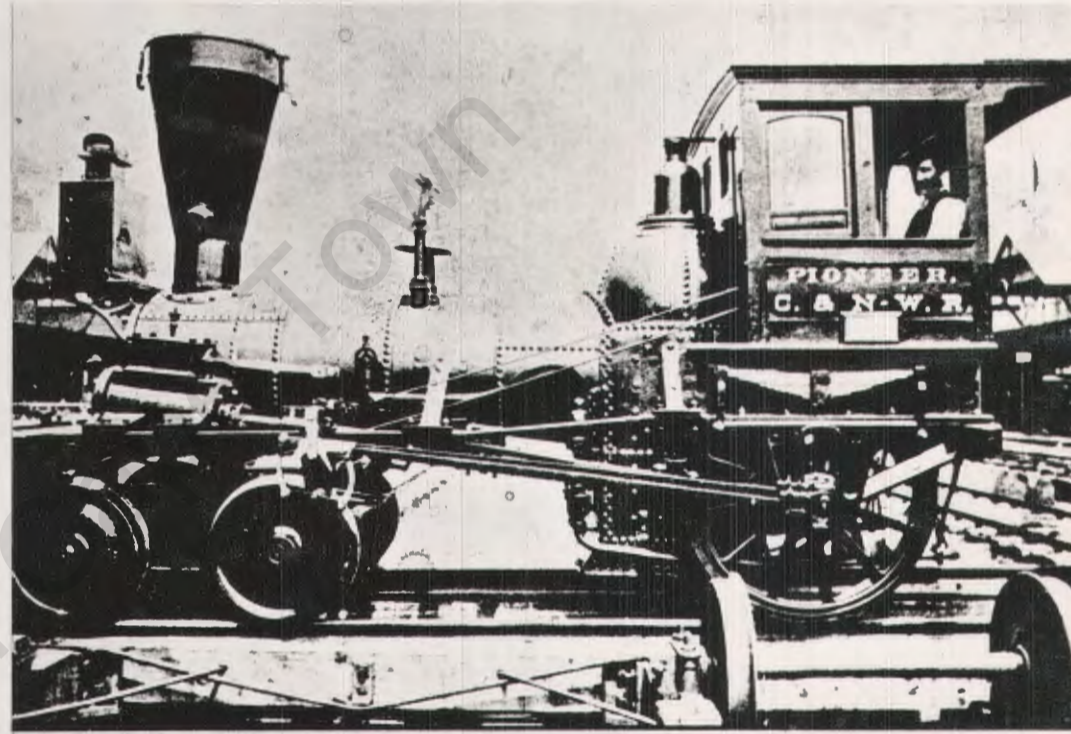




Technology and Urban Form



University of
TOWN

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Chicago 1830 - 1972



Thesis for Masters Degree in
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1 Introduction

1.1 AIMS OF STUDY - TERMS OF REFERENCE

The purpose of this study is to trace the influences which are exerted on the urban environment by changing developments in technology, operating in combination with social, economic and political factors, and to study the results of these influences by observing the evolving forms and conditions of the city at particular points in time.

The study also examines the converse situation where technology has in some cases been called on to provide new techniques, or systems of provision, to satisfy new demands caused by changing activity patterns in the city.

In essence therefore, the study is concerned with the inter-relationships of "Opportunity and Response" and "Need and Response", between urban factors and technological enterprise, and the resultant effects on the form and condition of the physical environment.

It is axiomatic that the degree of influence of technology on the urban environment does vary over time. At some stages in general historical development, technological changes have been extremely slow, as for example in early Egypt, or in Western Europe between the fifth and ninth centuries, whereas at other points in time, technological development has occurred at a remarkable rate, as at the turn of this century in Europe and America, and currently in Africa, Asia and Latin America.

It is also accepted that factors other than technology, such as war, economic depression, catastrophes, or human reactions to historical situations, have in some periods suppressed or drastically accelerated the effects of technological development.

Such factors have been accounted for in the methods of study and presentation of the thesis, so that factors of change in technology and urban response are always seen in relation to other non-technical generative forces, in order to obtain a balanced view.

Finally it must be clearly established from the outset that the term "technological development" does not automatically imply "advancement", either in technical or in human value terms. The evident ills of some of man's inventions or innovations are constant reminders of his shortsightedness or incomprehension of the long term effects of his inventiveness.

1.2 CONTEXT OF THE STUDY - REASONS FOR CHOICE

The context or area of investigation of the study is the city of Chicago and its immediate hinterland, during the period from 1830 to the present time.

