed in more detail in the next chapter.

Taking the above questions seriatim:

Firstly, when, how and why did the alliance between the wood and corrugated iron elements come about?

An interesting parallel can be drawn between the Australian and South African colonial experience on this question. Peter Bell writing in Australia on wood and iron houses in North Queensland Mining Settlements, 1861 to 1920, devotes an entire chapter to a discussion on the origin of the timber framed wall in that area (4). While it is beyond the scope of this study to deal with this topic in such detail, some of the points made are relevant to this study.

For example, in discussing the development of light stud and "balloon" type timber wall framing techniques in North Queensland, he refers to a form of construction originating for utilitarian purposes in Britain and adopted throughout the colonies. This reference is particularly interesting because it quotes G Herbert's "Pioneers of Prefabrication" as a source and cites "a heavier, widely spaced timber frame clad on one side only by corrugated galvanized iron" as the form of construction involved (5).

Bell also discusses the development of the so-called "balloon" timber frame with its characteristic skew-nailed jointing as against the superior form of framing employing morticing, tenoning, pinning etc. "according to the old established rules of architecture and carpentry" (6). Further reference will be made to this topic when discussing the question of pre- and site- fabrication techniques below.

As pointed out by Bell, Herbert deals at length with the British origin of the timber framed wall. Herbert, however, also makes a more particular reference to the origin of the use of corrugated iron with timber framing, as against cast-iron framing, in the context of the massive programme of prefabrication for the Crimean War of the 1850s (7). In doing so he poses a question and offers an answer which is relevant in the present context. His question is: why were the Crimean War buildings timber framed instead of cast-iron framed, despite the spectacular development of building in iron from the early 1840s? Briefly the points he cites which favoured the use of timber with corrugated iron, are: Firstly, there was already a well established and continuing tradition of building in timber at the time (8). Secondly, even the makers of iron-buildings made extensive use of timber elements in their buildings (9) and one pioneer , John Walker, had his own sawmills; Hemming, that recognized specialist of iron-house builders also made extensive use of timber elements. Thirdly and perhaps most importantly, the timber industry was long established and of sound repute and it was perhaps natural that a conservative user such as the War Board of Ordnance in the case of the Crimean War building requirements, would turn to such an industry rather than the more adventurous pioneers of iron buildings.

All the above points made by Bell and Herbert shed some light on the question of the coming about of the alliance between wood and corrugated iron in buildings in South Africa during the period 1850 to 1920. Bell also cites the advent of industrialization in the 1800s as opening up the possibilities in timber wall construction. More will be said on this topic when the development of the saw milling industry in this country during the period under review is discussed below.

Finally, as pointed out by Bell, all the timber techniques developed in Britain were available for adoption by local builders at the time of European settlement in the colonies (10). It was therefore not surprising to find the coming into use in all parts of the European occupied world of a timber and iron system so readily available and eminently suitable for local builders of limited resource and expertise.

The second question to be addressed is: what part did pre- as against site-fabrication play in the development of the wood and iron system of construction in South Africa?

This is a difficult question to answer in practice, because pre-fabricated and site built structures are often indistinguishable from one another after completion (11). It is significant to note that Herbert discusses this topic in relation to the corrugated iron buildings of the South African mining towns of the last third of the nineteenth century. It is also significant to note that he refers to it in the context of a "reversion... from the structurally and conceptually sophisticated corrugated iron prefabs of the 1850s to the utilitarian directness of the wood and iron buildings of the 1880s" (12). This would seem to suggest that the utilitarian directness of the wood and iron buildings of the 1880s might have had something to do with their being site erected by local less sophisticated builders. Wood and iron buildings could easily be erected on site by a carpenter. In a sense, the wood and iron system of construction could be regarded as the corrugated iron version of the timber "balloon" frame

The question of site- as against pre-fabrication is intriguing. Herbert deals with it at some length but leaves much unanswered. It would require much more research and field study to provide the complete answer: a task which is beyond the scope and resources of the present study.

For the purposes of this study it is perhaps sufficient to record, in the words of Herbert, that: "In a sense all wood and iron structures are partially prefabricated, because the major element, both for roofing and for wall cladding, is the manufactured corrugated iron sheet. Moreover, all of these buildings are portable ...." (13). This portability aspect is what makes it difficult to distinguish between the wood and iron building made locally and that brought in, in component form, from the coastal towns, or imported from Britain.

There is evidence that by the 1870s all the required components and elements of wood and iron buildings were readily available locally in South Africa (14). There is no doubt that many such buildings were site-built from such locally available materials. Because these buildings required little technical skill or experience in the building trades, it is reasonable to suppose that they could be easily and speedily erected by local workmen.

There is also evidence that wood and iron buildings were being made at the turn of the nineteenth century in prefabricated form, in such coastal towns as East London, for transport to the inland areas of development and that the wall framing for these buildings was being "properly morticed and tenoned (not cut square and spiked)" ILL 7A to 7C

In the final analysis it is only possible to determine whether a particular building was site- or pre-fabricated by opening up and examining methods and techniques of construction such as framing and jointing. This is not always feasible except perhaps during restoration work. In places such as Durban where the buildings are supported on piers it is sometimes possible to carry out such examinations at floor plate level by crawling into the space under the floor; a practice which is not to be recommended during the snake active periods of the year.

The third question, concerning limiting effects of the individual wood and corrugated iron elements on design and construction of buildings and possible modular planning disciplines imposed by these elements, will be dealt with in the chapter dealing with construction techniques and details.

It is just as difficult to determine at what time site fabrication took over from pre-fabrication of wood and iron buildings in this country as it is to distinguish between the two types of construction involved. Extensive research and field work would have to be carried out to throw further light on this question. A brief review of the history of the saw milling industry in South Africa may, however, be helpful in this regard.(15)

Up to about the time of the arrival of the 1820 Settlers all conversion of indigenous round logs was done by hand, using either axes to produce square beams, or pit sawing to produce planks. George Rex of Knysna is purported to have built the first mechanical sawmill in 1802, but no records exist of its actual operation. The Hon. Henry Barrington, M.P., who is reputed to be the father of the mechanical sawmilling industry in South Africa, commenced building a sawmill equipped with a water turbine for the propulsion of his sawing machines in 1860. Production is recorded as having started in 1869. The first boiler-driven engine arrived in 1875 in Knysna for William Lloyd's mill in the centre of the town. This was later to become the well-known Geo Parkes and Sons Sawmill. By the year 1890 there were reputed to be a least eight steam-driven sawmills in this district, which were mainly producing sleepers for the country's railway system. Saw milling on a fairly small-scale, localized, basis had thus become well established in the Cape by the 1890s.

In other parts of the country local suppliers of corrugated iron buildings are known to have had their own steam sawmills, for example: John Nicol of Durban and Joseph Wright of the West End Steam Saw Mills also of Durban, who advertized their wood and iron houses in 1899, had their own sawmills and offered a wide range of wood components for houses (16). In 1879 Kimberley's "Steam Saw Mills" were supplying deal planks for maintenance work at the local gaol.(17) By 1886 there were thirteen saw mills in Natal (18). Wright and Nicol were active on the Witwatersrand as well as at Barberton during the development of mining in these regions (19).

Another firm of expanding importance in the South African building industry in the latter half of the nineteenth century was Hunt Leuchars and Hepburn. At the turn of the century they had a large joinery workshop in Durban producing a wide range of joinery products and specializing in pre-fabricated wood and iron buildings for reerection up-country (20).

A thorough study of pre- as against site- fabricated wood and iron buildings is contained in Gilbert Herbert's book, "Pioneers of Prefabrication" (21). Herbert concludes that, except for the first critical stage of development when prefabrication played an important part, site fabrication was responsible for the greater part of the wood and iron buildings in Johannesburg. For this purpose, locally cut imported timber and imported corrugated iron was available from the stocks of local builders' merchants. This was also probably true of the other centres of mining developments of the latter third of the nineteenth century.

The final question to be considered is: did the possibility of fabricating the wooden framework on site from readily available sawn timber pieces play a part in the prolific use of the wood and iron form of construction in South Africa during its heyday?

The above review of the saw milling industry in this country would seem to suggest that sawn timber was probably readily available at the time. This availability of locally sawn light timber scantlings as well as the lighter gauges of galvanized corrugated steel sheets, such as 24 gauge, from the 1870s onwards, must have helped to promote the use of the wood and iron form of construction in South Africa. Portability of the elements and ease of construction must have also contributed to its prolific use throughout the country at this time.

ii DISTRIBUTION OF EARLY CORRUGATED IRON BUILDINGS IN SOUTH AFRICA

Any study of early corrugated iron construction in South Africa would be incomplete without some reference to the history of the occurrence and distribution of corrugated iron buildings in the various regions involved. To produce anything more than a general statement on this account would require much more detailed research,involving the examination of historical photographs, censuses and other documentary evidence, than is possible within the scope of the present study. A detailed survey and listing of extant buildings would also be desirable.

In order to provide something of a scenario for future possible further study in this regard and identify some of the points needing clarification, some general statistics gleaned from censuses conducted during the period of this study are examined and a sample field survey of extant buildings in some of the known areas of occurrence is described. (22)

A study of a census done in 1904 reveals some significant data regarding the distribution of wood and iron dwellings in the various regions comprising the nation at the time. The regions identified were the Cape, Natal, Transvaal and the Orange River Colony or Orange Free State.

In this census the total stock of wood and iron dwellings was shown as 65722 which represented about 23% of the total solid housing stock in the country at the time. Broken down into regions the figure of 65722 shows the greatest number in the Transvaal -26367 (40%), followed by the Cape -22831 (34%), then Natal -14767 (22%) and lastly the Orange River Colony -2767 (4%). A comparison within each region also reveals some interesting facts. In the various regions the figures for the proportion of housing in wood and iron to total solid housing stock show that the greatest proportion was in Natal (38,5%), followed by the Transvaal (33,3%), then the Cape (15%) and lastly the Orange River Colony (11,6%).

The census of 1904 also identifies areas of concentration of wood and iron dwellings in the various geographical regions: In the Cape, the main clusters of these dwellings were recorded in Kimberley, East London and Port Elizabeth plus the Cape Peninsula and Uitenhage; these areas containing more than half the total number. In Natal well over half of the total stock of wood and iron dwellings were concentrated in the Durban area (22%) and neighbouring Umlazi (31,5%) An additional 26% was recorded in the adjacent areas of Inanda (15%), Lower Tugela (6%), Camperdown (2%) and Alexandra Counties (3%), bringing the total to some 80% of the total stock in Natal.In the Transvaal the areas of greatest concentration of wood and iron dwellings were the Witwatersrand, Barberton and Pilgrims Rest. The greatest proportion was on the Witwatersrand, particularly in the mining areas. A later census of 1921 shows that there were over 10000 wood and iron dwellings in the Witwatersrand, this being twice as many as in the rest of the country combined. In the Orange River Colony most of the comparatively small number of wood and iron dwellings were concentrated in a few urban areas such as Bloemfontein, Harrismith and Kroonstad.

iii SURVEY OF EXTANT CORRUGATED IRON BUILDINGS IN SOUTH AFRICA

In order to gauge the nature and extent of extant corrugated iron buildings in South Africa, a visual study of buildings in the main known areas of concentration referred to above was made. The main areas surveyed were: Johannesburg and the Witwatersrand mining areas, Durban, Cape Town and the Cape Peninsula, Barberton, Pilgrims Rest and Irene and Heidelberg in the Transvaal.

It soon became apparent from the survey that a large repository of corrugated iron buildings was still to be found in the country and that the survey could only be regarded as a sample. For instance, in Durban alone, where a listing of such buildings has been made, no less than 121 wood and iron buildings have been identified. (23) Of this number 112 are houses, 4 are sheds, 2 are churches, 2 are temples and 1 is a cricket pavilion. During a train journey between Cape Town and Beaufort West, in 1989, a number of wood and iron sheds and houses were spotted alongside the railway line. Furthermore, no survey was carried out in such known areas of concentration of wood and iron buildings as Kimberley and East London. Reports have also been received of the existence of such buildings in the Bathurst-Port Alfred areas, as well as at Cape St. Francis and Cathcart in the Eastern Cape.

If anything, the sample survey carried out highlighted the need for a more systemmatic and comprehensive survey of extant corrugated iron buildings in South Africa than was required by the present study. More will be said on this topic when it is discussed in the context of the need for a conservation policy for corrugated iron buildings, in a later chapter.

Certain general observations can be confirmed from the sample survey, for example, the prevalence of the brick lined variety of wood and iron construction in the Johannesburg and Witwatersrand areas and the practice of founding the buildings on piers in such places as Durban.

The following general comments on the buildings surveyed are made:

a) Simmer and Jack Mines Limited: ILL 16A to 16R

This is an historically and architecturally significant group of extant brick-lined wood and iron mining buildings of the turn of the nineteenth century. It comprises a recreation hall and nineteen houses of various shapes and sizes. The buidings are reasonably intact and the Monuments Council is taking the necessary steps to have them suitably restored by the owners and declared a National Monument.

b) House, Parktown North, Johannesburg: ILL 17A to 17I

This is an interesting example of the evolution of this type of house in Johannesburg from a humble beginning in 1912, as a simple two-roomed cottage, to a verandahed house in 1916. It also illustrates the type of unsympathetic alterations to which these houses are sometimes subjected in the later years of their lives. The replacing of some of the original timber sliding sash windows, probably for perfectly good practical reasons, with the standard steel windows, is a case in point. If the original windows on the exposed faces of the house had been provided with a protector strip or hood in the first place it might not have been necessary to replace them with steel windows at a later stage. The apparent replacement of the timber supports to the verandah structure with plastered brick piers and balustrade walling is also somewhat unfortunate.

c) Melrose Temple, Johannesburg: ILL 18A to 18C

This a rare example of wood and iron temple architecture in the Transvaal (24). It is also another example of the unsympathetic alteration of a classic wood and iron building, where the original typical type of timber post and diagonal patterned balustrading of the period has been replaced with incongruous yellow facebrick piers and walling.

d) Temple and Church in Durban: ILL 19A to 19C

These examples illustrate the diversity of the wood and iron medium. The Cato Manor Hindu Temple is a small but surprisingly elegant example of the medium. (25) The less elegant utilitarian appearance of the Church of St. Michael's in Seaview is somewhat relieved by the deep overhanging eaves structures.

e) Church Hall, Durban: ILL 20A to 20F

This is an interesting example of the adaptability of the wood and iron medium to the Gothic style of church architecture. The handling of the pointed windows is particularly interesting, with the use of a soft metal projecting protector strip or flashing piece inserted between the top of the window frame and the corrugated iron cladding. The method of supporting the timber foundation plates and wall framework on special cast iron mushroom shaped piers is also of particular interest in this case.(26)

f) Houses in Seaview, Durban: ILL 21A to 21L

In this part of the survey a small selection of the large number of listed houses, mainly in the Seaview area of Durban, is included. This selection represents a cross section of some of the house types and forms found in Durban. It is interesting to note that all of the examples are supported on foundation piers with open spaces under the floors.

g) Houses, Bakoven, Cape Town: ILL 22A to 22F

It was surprising to find such a number of wood and iron cottages, in such good condition, virtually on the seafront at the Cape. The cottages have for the most part been sensitively restored and up-graded. They form a significant historical group in a well landscaped area against a magnificent mountain backdrop.

h) Other houses in Cape Town: ILL 23A to 23C

The house in De Lorentz Street was the only wood and iron building seen in central Cape Town. It has been provided with modern aluminium windows and is presently used as offices. The house in Rondebosch East is one of two houses found in the area which used corrugated iron with the ridges running horizontally as a wall cladding. Another example of this was seen at Bakoven. ILL 22E

i) Houses on the Cape Peninsula: ILL 24A to 24C

It was also surprising to find surviving wood and iron houses in such good condition near the seafronts in Seaforth near Simonstown and at Hout Bay.

j) Buildings in Barberton: ILL 25A to 25D

The Barberton Museum has been active in conserving and restoring significant examples of wood and iron buildings in the town. Belhaven, a gentleman's residence, was purchased by the Transvaal Provincial Administration in 1978. It was considered to be a building of significance in the history of Barberton and worthy of being preserved for its architectural value. It has been restored and furnished in the style of the period as a House Museum. Stopforth House is another historically and architecturally significant building in Barberton which is in the process of being restored. Another structure of great interest and historical significance is the restored Blockhouse, near Belhaven, which has been declared a National Monument. The construction system of this Blockhouse is discussed in some detail in the following chapter of this study.

ILL 25 A to C

ILL 25 G to I

ILL 25 J to O

k) Buildings in Pilgrims Rest: ILL 26A to 26F

The well-known village of Pilgrims Rest in the Northern Transvaal with its many restored wood and iron buildings of the turn of the nineteenth century,is featured in this part of the survey. A few of the commercial buildings and houses fronting the main road through the village have been included in the sample survey.

l) Houses in Irene and Heidelberg in the Transvaal: ILL 27A to 27C

Two isolated examples of extant wood and iron buildings in the Transvaal have been included in this part of the survey. The first building is the well-known House Smuts, Doornkloof, Irene, which is a good example of the portability of the wood and iron technique. (27) The second example is the only extant wood and iron house in Heidelberg found during a conservation study in the town in 1988.

REFERENCES AND NOTES CHAPTER 3

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3 Ibid. p. 91.

4 Peter Bell, "TIMBER AND IRON Houses in North Queensland Mining Settlements, 1861-1920", University of Queensland Press, Queensland, 1984, p. 41 et. seq.

5 Ibid. p. 43.

6 Ibid. p. 58.

7 Gilbert Herbert, Op. Cit., p. 89-91.

8 Peter Bell, Op. Cit. p. 41.

9 Gilbert Herbert, Op. Cit., p. 91: John Henderson Porter, one of the pioneers of corrugated iron in the 1840's, later patented a system of fixing the iron sheets to timber framing.

10 Peter Bell, Op. Cit. p. 41 et. seq.

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12 Ibid.

13 Ibid. p. 130.

14 Ibid.

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16 Gilbert Herbert, Op. Cit. p. 137.

17 DWB Yuill, "The Architecture of Kimberley: 1871-1914", Dissertation, M. Arch., University of Witwatersrand, 1984, p. 25.

18 Brian Kearney, "Architecture in Natal from 1824 to 1893," A.A. Balkema, Cape Town, 1973, p. 68.

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24 Paul Mikula, Brian Kearney, Rodney Harber, "Traditional Hindu Temples in South Africa", Hindu Temple Publications, Durban, 1982, p. 9 and 100.

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CHAPTER 4

CONSTRUCTION TECHNIQUES AND DETAILS

i CONSTRUCTION SYSTEMS

Four basic systems of construction employing corrugated iron have been identified. They consist of:

A a wooden framework with corrugated iron sheathing externally and no lining internally;

B a wooden framework with corrugated iron sheathing externally and a wooden lining internally;

C a wooden framework with corrugated iron sheathing externally and a half-brick plastered lining internally; and

D a frameless structure with a one brick external wall with horizontal wooden rails built into the brickwork for fixing of a corrugated iron cladding externally.

Variations on the above systems have also been found, for example: the use of a solid one brick front facade wall in combination with systems B or C above (1), and the use of a double skin of corrugated iron with the space between skins filled with a sand and stone mix in the construction of early military blockhouses. The latter system of construction is described in greater detail below.

The first three systems of wood and iron construction outlined above are really variations on a central theme, namely, the sheathing of a "balloon" type of timber framework and roof structure with corrugated iron to form a waterproof shell. A timber framework of sorts is common to all types of wood and iron buildings. Some variations occur in the sizes and spacing of timber members used according to the type and size of building involved. Other variations occur according to the type of lining used internally.

The basic systems of construction outlined above also illustrate the wide spectrum of the wood and iron technique used in this country, ranging from the simple uninsulated box often built directly on the ground to the relatively sophisticated and more permanent brick-lined variety often graced with verandas, high ceilings and an imposing stone or brick podium and elegant Victorian embellishments.

ii FRAMEWORK

The timber used for the framework in early wood and iron structures was usually a "good red Baltic timber" (2).

The sizes of scantlings used varied according to the basic system of construction used. In the case of types A and B systems outlined above a framework width of 3 ins. (76 mm) was often used (3) as well as the more familiar 4½ in. (114 mm) width. In type C a framework width of 4½ ins.(114 mm) was used to coincide with the standard width of brick lining used.(4) Nominal sizes of scantlings used were as follows:

	4½in.(114mm) frame width	3in.(76mm) frame width
foundation and roof plates	4½in.X 3in. (114mm X 76mm)	3in.X 3in. (76mm X 76mm)
principal and corner posts	4½in.X 3in. (114mm X 76mm)	3in.X 3in. (76mm X 76mm)
intermediate posts	4½in.X 1½in. (114mm X 38mm)	3in.X 1¾in. (76mm X 44mm)
horizontal rails or transomes	4½in.X 1½in. (114mm X 38mm)	3in.X 1¾in. (76mm X 44mm)

The method of attaching the framework to the masonry foundation wall has been described in an early building construction text book as follows: "in the case of the best work (the foundation plate is continuous and rests) on a masonry foundation to which it is attached by ½-inch holding down bolts. Each of these bolts is provided with a large square washer, and about a foot length of each bolt, together with its washer, is built into the stonework of the foundation. The foundation-plate should either be tarred, or treated with carbolineum or creosote."(5) Field studies have not revealed any evidence of the use of this method of fixing.(6)

Wood and iron structures were usually supported on brick or stone perimeter foundation walls and piers internally. In places such as Durban, where steeply sloping sites were often encountered, it was common to support the foundation plate of the wooden framework on brick or stone piers both externally and internally. This ILL 20F not only made it possible to take up differences in level without 21 resorting to extensive cutting and filling, but provided ventilation and easy accessibility to the spaces under the floor, for control of termite and other infestations. An interesting example of the use of a special cast-iron pier, which also acted as an ant-guard, can be seen at the Hall for the Seaview Congregational Church, Sarnia Road, Durban. ILL 20D 20E

The early building construction text book referred to above specifies posts as being notched three eighths of an inch (10mm) into the foundation plate and roof plate and rails as being checked one eighth of an inch (3mm) into posts. Field studies confirm the practice of notching posts into plates (7) but no evidence has been found of checking of rails into posts. More extensive field studies would be required to confirm whether these specifications were standard practice or not. Alternative methods of framing were morticing and tenoning and square cutting and spiking (8). Field studies have not revealed any evidence of morticing and tenoning of wooden frameworks but square cutting and spiking has been seen, particularly in brick lined examples.

The setting out of framework both in the horizontal and vertical directions depended largely on the design and planning of the building. Posts were usually located at all external corners of the building and at junctions between cross walls and external walls and on either sides of door and window openings. Horizontal rails were spaced at a maximum distance of four feet (1200mm) apart for 24gauge sheeting. A rail was also located at heads of doors and windows and at cill level of windows. Additional intermediate posts were provided between the principal posts and door and window posts on a more or less empirical basis where required.

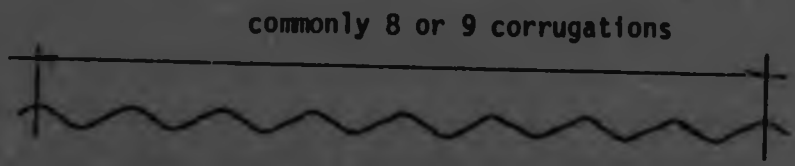
The resulting framework was self-supporting and also provided a structural support for the roof structure and suspended floor. All vertical posts were continuous from foundation plate to roof plate and all horizontal rails were cut and fitted between posts. Foundation and roof plates were also continuous. Because of the rigidity of the corrugated profile of the sheathing no diagonal bracing of the framework was found necessary and the posts could be located further apart than was necessary for timber clad structures of the time. The resulting wood and iron form of construction could be described as a corrugated iron version of of the so-called"Balloon" timber frame structure developed in England in the 1830s.

It was considered good practice for all woodwork to be creosoted. (9) Whether or not this was done would have to be confirmed during maintenance or restoration work.

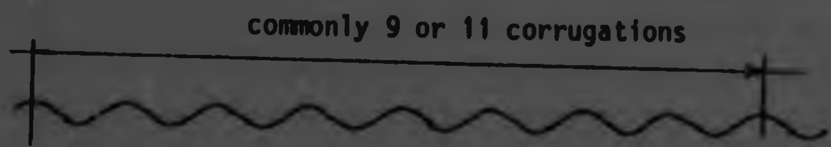
iii IRONWORK

The manufacture and galvanizing of corrugated iron sheets has already been discussed. Shapes and patterns of sheets have been described as well as common thicknesses manufactured. In describing the sheathing of the wooden framework other characteristics of the corrugated iron sheeting need to be considered. For example: the lengths and widths of sheets made and the arrangement of corrugations across the width of the sheets. As will be seen below, the latter arrangement has a bearing on the lapping procedure adopted.