Chicago has been chosen primarily because in many ways it can be considered to be a prototype of the large occidental city, which, in this case, has grown from a small settlement to a major metropolis over a relatively short period of time; a period in which some of the most far reaching technological, social, economic and environmental changes have occurred in the history of urban man.

Technological changes which have occurred during Chicago's urban life span include major developments in transportation, services, communications, building construction, agricultural mechanisation, and in the harnessing of new energy sources. During this period the population distribution of the United States of America changed from a predominantly rural, agricultural based population, to a predominantly urban population, more involved with commercial and industrial activities, than in agriculture.

The condition of the urban environment and the structural fabric of its component parts, also underwent major changes during this period. New ways were developed of using land, at levels both above and below, as well as at ground level, both in the city itself as well as in its extra-urban areas which have now become integral extensions of the "greater" city, because of man's increased mobility.

The fact that all these developments can be traced in Chicago at their most formative periods of evolution makes the city an ideal vehicle for this particular research programme, particularly because of the added anomaly of the city having to restart its development, in the central areas, after the disastrous fire of 1871.

Moreover, because of its locational condition, in terms of its relationships to other cities, its hinterland, the lake shoreline, and its resultant asymmetrical urban field, Chicago exhibits many of the classic conditions of urban morphology.

An added advantage is that Chicago is also one of the most widely researched and documented cities in the world in the fields of urban and regional studies.

A final reason for the choice of Chicago as the subject for this thesis is purely personal in that it is a city in which the writer has always had great interest, stimulated both by living in the city and by travels through its surrounding hinterland.

1.3 METHOD OF STUDY

It was felt at the outset that a subject of this nature involving so many inter-related factors required the development of a new study method and approach. The structure of the study was devised and all relevant data recorded on cards and filed in relation to the structure. In this way meaningful relationships suggested themselves through the classifying system, and these were then analysed and more exhaustively researched, recalled, and related to other factors in a meaningful way.

To achieve this easy recall and cross-referencing, the file cards were mounted on a large wall-board, which was divided into a series of five-year time intervals horizontally, and into three groups of factors vertically. These vertical subdivisions were related firstly to "Generative Factors", such as: General historical or political growth stimuli, Trade, Commerce, Industry, Population, Land Values and other forces. The second vertical subdivision was related to "Technological Factors" such as: General Mechanisation, Transport, Services, Communications, Energy sources and Construction. The third vertical subdivision related to "Resultant conditions of the Urban Environment", where the form and condition of the various urban components could be assessed and recorded. (These urban components included: Commerce, Industry, Residential, Community facilities, Recreation, Open Space and Movement).

The visual relationship between cause and effect was established by an extensive use of photographic illustrations.

This framework for research was adjusted as work proceeded, so that it bore direct relationships to the outputs required in the final documentation, and it has in fact become, with minor adjustments, the organisational framework for the present document.

1.4 FRAMEWORK FOR DOCUMENTATION

The study framework outlined in the previous section forms the basis on which the documentation has been ordered.

In detail, the main body of the document is subdivided chronologically into seven main time periods which are defined in relation to major trends or events in the history of the development of Chicago.

These seven main sections are, with two exceptions, (the first and last) divided into four main sub-sections, relating directly to the three "vertical" study areas as described in 1.3 previously - i.e. 1. Generative Factors 2. Technological Factors, 3. Resultant Conditions, added to which is the fourth sub-section of Conclusions. The first three of these sub-sections are analytical assessments of the cause and effect, or call and response, relationships referred to previously. The fourth sub-section is a synthesis of the findings of the first three sub-sections.

The factors studied under each of the first three sub-sections are accepted as being mutually dependent in many cases. In some situations therefore, technological factors may in fact be "generative", and may influence greatly some factors grouped in the "generative" category such as Land Value or even Population Increase.

It must therefore be accepted that the factors being analysed are grouped in this way for general convenience, and that time, or sequence anomalies, will have to be dealt with, in the text, as they occur. A reasonable degree of flexibility in reference across these groupings must therefore be anticipated.

The seven chronological divisions are followed by a section which deals with future planning proposals for Chicago and some predictions and assessments of future relationships between Technological change and urban conditions.

The final section is in the form of a brief summing up of all findings in the thesis. A copy of this conclusive section is loose-bound at the beginning of the document to facilitate easy reference.

Throughout the document free use has been made of photographic and other illustrative material in order to assist close correlation in the reader's mind between the generative and technological factors being studied and, more particularly, the environmental conditions resulting from the interaction of these factors.