During the period of this study it appears that corrugated iron sheets were made symmetrically across their widths. This arrangement can best be described graphically as follows:

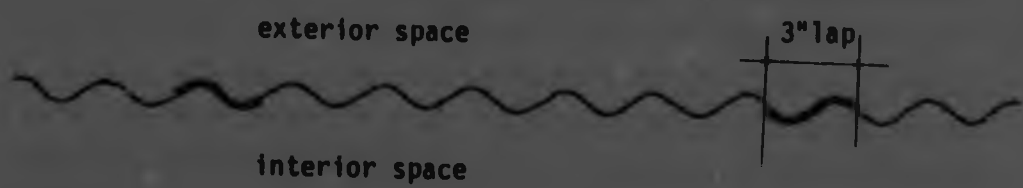


It will be seen that both side corrugations end on a down turn. In recent times, where sheets are often pre-painted on the outside with a relatively expensive coating and on the inside with a less expensive coating, sheets are made asymmetrically as follows:



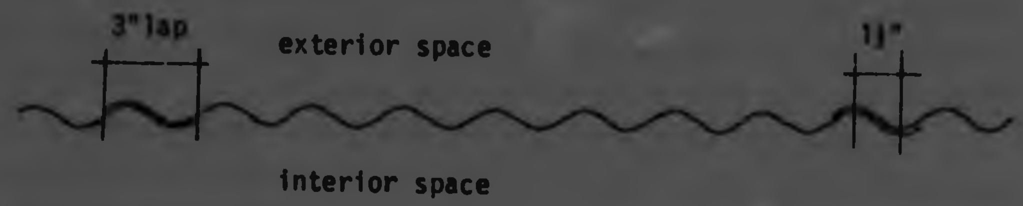
In this case it will be seen that one side corrugation ends on a down turn and the other side corrugation ends on an up turn.

In the case of the earlier manufactured sheets, the sheets did not have a distinct outside or inside face, and could be fixed with end corrugations facing "upwards" or "downwards". It was considered good practice for both edges of alternate sheets to lap over on top of sheets between them as follows:(10)



This method of lapping ensured that the end corrugation of each under sheet faced upwards, particularly on roofs, and resulted in alternate sheets being fixed "face upwards" or "face downwards". This method of lapping apparently prevents water from being directed downwards or inwards into the interior spaces.

In the case of the modern sheet the same waterproofing effect is achieved by fixing all the sheets "face upwards" as follows: ILL 4A and 4B



In both cases the resulting side lap is a minimum of 3inches (76mm). End laps were usually a minimum of 6inches (152mm).

Corrugated galvanized iron wall sheathing was usually continuous from foundation level to underside of eaves projections, particularly in the case of dwellings. Roof covering and wall sheathing sheets were nailed to purlins or horizontal rails with galvanized iron screws with a galvanized iron washer and a lead washer. The lead washer was placed below the galvanized iron washer. ILL 6A to 6C It was considered good practice to nail sheets to horizontals with screws passing through alternate ridges of the corrugated iron (11). This sometimes made it necessary to skip one ridge in order to ensure that a screw passed through the lap joint at each end of a sheet.

It was also considered good practice to bend one end of one sheet around corners of buildings to achieve a typical full side lap at the corner. It was not always done in this manner, however, and it ILL 9 was not uncommon to find the end ridges of corner sheets only, rolled around each other and nailed together at the corner with the galvanized iron screws. Depending on plan dimensions, positions of windows and doors, and positions of projecting bay windows etc., variations were often taken up at corners of buildings by bending sheets at convenient points to suit. Variations in plan dimensions could also be taken up by increasing side laps as required. It was therefore possible to achieve quite a degree of flexibility in design and plan form. However, corrugated iron does not lend itself to extravagant detailing or highly modelled forms, for example, in fitting pointed windows (12). An interesting and quite successful example of the integration of Gothic style pointed windows into a wood and iron structure can be seen in a Hall for the Seaview Congregational Church, 550 Sarnia Road, Durban. ILL 20C

It is relevant to deal, at this point, with a question raised previously regarding the limiting effect, if any, of the individual wood and iron elements on the design and construction of buildings, and possible modular planning disciplines imposed by these elements. Although corrugated iron may not lend itself to extravagant detailing or highly modelled forms, it has proved itself to be very adaptable to a wide variety of building types and forms. Thinness of walls resulting in virtual absence of deep door and window reveals, together with the characteristically even rippled texture of the corrugated iron sheathing itself, impart a taut, almost bland aesthetic to the wood and iron structure which is unique. At the same time, the wooden framework is sufficiently adaptable both in size and arrangement of members, and the corrugated iron sheathing is sufficiently adaptable in bendability and sheet overlap, to accommodate a wide variety of building shapes and forms.

Prefabrication may presuppose a high degree of modularity in design and planning, but site fabrication lends itself to greater flexibility. Although the corrugated iron sheet is in itself a modular component, it has proved itself to be equally adaptable to both pre- and site fabrication. One of its greatest attractions was, in fact, its flexibility.

The available lengths of corrugated iron sheets may, however, have had some modulating effect on wood and iron structures, although even in this case variations in height could be accommodated to a great extent by varying horizontal lap dimensions.

Corrugated iron sheets were generally fixed with the ridges of the corrugations running in a vertical direction. In the case of roof coverings this method of fixing was essential to achieve a proper run-off of rain water. In the case of wall sheathing, however, this method of fixing was not essential and it was not uncommon to use the sheets with the ridges running horizontally, or even diagonally. Extant examples can be found in this country of the use of horizontally fixed corrugated iron wall sheathing but no evidence of ILL 22E
the use of diagonally cut sheets in South Africa has been found. An 23B
example of a house in North Queensland using the material cut diagonally is commented on by Peter Bell in "Timber and Iron Houses

in North Queensland " as follows: (13)

> "There are certainly good reasons for not building in iron. It is not usually regarded as an attractive material, although appearance was not highly influential in the design of many North Queensland buildings. But aesthetic acceptance of corrugated iron came quickly. *Ay ot* in Charters Towers, a two-storey stud-framed house probably built about 1890, employed iron panels for veranda shades on its ground floor - constituting an enormous area of its facade - but used it cunningly, with each sheet cut at a slight diagonal to create a subtle herringbone texture surprisingly delicate for a material normally regarded as one of the most monotonous devised."

His comment is, incidentally, an example of yet another reference to the prevailing attitude to the aesthetic unacceptability of corrugated iron. Examples of the contemporary use of corrugated iron horizontally in Australia will be discussed later. (14)

iv LININGS

As mentioned previously, a timber framework is common to all types of wood and iron buildings but variations occur according to the method of lining used internally.

The most common methods of lining used were timber match boarding and brick. An unique example of the use of pressed steel panel wall linings to a wood and iron building is the well-known house museum, Belhaven, in Barberton. In this building some eighteen different designs of pressed steel wall and ceiling patterns can be seen(15). ILL 25C

Tongued and grooved boarding of a nominal size of six inches by five eighths of an inch (152 X 16mm) was used for both wall and ceiling linings. Each board was divided down the centre with a v-groove to create the impression of a narrower width boarding as illustrated below: ILL 21E

Mention has been made of the question of when and why the practice of lining wood and iron buildings with brick came about.

Walls consisting of vertical posts carrying the roof load, and the intervening space filled in with a variety of materials, including brick, have been known in Europe since Roman times. (16) These "post-and-infill walls were loosely known as"half-timbered" walls. The brick lined wood and iron structure as we know it in this country today, cannot be directly compared with the post-and-infill type of wall described above. In the wood and iron system of construction the posts do not directly support the roof structure. The posts together with foundation and roof plates and horizontal rails function as a diaphragm which bears the roof load more or less evenly along its length. Be that as it may, the idea of filling a timber framed structure with brick was not new.

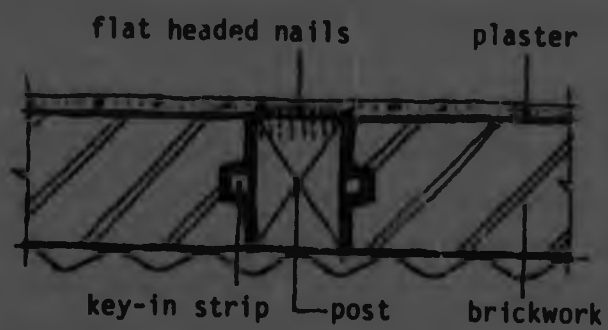
Just when this practice started in this country is not clear. More detailed investigation, beyond the scope of this study, would be required to clarify this point. The technique seems to have been used extensively in the Witwatersrand mining areas at the turn of the nineteenth century. A census conducted in 1921 indicates that the vast majority of dwellings in this category (7823) were on the Witwatersrand where they formed the bulk of the wood and iron group (17). Whether or not this technique was a regional phenomenon is also a subject for further investigation.

There is a dearth of literature on the subject of brick lined wood and iron buildings at this time. One can only speculate on the origin of this technique. Whether brick was regarded at the time as the prime element and corrugated iron as a secondary protective element is not clear. Nor is it clear whether the main motivation for the use of brick was for its insulating properties, and for the addition of corrugated iron for its waterproofing properties. If this was the case, one would have expected more buildings with load bearing, corrugated iron clad, brick walls to have been built. There were undoubted advantages to incorporating half brick walls into wood and iron structures. Inferior quality sun-dried bricks which were vulnerable to moisture and had poor load bearing capacities, could be used in narrow widths for their thermal and sound absorbing properties. The corrugated iron sheathing could be used to protect the sun dried bricks from moisture penetration and to prolong their life. At the same time the bricks could be used to provide a comparatively low cost flush internal face suitable for plastering and papering.

If the aspect of appearance is disregarded , the brick lined variety could be regarded as an up-graded, top of the range, form of wood and iron construction. In terms of comfort the brick lined, verandahed house placed on an imposing solid podium, could rank as high as one built by more traditional methods. (18) It also could retain some of the advantages of the wood and ir technique, such as ease of erection and cheapness.

The use of brick linings presented the builder with certain practical problems such as keying-in of brickwork to the timber posts and keying-in of plasterwork to the outer faces of the timber framework. Bricks were laid on their faces, in stretcher bond, to fill up the rectangular spaces between the horizontal and vertical members of the timber framework.

A recommended method of keying-in of brickwork to posts involved the fixing of three quarter inch square (20 X 20mm) continuous vertical timber key strips to the posts between the horizontals, with brick-work notched to receive the key strip as shown below: (19)



Alternative methods of keying-in of plaster to timber framing have also been recommended (19). Wood surfaces could be studded with flat headed nails left projecting slightly; wood surfaces could be cut into in a downward direction with a chisel to form projecting tags (not suitable for horizontals, however,); or strips of rough metal mesh work could nailed onto the wood surfaces, to form a key for plaster work. An example of the first method of keying-in of plaster to the timber framework has been seen at the Barberton Museum but no examples of the method of keying in of brickwork using timber key strips has been encountered. Methods used, if any,of keying in of brickwork or plaster to the timber framework only become evident during restoration or maintenance work on brick lined wood and iron buildings.

Mention has been made,in trade literature of the time, of the use of inodorous felt to be placed between the timber lining and corrugated iron sheeting as a "non-conductor of heat, cold and sound." (20). The efficacy of such a provision is questionable, and in any event, cannot be as effective as the use of brick as a lining.

V SPECIAL CONSTRUCTION SYSTEMS

The first three of the four construction systems employing corrugated iron have been discussed up to this point and the fourth method involving the use of a load bearing one brick wall with corrugated iron cladding externally has been mentioned. This method will now be discussed in a little more detail and reference will be made to few interesting variations on the basic systems identified above.

System D, is a clear example of the use of corrugated iron for its protective quality. One also questions whether this method might have been used to achieve a better class of building on a higher social scale, while retaining an uniformity of appearance with brick lined wood and iron structures in the vicinity on a lower social scale. In this type of construction horizontal strips of timber of a brick course width were built into the external load bearing brick walls and the corrugated iron was nailed to the strips as described above.

A variation on the wood and iron systems B and C involved an up-grading by building a front facade wall in load bearing brick and reserving the more humble wood and iron walls for the less visible side and back walls of the building. This method of building seems to be peculiar to certain houses in the Durban area. Examples can also be seen in Durban of more recent attempts to "gentrify" street facades of wood and iron houses by the application of plaster on metal lathing to the corrugated iron surfaces involved.

An interesting example of the adaptability of corrugated galvanized iron to specialized uses can be seen in the construction of blockhouses in South Africa about the time of the South African War. A typical building of this type has been restored and declared a national monument in Barberton. An account of the earliest pattern of corrugated iron blockhouse of this type is given by a British Colonel, E H Bethell, D S O, R E, in a paper entitled, "The Blockhouse System in the South African War".(21) These blockhouses were erected specifically to protect the railways from persistent attack by the Boer forces. Colonel Bethell described these structures as follows: ILL 25J to 25O

> "The wrecking of the railways reached a maximum in November and December, 1900, and the first blockhouses were put up for us by a Lorenço Marques contractor, in January, 1901; only some half dozen, at Nelspruit, Kaapmuiden and Komatipoort.
> They were oblong, about 9 or 10 feet by 15 feet, consisting of two rows of posts, 3"x3" and 2 feet apart, with a skin of corrugated iron fixed to each row, and stony sand filled into the space between the skins; the loopholes were 3"x4" holes in steel plates, 2 feet wide and 9 inches deep, and were fixed in wooden casings placed in openings cut in the corrugated iron walls; a corrugated iron roof completed the structure.
> The door was traversed in the usual way, a water tank provided, and the whole surrounded by an entanglement of wire.
> The result was a very good blockhouse, but one which required a lot of material and much time to erect, and for which the steel plate loopholes were not obtainable quickly in sufficient numbers.
> It would not have been possible, in the time available, to develop the cross country blockhouse system to the extent to which it was developed, had not something less cumbrous been invented.

Colonel Bethell then describes less "cumbrous", more sophisticated, methods of constructing blockhouses using corrugated iron developed by a Major Rice, R E, Commanding 23rd (Field) Company. His reference to the prefabrication of these blockhouses is particularly relevant in the context of this study.

> Major Rice's company at Middelburg in the Transvaal, soon became an extremely well-organised block house factory, the construction of each separate part being in the hands of the same men.
> Every part was made to template, and, consequently, these

blockhouses all fitted well together, which was far from being the case with those made by contract at the coast.

vi BUILDING IN OF WINDOWS AND DOORS

The method of trimming the timber framework for window and door openings is similar. In both cases posts are located on both sides of the window or door opening. In both cases a horizontal rail is located above the opening and in the case of window openings, a horizontal rail is located under the window cill.

The method of trimming around door and window openings will depend on the type of door and window frames being used. In some cases the doors or window sashes may be hung directly from the wall framing posts or transomes. The window frame may be solid or hollow; the latter being termed a box-frame. Although doors were sometimes hung directly from posts, eg. in the case of simple sheds and outhouses, it was more usual to provide more sophisticated jamb linings to door openings. A good text-book description of a typical method of building in of a box-frame into a wood and iron building is given in ILL 10. This description is self-explanatory and mentions such important provisions as the insertion of a galvanized iron protector strip between the corrugated iron and the top of the window frame. ILL 10

vii CASE STUDIES OF CONSTRUCTION AND DOCUMENTATION METHODS ILL 11 to 15

Good examples of construction and documentation methods used in early wood and iron buildings have been found in copies of drawings for the South African Railways' Engineers. These drawings relate to the following projects: Manley Flats Station, 1884 (ILL 11); NGR Platelayers Single Quarters, 1905 (ILL 12); NGR Manager in Charge, Donnybrook, 1903 (ILL 13); Stations, Vredenburg and Saldanha, 1911 (ILL 14); and SAR, Station, Berg River, 1911 (ILL 15).

The drawings for the Manley Flats Station project relate to the assembly of the components of the building as received from the suppliers in England, namely, Firbank & Co., The Sanctuary, Westminster. The drawings consist of schematic plans and elevations of studding and sheeting with all components numbered according to a standardized system. Roman numerals were used for the external timber framework members and Arabic numerals for the internal framework members and corrugated iron sheets. Evidence of the use of Roman numeral marked timber members has been seen at the Barberton Museum. ILL 11A to 11G

The drawings also illustrate the common arrangement and setting out of studding, including common sizes in use at the time. They also illustrate the common setting out of roof rafters and purlins. On the Plan of Sheeting on the Roof attention is drawn to the fact that numbers are marked on the underside of sheets, not on top. An examination of an Elevation of Sheeting shows a peculiar variety of sheet widths ranging from about 12 inches (no.221) to 32 inches (no.164). Sizes of studding mentioned on the drawings are: 4½"x3" intermediate posts, foundation and roof plates; 4½"x4" corner posts; and 4½"x2" horizontal rails. All of these sizes seem to have been in common use at the time. The method of trimming door and window openings as shown on the drawings accords with the common methods already described. ILL 11C ILL 11E ILL 10

The drawings for the NGR Platelayers' Single Quarters project, Weenen Railways, illustrate a typical studding system of the time in plan and section. Wall widths are shown as 3" with 3"x3" intermediate posts set out at approximately 4'-0" centres. Posts at corners and at junctions between external and cross walls are shown as 4½"x3". Foundation plates are shown on section as 4½"x3" and roof plates as 3"x3". The foundation structure consisted of 5"x5" timber stumps presumably driven into the earth; a variation on the masonry pier system to be seen in Durban. Internal linings are shown as 6"x½" and horizontal rails as 3"x2" timber. The sizes of members shown are similar to those seen at Durban and Barberton. Ant guards are shown on the section between foundation stumps and plates, presumably of sheet iron. ILL 12A and 12B

The drawings for the NGR Manager in Charge, Donnybrook, illustrate assembly of the components of the building as received from the suppliers in England, namely, Firbank & Co., The Sanctuary, Westminster. The drawings consist of schematic plans and elevations of studding and sheeting with all components numbered according to a standardized system. Roman numerals were used for the external timber framework members and Arabic numerals for the internal framework members and corrugated iron sheets. Evidence of the use of Roman numeral marked timber members has been seen at the Barberton Museum. ILL 11A to 11G

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The drawings for the NGR Manager in Charge, Donnybrook, illustrate a studding system similar to that of the Platelayers' Single Quarters, except that all posts are shown as 3"x3". Foundation plates are 4½"x3" supported in this case on 6"x6" hardwood stumps and no ant guards are indicated on the drawings. The method of supporting the 4½"x2" floor joist directly on the foundation plate of the studding is characteristic of the wood and iron form of construction, and can be seen in all parts of the country where this type of structure has been erected. It is also interesting to note that the width of the verandah as well as the height of the building appear to have been designed to take a standard length of sheet. This is an example of the possible modul[illegible]ing effect of the size of the corrugated iron element. ILL 13A to 13D

The drawings for the Vredenburg and Saldanha Stations, illustrate a similar typical studding system to those discussed above, except that in this case both 4½"x3" and 3"x3" post sizes have been shown. In this case the foundation plates have been supported on 18" wide masonry walls externally and on 18"x18" masonry walls internally. This method of supporting the foundation plate on masonry is also characteristic of the wood and iron form of construction. Again, in this case verandah widths and building heights appear to have been designed to suit standard available lengths of corrugated iron sheeting. No ant guards have been shown on these drawings. ILL 14A to 14D

The drawings for the Berg River Station show a similar system of construction in all respects to that of the Vredenburg and Saldanha Stations. ILL 15A to 15C

REFERFNCES AND NOTES CHAPTER 4 .

1 This system has been employed in houses in Durban.

2 See "Specification of the Construction of Wood Framed buildings covered with Galvanized corrugated sheets", Ill. 7B., p. 67.

3 Examples of the use of 76mm widths of framing have been seen in Durban and Barberton. See also Ill. 13A p. 83 and Ill. 14B, p. 88.

4 Examples of the use of 114mm widths of framing have been seen at Simmer and Jack Mines Limited. See also Ill. 16.

5 WSH Cleghorne, "Farm Buildings and Building Construction in South Africa", Longmans Green & Co., London, New York, 1916, p. 78.

6 A "tar and sand" Damp Course has been specified in one instance. See Ill. 17D, Application for Approval of Plans, House, Parktown North, Johannesburg, October 9th 1912.

7 An example of the notching of posts into foundation plates was seen at the house at 23 Southend Ave, Durban. See also Ill. 21D and E.

8 See Specification, Ill. 7B, p. 67.

9 WSH Cleghorne, Op. Cit., p. 79.

10 Ibid.

11 Ibid.

12 Gilbert Herbert, Op. Cit., p.101-102.

13 Peter Bell, "TIMBER AND IRON Houses in North Queensland Mining Settlements, 1861-1920", University of Queensland Press, Queensland, 1984, p. 130.

14 See p. 55.

15 Belhaven, 1 Lee Road, Barberton: Brochure compiled and published by Transvaal Provincial Library and Museum Service, Pretoria, p. 7.

16 Peter Bell, Op. Cit., p. 41.

17 Professor Dennis Radford, "The Wood and Iron House: A Study of its Occurrence and Distribution in Southern Africa." Copy of draft article given to me by Professor Radford.

18 Ibid.

19 WSH Cleghorne, Op. Cit., p. 80.

20 See Specification, Ill. 7B, p.67.

21 A copy of this paper was given to me by Mz A. Bornman, Museum Human Scientist, Barberton Museum.

CHAPTER 5

CONCLUSIONS-THE NEED FOR A CONSERVATION STUDY AND POLICY

Up to this point the subject of early corrugated iron construction in South Africa has been reviewed against the broader vision of the history of the development of Europe and the Colonies from the time of the Renaissance. The history of its manufacture and use against the narrower vision of the one hundred year period of its development from about 1820 to 1920 and some of the principal merits and demerits of the material have been identified and discussed.

The historical evolution of some of the systems of construction using corrugated iron have been analysed and some general observations on the occurence and distribution of early corrugated iron dwellings in South Africa have been made. Comments on a sample visual survey of extant buildings carried out in some of the known areas of concentration have then been made.

Basic systems of construction employing corrugated iron have also been identified and discussed. Construction details relating to the framework, ironwork and linings used have been described and some special applications of the wood and iron technique have been reviewed. Methods of building in of windows and doors have been described, and a few case studies of construction and documentation methods reviewed.

This study has revealed that the subject of corrugated iron construction and the wood and iron tradition in this country is a vast one. Many questions remain to be answered, and the present study cannot be regarded as anything more than a general introduction to the subject.

The main points to emerge from this study are: firstly the dearth of literature on the subject in South Africa, and secondly, the lack of knowledge and records of extant corrugated iron buildings in the country at the present time. Corrugated iron has become a Cinderella of a material, often neglected and overlooked.

The reasons for this are not difficult to find. It is a material which has not been admired for its aesthetic appearance and has been regarded in some quarters as socially unacceptable. Its severe industrial character tends to limit its consideration as a traditional vernacular material, particularly in relation to such more socially acceptable materials as stone and brick (1). Architects have had very little to do with the development of the tin tradition and wood and iron buildings have received scant attention from architectural historians or building construction chroniclers(2). In this context Peter Bell in "Timber and Iron Houses in North Queensland Mining Settlements, 1861-1920", argues that "the circumstances of mining settlement encouraged the construction of the very types of building that architectural history has been criticized for ignoring." He goes on to say "very few of the buildings in North Queensland were designed by architects in the sense that title has today. Indeed, there was frequently overt resistance to the intrusion of architects who, it was feared, brought unnecessary elaboration and expense in their wake." Developers in North Queensland at the time did "not want to spend large sums on buildings which may cease to be necessary in two or three years'time and then fall into decay." (3) It would not be surprising to find that the same attitude to the intrusion of architects prevailed at the time of the heyday of the wood and iron tradition in the mining towns in South Africa from the 1890s to the 1920s.

What seems to be needed, therefore, is a survey of the existing stock of corrugated iron buildings in this country leading to the preparation of a conservation study and policy related specifically to the preservation of this type of building. Before embarking on such a study the conservation worthiness of this type of building will have to be determined.

The present study also shows that corrugated iron construction has a rich past and played an important part in the historical development of the country as an emerging colony of the time. The extant corrugated iron buildings to a greater or lesser degree represent an expression of the pioneering spirit of the time, and there is undoubtedly a need to preserve some of what remains of this valuable heritage of the past. The present study also shows that there is still a reasonably good sized stock of surviving wood and iron buildings of varying types in the country today, many of which may be worthy of preservation for their historical and architectural interest and significance.

A difficulty which may arise in carrying out a conservation study of wood and iron buildings is that it may be difficult to evaluate them in the same architectural terms as their stone and brick counterparts. Technically, as well as architecturally, they may need to be evaluated according to their own set of criteria. It is submitted, therefore, that in formulating a conservation policy for early corrugated iron buildings in this country, a countrywide survey and record of such buildings should be made as a basis, and that the buildings should be evaluated in their own technical terms to decide what is worthy of preservation.

It is also submitted that the decision as to whether wood and iron buildings, as such, are worthy of conservation, is one that needs to be made mainly in historical terms and reference to architectural criteria more applicable to buildings of other materials and styles should be avoided.

Some work has already been done in Durban and East London in the study of wood and iron buildings. (4). Some success has already been achieved in the restoration and declaration as National Monuments of significant wood and iron buildings in such places as Pilgrims Rest, Barberton, Irene and Johannesburg. (5) Much more needs to be done if we are not to lose such buildings to demolition or irreversable change in appearance. Only prior knowledge of their existence and condition will enable timely decisions to be made in this regard.

REFERENCES AND NOTES CHAPTER 5

1 Professor Dennis Radford, "The Wood and Iron House: A Study of its Occurrence and Distribution in Southern Africa." Copy of draft article given to me by Professor Radford.