The detailed emphasis of the thesis is concentrated more on the study periods up to the beginning of the twentieth century because it was during these periods that the city was at the most formative stages of its development. It was also at these stages that the impact of developing technology on everyday life was the most dramatic. Rural towns were transformed into bustling, smoky, rowdy, congested cities within relatively short periods, with the advent of steam-power, railroads, telephones, electricity, high-rise and multi-use structures and the first automobiles. The only radically new developments acting on the city since the beginning of the twentieth century are the aeroplane, nuclear energy and improved communications systems. All these can be argued to have had less direct influences on the patterns and physical condition of man's urban environment than the technological developments of the nineteenth century.

For these reasons the earlier periods are studied in fine scale, with as many detailed interrelationships as possible established between urban activities, technology and resultant conditions. In the later study periods when the city expanded to become a mammoth sprawling regional metropolis, the scale is so vast that the same degree of study detail would be both presumptuous and impossible. Therefore the analysis in the more recent periods, which are in any case covered by a wealth of contemporary research, becomes a more broad scale study of general trends of growth and change in the city, as related to the previously determined patterns and conditions.



Fig. 1 Geographical Location Map. Showing major trade and immigration routes in relation to Chicago

Fig. 2 Map of Chicago Region. Showing geographical features and Indian trails. Circa. 1800



2 Chicago Before 1830

2.1 LOCATIONAL FACTORS AND HISTORICAL BACKGROUND

The geographic position of Chicago has been a vital factor in the city's development since man's first contact with the region. The early American Indian population who lived in or around the area, realised the importance of the Checagou river mouth as a transport linkage point for canoe and overland travel long before the first recorded European explorations in 1673.

The Indians used the shallow muddy river at the Southern end of Lake Michigan to take their canoes across the narrow land divide between Lake Michigan and the Desplaines River, which connected into the Illinois and Mississippi River, which in turn gave access to the whole of Central North America and the Gulf of Mexico. In the rainy season canoes could be paddled or pulled across the partly flooded land-divide between the lake and the Desplaines River with a maximum of a mile of overland portage, by using the Chicago River route. In the dry season the portage over land was at the most nine miles. The Chicago area at this early time therefore served as a link between the fur trapping lands to the North and the fertile valleys of the great rivers of the South.

Later when the early East Coast settlement areas began to expand Westwards, the most frequently used migration route was through the Ohio Valley towns of Pittsburg, Cincinatti and Louisville and across to St. Louis. (Fig. 1) This route lay some two hundred miles to the south of Chicago so that the early developments at the river mouth were related rather to strategic requirements than to the general settlement expansion originating from the Eastern Seaboard.

Fig. 1

The natural locational potential of the Chicago River mouth was realised by the first white explorers, Joliet and Marquette, two Frenchmen, who visited the area in 1673. They made two important observations which preceded later developments by almost one hundred and fifty years. Firstly they realised the importance of maintaining control of access to the waterways and that this would require a fort for a military garrison at Chicago. Secondly, they realised the necessity of digging a canal at the Chicago portage in order to ensure year-round water access between the French-Canadian settlements to the North and French owned New Orleans in the South.

The map in Figure 1 indicates that Chicago is located at the confluence of the Northern overland route from the East Coast, the sea route from Europe via the St. Lawrence River and the Great Lakes, and the Southern river route from New Orleans on the Gulf of Mexico, via the Mississippi, Illinois and Desplaines Rivers. The fact that, until the advent of railroads in the late 1840's, the cheapest and often the quickest means of transportation was by water, meant that even with the longer distance, the Northern route via Chicago, was in the early days of the city more efficient than the overland, Ohio Valley route. This was particularly the case for the transport of bulk goods and produce such as timber, wheat, grain and farming equipment.

The potential importance of Chicago's location was not given further acknowledgement until some one hundred and twenty years after the first French explorers' observations on the area, mainly because of the remoteness of the region. The French did use the trading route through Chicago during this time but relinquished control of the river mouth area in 1763 to the English, as a part of the settlement to the Seven Years' War. Twenty years later it became part of the United States by the treaty which gave independence to the young republic.

Initial settlement of the region, by the Americans, was only attempted after the defeat of the marauding bands of Indians in the area by General Anthony Wayne, and the subsequent treaty of Greenville in 1795, whereby six square miles of land at the mouth of the Chicago River was ceded to the United States by the Indians. Wayne recognised the strategic importance of the location and pressed for the building of an outpost so as to ensure free access to the waterways.