2 Peter Bell, "TIMBER AND IRON Houses in North Queensland Mining Settlements, 1861-1920", University of Queensland Press, Queensland, 1984, p. 6 and 7.

3 Ibid. p. 7.

4 See Notes: Chapter 2, No. 29, p. 22 ii, and Chapter 3, No. 23, p. 36 ii.

5 143 Fulham Road, Brixton, Johannesburg.

E P I L O G U E

T H E F U T U R E O F C O R R U G A T E D I R O N

Corrugated iron in this country undoubtedly has a rich past, but what of its future?

The traditional corrugated iron profile is being ousted by its slick, streamlined long-span successors. (See ILL 4A) It is a material which some would like to see eradicated or banished to the lowest of low-cost applications. It is, however, a material which refuses to die and continues to "rear its ugly head" in the most unlikely places, for example, atop the new Witwatersrand Technikon buildings to revive the "Doornfontein" character of the area, and then only where it can be seen. ILL 4A

In recent years in Australia, the material has been re-discovered in enthusiastic terms by an Australian architect, Glenn Murcutt. In a book entitled: " Leaves of Iron, Glenn Murcutt: Pioneer of an Australian Architectural Form ", by Philip Drew, The Law Book Company Limited, 1985, the author reviews Murcutt's work and the philosophy of his re-evaluation of the material, corrugated iron.

Murcutt was apparently particularly attracted to the "leafiness" of corrugated iron which he felt had an affinity with the early bark-clad Aboriginal shelters of the Northern Territory of Australia. (1) ILL 28A
He also liked to use corrugated iron cladding horizontally to express its leafiness, thus:

> The thinness of the iron sheets and the hard leaf-like character of the buildings is advanced by expressing the edges of the sheets.

ILL 28B

Murcutt also exploits the roundness of forms to which corrugated iron is so adaptable, and likes to round the ridges to his buildings to "increase the identification of the roof with the sky." (2)

Finally, the following quotation from "Leaves of Iron" is submitted as a possible pointer to the future of corrugated iron in South Africa: (3)

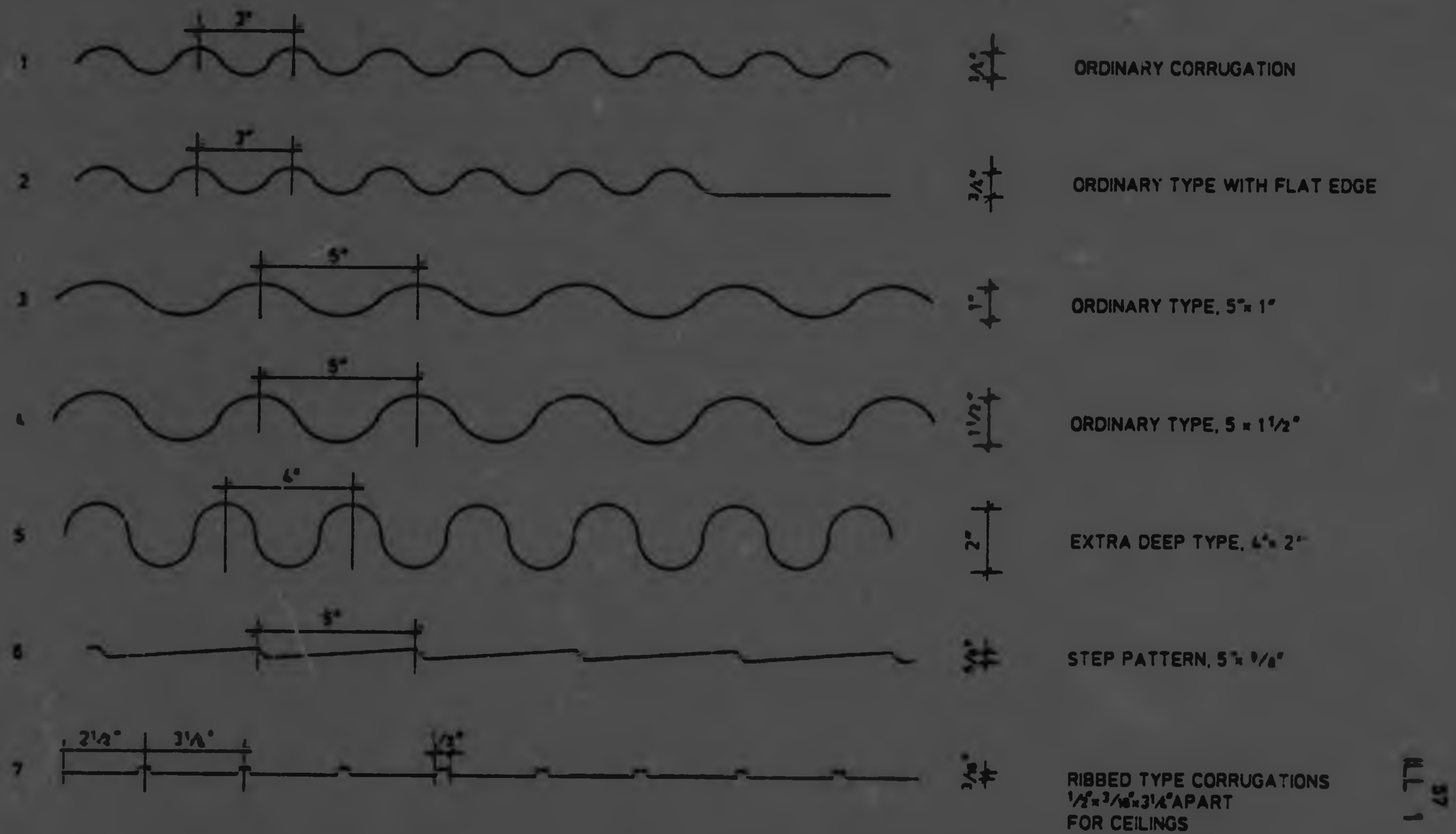
> ....the use of corrugated iron by Glenn Murcutt is an important link, though not the only one, between his architecture and Australian vernacular buildings. The association with the vernacular is strengthened by the introduction of such things as corrugated iron rainwater tanks in some of his farm-houses, the transformation of the traditional verandah into an outdoor room screened from insects, and the inclusion of such items as cedar external storm blinds, glass louvre windows, lattice screens, and ripple iron for ceilings. The significance of this identification with vernacular building is twofold: in the first instance, it ties his buildings to the commonest facts in the Australian experience, and in the second, it- that is the vernacular- illustrates a range of responses to the climate and the landscape. In so many ways vernacular buildings act as a guide to the physical environment and furnish Glenn Murcutt with a range of solutions which are the products of free improvisation and invention.
>
> Murcutt uses corrugated iron because it is a light, strong, and versatile material, and in recognition of such properties as its economy, fineness of line, and the natural-looking profile which imparts stiffness to the sheet. The iron, like water, has the property of reflecting the quality of the daylight and so responds to changes of the weather.
>
> ....Murcutt prefers ordinary materials. He chooses materials which are associated with vernacular usage, or are compatible with the vernacular, and, in a sense, represent a sensible modern extension of lightweight or climatically appropriate design,.....
>
> It is very easy to misunderstand the importance of corrugated iron to Murcutt's architecture. It is not a gimmick or a cheap trick to attract notice. Rather it arises from his sense of the beauty and poetry in ordinary things and his desire to create buildings which speak to the people. His rediscovery of corrugated iron, Pillar Naco clip louvres, patent glazing bars, external venetian blinds, these are not ends in themselves. Rather they are examples of sensible responses which have somehow been forgotten or ignored over time, and which, in their own way have not been bettered. But in addition to his resuscitation of earlier neglected materials and building components, Murcutt is intent on finding new products and in adapting existing components, using them in novel ways, to deal with the issue of the environment. These new elements share with the older vernacular materials, the same qualities of lightness, toughness and delicacy. So the two are always related.

REFERENCES AND NOTES EPILOGUE

1 Philip Drew, "Leaves of Iron, Glenn Murcutt: Pioneer of an Australian Architectural Form", The Law Book Company Limited, 1985, p. 65.

2 Ibid., p. 49.

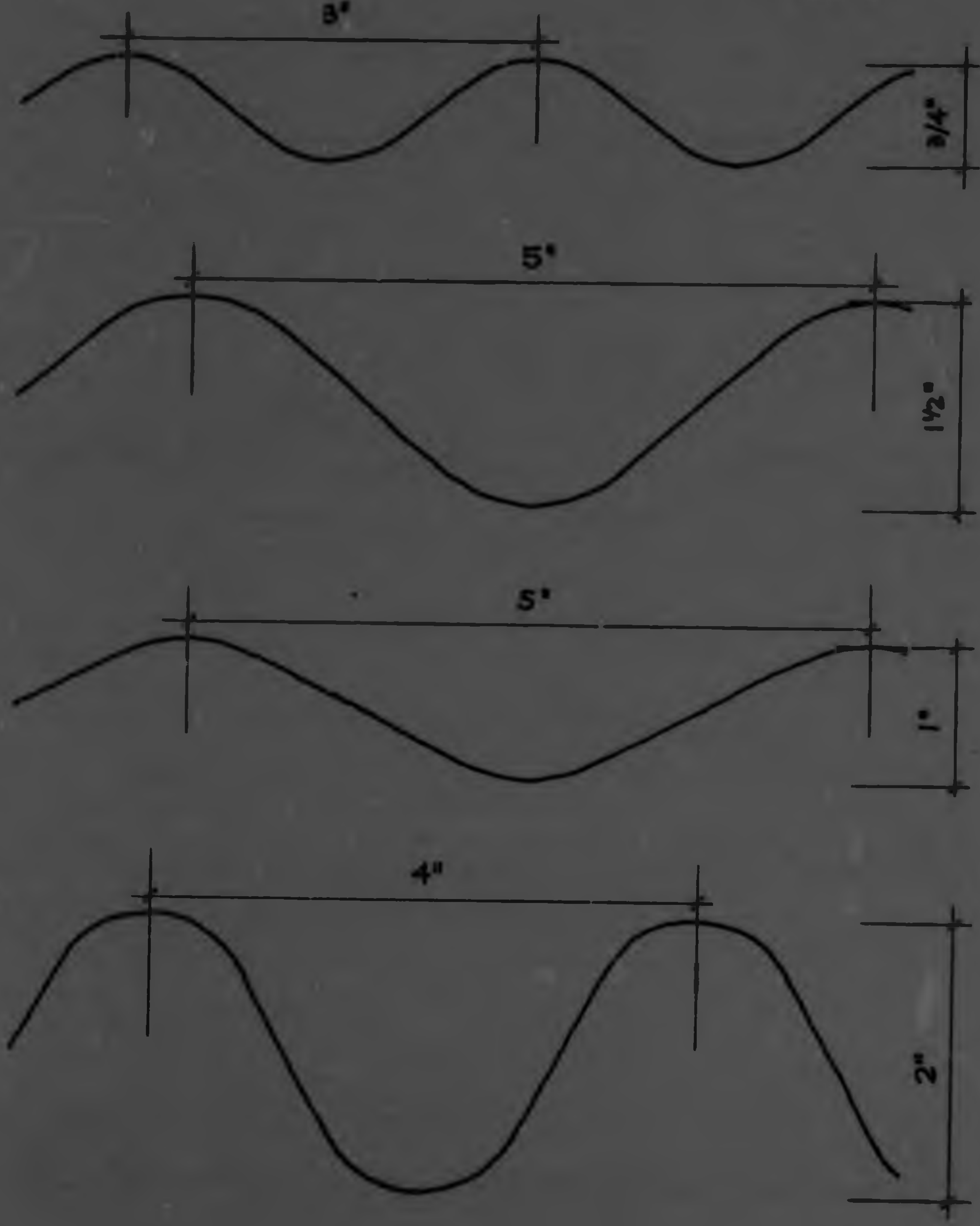
3 Ibid., p. 77.



SHAPES AND PATTERNS OF CORRUGATED STEEL SHEETS

FREDERICK BRABY & CO.LTD (ENCYCLOPAEDIA BRITANNICA, 14TH ED. PAGE 471 CIRCA 1927)

ILL[58] 2



ENGLISH CORRUGATED SHEET STEEL PATTERNS
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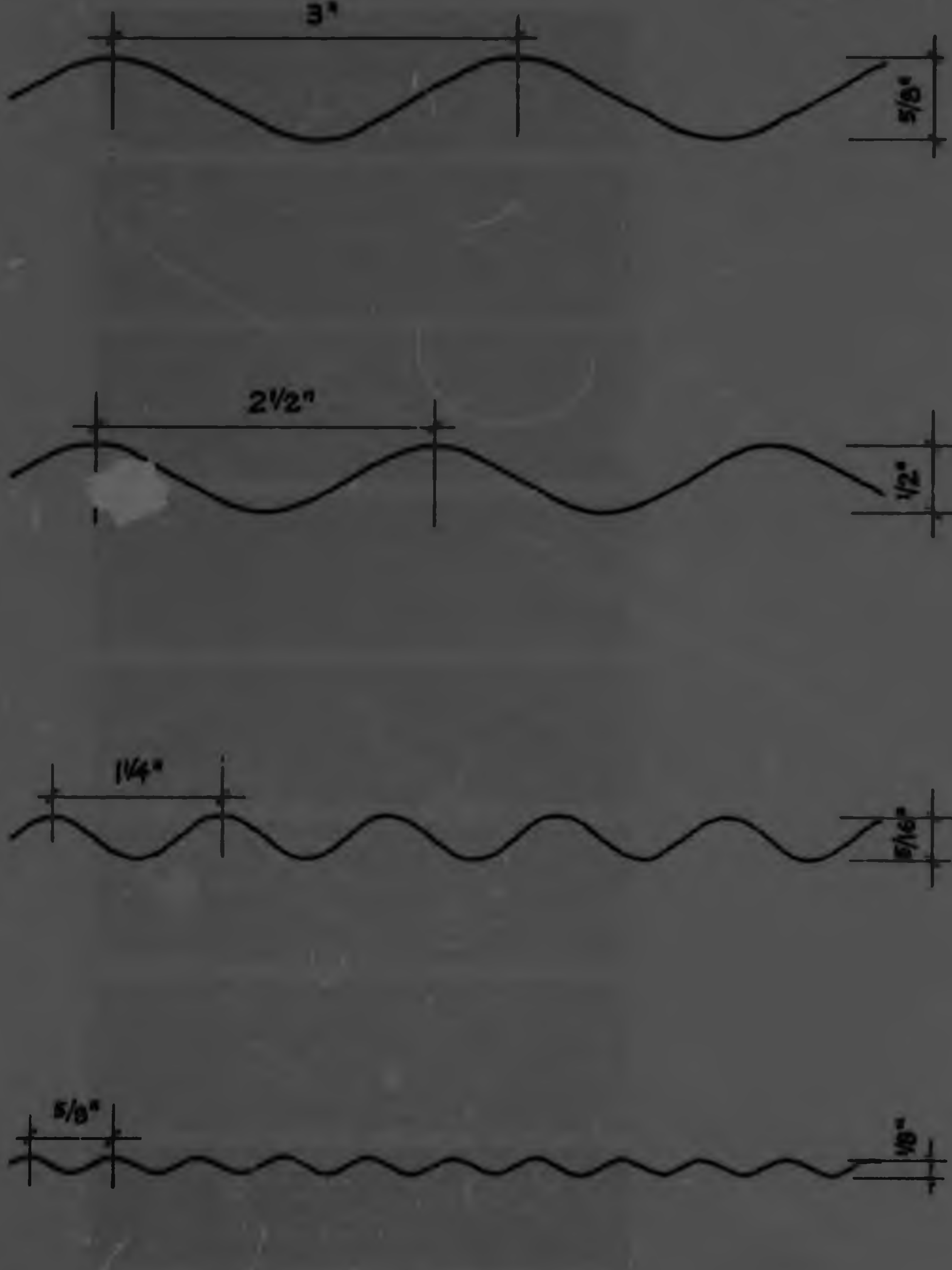

AMERICAN CORRUGATED SHEET STEEL PATTERNS
FROM MILLEKEN BROTHERS CATALOGUE C1905

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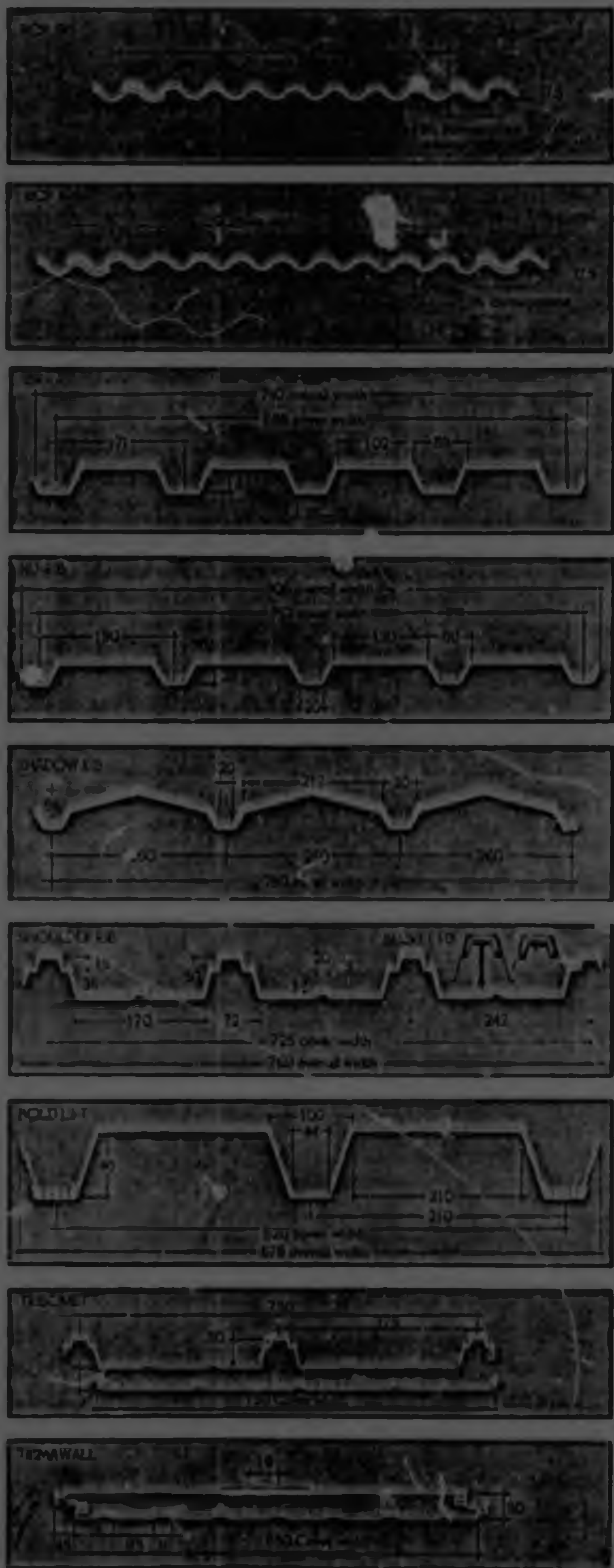
ILL 4 A



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NU RIB 'n Vlakker profiel as IBR en wat besparing meebring wat gekoppel word aan verbeterde dekbreedte
SHOULDER RIB/SECRET FIX 'n Diep-geriffelde profiel wat addisionele ontwerpsmoe·'·ikhede bied
SHADOW RIB 'n Unieke argitektoniese bekleding wat ekstra wye dekwydte bied
BOLD LINE 'n Buitengewoon diep bosseleerprofiel, ontwerp as 'n argitektoniese muurbekleding Die groot groewe bied groter sterkte en windlaskenmerke met 'n minimum struktuurstutrelings Die grootte verleen perspektief aan groot oppervlakte muurbekleding waarvoor dit ideaal geskik is
TRISOMET en TRIMAWALL Lig maar uiters sterk, gereed om vas te heg, geïsoleerde toebroodjiepaneel
VEE LINE MULTI-LINE WIDE MULLION en NARROW MULLION Vier verskillende argitektoniese muurpanele wat aantreklike en afsonderlike fasades bied deur middel van 'n kombinasie unieke vorms en kleure

Bykomstighede
Voegstroke sluiterstukke hegstukke en geutpypgoedere
Alle profiele word aangevul deur effe of gekleurde GVP lamel deurskynende plate met die oog op daglighverskaffing
Plate kan in enkelvel gebruik word of kan gekombineer word met 'n Robertson geïsolasie stelsel

Voorkoms
Alle produkte is beskikbaar in gebosseleerde gegalvaniseerde of vlekvrye staal met óf 'n Colomet moffelemalje óf 'n Versacor laag afwerking in elf standaard kleure

Q LITE GVP Plate beskikbaar in blou, geel, groen en verskillende deurskynende skakerings

Diens
Gratis konsultasie, ontwerp en ingenieurswerkbystand ondersteun deur aflewerings installasie/oprigtings- en instandhoudingsdienste

Size and mass / Grootte massa

Profile	Maximum length (m)	Nominal thickness (mm)	Nominal mass (kg/m^2)	Cover width (mm)
RCP 8½	13.2	0.6	5.8	610
RCP 10½	13.2	0.6, 0.8	6.7.8	762
IBR	18.6	0.6, 0.8, 1.0	7.11	686
Nu Rib	15.5	0.6, 0.8, 1.0	6.10	762
Shoulder Rib/ Secret Fix	18.6	0.6	7	725
Bold Line	18.6	0.8	9.7	620
Shadow Rib	9.0	0.6, 0.8, 1.0	5-10	780
Trisomet Panel	12.0	0.6	7-11	750
Trimawall	12.0	0.6	12.5	850
Profiel	Maksimum lengte (m)	Nominale dikte (mm)	Nominale massa (kg/m^2)	Dekwydte (mm)

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MODERN PROFILED STEEL SHEETING

Galvanizing and Corrugating.—The black sheets are first put through the pickling process. This is done in a stone or timber tank which is filled either with sulphuric or hydrochloric acid to remove all scale, oxide or rust. This operation can be carried out either by hand pokers or by an automatic pickling machine. After being cleansed in a water tank, the flat sheets are then fed into the galvanizing bath either by hand or by an automatic feeder, one at a time. The galvanizing bath is made of steel plates from 1in. to 1½in. thick and of a size to suit the width of sheets to be treated. Inside the bath there is the galvanizing machine with rollers which revolve in the molten spelter or zinc which is heated to 850° F. The sheets pass rapidly through the zinc and emerge at the other side of the bath through two exit rollers; these rollers, together with the speed of the machine and temperature of the bath, regulate the quantity of zinc covering, viz., from 1½ to 2½oz. per square foot. A flux is used in the process made from muriate of ammonia and this causes the zinc to flow freely and gives the sheet a smooth surface. When sheets are wanted with a bright flowery spangle, it is necessary to add a small proportion of tin to mix with the zinc. The sheets automatically pass through a tank of hot water to wash off any flux stains and then they pass on to a drying fire and finally they are examined by inspectors.

The sheets then pass to the corrugating department. The galvanized flat sheets are here corrugated to the size of corrugation required, either by powerful presses when several sheets are corrugated at a time or in rotary corrugated rollers usually doing one sheet at a time. In either case the process is rapid and a large tonnage is obtained. The corrugated sheets are then weighed up, bundled or packed for shipment; or they are put into store in their various sizes and gauges.

Laying Corrugated Sheets.—For roofs the sheets should have end laps of not less than 6in. The usual side lap for ordinary purposes is half a corrugation, that is to say, the last corrugation in each sheet overlaps. This is known as "single side lap." For special purposes such as stores, warehouses and dwelling-houses, the last two corrugations in each sheet should be overlapped, otherwise termed "double side laps." Sheets for sides of buildings can be laid with 3 or 4in. end laps, and half corrugation or single side laps.

Bolts, nails or screws should always be placed in the top corrugation. Wood screws or nails should be placed 6in. apart. Bolts for fixing sheets together should be about 15in. apart along the side corrugation. Hook bolts for iron framed buildings should be about 12in. apart. All screws and sheet bolts should have at least one iron or lead washer under the head; one of each is recommended. Hook bolts should have curved washers, either round or diamond shaped. In laying sheets the workmen should begin at the bottom row, and work towards the ridge of roof.

Galvanised sheets should be stored very carefully in a dry, well ventilated place, and any sheets which have become damp or wet in transit should be wiped thoroughly dry before storing. On no account should they be stored in bundles in a damp atmosphere. If sheets must be stored in the open air or under poor conditions, they should be stacked in such a manner as to allow a good air space between them. (*See also* GALVANIZED IRON AND STEEL.)

GALVANIZING, CORRUGATING AND LAYING OF CORRUGATED STEEL SHEETS

AS DESCRIBED IN 14TH ED. ENCYCLOPAEDIA BRITANNICA P471-2 C1927

63
ILL 6 A

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KEENE'S CEMENT
Gives a superfine, glosslike wall surface for Hospitals, Laboratories, etc
112 lbs. and per lb.

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White cement for pointing glazed tiles and for terrazzo work.
Packed in 94 lb. paper packets and loose per lb.

TILE FIXING CEMENT
For wall and floor tiles.
Moisture and heat resistant.
1 gallon, ½ gallon, 1 pint and ½ pint tins.

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Sizes: 6' x 3' and 8' x 4'
Gauges: 18, 20, 22 and 24 S.W.G.

COPPER STRIP IN COIL
Widths: 12", 16" and 18".
Gauges:
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COPPER CIRCLES
Over 15" up to 24" diameter.
Gauges: 18, 20, 22 and 24 S.W.G.

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Sizes: 3'0" x 1'0", in thickness from 1" to 12".

CRACK FILLER
For repairing damaged surfaces, plaster, wood, brick, jointings, etc.
1 lb. packets.

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Preservative.
Packed in 1 gallon and 4 gallon tins and 45 gallon drums.

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Packed in 200 lb. bags.

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Clear (16 and 21 oz.), Obscure, Wired, Drawn Sheet, etc.
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Per square foot.

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Heavy Rubber.
In three sizes: 11", 18" and 22" long.
Light Rubber.
One size only: 11" long.

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Sizes: [illegible]" x 2" x 1"
8" x 2" x 1"
Available in Coarse, Medium and Fine.

CORRUGATED IRON
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6', 7', 8', 9', 10', 11', 12'.
and in the following widths:
1. 8 x 3" corrugations
Overall width 26".
Coverage 24".
2. 10 x 3" corrugations.
Overall width 32".
Coverage 30".
All Corrugated Iron is 24 gauge.

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Flat Sheets (Galvanized).
Sizes: 6' x 3', 8' x 3' and 8' x 4'.
Gauges:
14, 16, 18, 20, 22, 24 and 26.
Flat Sheets (Black) (Cold Rolled).
Sizes: 6' x 3', 8' x 3' and 8' x 4'.
Gauges: 16, 18, 20, 22, 24 and 26.
Only 6' x 3' sheets are available in 28 gauge.

HOOP IRON
Black.
1" x 16 Gauge.
1¼" x 16 Gauge.
1½" x 16 Gauge
In Coils
Galvanized.
1" x 16 Gauge.
1¼" x 16 Gauge.
1½" x 16 Gauge.
1½" x 17 Gauge.
1½" x 18 Gauge.
¾" x ⅛" Gauge.

HOOGOONDSEMENT
(McClory)
'n Uitstekende lasmengsel vir hoogoonde, ketels en stowe.
Verpak gereed vir gebruik in blikke van 2 pond.

KEENE SE SEMENT
Gee 'n superfyn, glasagtige muuroppervlakte vir hospitale, laboratoriums, ens.
112 pd. en per pond.

SNOWCRETE
Wit sement vir voegstryking van geglasuurde teels en vir terrassowerk.
Verpak in papiersakke van 94 pd en los per pd.

TEELVASHEGTINGSEMENT
Vir muur- en vloerteëls.
Bestand teen vogtigheid en hitte.
Blikke van 1 gelling, ½ gelling, 1 pint en ½ pint.

KOPERPLATE
Groottes: 6' x 3' en 8' x 4'.
Mate: 18, 20, 22 en 24 S.W.G.

KOPERSTROOK IN ROL
Breedtes: 12', 16" en 18"
Mate: 16, 18, 24, 26 en 28 S.W.G.

KOPERSIRKELS
Oor 15" tot 24" deursnit.
Mate: 18, 20, 22 en 24 S.W.G.

KURKPLAKKE
Groottes: 3'0" x 1'0", in diktes van 1" tot 12".

KRAAKVULLER
Vir herstel van beskadigde oppervlaktes, pleister, hout, baksteen, voeë, ens.
1 pd. pakkies.

KREOSOOT
Bewaarmiddel.
Verpak in blikke van 1 en 4 gelling en tromme van 45 gelling.

VUURVASTE KLEI
Verpak in sakke van 200 pd.

RUITGLAS
Helder (16 en 21 ons), mat, bedraad, getrokke plaat, ens.
Volgens enige groottes gesny.
Per vierkante voet.

HANDSKOENE (NYWERHEID)
Swaar Rubber.
In drie nommers: 11", 18" en 22" lank.
Ligte Rubber.
Slegs een nommer: 11" lank.

OLIESTEEN (INDIË)
Groottes: 6" x 2" x 1"
8" x 2" x 1"
Beskikbaar in grof, medium en fyn.

GEGOLFDE YSTER
Beskikbaar in die volgende lengtes:
6', 7', 8', 9', 10', 11', en 12'.
en in die volgende breedtes:
1. 8 x 3" golwings.
Totale breedte 26".
Dekking 24"
2. 10 x 3" golwings.
Totale breedte 32'.
Dekking 30".
Alle gegolfde yster is 24" maat.

PLAT YSTER
Plat Plate (Ge[illegible])
Groottes: 6' x 3', 8' x 3' en 8' x 4'.
Mate: 16, 18, 20, 22, 24 en 26.
Plat Plate (Swart) (Koud gewals).
Groottes: 6' x 3', 8' x 3 en 8' x 4'.
Mate: 16, 18, 20, 22, 24 en 26.
Slegs 6' x 3' plate is beskikbaar in 28 maat.

HOEPELYSTER
Swart.
1" x 16 maat.
1¼" x 16 maat.
1½" x 16 maat.
In rolle.
Gegalvaniseer.
1" x 16 maat.
1¼" x 16 maat.
1½" x 16 maat.
1½" x 17 maat.
1½" x 18 maat.
¾" x ⅛" maat.

QUALITY HOUSE, 130 FOX ST., JOHANNESBURG

CORRUGATED IRON SHEETS W. R. BOUSTRED LTD. (EST. 1890) CATALOGUE P547

W. R. BOUSTRED, BPK.

BOUERSDIVERSE	BUILDERS' SUNDRIES

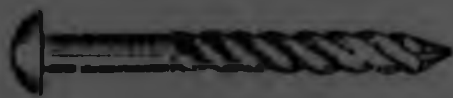
G 68

Straining Eye Bolt
S'ze 12" × ½". Galvanized

ʼOogspanbout
Grootte 12" × ½" Gegalwaniseer

G 69
Hook Bolt
Galvanized
Sizes: 3", 3½", 4", 4½", 5" and 6" × ¼" and ⁵⁄₁₆"

Haakbout
Gegalwaniseer
Groottes: 3", 3½", 4", 4½", 5" en 6" × ¼" an ⁵⁄₁₆"



G 70 Roofing Screw
Screw thread, gimlet point and drive. Galvanized.
Sizes: 2½" and 3"

Dakskroef
Skroefdraad, frokboorpunt en drywing. Gegalwaniseer.
Groottes: 2½" an 3"

G 71
Timber Connecter
Houtverbinder

G 72
Lead Roofing Washer
Waterproof Type (Patent)
Sizes: ¼" and ⁵⁄₁₆" diam. hole

Looddakwaster
Gewone tipe.
Gat met ¼" en ⁵⁄₁₆" deursnit

G 73
Roofing Washer (Round)
Galvanized Ste.
¼" diam. hole

Dakwaster (Rond)
Gegalwaniseerde staal
Gat met ¼" deursnit

Diamond Washer
¼" and ⁵⁄₁₆" dia. hole

Diamantwaster
Gat ¼" an ⁵⁄₁₆" deursnit

G 74
LEAD ROOFING WASHER
Plain Type
Sizes: ¼" and ⁵⁄₁₆" diam. hole.

3 75
Verandı Bolt and Nut
Sizes: ¼" diam. × ½", ¾", 1", 1¼", 1½", 2"
Finish: Galvanized

Verandabout en moer
Groottes:
¼" deursnit × ½", ¾", 1", 1¼", 1½" en 2"
Afwerking: Gegalwaniseer

G 76
Curved Conical Washers
Galvanized Steel
⁵⁄₁₆" diam hole

Gekromde koniese wasters
Gegalwaniseerde staal
Gat met ⁵⁄₁₆" deursnit

G 77 Carriage ʼolt and Nut
Cup head, square shoulder, square nut.

Balkbout en moer
Domvormige kop, vierkantige skouer, vierkantige moer

Diam. deursnit	long lenk
¼"	1" — 6"
⁵⁄₁₆"	1" — 6"
⅜"	1" — 12"
½"	1" — 18

QUALITY—GIBBON, LOSSER, LTD., JOHANNESBURG

ROOFING FIXINGS W. R. ʼOUSTRED LTD. (EST. 1890) CATALOGUE P580

W. R. BOUSTRED, BPK.

GEREEDSKAP	TOOLS

C 342

LETTER AND FIGURE PUNCHES

In sets A to Z, 1 to 0.
Sizes: [illegible]

LETTER- EN FIGUURPONSE

In stelle A tot Z, 1 tot 0.
Groottes: [illegible]

C 343

ROOFING PUNCH

Size: 7" × [illegible]"

DAKPONS

Groottes: 7" × [illegible]"

C 344

PLUGGING CHISEL

10" × [illegible]" Octagon.
Cutting sizes: [illegible]

MUURPONS

10" × [illegible]" aghoekig
Snygroottes: [illegible]

C 345

KEY HOLE SAW HANDLE

Made of Ash
Sizes: Nos. 1, 2 and 3

SLOTSAAGHANDVATSEL

Gemaak van esdoringhout
Groottes: Nrs. 1, 2 en 3

C 346

COLD CHISEL

KOUBEITEL

Sizes/Groottes:
6" × [illegible]", 7½" × [illegible]", 8" × [illegible]", 10" × [illegible]" & 1", 12" × [illegible]" & 1"
14" × 1" & 1[illegible]", 16" × 1" & 1[illegible]", 18" × 1" & 1[illegible]"

C 347

FOLDING SURVEYOR'S LATH

Black with white figures marked in feet and inches. In [illegible]" both sides. Feet figures in red. Length 6' 0".

OPVOUBARE LANDMETERSLAT

Swart met wit syfers gemerk voet en duime. In [illegible]" weerskante. Voetsyfers in rooi. Lengte 6' 0".

C 348

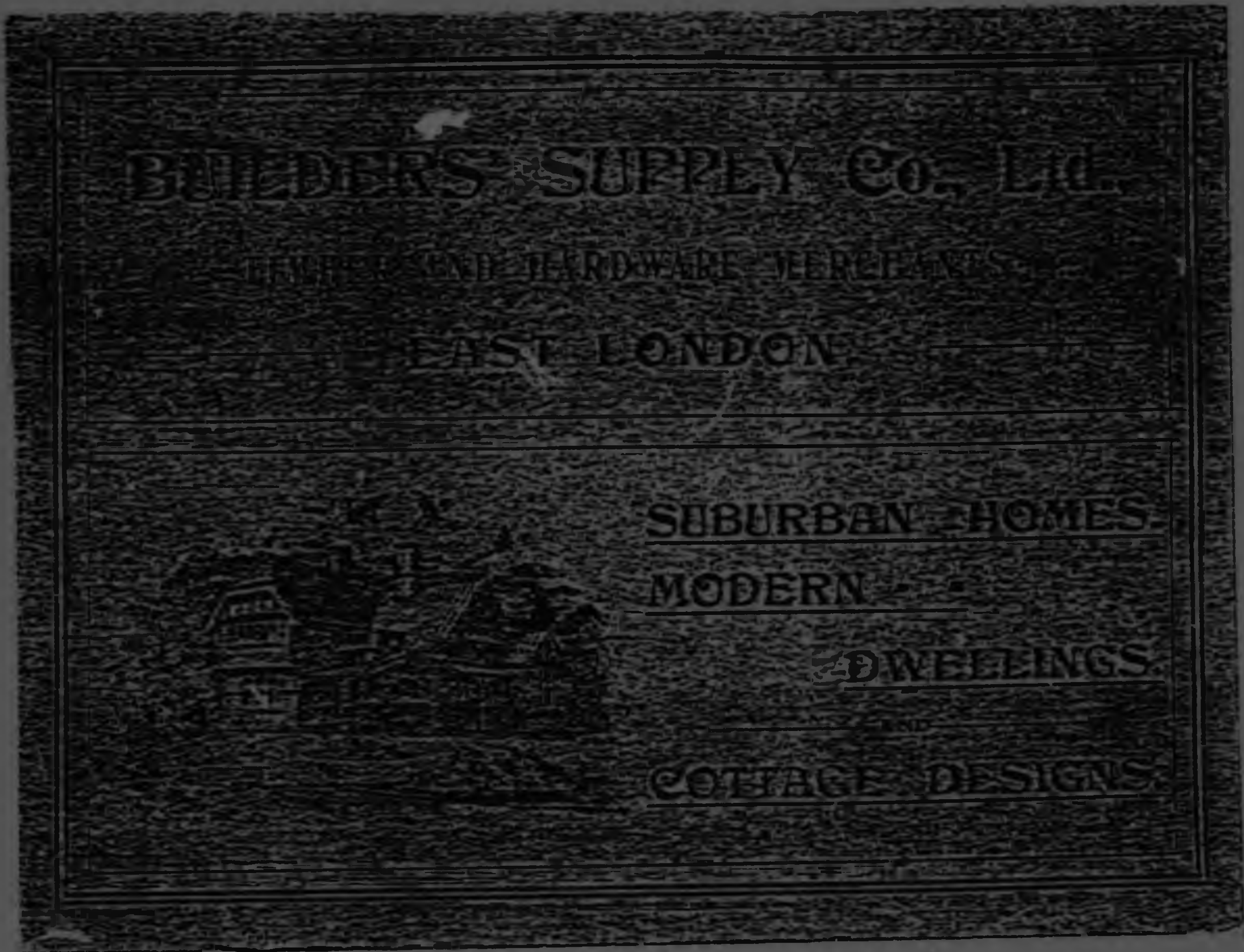
STEEL STRAIGHT EDGE

Polished, hardened and tempered. One beveled edge.
Sizes: 24" × 1½", 36" × 1[illegible]", 48" × 2".
Marked in 1/16 inches.

STAALREI

Gepoleer, verhard en getemper. Een skuinskant.
Groottes: 24" × 1½", 36" × 1[illegible]", 48" × 2".
Gemerk in 1/16 duime.

ROOFING PUNCH W. R. BOUSTRED LTD (EST. 1890) CATALOGUE P468



ORIGINAL COPY (C1918) IN THE PRIVATE COLLECTION OF MR [illegible]
ASSISTANT DIRECTOR,
NATIONAL MONUMENTS COUNCIL

MAY 1989.

BUILDERS' SUPPLY Co., Ltd.,

TIMBER AND HARDWARE MERCHANTS,

EAST LONDON.

SUBURBAN HOMES.

MODERN - -

DWELLINGS.

AND

COTTAGE DESIGNS.

ILL 7A

66

ORIGINAL COPY (C1918) IN THE PRIVATE COLLECTION OF MR C ZIETSMAN,
ASSISTANT DIRECTOR,
NATIONAL MONUMENTS COUNCIL

MAY 1989.

SPECIFICATION of the Construction of Wood Framed Buildings covered with Galvanized Corrugated Sheets.

Framing — All framing is of good red Baltic timber, the [illegible] framing being properly morticed and tenoned [illegible], [illegible] and [illegible].

Scantlings as follows:—

Top and bottom plates, principal and corner uprights, and gable [illegible] 4½in. x 3in.

[illegible] uprights and [illegible] 4½in. x 1½in.

Principal rafters and collars 4½in. x 3in., according to span, strengthened with rods.

Purlins, 3in. x 2½in.

Partition framing, 4½in. x 1½in.

Flooring — To be of 1in. i.e. ⅞in. finished, tongued, grooved, and planed, red Baltic floor boards, nailed to 4½in. x 1½in. joists, 18in. apart in the clear. The joists to be laid on 4½in. x 3in. sleeper plates, and to be dovetailed at outer ends to the bottom plates of walls, thus securely tying in the building at floor level.

Lining — The interior of building to be lined throughout with ⅝in. i.e. ½in. finished, tongued, grooved, and beaded red Baltic boards.

Felt — A layer of inodorous felt to be placed between the lining and galvanized corrugated sheeting as a [illegible] of heat, cold and sound.

Doors — Outer doors to be 2in. i.e. 1⅝in. finished, [illegible] and [illegible], and hung to 4½in. x [illegible] [illegible] frames [illegible] [illegible].

Inner doors to be [illegible] 1½in. [illegible] four-panel, with 1½in. [illegible].

Windows — All windows to be 1½in. finished, [illegible], top part [illegible] to open inwards, with [illegible], and pulleys [illegible], or box sashes may be provided in lieu if desired.

Mouldings — Suitable mouldings round windows and door openings, inside and outside.

Ventilators — Louvre ventilators in roof.

Finials — Ornamental wood finials at the apex of gables.

Facia Boards — Ornamental gable and plain eaves boards 9in. x 1in. [illegible] along sides at top of walls and up the gables.

Galvanized Corrugated Sheeting. The exterior of building to be covered with No. 24 gauge galvanized corrugated sheets of best quality, lapped one corrugation at sides and not less than 3in. at [illegible], [illegible] with galvanized screws.

Ridge Capping Galvanized rolled capping along ridge.

Gutters — Necessary O.G. eaves gutters with outlets, and stop ends.

Pipes — Sufficient rain water pipes with shoes.

Varnishing — The internal lining to be [illegible] and finished with one coat of good hard drying varnish. With the second coat of size the staining material is applied. (The stain to be either light oak or pitch pine tint.)

Painting — The doors, windows and all external wood work to be painted two coats good oil paint (ordinary colours) in addition to the [illegible] of priming applied to them before leaving our works.

Ironmongery — Necessary locks and hinges for doors and fastenings for windows.

Wood and Iron Bungalow.

COMPRISING

Dining Room, Drawing Room, Three Bedrooms,

— Kitchen, Pantry, and Bathroom. —

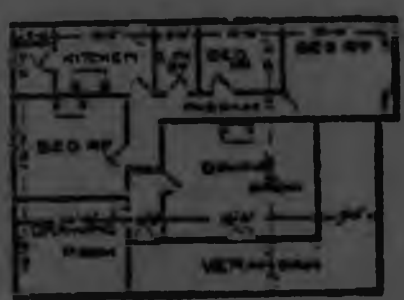
Estimated Cost of Material only £230.

Approximate Weight, 18 tons

Approximate Measurement, 1,600 cubic feet.

B.S.C. No. [illegible]

ELEVATION.



PLAN.

Hout en Yzer Landhuis.

BEVATTENDE

Eet-kamer, Zit-kamer, drie Slaap-kamers,

— Kombuis, Dispens, en Bad-kamer. —

Koste van Materiaal geschat tegen slechts £230.

Naaste gewicht 18 tonnen.

Naaste afmeting 1,600 kubieke weten.

Wood and Iron Bungalow.

COMPRISING

Dining Room, Drawing Room, Four Bed-Rooms, Servants' Room, Kitchen, Pantry and Bath Room.

Estimated cost of Material, only £475.

Approximate Weight, 30 tons.

Approximate Measurement, 27 cubic feet.

[illegible] No. [illegible]

ELEVATION.

PLAN.

Hout en Yzer Landhuis.

BEVATTENDE

Eet-kamer, Zit-kamer, vier Slaap-kamers, Kamer voor Dienstbode, Kombuis, Dispens en Bad-kamer.

Koste van Materiaal geschat tegen slechts £475.

Naaste gewicht, 30 tonnen.

Naaste afmeting, 2,700 kubieke voet.

HOSPITAL WITH ADMINISTRATION BLOCK.

This structure can be made to any size and can be supplied without Kitchen Department. Any size of Building can be supplied in an incredibly short time and occupied immediately after erection.

Unequalled for Comfort and Durability. Designs of Every Description Free on Application.

B.S.C. No. 28.

ELEVATION.

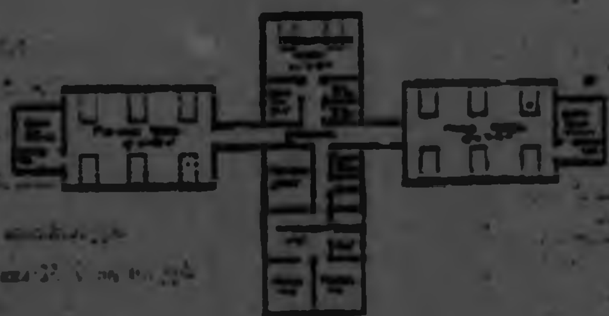
HOSPITAAL MET TOEDIENINGSBLOK.

Dit gebouw kan gemaakt worden naar enige grootte en kan geleverd worden zonder Kombuis Departement. Gebouwen van enige grootte kunnen verschaft worden in een [illegible] korte tyd, en bewoond worden dadelik na aflevering.

Ongeevenaard voor Gerief en Langdurzaamheid. Plannen van Elke Beschrijving Vrij op Applikatie.

Estimated Cost of Material.

8	Beds,	£250.
12	"	£300.
16	"	[illegible]
20	"	£370.
24	"	£400.
28	"	£430.



PLAN.

Geschatte Kosta van Materiaal.

8	Beddens	£250.
12	"	£300.
16	"	£340.
20	"	£370.
24	"	£400.
28	"	£430.

SHEET STEEL

Flat sheets are generally rolled from mild steel, although wrought-iron sheets, ingot-iron sheets and high-tensile sheets may be ordered if required.

The gauges usually stocked range from 10 to 26 or 30. Sheets are usually stocked in lengths of 6 ft. with a maximum width of 3 ft. Sheets of certain gauges may be obtained in lengths exceeding 6 ft. with a maximum width of 4 ft. Reliable information regarding the stock sizes of sheets can be obtained from the manufacturers' current lists.

Mild steel sheets are stocked black (i.e., self-coloured), galvanized, tinned, lead-coated, blue planished, bright polished, etc.

Black and galvanized are obtainable in various grades. A good specification for general purposes is: "best working-up quality mild steel sheets, cold rolled, close annealed, patent flattened, grip marks removed."

Corrugated sheets are generally made of galvanized mild steel. At higher prices it is possible to obtain corrugated sheets made of "genuine Staffordshire wrought iron" or of "ingot iron." These sheets should have a longer life than steel but should be specified in full. It is almost an established trade custom to supply steel when iron corrugated sheets are specified.

Corrugated sheets are made in all lengths from 3 ft. to 10 ft. Each sheet when laid and lapped 3 in. will cover 2 ft. in width. When specially ordered, sheets can be obtained 2 ft. 3 in. wide over all.

Laps will vary according to the pitch or if the position is exposed. Galvanized ridging may be obtained in 6-ft. lengths either plain or corrugated.

Sheets are usually stocked galvanized, but they can be supplied self-colour or painted, or protected by patent bituminous coverings (see page 353). Galvanized sheets should, when exposed to sea air or acid vapour, be painted with oxide of zinc.

The life of galvanized sheeting depends upon thickness of galvanizing and maintenance.

A specification that was operative before 1939 called for 1.75 oz. of zinc per sq. ft., including both sides, of sheeting. The sheet so galvanized was known as 175 sheet.

Galvanized sheeting will stand in an uncontaminated atmosphere for 5–7 years without attention. Thereafter it should be painted at intervals as required, and well looked after, it will give service for 50—60 years or more.

There is a very large trade in "seconds"—i.e., galvanized corrugated sheets not up to the manufacturers' self-determined standard of first quality.

APPROXIMATE WEIGHT PER SHEET

wire gauge	5 ft. long	6 ft. long	7 ft. long	8 ft. long	9 ft. long	10 ft. long
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

APPROXIMATE NUMBER OF SHEETS PER TON

wire gauge	5 ft. long	6 ft. long	7 ft. long	8 ft. long	9 ft. long	10 ft. long
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AREA COVERED PER TON ALLOWING FOR LAP

gauge —	16	18	20	22	24	26	28
sq. ft. —	[illegible]	[illegible]	1,700	2,180	[illegible]	[illegible]	[illegible]

WEIGHT PER 100 SUPER FEET

gauge — —	18	20	22	24	26
weight in cwt. qr. lb.	3.1.21	2.3.21	2.2.7	2.1.7	2.0.0

One square of corrugated sheeting requires from 2½ to 3½ lb. of rivets.

Gauges. The above-named gauges are those in general demand. Lighter and heavier gauges can be obtained, but they have to be specially ordered and they cost an extra. In ordering both corrugated and flat galvanized sheets 24 gauge is likely to be understood unless otherwise specifically stated, and in 6-ft. lengths. For export markets special gauges are required.

WIRE GAUGES

There are various wire gauges, but the Imperial gauge and the Birmingham gauge are the only two legal gauges in this country and these are the only gauges recognized by the British Standards Institution in specifications.