Within eight years (1803) a garrison outpost named Fort Dearborn had been built on the South bank of the river mouth near the original trading station



Fig. 3 Site of Chicago with Du Sable Cabin 1779



Fig. 4 The Original Fort Dearborn 1803-12

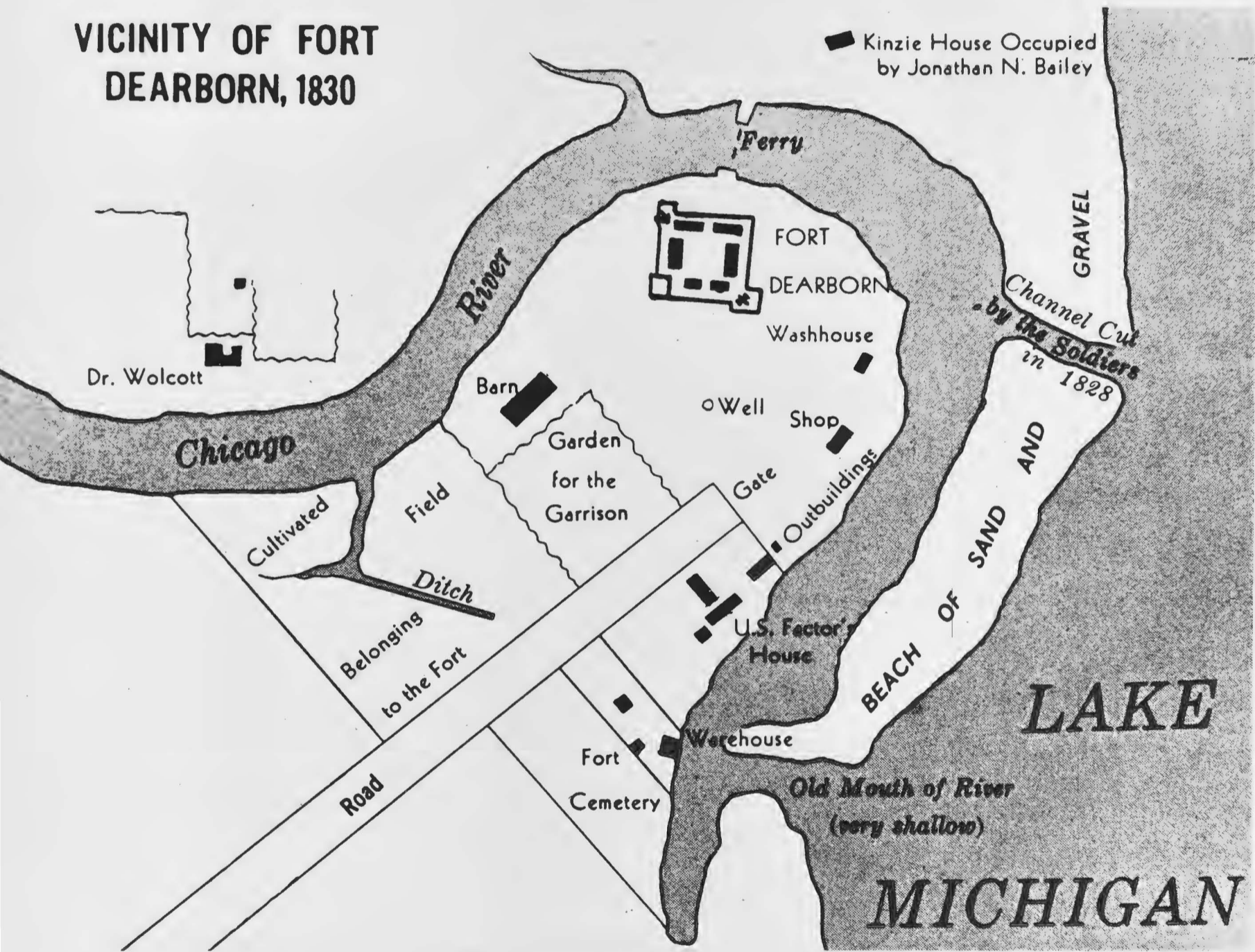


Fig. 5 Map of Vicinity of Fort Dearborn 1830

Fig. 6 View of Chicago from Lake Michigan 1820



established by Du Sable in the 1770's (Fig. 3). The fort was a group of simple timber buildings surrounded by a log palisade, constructed on the highest available ground. (Fig. 4) Around the base of the fort were spread five or six log cabins belonging to the "half breed" fur traders, who bartered with the Indians and assembled the consignments which were sent back to the East Coast with the supply vessel which called once a year with provisions for the outpost.

Fig. 3

Fig. 4

The fort remained in this condition until it was destroyed and the occupants massacred by Indians in 1812.