WIRE GAUGES TABLE OF THICKNESS

Imperial standard gauge		Birmingham gauge	
No.	diameter in inches	No.	diameter in inches
[illegible]	[illegible]	[illegible]	[illegible]

CORRUGATED SHEET STEEL SPECIFICATIONS

FROM SPECIFICATION, F.R.S. YORKE, THE ARCHITECTURAL PRESS, LONDON, 1947

ILL 72 9

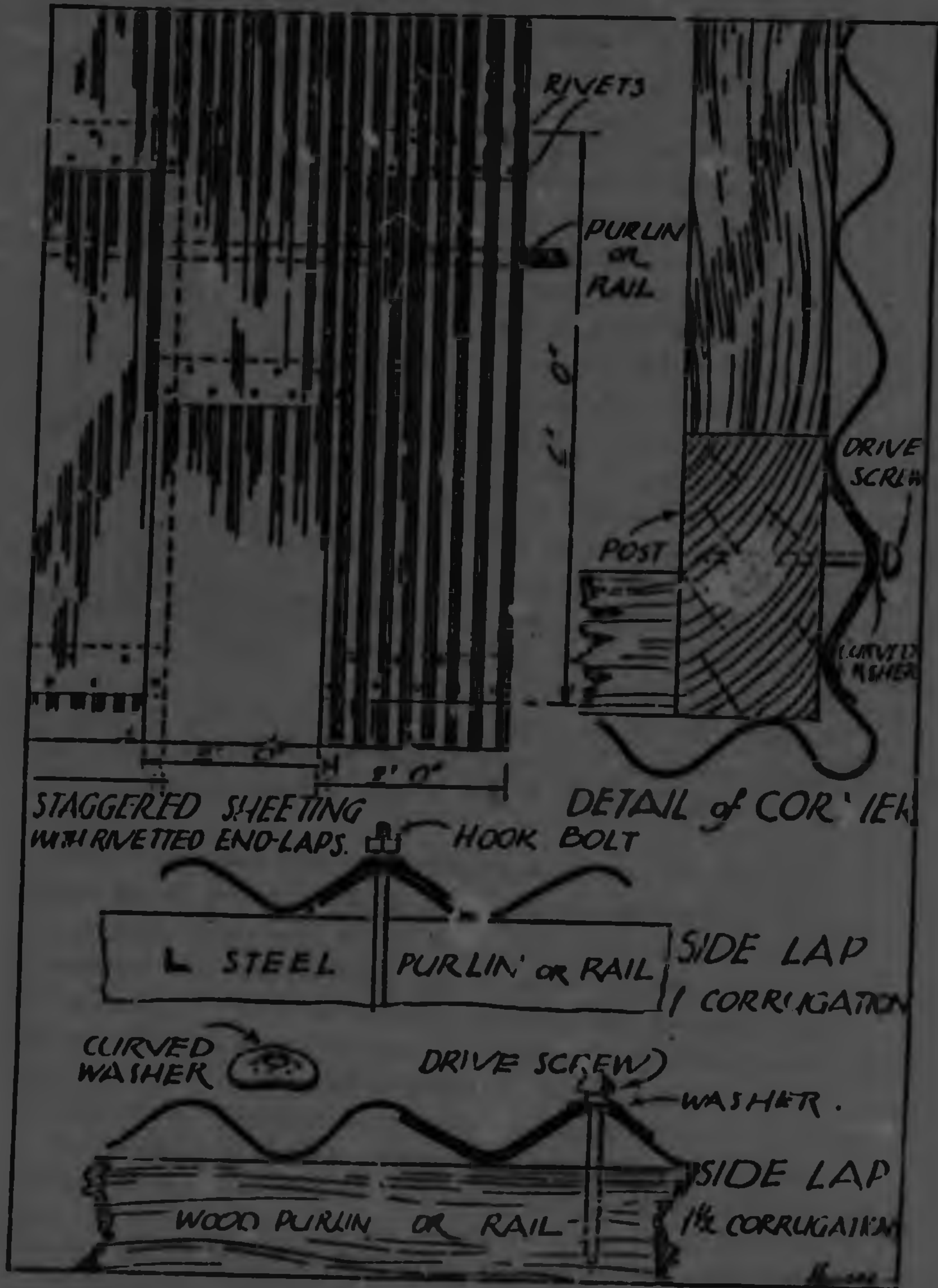


Fig. 36.—Corrugated Iron applied to Wood and Steel Framing.

CORRUGATED IRON FIXING DETAILS

FROM LIGHT BUILDINGS, EDGAR LEWIS, THE TECHNICAL PRESS LTD. LONDON, 1935

Windows in Corrugated Iron Buildings.—The method of fixing a box window-frame in a wood-and-iron building is evident from Fig. 112.

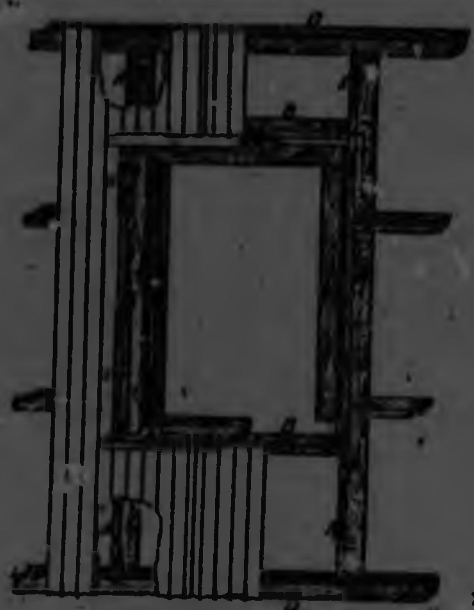


Fig. 112.

A couple of 4½" by 1½" posts, A, A, are erected about 1 inch further apart than the extreme width of the window-frame, their ends being checked into the topmost and bottommost rails, D, D, to a depth of about [illegible] inch. Between these posts two rails, B, B, are inserted at a vertical distance apart exceeding the extreme vertical height of the window frame by about 1 inch; the ends of these rails are checked into the posts to a depth of about [illegible] inch. The window-frame rests on the lower B rail, so that its outer face projects [illegible] inch beyond the faces of the posts A and the rails B. This allows room for the corrugated iron. The window-frame is wedged in position by wooden wedges driven between it and the posts A, and is also stitch-nailed to the rails B.

Rain is prevented from penetrating between the corrugated iron and the top of the window-frame by a protector C, consisting of a strip of plain galvanised iron bent to an angle as shown, and having its upturned part inserted behind the corrugated iron and attached to the upper B rail by the same screws as attach the corrugated iron. The protector C is longer than the window-frame is wide, by about 4 inches, the ends being inserted in horizontal slits cut in the corrugated iron which runs right up and down each side of the window.

An architrave, E, is fitted round the window-frame, to hide the junction of the wood and the iron. It is nailed to the window-frame and to the posts A, A. In driving nails care should be taken that they do not penetrate the interior of the box-frame, where they might interfere with the balance weights.

A solid-frame window is similarly fitted. Sometimes, however, the solid frame is entirely dispensed with, its place being taken by the posts A, A, and the rails B, B, and the sash being hinged either to the lower B rail, or to one of the A posts.

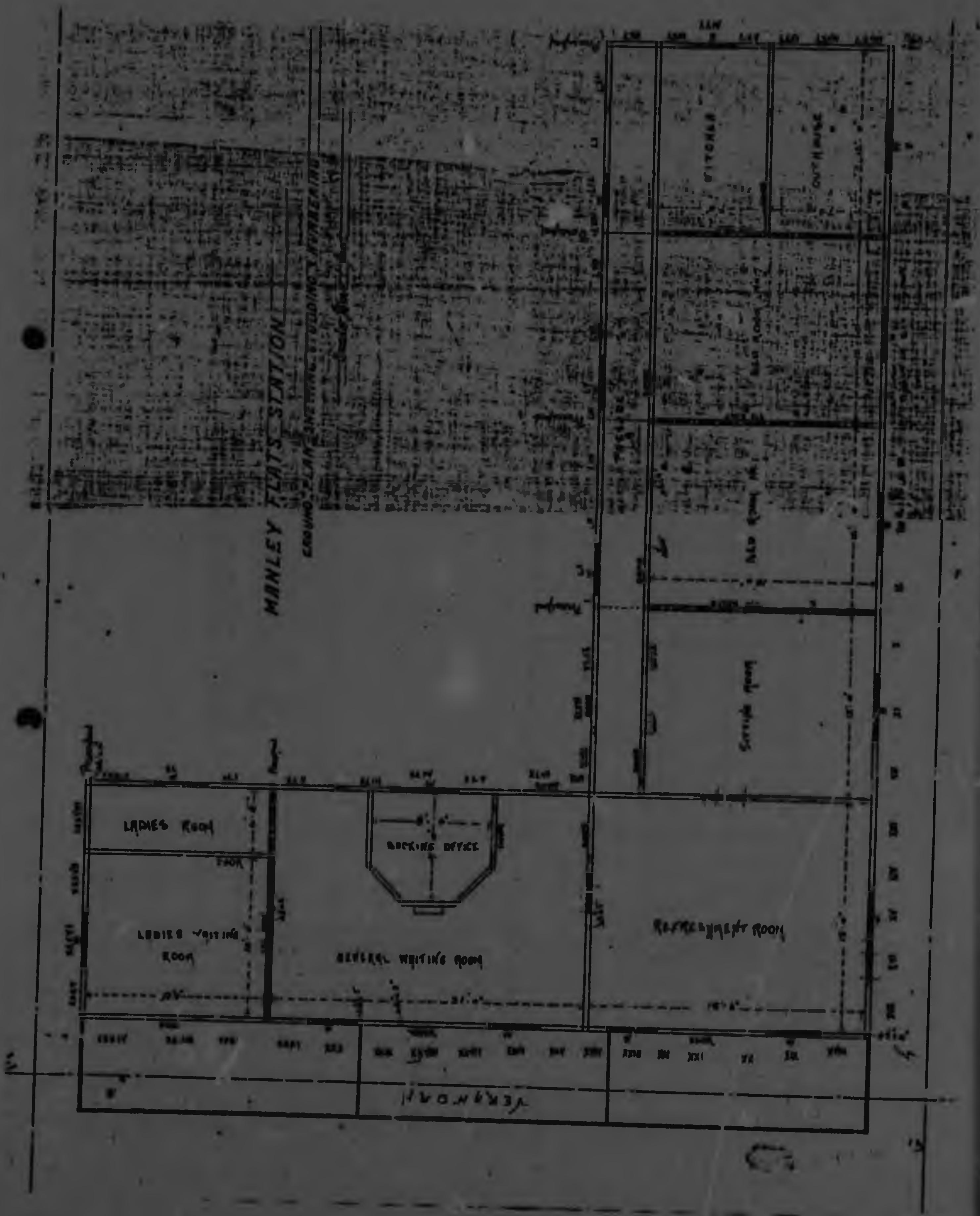
WINDOWS IN CORRUGATED IRON BUILDINGS

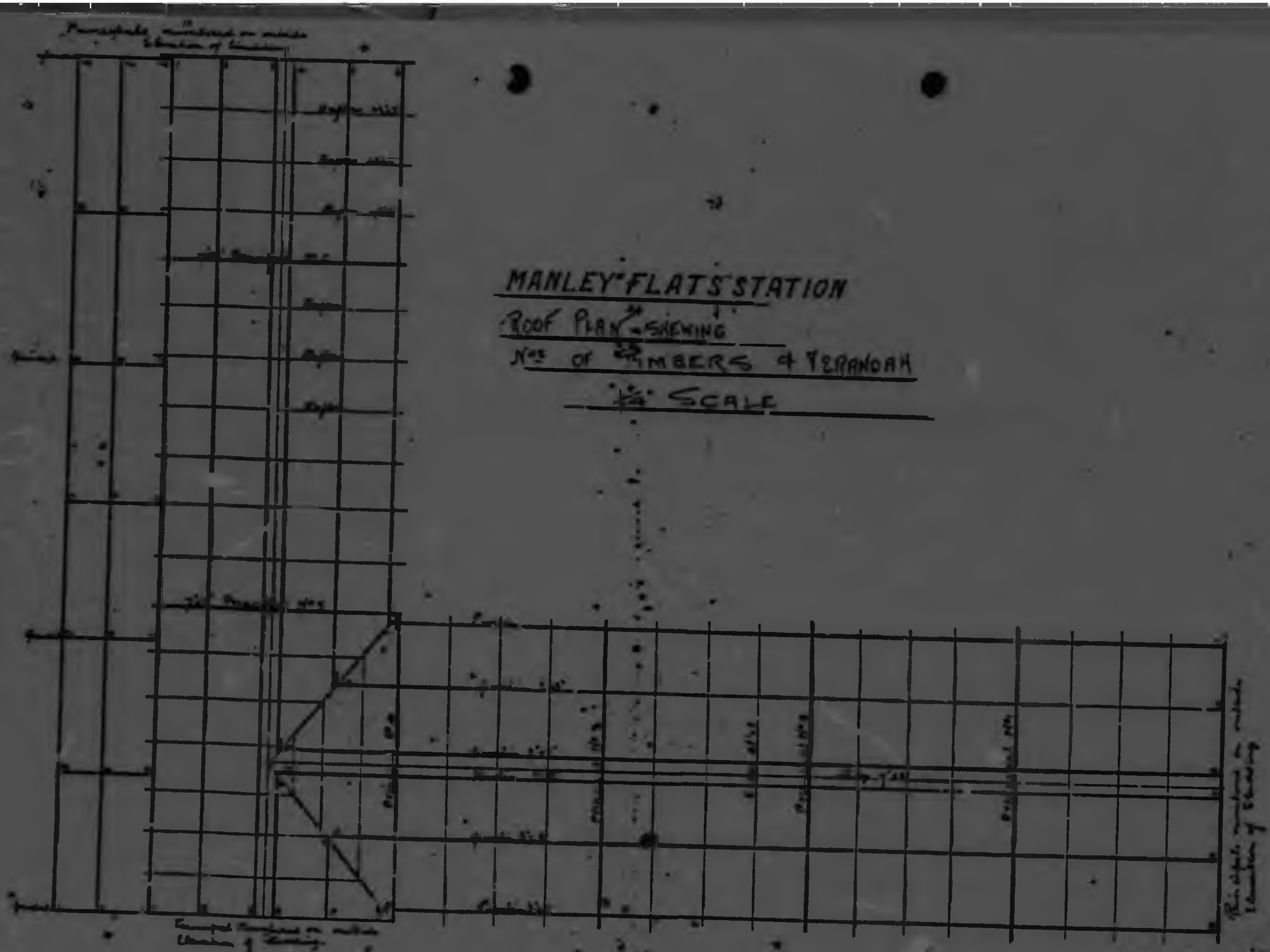
FROM FARM BUILDINGS AND BUILDING CONSTRUCTION IN SOUTH AFRICA,
W.S.H. CLEGHORNE, LONGMANS GREEN & CO., LONDON, 1916

MANLEY FLATS STATION 1884

ILL 11 A

Copies of Railway Archives drawings from
Prof. D J C Radford's collection



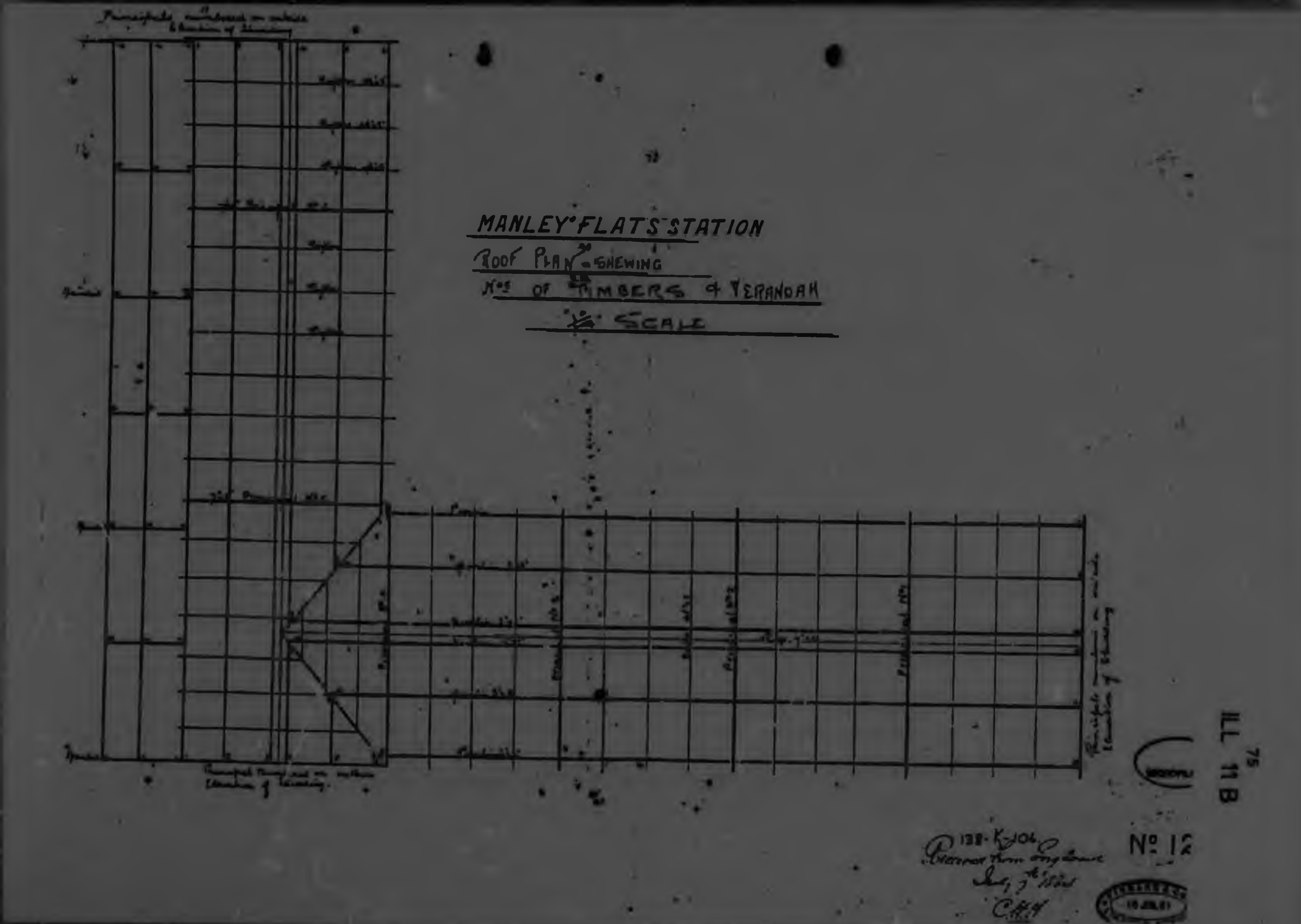


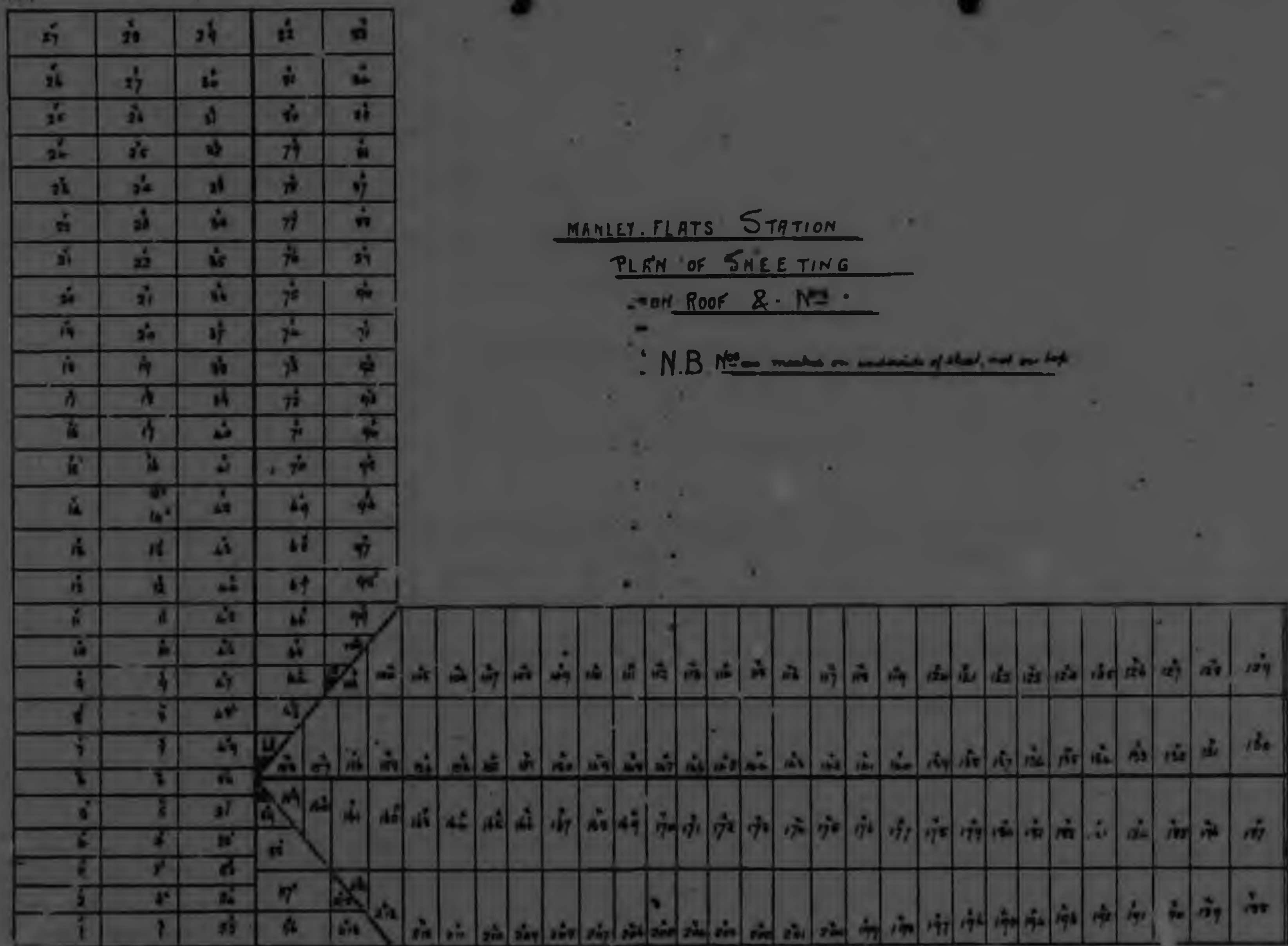
MANLEY FLATS STATION

ROOF PLAN SHEWING

Nos OF TIMBERS & VERANDAH

1/4" SCALE


MANLEY FLATS STATION
ROOF PLAN SHEWING
Nos OF TIMBERS & VERANDAH
1/4" SCALE
138-K-104
No 12
ILL 11B
75



MANLEY. FLATS STATION

PLAN OF SHEETING

ROOF & No.

N.B. Nos. marked on underside of sheet, not on top

138-K-106

No 14

Received from Engineer
July 7th 1902
C.H.A.

MANLEY FLATS STATION

ELEVATION ON LINE AB

SHEWING STUDDING & Nos

1/8 INCH SCALE

138-K-106.

Received from England July 7th 1884

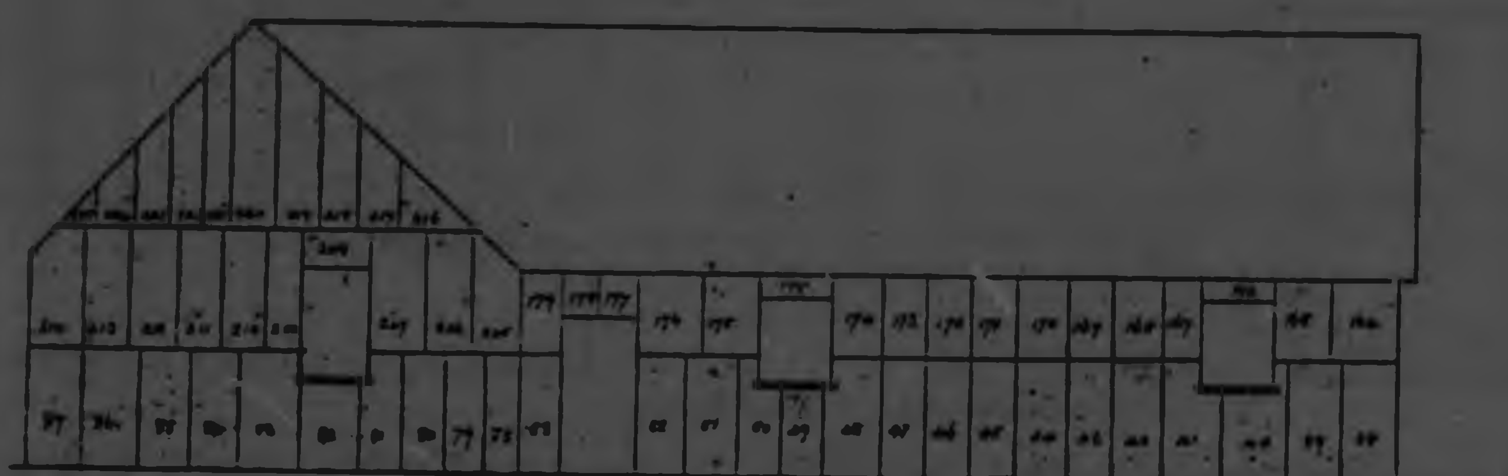
No 7

MARLEY FLATS STATION

ELEVATION ON LINE A. B.

SHEWING No.s OF SHEETING

·6" SCALE



138- K- 106

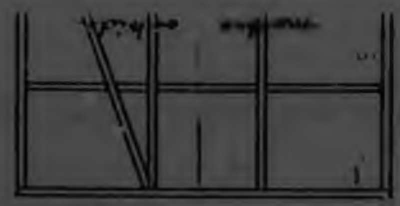
ILL 79 11 F

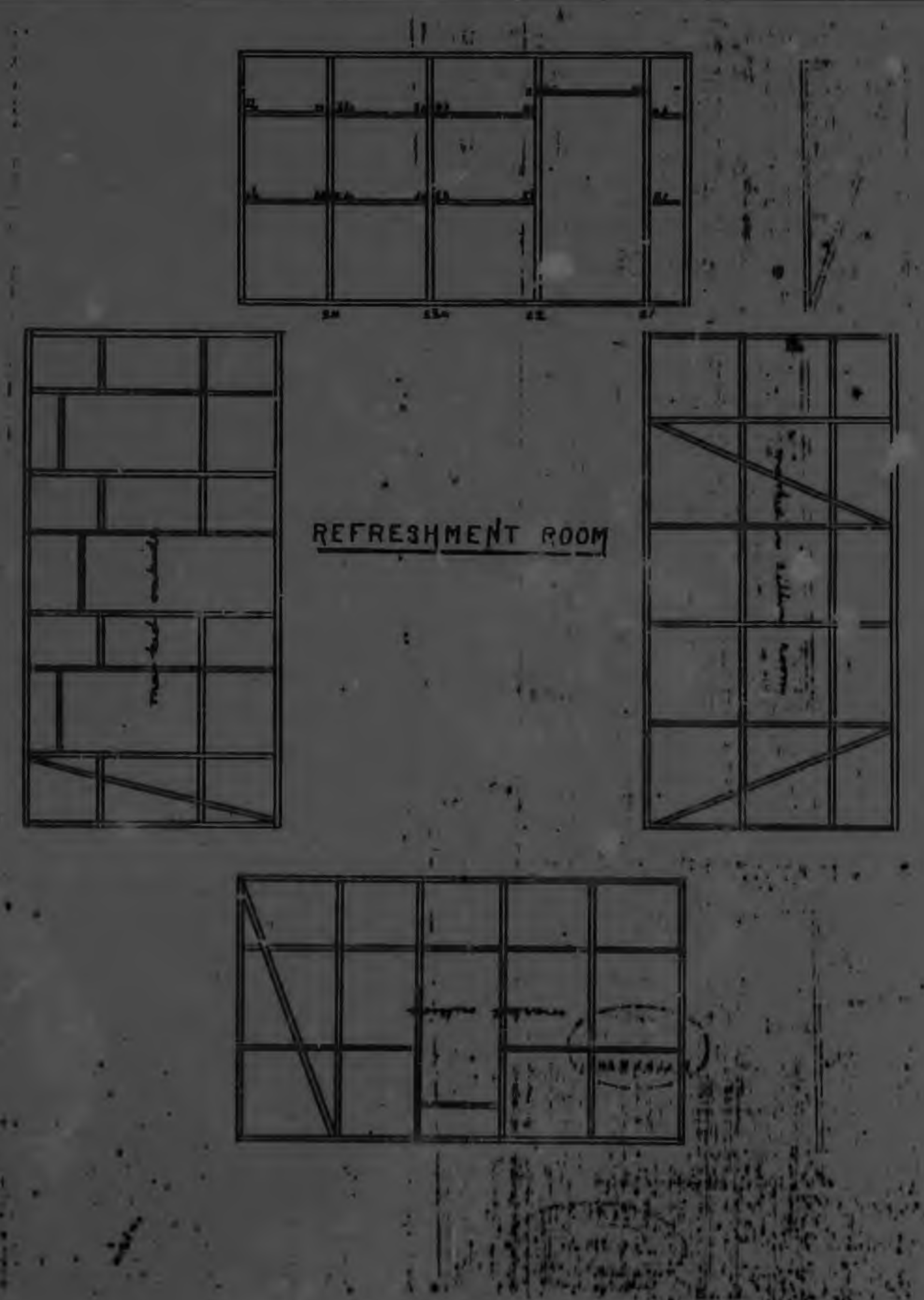
MANLEY FLATS STATION

ELEVATION OF STUDDING SHEWING No.

1/4 SCALE

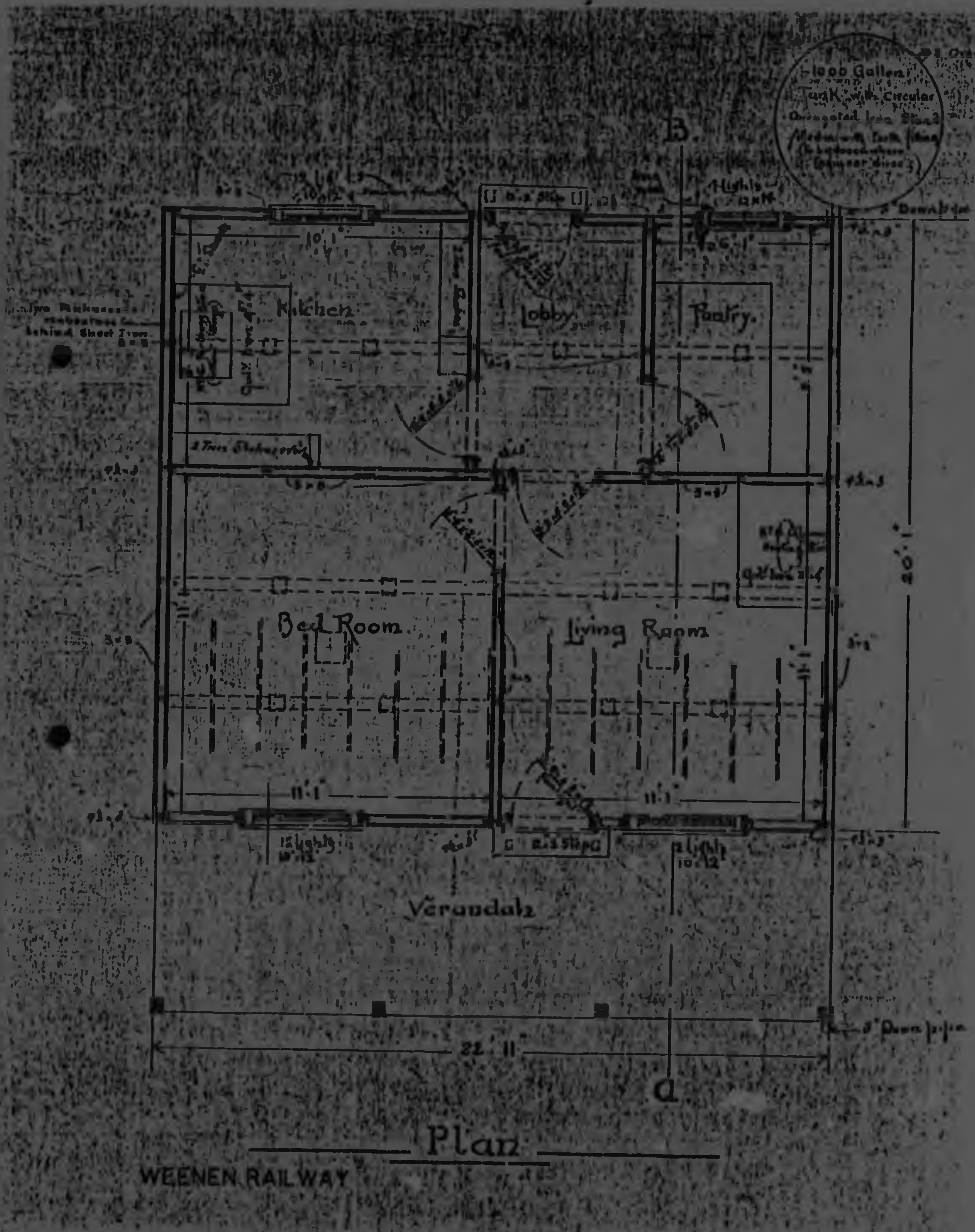
ILL 11 G



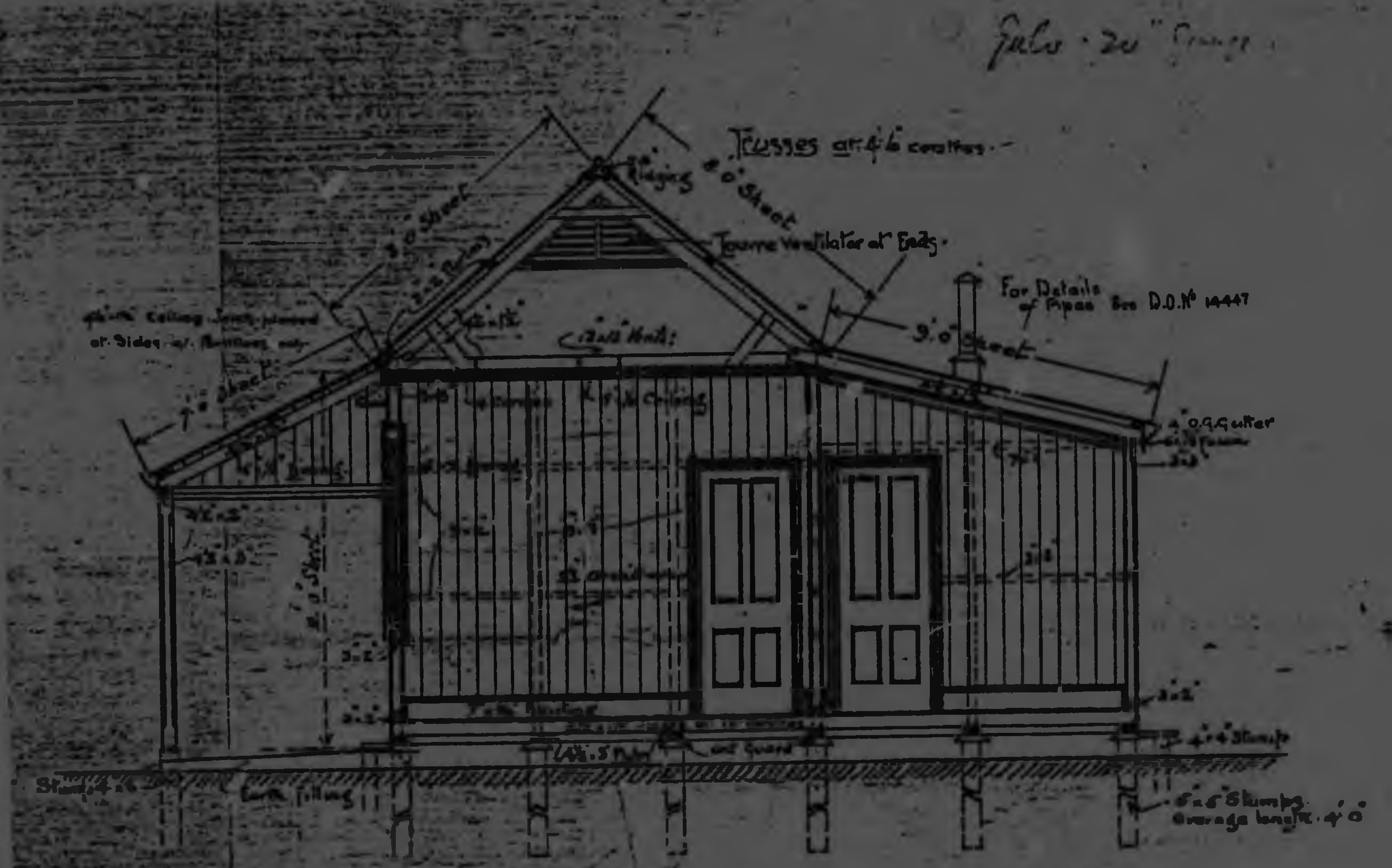


NGR PLATELAYERS SINGLE QUARTERS 1905 ILL 12 A

Copies of Railway Archives drawings from
Prof. D J C Radford's collection



WEENEN RAILWAY

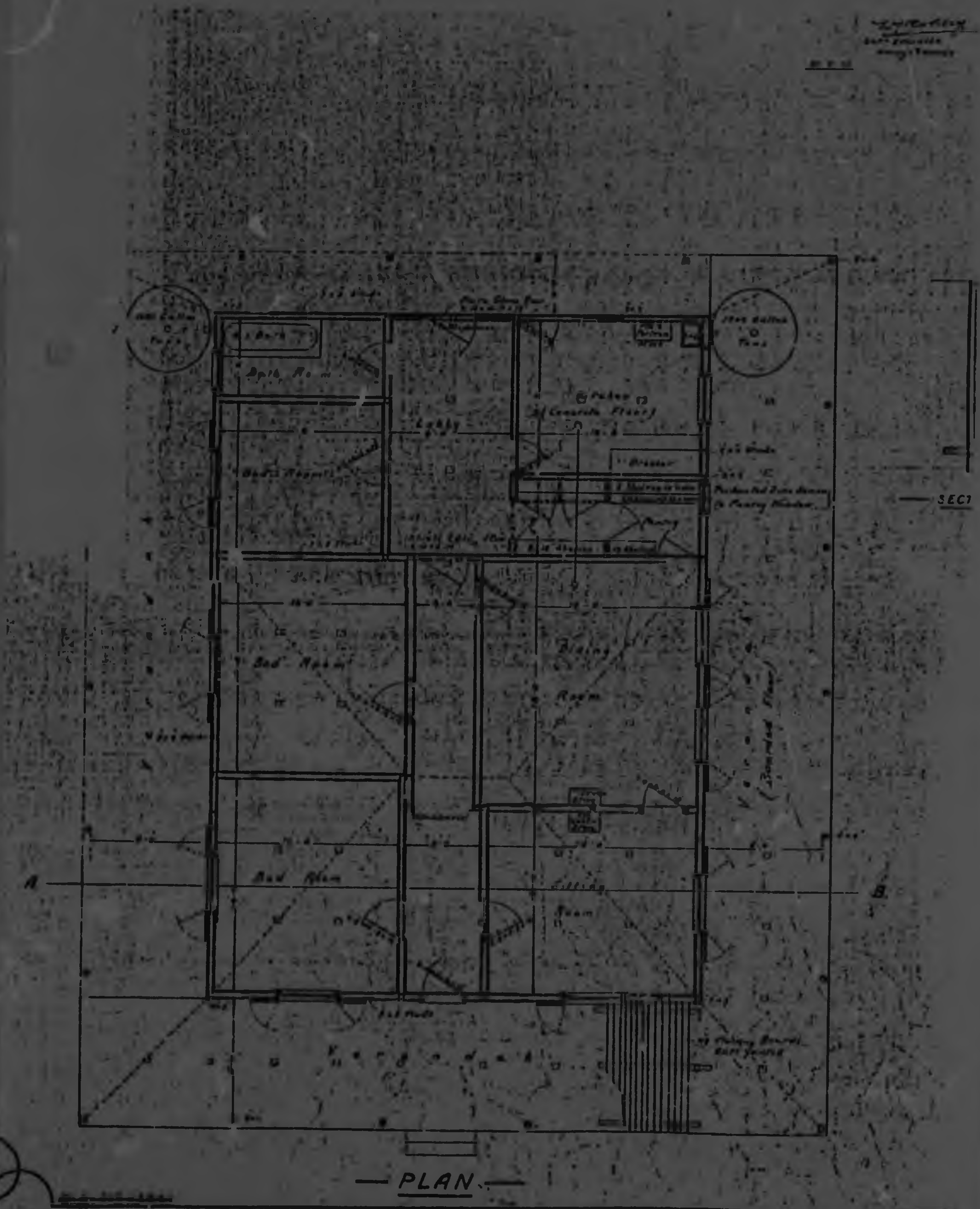


Galv. 26" Gauge
Trusses at 4'6" centres.
8'0" Sheet
9'0" Sheet
7'0" Sheet
Louvre Ventilator at Ends.
For Details of Pipes See D.O. No 14447
4" O.G. Gutter
4"x4" Stumps
6"x6" Stumps average length 4'0"
Earth filling

Section . A : B.

NGR MANAGER IN CHARGE DONNYBROOK 1903 ILL 13 A

Copies of Railways Archives drawings from
Prof. D J C Radford's collection




SECTION A. B.

SIDE ELEVATION

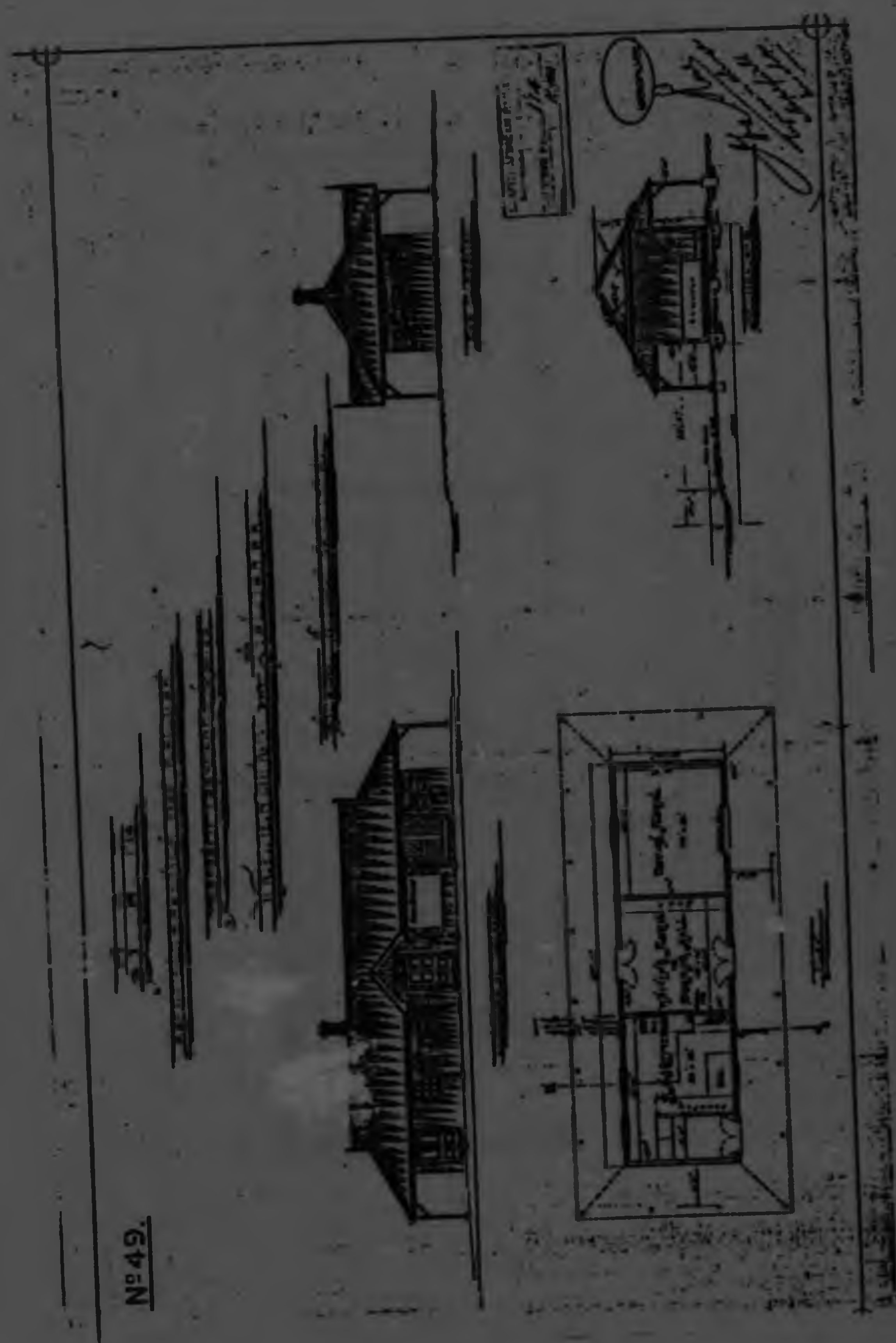
ILL 13 C 65

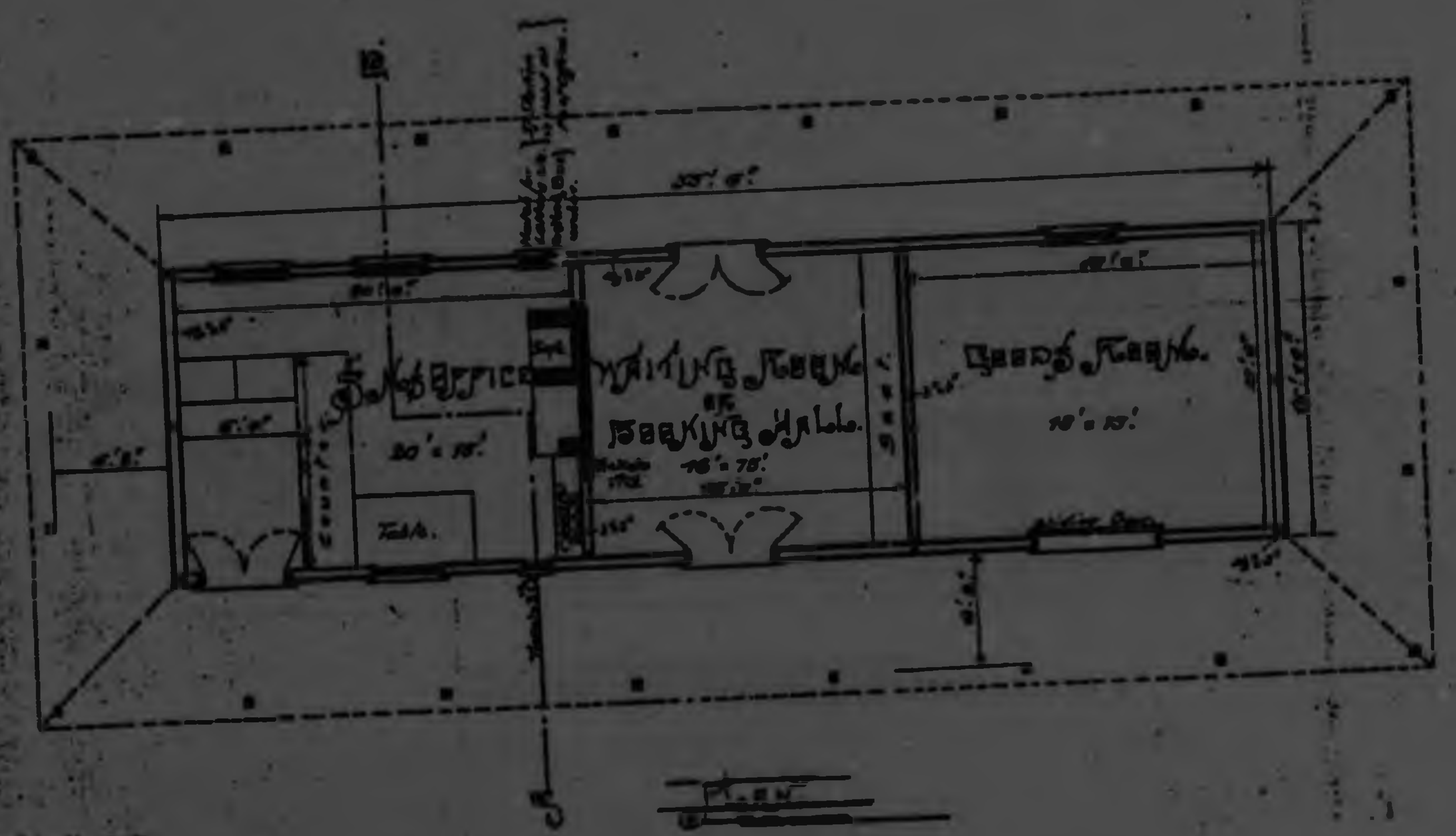
FRONT ELEVATION.