A new fort was built in 1815 and remained in existence until 1857 although its military significance had ended by 1836, when the Federal Government ceased operation of the garrison. The new fort, in its early days, became the nucleus of the small community which had gathered around its base. This was comprised of ten or twelve log cabins, described by a certain Major Long as "Low, filthy and disgusting, occupied by about sixty half-breeds who were engaged in the fur trade". (1)

Ref. 1

The second observation of the early French explorers, that a canal should be excavated so as to ensure year-round water access to the inland rivers, was made again at the time when the first Fort Dearborn was constructed in 1803. It was then thought that a relatively simple, short connecting channel could be made, between eight and ten miles in length, to connect the Lake to the Desplaines River by following the main course of the South Arm of the Chicago River.

Later investigations however, established that the bed of the Desplaines River was shallow and that if reasonably large vessels were to be accommodated, the canal would have to be in the region of one hundred miles in length, extending from La Salle in the South to Chicago in the North.

Before following subsequent developments in the history of the all important canal story, it is important to consider some of the geographic, topographic and geological characteristics of the area which originally gave rise to Chicago's locational advantages and which continue to this day to influence the growth and form of the city.

2.2 GEOGRAPHICAL FACTORS - THE NATURAL LANDSCAPE

It is important to understand the natural characteristics of the study area before man began to impose on it the patterns of his movements, of his settlement and of his work on the land. The natural geographic conditions of the site largely determined the way in which the first settlement patterns occurred. Some of these natural determinants are still strongly evident today - the river routes, the high ground ridges which offered the best transport routes to the early trappers (and which have evolved to become the freeway routes of today), the wooded hillocks further inland, which have remained regional recreational areas, these are all natural factors to which the original settlers responded. These have been adapted during the city's history as a result of the changing requirements of urban life by means of man's evolving technical skill and ability.

The surface of the land in the Chicago region is relatively flat and featureless as a result of glacial action over the original sedimentary limestone formations. Overlaying the limestone, are thick surface clay deposits, which because of their impermeability, result in high water table conditions. Snow and rainwaters do not seep into the topsoils sufficiently to prevent large areas of water forming on the surface during the winter periods, and remaining there until evaporation eventually removes them during the drier seasons. This factor is important in that it resulted in the early paths, roads and settlement areas becoming an impassable morass of stagnant, churned-up, odorous mud for most of the year, eventually requiring the whole city level to be raised by heights varying between four and fourteen feet. (2)

Ref. 2

Of course, had the water not lain on the surface for long periods, the advantages of Chicago as a waterway and portage route would not have been as great, but on balance it would seem that this high water table condition was a serious disadvantage, only overcome by a technical 'tour de force' at a later stage in the settlement's development.

Surface erosion, caused by later periods of glaciation and the sporadic scouring action of overflowing lake waters, had in pre-historic times, formed two main drainage routes or "Sags" which penetrated the low ridge dividing the shoreline of Lake Michigan from the Desplaines River basin to the south. (Fig. 2) These two Sags were to be of primary importance to the development of the inland waterway system which would later connect Chicago to the Gulf of Mexico.

Fig. 2

The one Sag division known as the Chicago Portage route, ran between the end of the South Branch of the Chicago River and the Desplaines River valley. This is the route taken by the first canal system built between 1836 and 1848.

The other Sag - the Calumet Sag Channel was also to be developed, at a later stage, as an essential link in the nation-wide inland waterway system.

The difference in land levels between Lake Michigan and the upper reaches of the Desplaines River near Chicago is only six to eight feet in height along the route of the Chicago Portage Sag - hence the early optimism that the construction of a short and inexpensive canal was all that was needed to release the great opportunities to be derived from a water link to the centre and south of the continent.

The geological resources of the Chicago local and hinterland regions were to play a significant role in the future development of the area. To the North, towards Green Bay are the rich iron ore deposits which could be easily transported by lake steamer to Chicago, and elsewhere, for the production of iron and later, of steel.

The other raw materials required for the production of iron were also in abundant supply in the region. Coal for making blast furnace coke, was easily mined in the Illinois River valley region to the South. Limestone, used as flux in the reduction processes of steelmaking, was in fact the bedrock lying under Chicago. With the invention of the Bessemer Converter and the Siemens Open Hearth methods of steel production in 1856 (3), and with the demand for agricultural implements and railway tracks at this time, Chicago was able to capitalise on both its natural endowments and its location to trigger off one of the most remarkable periods of urban expansion seen anywhere in the world.

Ref. 3

The local clays from the lake shore areas of Chicago, make good quality bricks and the limestone bedrocks are highly suitable both for masonry construction and for cement making. Good quality building sands were also freely obtainable in the area. The timber, from the pine forests in Michigan, provided the first settlers with an easily used building material which was later to become the universal fabric of the lower cost houses which were built by the thousands during the later, more intensive development periods.

The conjunction of plentiful local resources, favourable topographic and geological conditions, and an advantageous location at the junction of the Northerly and Southerly waterway routes, at this point in American history when the great Westerly expansions were about to begin, poised Chicago in readiness for remarkable growth once the canal building programmes got under way.

2.3 THE CANAL - INITIAL PROPOSALS AND PREPARATIONS

That a canal would eventually be built to connect Lake Michigan to the Southern river system via the Chicago portage route, seemed inevitable. The only factor which was in any doubt was the time at which it would be built.

Joliet had perceived its need in 1673, proposals for canal building had been made in 1803 when the first Fort Dearborn was built. By 1808, a firm construction proposal was made by a local statesman, Gallitan, in his programme for internal improvements. In 1814 President Madison recommended the canal's construction to Congress. (4) (Two years after the massacre and destruction of the first Fort Dearborn). In 1816 the United States purchased land for the canal route from the Indians. (5) When Illinois was admitted as a state in 1818 its Northern boundary was extended so as to include the strip of land required for the proposed canal, after the favourable reports of the first surveys, concluded in 1817.

Ref. 4

Ref. 5



Fig. 7 Original Town Plan for Chicago 1830



Fig. 8 Chicago River Fork, Wolf Point 1833



Fig. 9 Plan of Chicago in Mile Square Grid 1830

Fig. 10 South Water Street 1834



Fig. 11 Early Log Cabin c.1830



Pressure began to be exerted by the Southern state of Illinois for the building of the canal which would give the settlers there an alternative trade route to that of the St. Louis - New Orleans route, which because of its monopoly kept transport costs high.

In 1819 the military establishment pressed for the canal's construction for purposes of national defence. These combined pressures resulted in Congress authorising the state of Illinois to survey the area in more detail and to take a strip of land ninety feet wide for the canal. A Board of Canal Commissioners examined the routes and the estimated costs of five alternative proposals in 1823, the Chicago - Desplaines River route finding the most favour at this stage.

In early 1825 the legislature incorporated the "Illinois and Michigan Canal Company", a private company with an authorised share capital of one million dollars, formed expressly to construct the canal.

Speculation at local, national and even international levels, followed this news but was shortlived as the charter of the company was repealed a year later for internal, political and financial reasons.

In 1826 the state petitioned Congress for a land grant to assist the financing of the canal. This request was granted in 1827 and alternate squares of land, in checkerboard pattern, for five miles on either side of the proposed canal route were given to the state for selling purposes. The condition was imposed, that the canal was to be commenced within five years and completed within twenty years of the passing of the act, failing which the money received by the state for the granted land would revert to the Federal Government. (6)

Ref. 6

In January 1829, the Illinois legislature, having accepted the terms of the land grant, appointed three canal commissioners to establish the final route for the canal and to select the alternate land areas for the state, which were to be sold at \$1.25 per acre.

Presidential approval was given in 1830 to the land areas chosen for the canal, following the Chicago - Desplaines river route. A part of one of the land areas chosen, at the fork in the Chicago River, was surveyed and divided into town lots. This was the first formal layout plan for the town of Chicago, and it was superimposed in a North-South directional grid over the old Fort Dearborn layout. (Compare Figures 5 and 7)

Figs. 5
& 7

A similar town layout was also established at the southern terminal end of the proposed canal route at a place called Ottawa but it never achieved any great significance in terms of its urban development, mainly because of Chicago's lake-shore locational advantages.

The actual work on the canal was not started until July 1836, but the planning and the announcement of the canal provided great initial stimulus to the development of the Chicago area as a focal point of the central regions of the United States of America.

2.4 EARLY SETTLEMENT PATTERNS - THE PLAN OF 1830

The original 1830 plan of Chicago was based on a simple rectangular grid similar to that of most small American towns established during this period. The limits of the town were three-eighths of a mile square with a street and alley system of sixty-six foot, and sixteen foot widths respectively. Streets along the banks of the river were also provided for, in the original subdivision plan, giving slight internal angular distortions to the rectilinear geometry of the layout. (Fig. 7) The overall pattern into which this small area of town-land fitted was the One Mile Square grid, enforced by the Federal Ordinance of 1785 which called for the subdivision of all land into units one mile square, set out on a True North axis.

Fig. 7

This pattern is more easily traced on Figure 9 where the town area can be seen in relation to the one mile and half mile grid, and also in relation to the checkerboard pattern of alternative panels of canal land owned by the State of Illinois (odd numbered panels) and the even numbered panels which were Federal owned. Also shown on Figure 9 are the positions of the two plank roads which run diagonally across the mile square grid and relate to the old Indian trails (fig. 2) which radiated out from the river mouth in the fan shaped pattern which is still in strong evidence today.