87

STATIONS VREDENBURG & SALDANHA 1911 ILL 14 A

Copies of Railway Archives drawings from
Prof. D J C Radford's collection

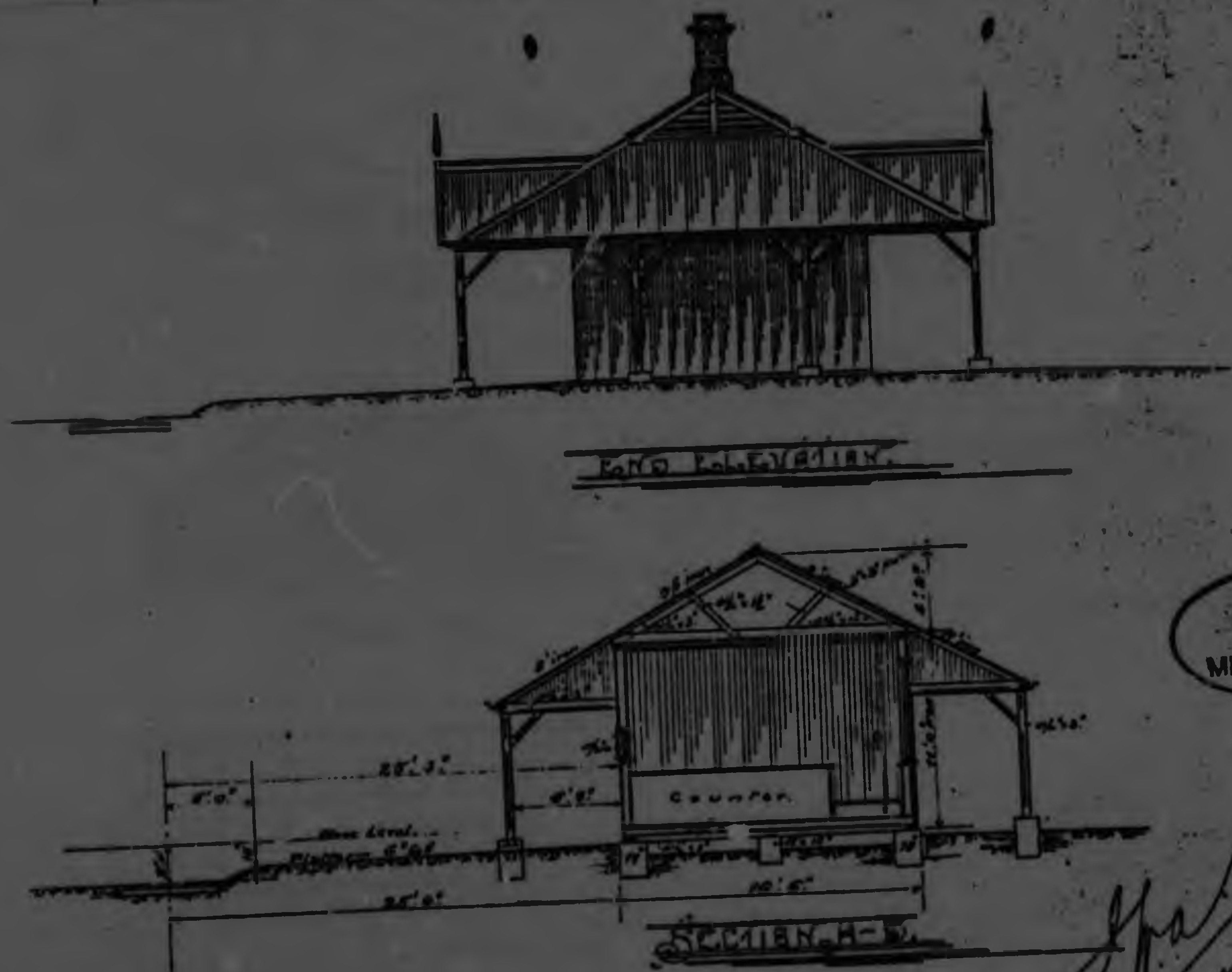




ILL 14 B

[illegible]

ILL. 14 C

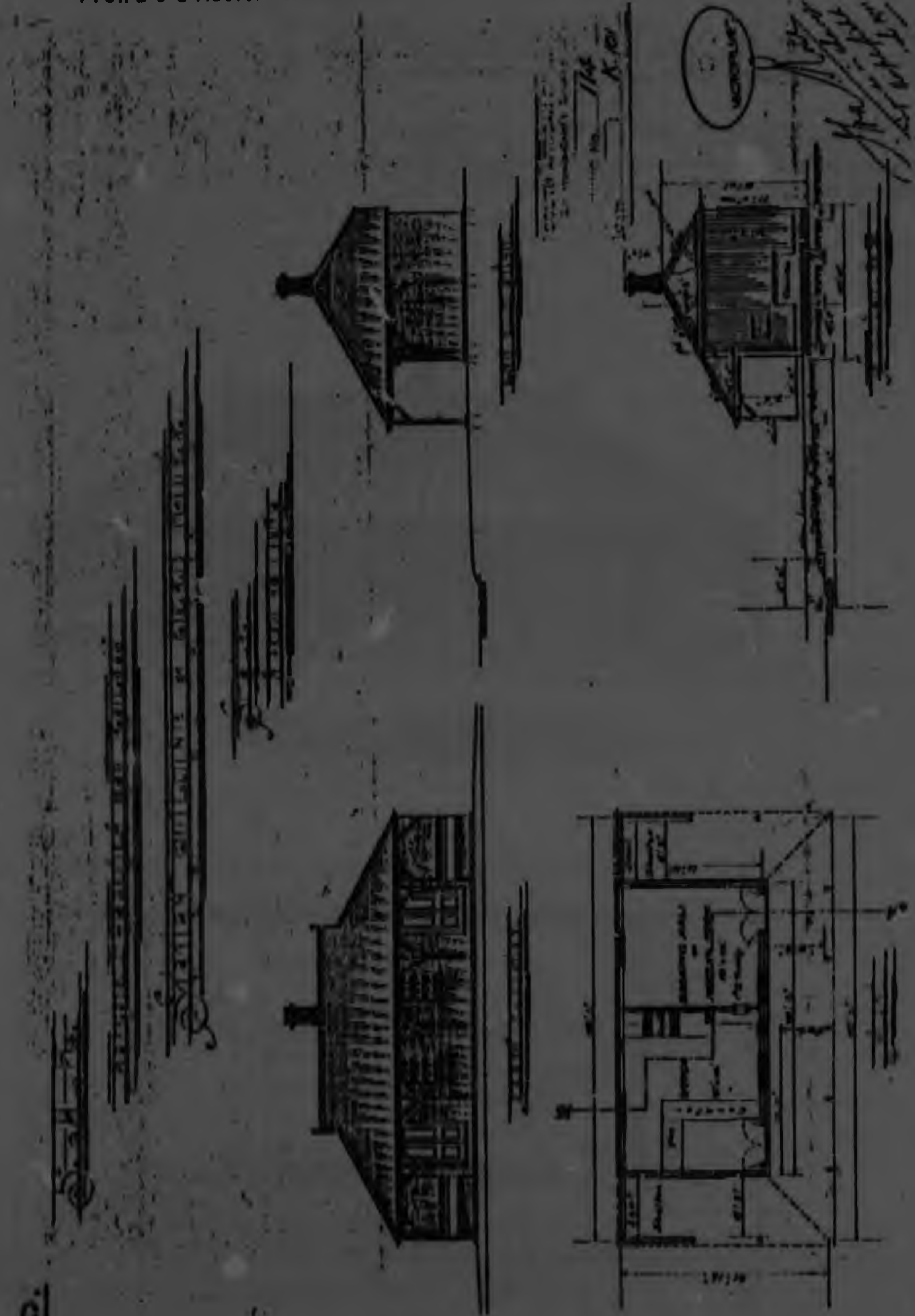


Engineer in charge
March 1911

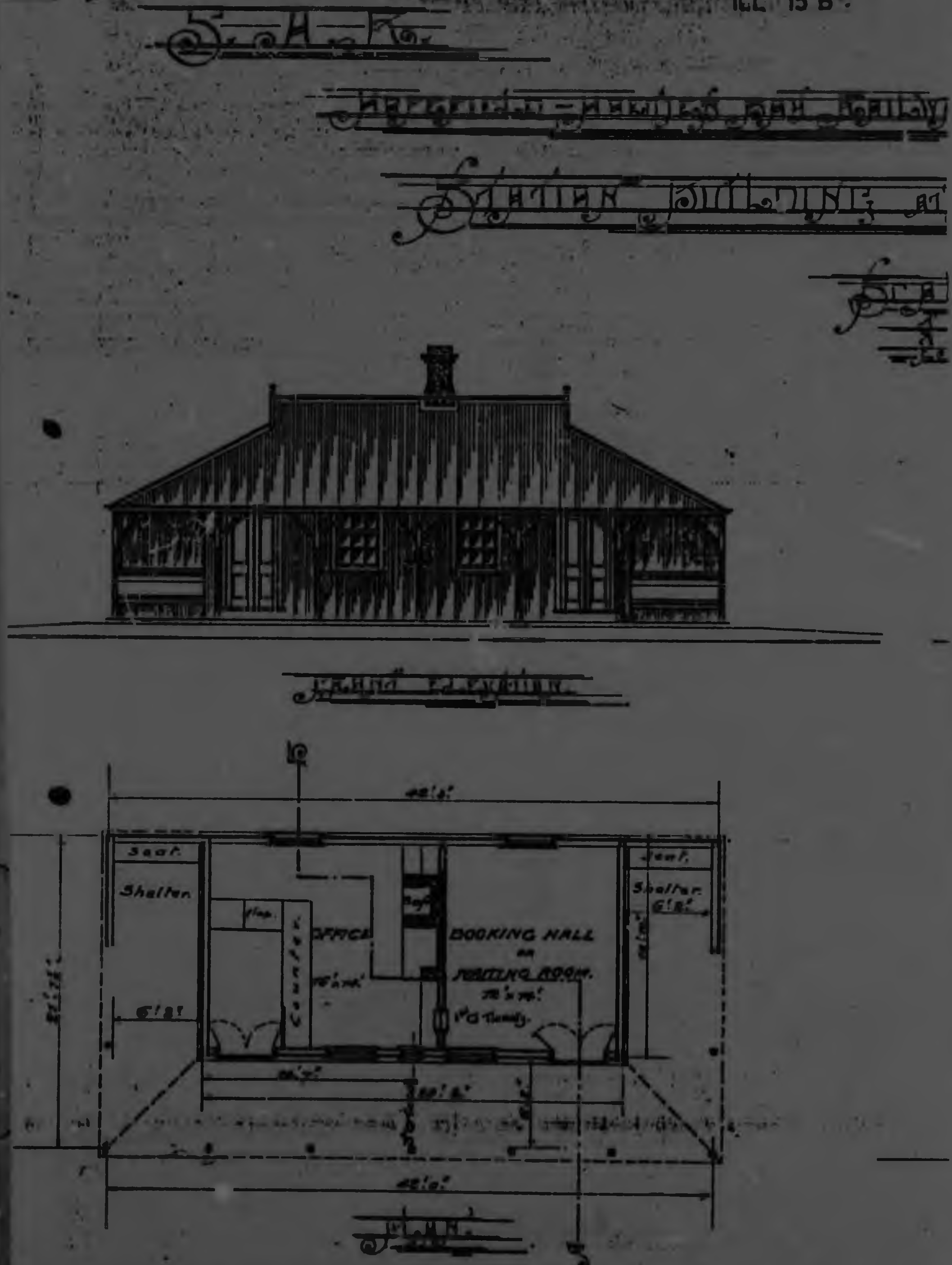
ILL 15 A

SAR STATION BERG RIVER 1911

Copies of Railway Archives drawings from
Prof. D J C Radford's collection



5.


Seat.
Shelter.
OFFICE
Counter
BOOKING HALL
or
WAITING ROOM.
Seat.
Shelter.

ILL 93 16 C

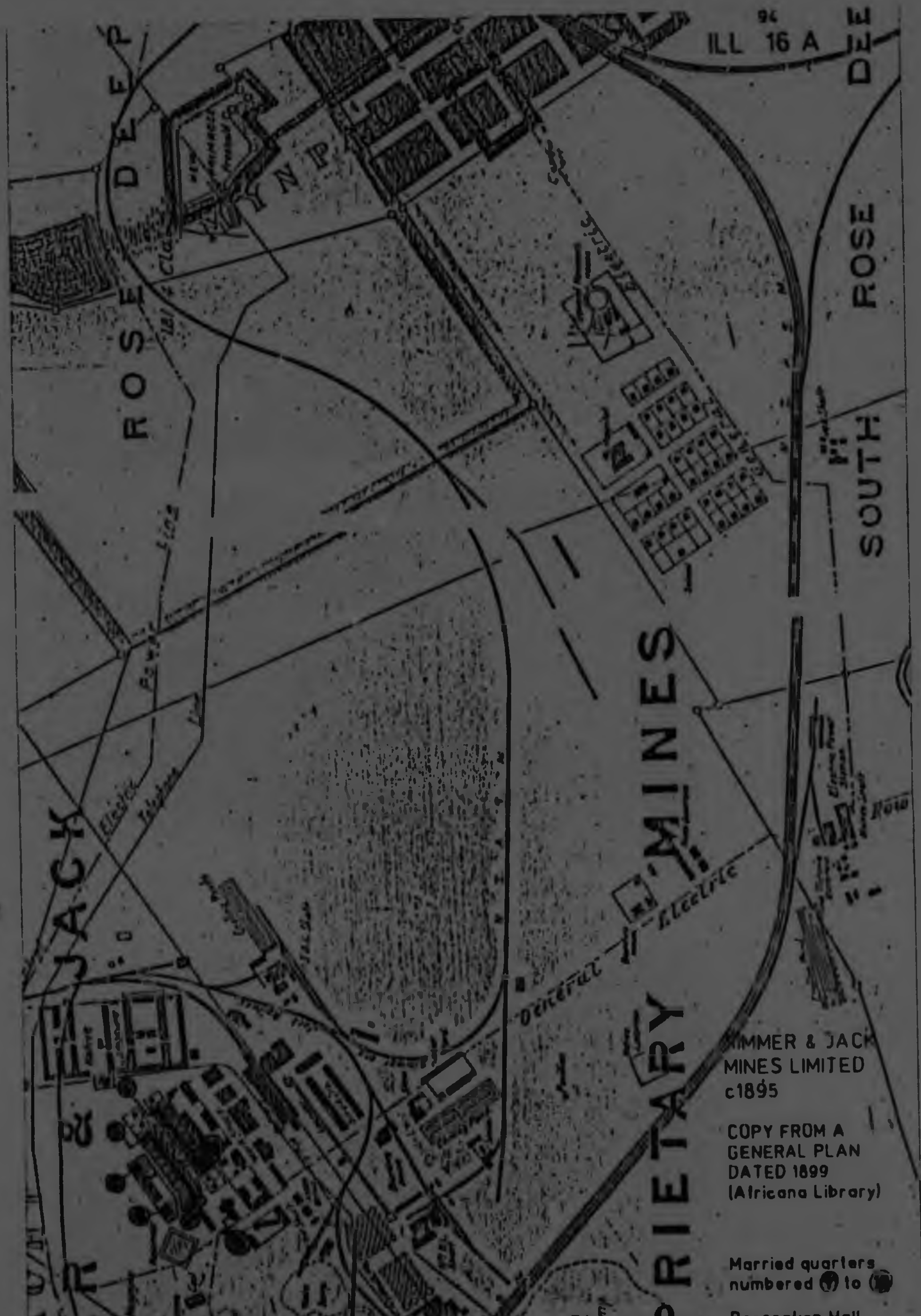
END ELEVATION

SOUTH AFRICAN R...
...eer-in-Chief's Draw...
...No. 114
Date ... K.101

SECTION A-B

MICROFILMED

Engineer in charge
Hopefield
1911


SIMMER & JACK
MINES LIMITED
c1895
COPY FROM A
GENERAL PLAN
DATED 1899
(Africana Library)
Married quarters
numbered to
Recreation Hall
numbered
N
PRIETARY MINES
ROSE DEEP
SOUTH ROSE DEE
ILL 16 A
JACK
Electric Power Line
Telephone Line
General Electric
Tailings Dump

ILL 16 B

①

②

③

SIMMER & JACK
MINES LIMITED

Married quarters

ILL 16 C

④

⑤

SIMMER & JACK
MINES LIMITED

Married quarters

⑥

ILL 16 D

⑦

⑧

⑨

SIMMER & JACK
MINES LIMITED

Married quarters

ILL 16 E

⑩

view to south east

SIMMER & JACK
MINES LIMITED

Married quarters

⑪

ILL 16 E

⑩

view to south east

SIMMER & JACK
MINES LIMITED

Married quarters

⑪

ILL 16 F

⑫

⑬

⑭

SIMMER & JACK
MINES LIMITED

Married quarters

ILL 16 G.

(15)

(16)

SIMMER & JACK
MINES LIMITED

Married quarters

(17)

ILL 16 H-J

ILL 16 H

ILL 16 I

SIMMER & JACK
MINES LIMITED

Married quarters

cladding details

ILL 16 J

ILL 16 K-M

ILL 16 K

ILL 16 L

SIMMER & JACK
MINES LIMITED

Married quarters

hood details

ILL 16 M

ILL 16 M

(18)

(18)

(18)

SIMMER & JACK
MINES LIMITED

Married quarters

ILL 16 N-P

ILL 16 N

ILL 16 O

SIMMER & JACK
MINES LIMITED

Married quarters

details

ILL 16 P

ILL 16 Q

(19)

SIMMER & JACK
MINES LIMITED

Married quarters

(19)

SIMMER & JACK
MINES LIMITED

Recreation Hall

ILL 106 16 R

SIMMER & JACK
MINES LIMITED

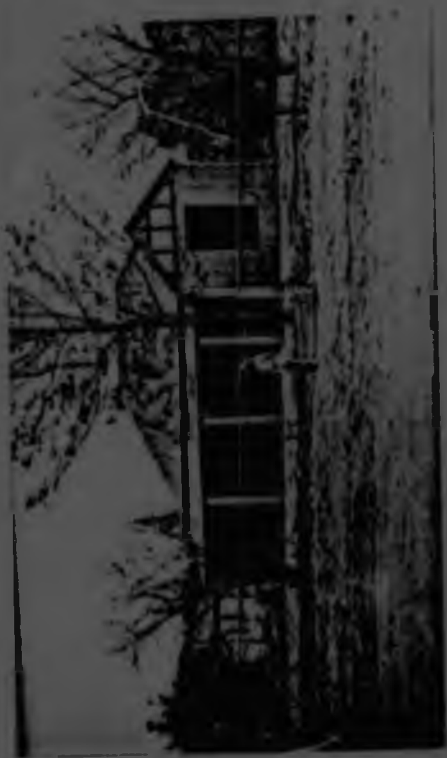
Recreation Hall

ILL 17 A

HOUSE
MRS. S M RODD

Stand no. 77
Parktown North
Johannesburg

HOUSE 1989



HOUSE 1936 photograph courtesy of owner

108

ILL 17 B

Municipal Council of Johannesburg.

Application for Approval of Plans.

Cottage on Stand No 77 Parktown North.

WARNING.—ELECTRIC CABLES.

Builders and others are hereby cautioned that any person interfering with ELECTRIC CABLES either above or below ground will be rigorously prosecuted and held liable for damages.

ELECTRIC CABLES ARE DANGEROUS TO TOUCH.

LIGHTNING.

The attention of the public and property owners is directed to the damage from lightning in the Transvaal which is very much greater than in countries in Europe and America, and it is strongly recommended that in all cases a bar, band or strip of iron or copper should be attached metallically to the foot or shoe of downpipes and the lower end carried down into damp earth or into a bed of charcoal or ashes buried in the earth or preferably metallically united to the water service pipe.

For use in Town Engineer's Department.	
Fees Payable £	10/-
Paid	1917 Receipt No. [illegible]
Received	17 MAY 1912
Passed	9 AUG 1912
Estimated Cost	£25
Inspector's Valuation	
Plan No.	[illegible]
Accommodation	......Eur. / ......Nat. / ......Eur. / ......Nat.
Commenced	
Foundations	
Drains: Com.	
Test	
Finished	

[illegible] 15th May 1912

To the TOWN ENGINEER,
MUNICIPAL COUNCIL OF JOHANNESBURG.

I herewith beg to submit Plans, Sections, and Elevations for Cottage
(New Building, Alteration, Addition or Drainage.)

under the Domestic Building Class
(Insert whether of Public Building, Warehouse, Office or Domestic Building Class.)

Class to be executed by me on Stand No. 77 Township Parktown North such Stand having frontage on [illegible] Streets, and also submit the following proposed means of construction and other particulars:—

External Walls to be built of [illegible] If Brick, state quality Grey

Internal Walls to be built of [illegible] If Brick, state quality Grey

Mortar in Walls to be composed of —

Damp Course to be of Tar

Foundations to be of Stone Mortar composed of Lime and sand

Roof to be covered with Galvanized Iron

Stairs Width of Going ...... in. Height of Rise ...... in.

Minimum Height of Floor above Ground 18 ins [illegible]

(Floors of Stables and Closets are to be of impervious material—to be coloured grey on plans.)

Scantlings of Timber:

	Inches	Inches		Inches	
Ground Floor Joists	4½	x 1½	spaced	18	apart.
First Floor Joists		x	spaced		apart.
Other Floors		x	spaced		apart.
Roof Ceiling		x	spaced		apart.
Roof Rafters	4½	x 1½	spaced	3 ft. 0	apart

[Stamp: [illegible] 12 SEP 1912]

Means of Water Supply Well

NOTE.—Applicants are recommended to acquaint themselves with the Water By-Laws of the Council.

Drainage Arrangements:

Material of Sewage Drains [illegible]

Soil Pipes

Waste Pipes (State if Trapped and Anti-Syphoned)

Ventilation Shafts

Habitable Rooms.—Will the Window Space be at least 1/10th area of Floor? Yes

Will there be Gutters and Down Pipes on Roof? Yes

Closets.—Will each be provided with at least 2 sq. ft. of light and ventilation? Yes

Waste Water.—How disposed of [illegible]
(Whether in Tanks or Vision Pans Trenches)

Architect (if any)

Address of ditto

(Signature of Owner) [signature]

OWNER IS ALSO TO SIGN PLANS.

P.O. Address of Owner General Manager's Office, [illegible] Johannesburg

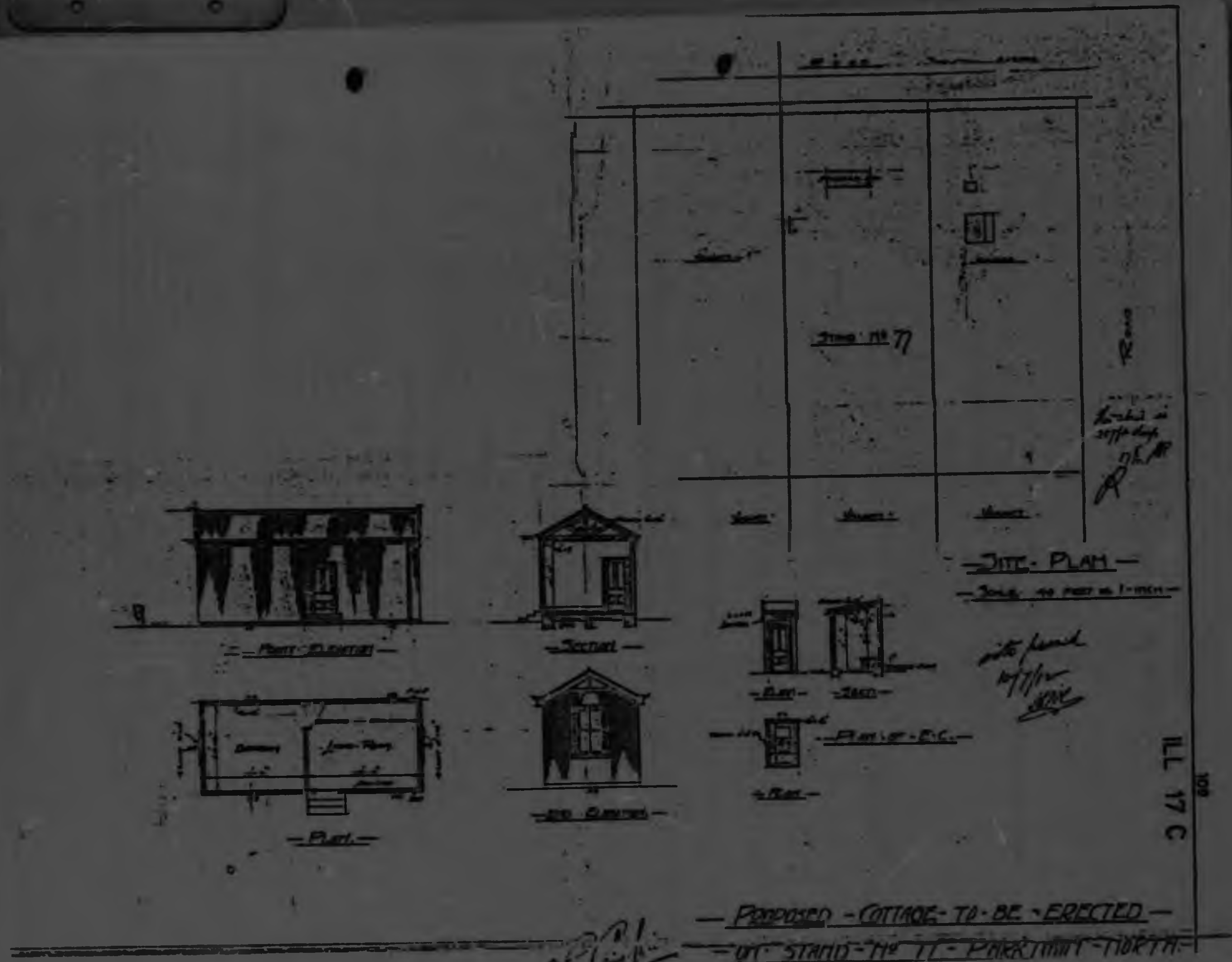
NOTE.—Extra particulars are to be furnished in regard to Public Buildings, High Buildings, and Fire-Proof Structures. Minimal proofs to be given of Steel Roof or other Trusses.

PUBLIC BUILDINGS.—Applicants for approval of Plans of Public Buildings should ascertain for themselves the requirements of the Health and Fire Departments regarding ventilation and fire appliances before submitting plans to the Town Engineer. The Fire Department should also be notified regarding all buildings in which fire appliances are required under the Building or Fire By-Laws.

[illegible]

25×10

ILL 17 C


— SITE - PLAN —
Stand No 77
Road
— Front Elevation —
— Section —
— Plan —
— Plan of E.C. —
— Proposed - Cottage - to - be - Erected —
— on - Stand - No 77 - Parkhurst - North -

110

ILL 17 D

Municipal Council of Johannesburg.

Application for Approval of Plans.

WARNING.—ELECTRIC CABLES.