Fig. 9

Fig. 2

The land subdivision of the original town of Chicago was based on blocks of land 320 x 360 feet in size, surrounded by streets of 66 foot widths, and divided into 8 lots, set in two rows of four, with the access lane down the centre, between rows, each lot being 80 feet wide to the street and 180 feet deep. (7)

Ref. 7

The first lots of the first Chicago subdivision were sold by auction on September 4, 1830. (8) Prices were modest, the highest being \$100 for an 80 x 180 foot lot. (9) The anticipation of the completion of the canal and the trade that it would bring, quickly gave rise to land speculation which increased in intensity as each year passed and as the completion of the canal seemed nearer. Within two years, land in advantageous positions which had been bought for \$100 in 1832, had been sold for \$3000 in 1834, a year later it was sold for \$15000. (10) This example, although occurring after the period studied in this section, is used to indicate the rapid change in tempo of activity in Chicago after 1830, even although construction on the canal did not actually start until six years later.

Ref. 8

Ref. 10

As can be seen in Figures 8 and 10, by 1833 - 1834 the pattern of structures built on the new land subdivisions was still sparse. In 1830 there were approximately fifty settlers living in the vicinity of Fort Dearborn, all in log cabins, probably very similar to that shown in Figure 11. Most of these people were fur traders but with the advent of the town layout, many others were attracted to the settlement and established small stores or workshops for the plying of their trades. These were clustered around the fort, mainly for reasons of safety.

Fig. 11

The alignment of the routes radiating out from Chicago to its hinterland followed closely the old Indian trails. (Fig. 2) These routes in combination with the rectangular grid have been the main determinants of Chicago's urban form up to the present and are of great importance in understanding the city's patterns of growth at all intermediate stages.

In short, Chicago was still at the scale of a rural village in 1830, as yet relatively untouched by the bustle and noise of the forces of mechanisation and industrialisation which were about to transform it.

2.5 PREVAILING TECHNOLOGY

Because of the vital role which changing technology was to play in the transformation of the small village of 1830 into the control centre of the world's largest railroad and waterway network, and of the wheat clearing and meat packing industries, all within twenty or thirty years, it is necessary to take stock of some of the changes in technology which were taking place elsewhere in the United States, and particularly in Europe. There the full impact of the industrial revolution was felt several decades earlier and, in the case of certain technical innovations, even a century earlier.

For the sake of consistency, changes in technology, and the effects of these on the urban environment, are analysed here within the same framework employed in the following sections, comprising the following categories: Mechanisation in General, Transport, Services, Communications, Energy Sources and Construction. In each of these categories, only the more significant developments of the period up to 1830 are traced, subsequent developments being analysed in more detail in later sections.

2.5.1 GENERAL MECHANISATION BEFORE 1830

NEW ENERGY SOURCES - NEW AND BETTER MATERIALS

The technological developments which had brought about the most significant changes in living conditions in both urban and rural situations, are most readily traced to the early period of industrialisation in England at the start of the Eighteenth Century.

These developments hinged primarily on two main factors. Firstly, during this period sources of energy were harnessed more intensively than before to aid in the production of goods - i.e. windmills and water power were used for tasks other than pumping water or grinding corn; and towards the

end of the Eighteenth century, new energy sources were harnessed for the first time - i.e. steam and coal gas.

Secondly, new materials were developed, or new ways were found of producing previously known materials to higher standards and in greater quantities than previously, so that the full potential of the new energy sources could be used. Cast iron, and later, steels of higher tensile strength, were the materials which made possible the use of the new energy sources.

Whereas mills in earlier times had used hardwood gears, driveshafts, bearings and linkages to harness water or wind power for milling or weaving, the higher power outputs and the heat generated by the new energy sources required, on the part of materials, greater strength, closer tolerances, and freedom from swelling with water.

Tools for manufacturing the new machines had, themselves, to be made of the stronger new materials. (Maudslay's metal turning and screw cutting lathe of 1797 was of major importance in the new production processes of the following century, and could not have existed had it not been for the new materials).

The first major breakthrough in the development of new sources of energy and motive power came with Watt's development of the steam engine (1765-1769) which was originally developed for pumping sub-surface water from mines. Within twenty years however, steam motive power was being used to drive a spinning mill at Pappelwick (1785). Stephenson's use of steam power for hauling railroad loads was not to occur until 1825, but so quickly did technical innovation spread that railroads were being proposed in the Chicago area by 1837, only twelve years later. (11)

Ref. 11

The industrial revolution in England was characterised by the rapid increase in the use of steam power, the development of mechanical methods in spinning, weaving and similar industries, and the rapid spread of the canal and railway links throughout the Midland manufacturing regions.