Builders and others are hereby cautioned that any person interfering with ELECTRIC CABLES either above or below ground will be rigorously prosecuted and held liable for damages.

ELECTRIC CABLES ARE DANGEROUS TO TOUCH.

LIGHTNING.

The attention of the public and property owners is directed to the danger from lightning in the Transvaal, which is very much greater than in countries in Europe and America, and it is strongly recommended that in all cases a bar, band or strip of iron or copper should be attached metallically to the foot or shoe of downpipes and the lower end carried down into damp earth or into a bed of charcoal or coke buried in the earth or preferably metallically united to the water service pipe.

FOR USE IN Town Engineer's Department.

Fees Payable £ 1/- Paid ... Received 18/10/13 Passed ...

Estimated Cost £225

Inspector's Value ...

Plan No. 35939

Commenced ... Foundations ... Drains: Con. ... Test ... Finished ...

FOR USE IN Valuation Department.

19 NOV 1913

Oct 9th 1912

To the TOWN ENGINEER, 27 JAN 1913

MUNICIPAL COUNCIL OF JOHANNESBURG.

I herewith beg to submit Plans, Sections, and Elevations for Additions (New Building, Alteration, Addition or Drainage)

under the Domestic (Insert whether of Public Building, Warehouse, Office or Domestic Building Class.)

Class to be executed by me on Stand No. 77 Township Parktown North Streets, and also such Stand having frontage to 12th Avenue

submit the following proposed means of construction and other particulars:—

External Walls to be built of ... If Brick, state quality ...

Internal Walls to be built of Brick If Brick, state quality ...

Mortar in Walls to be composed of Lime & sand

Damp Course to be of Tar & sand

Foundations to be of Stone Mortar composed of Lime

Roof to be covered with Iron

Stairs—width of Going ... in. Height of Riser ... in.

Minimum Height of Floor above Ground 12"

(Floors of Stables and Closets are to be of impervious material—to be coloured grey on plans)

	inches		inches		inches	
Ground Floor Joists	4½	x	1½	spaced	18	apart.
First Floor Joists		x		spaced		apart.
Other Floors		x		spaced		apart.
Roof Ceiling	4½	x	1½	spaced	24	apart.
Roof Rafters	4½	x	1½	spaced	24	apart.

Means of Water Supply existing

NOTE.—Applicants are recommended to acquaint themselves with the Water By-Laws of the Council.

Drainage Arrangements:

Material of Sewage Drains ...

Soil Pipes ...

Waste Pipes Iron (State if Trapped and Anti-Syphoned) Yes

Ventilation Shafts ...

Habitable Rooms.—Will the Window Space be at least 1/10th area of Floor? Yes

Will there be Gutters and Down Pipes to Roof? Yes existing

Closets.—Will each be provided with at least 2 sq. ft. of light and ventilation? existing

Waste Water.—How disposed of Tanks (Whether in Tanks or Vision Poore Trenches.)

Architect (if any) ...

Address of ditto ...

(Signature of Owner) ... [signature]

OWNER IS ALSO TO SIGN PLANS.

P.O. Address of Owner General Managers Office, S.A.R., Johannesburg.

NOTE.—Extra particulars are to be furnished in regard to Public Buildings, High Buildings, and Fire-Proof Structures. Statical proofs to be given of Steel Roof or other Trusses.

PUBLIC BUILDINGS.—Applicants for approval of Plans of Public Buildings should ascertain for themselves the requirements of the Health and Fire Departments regarding ventilation and fire appliances before submitting plans to the Town Engineer. The Fire Department should also be notified regarding all buildings in which fire appliances are required under the Building or Fire By-laws.

(P.T.O.)

ELEVATION
SECTION. A-B.
PLAN
SITE - PLAN.
ELEVATION
SECTION
PLAN OF BATH ROOM
PLAN
PROPOSED · ADDITION · TO · COTTAGE
ON · STAND · Nº 77 : PARKTOWN - NORTH.
FOR · T · P · CRISPIN · ESQ.
ILL 17 E

ILL 17 F 112

MUNICIPAL COUNCIL OF JOHANNESBURG.

Application for Approval of Plans.

BY-LAW REGARDING PAVEMENTS.

WARNING.—ELECTRIC CABLES.

ELECTRIC CABLES ARE DANGEROUS TO TOUCH.

4113/16 2 May 1916

To the TOWN ENGINEER,
MUNICIPAL COUNCIL OF JOHANNESBURG.

18 MAY 1916

I herewith beg to submit Plans, Sections, and Elevations for Addition to Residence (New building, alteration, addition or Drainage)

under the Domestic Building Class (Insert whether of Public Building, Warehouse, Office or Domestic Building Class)

Class to be executed by me on Stand No. 77 Township Parktown North

such Stand having frontage to 12th Avenue Streets, and also submit the following proposed means of construction and other particulars:—

External Walls to be built of Brick If Brick, state Quality Stock

Internal Walls to be built of ✓ If Brick, state Quality ✓

Mortar in Walls to be composed of Lime & Sand

Damp Course to be of Tar & Sand

Foundations to be of Masonry Mortar composed of Lime & Sand

Roof to be covered with Galvanized Corrugated Iron

Stairs-width of going ✓ in Height of Riser ✓ in

Minimum Height of Floor above ground Three feet

(Floors of Stables and Closets are to be of impervious material - to be coloured grey on plans)

	Inches		Inches		Inches	
Ground Floor Joists	4½	x	1½	spaced	2 ft	apart
First Floor Joists	✓	x	✓	spaced	✓	apart
Other Floors	✓	x	✓	spaced	✓	apart
Roof Ceiling	4½	x	1½	spaced	2 ft	apart
Roof Rafters	6	x	1½	spaced	4.8	apart

Means of Water Supply Well

NOTE.—Applicants are recommended to acquaint themselves with the Water By-Laws of the Council.

Drainage Arrangements:
Material of Sewage Drains ✓
Soil Pipes ✓
Waste Pipes ✓ (State if Trapped and Anti-Syphon...) ✓
Ventilation Shafts ✓

Habitable Rooms.—Will the Window Space be at least 1/10th area of Floor? Yes

Will there be Gutters and Down Pipes on Roof? Yes

Closets.—Will such be provided with at least 2 sq. ft. of Light and Ventilation? ✓

Waste Water.—How disposed of Garden (Whether to Tanks or Tin... Drains, or other method)

Architect (if any) ✓

(Signature of Owner) J. Kirkaring
Owner is also to Sign Plans.

P.O. Address of Owner P.O. Box 2900 Johannesburg.

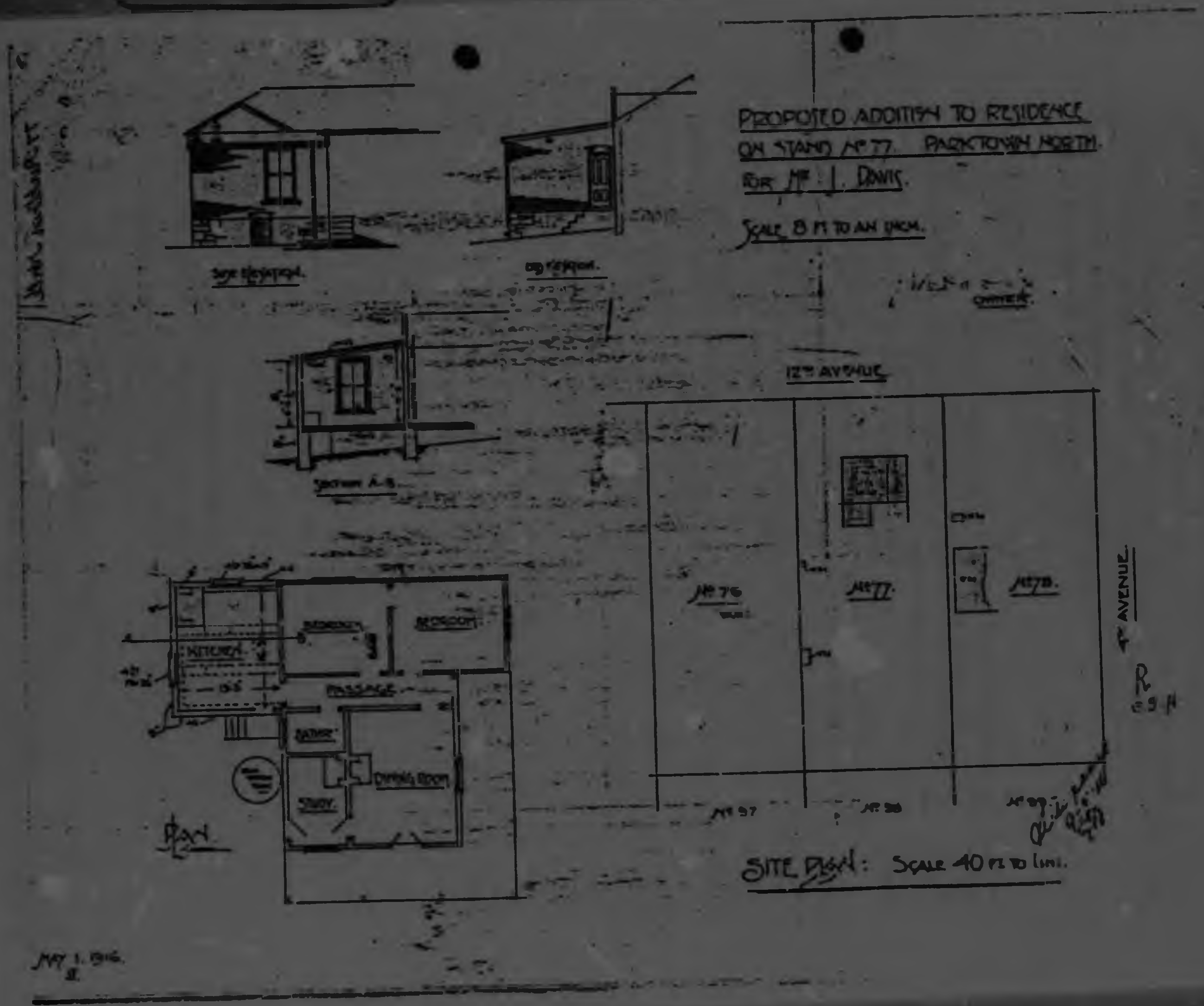
NOTE.—Extra particulars are to be furnished in regard to Public Buildings, High Buildings, and Fire-Proof Structures. Statical proofs to be given of Steel Roof or other Trusses

PUBLIC BUILDINGS.—Applicants for Approval of Plans of Public Buildings should ascertain for themselves the requirements of the Health and Fire Departments regarding ventilation and fire appliances before submitting plans to the Town Engineer. The Fire Department should also be notified regarding all buildings to which fire appliances are required under the Building or Fire By-Laws.

PLEASE TURN OVER for Special Note.

FOR USE OF Town Engineer's Department.
Fees Payable £ 10/-
Paid 18/5/1916
Received 22 MAY 1916
Passed 18 MAY 1916
Estimated Cost £40
Inspectors' Value 40
Plan No. 41163
Accommodation
Commenced
Foundations
Drains: Con. Test
Finished 22-7-16

FOR USE OF Valuation Department.
£ 70 (complete) (part)
Date 22-7-16
Entered ... Roll ...
£ ... (complete) (part) Value ...
Date ...
Entered ... Roll ...


PROPOSED ADDITION TO RESIDENCE
ON STAND No 77. PARKTOWN NORTH.
FOR Mr I. DAVIS.
SCALE 8 FT TO AN INCH.
SIDE ELEVATION.
END ELEVATION.
SECTION A-B.
12TH AVENUE.
No 76
No 77.
No 78.
AVENUE.
No 97
SITE PLAN: SCALE 40 FT TO 1 INCH.
KITCHEN
BEDROOM
BEDROOM
PASSAGE
BATH
DINING ROOM
STUDY
PLAN
MAY 1. 1916.

ALSO BE OBTAINED IN AFRIKAANS. — DIE VORM IS OOK VERKRYGBAAR IN AFRIKAANS.

THE APPROVAL OF THIS PLAN DOES NOT OVERRULE ANY RESTRICTION CONTAINED IN THE TITLE DEEDS CONCERNED.

ILL 17 H

City of Johannesburg.

APPLICATION FOR APPROVAL OF PLANS.

WARNING.—Electric Cables, etc. Builders and others are hereby cautioned that any person damaging PAVING, KERBS or STREET GUTTERS or interfering with ELECTRIC CABLES, either above or below the ground, will be rigorously prosecuted and held liable for damages.

ELECTRIC CABLES ARE DANGEROUS TO TOUCH.

CITY OF JOHANNESBURG
APPROVED
26 NOV 1940

18 = 10 = 1940

To the City Engineer,
City of Johannesburg.

24.11.40

I herewith beg to submit ... and Elevations for DRAINAGE — BATH ROOM AND ... (New Building, Alteration, Addition or Drainage) ... Class to be executed by me on Stand No. 77 under the DOMESTIC ... Class (Insert whether of Public Building, Warehouse, Office or Domestic Building Class) ... such Stand having frontage to

Township .... PARKTOWN — NORTH .... Streets.

TWELFTH AVENUE

and also submit the following proposed means of construction and other particulars:—

External Walls to be built of	BRICK	If Brick, state quality	STOCKS
Internal Walls to be built of	"	If Brick, state quality	"
Mortar in Walls to be composed of	LIME	Damp course to be of	MALTHOID
Foundations to be of	CONCRETE	Concrete / Mortar composed of	6/3/1 ... 3/1
Roof to be covered with	24 G. IRON	Minimum Height of Floor above ground	1'6"
Stairs (width of going)		in. Height of Riser	in.

(FLOORS OF STABLES AND CLOSETS ARE TO BE OF IMPERVIOUS MATERIAL —to be coloured grey on plans.)

	Inches.	Inches.		Inches.	
Ground Floor Joists	CONCRETE	x	spaced		apart.
First Floor Joists		x	spaced		apart.
Other Floor Joists		x	spaced		apart.
Roof Ceiling Joists		x	spaced	36	apart.
Roof Rafters	4½	x 1½			

Means of Water Supply .... MUNICIPAL

(Note.—Applicants are recommended to acquaint themselves with the Water By-laws of the Council.)

Will the premises be a factory within the meaning of the Factories Act, 1918, Section 1, Sub-sections (a), (b) and (c)? ....

How many Europeans (Males / Females) to be employed? ....

How many Native and Coloured (Males / Females) to be employed? ....

Drainage Arrangements:
Material for Sewage Drains .. 4" C. I. ...... Material of Soil Pipes ....
Material of Waste Pipes .. 1½" LEAD .. (State if Trapped and Anti-Syphoned) YES
Material of Ventilation Shafts .... 4" C. I.

Habitable Rooms:
Will the Window Space be at least 1/10th area of Floor? .... YES
Will there be Gutters and Down Pipes on Roof? .... YES

Closets:
Will each be provided with at least 2 sq. ft. of Light and Ventilation? YES

Waste Water:
How disposed of .... GULLY TO SEWER
(Whether in Tanks or Vivian Paste Trenches, French Drains, or other methods.)

Architect (if any) .... Will Architect supervise work?

Address of Arch. ....

(Signature of Owner) .... A. E. Williams
Owner is also to Sign Plans.

P.O. Address of Owner .... 12 - 12 Ave Parktown North

(Note.—Extra particulars are to be furnished in regard to Public Buildings, High Buildings, and Fire-proof Structures. Statical proofs to be given of Steel Roof and other Trusses.)

PLEASE TURN OVER for Special Note

FOR USE IN City Engineer's Department.

	Building	Drainage
Fees Payable £	10/-	30/-
Paid 12 MAY 1941	Receipt No.	
Received	21 OCT 1940	
Passed	28 MAY 1941	
Estimated Cost	£75	£10

Inspector's Value. ....

Plan No. 163178

Accommodation.

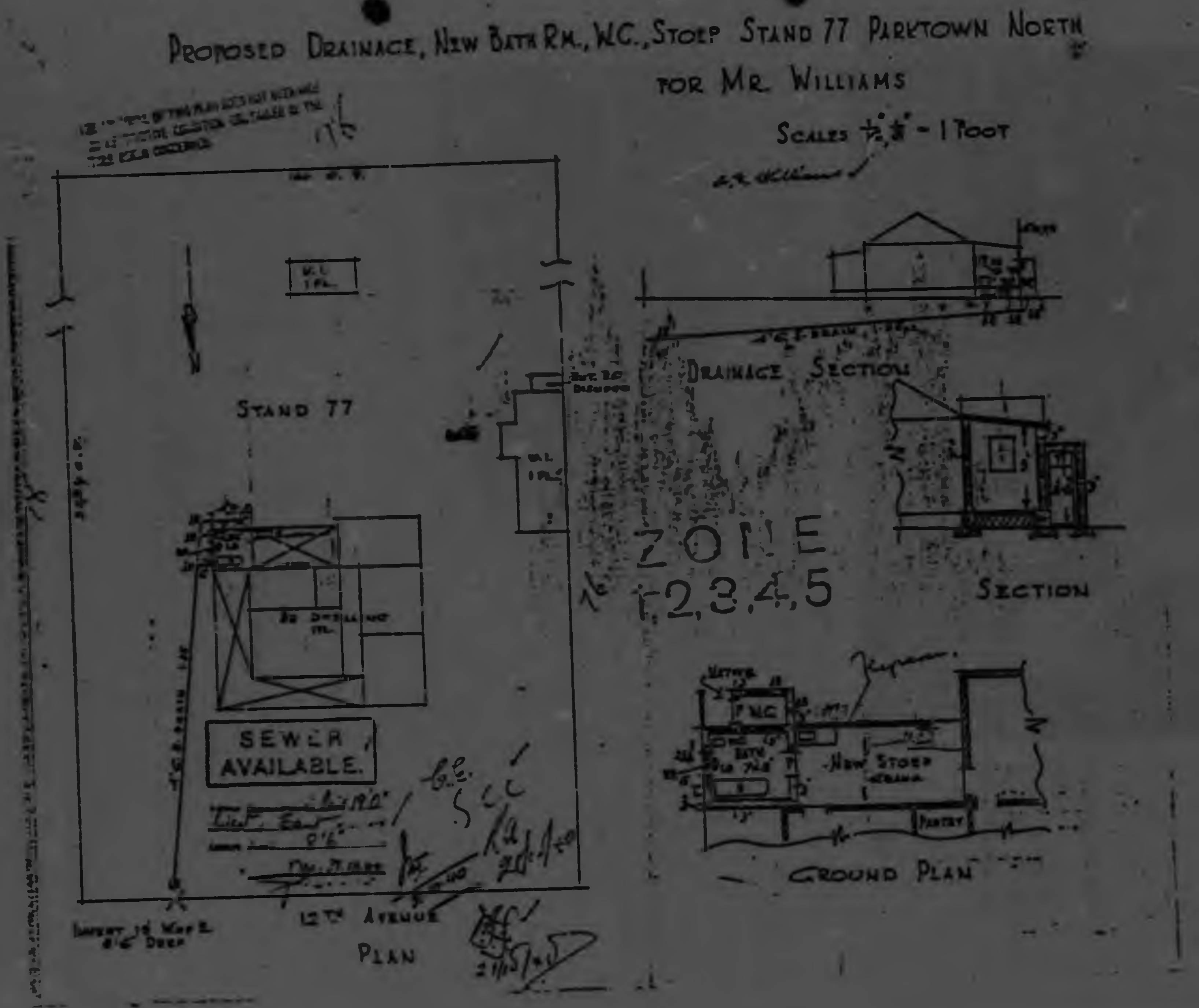
Board.	Glass.	
—	—	Eur.
—	—	Nat.

Commenced ....
Foundations ....
Drains:
Com. ....
Test ....
Finished ....

FOR USE IN Valuation Department.

£ 75 ......(complete) (part).
Class ...... Value.
Date ....
Entered ...... Roll ....

£ ....(complete) (part).
Class .... Value.
Date ....
Entered .... Roll ....


PROPOSED DRAINAGE, NEW BATH RM., W.C., STOEP STAND 77 PARKTOWN NORTH
FOR MR. WILLIAMS
SCALES 1/8", 1/2" - 1 FOOT
STAND 77
SEWER AVAILABLE.
12TH AVENUE
PLAN
DRAINAGE SECTION
SECTION
ZONE
1,2,3,4,5
NEW STOEP
GROUND PLAN
PANTRY

115
ILL 171

ILL 18 A-C

JOHANNESBURG

Melrose Shree Shiva Subrahmanya Temple 37 Second St. Abbotsford

ILL 18 A

ditto
early photograph before verandah alteration

ILL 18 B

ditto
measured drawings

(ill 18B & C from Traditional Hindu Temples in South Africa
Brian Kearney)

ILL 18 C

ILL 19 A-C

DURBAN

Cato Manor Hindu Temple Bellair rd Durban c1918

ILL 19 A

St Michael's Church Sarnia Rd Durban c1916

ILL 19 B

St Michael's Church

ILL 19 C

ILL 19 A-C

DURBAN

Cato Manor Hindu Temple Bellair rd Durban c1918

ILL 19 A

St Michael's Church Sarnia Rd Durban c1916

ILL 19 B

St Michael's Church

ILL 19 C

ILL 20 A-C

DURBAN

Hall Seaview Congregational Church Sarnia Rd. c1880

ILL 20 A

ditto
window detail

ILL 20 B

ditto
corner detail

ILL 20 C

ILL 20 D-F

DURBAN

Hali Seaview Congregational Church

detail of floor support

ILL 20 D

ditto
floor support
detail

ILL 20 E

ditto
floor support
detail

ILL 20 F

ILL 21 A-C

DURBAN

23 Southend Ave
Seaview
c1902

ILL 21 A

ditto

ILL 21 B

ditto

ILL 21 C

ILL 21 D-F

DURBAN

23 Southend Ave
Seaview
c1902

Window and hood detail

ILL 21 D

ditto
interior wall lining details

ILL 21 E

14 Caledonian Place
Seaview
c1910

ILL 21 F

ILL 21 G-I

DURBAN

10 Marnevale Rd
Seaview
c1905

ILL 21 G

109 Marnevale Rd
Seaview
c1900-1925

ILL 21 H

144 Redhill Rd
Seaview
c1910

ILL 21 I

ILL 21 J-L

DURBAN

29 Railway Rd
Seaview
c1905

ILL 21 J

18 Forest Place
Seaview
c1910

ILL 21 K

6 Gumtree Rd
Sea-cow Lake
c1915

ILL 21 L

ILL 22 A-C

CAPE TOWN

Houses
Beta Road
Bakoven

ditto

ILL 22 A

ditto

ILL 22 B

ditto
1980s infill

ILL 22 C

ILL 22 D-F

CAPE TOWN

Houses
Beta Road
Bakoven

ditto

ILL 22 D

ditto
no'e horizontal
cladding

ILL 22 E

ditto

ILL 22 F

ILL 23 A-C
CAPE TOWN

De Lorentz Street

ILL 23 A

15 Wolsey Road
note horizontal
cladding

ILL 23 B

15 Wolsey Road
Rondebosch East

ILL 23 C

ILL 24 A-C

CAPE
PENINSULA

Grant Road
Seaforth
Simonstown

ILL 24 A

cor St Georges
and Houghton Sts.
Seaforth
Simonstown

ILL 24 B

Hout Bay Road
Hout Bay

ILL 24 C

ILL 25 A-C

BARBERTON

Belhaven House
Museum
Lee Road c1900

ILL 25 A

ditto
verandah detail

ILL 25 B

ditto
interior pressed
steel wall linings
and ceilings

ILL 25 C

ILL 25 D-F
BARBERTON

Stopforth House
Bowness Road
~1896

ILL 25 D

ditto
verandah in process
of restoration

ILL 25 E

ditto
verandah
balustrade detail

ILL 25 F

ILL 25 G-I

BARBERTON

Seaforth House
window head detail
in process of
restoration

ILL 25 G

ditto
window cill detail

ILL 25 H

ditto
window head detail
with hood

ILL 25 I

ILL 25 J-L

BARBERTON

Blockhouse
c1901
Lee Road

ILL 25 J

ditto

ILL 25 K

ditto

ILL 25 L

ILL 25 M-O

BARBERTON

Blockhouse
Lee Road

interior detail

ILL 25 M

ditto
corner foundation
detail

ILL 25 N

ditto
door threshold
detail

ILL 25 O

ILL 26 A-C

PILGRIMS REST

Royal Hotel

ILL 26 A

The Village Craftsman

ILL 26 B

The Highwayman's Garage

ILL 26 C

ILL 26 D-F

PILGRIMS REST

House

ILL 26 D

House

ILL 26 E

House

ILL 26 F

ILL 27 A-C

IRENE TRANSVAAL

House Smuts
Doornkloof
c1908

ILL 27 A

ditto
verandah de[illegible]

ILL 27 B

HEIDELBERG
TRANSVAAL

House
71 b van der
Westhuizen St

ILL 27 C

ILL 28 A

Photographs from "Leaves of Iron" Philip Drew

Left
Aboriginal bark-clad hut

Below
Local History Museum and Tourist Centre South Kempsey 1983 Glenn Murcutt Arch.

ILL 28 B

Photographs from "Leaves of Iron" Philip Drew

Left
Henric Nicholas farmhouse Mt. Irvine 1980

Below
Tourist Information Centre
Detail West Elev.

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