Smoke, dirt, noise and the appalling living conditions which accompanied rapid urbanisation, became characteristic of the urban environment where the new industries provided employment on an unprecedented scale.

Similar conditions evolved early in Chicago and should therefore be noted at this point.

The development of the techniques of manufacturing iron and steel which enabled mechanisation to occur in the Eighteenth century, began with the experiments of Abraham Darby at Coalbrookdale in 1709 where iron ore was first smelted with coke instead of charcoal. (12) Later experiments by Darby in the 1750's led to the mass production of pig iron castings which could be forged into iron bars of much higher strength than ordinary cast iron. In 1740 Huntsman had succeeded in casting steel in small quantities but it was cast iron with its low tensile stress characteristics which was to be the main material for mechanical use for almost a hundred years, until the Bessemer process made mass produced cheap steel possible in 1856. (13)

Ref. 12

Ref. 13

Smeaton's improvements to furnace techniques in 1761 and further developments in the production techniques of iron making, led eventually to the first cast iron structure being built in 1775-1779. This was a one hundred foot span cast iron bridge over the river Severn, built by Abraham Darby with iron made at the Coalbrookdale works. (14)

Ref. 14

From this time onwards cast iron was more widely used both for construction purposes and for machinery, and by the beginning of the Nineteenth century cast iron rails were being used for horse drawn railways (Wandsworth to Croydon in 1801) and were also used as tracks by Trevithick for running his first steam carriage, in the same year. (15) The scene was now set for the adaption of Watts' stationary steam engine to the mobile steam traction engine which pulled waggons on cast iron rails (Stephenson 1825).

Ref. 15

Chicago in 1830, therefore stood at a critical point in time in relation to these European and American technological developments. Up to this time mechanisation and industrialisation had not materially affected the environmental conditions of Chicago, but in the following decades their impact was

to be felt with full force as transport, manufacturing, trade, communications and construction all capitalised to the maximum on the potentials offered by the new technology. Canals were excavated, railroads were built in profusion, and farming techniques became progressively more mechanised. Iron and steel industries sprang up, reaping machines were manufactured, grain elevators were built to store, and dispatch, the harvests of the middle west, meat packing became a prime industry, and telegraph lines linked the city with its world-wide markets.

As will be shown, the effects of these activities and incentives on Chicago's rate of growth and on the quality of its urban environment were enormous.

2.5.2 TRANSPORTATION BEFORE 1830 - WATER TRANSPORT

Because of the expense of making and maintaining all-weather roads, which would not become mud hazards in winter, water transport, where it was possible, had distinct advantages, particularly for the carrying of bulky or heavy loads. This was to favour the growth of Chicago, particularly before the advent of railroads. The use of water transport had by 1800 been extensively developed in England by the construction of some thirty canals or canal branches connecting to all the major rivers, with lock systems where level changes were required. (16)

Ref. 16

Later, when the Chicago canal had been completed, sailing ships and, later still, steam driven paddle steamers, were to be the main carriers of the timber imports and grain and meat exports until the railways took over some of the short-distance load carrying. The long-distance and overseas transport of bulk goods, remain to this day the domain of the ship.

Ships were of timber construction, often copper sheathed under water to prevent worm attack, until the first iron boat was built by Wilkinson in 1787. (17) Sail was the motive force except on inland waterways and canals, where barges were hauled by horse or man until 1781 when Joufroy developed the first steam driven boat. (18) The combination of iron boat with steam driving power only came into being in 1821, just four years before Stephenson's locomotive. The early years of Chicago's development as a lake port saw the change in ship design from timber and sail, to steel and steam paddle, and later steam driven propellor.

Ref. 17

Ref. 18

With the opening of the Erie canal in 1825, the sizes and number of visiting craft increased enormously, as did the cargoes carried. Passenger traffic grew at a rapid rate as population migration westwards gathered momentum.

TRANSPORT BY ROAD

Overland transport in the earliest days of Chicago was by cart or "Prairie Schooner", the name given to the billowing transport wagons of the early settlers and traders.

Because of the high water table levels and flooding in winter, plank roads were eventually built (after 1830) to keep the lines of transport to and from the hinterland open in all seasons. The railways, with their more permanent movement channels, were to offer immediate advantages over road transport and were intensively developed in the periods after 1848.

Roads in the urban area were quagmires in winter and were only marginally improved when "planking" was introduced on the main streets and external transport routes after 1830. Roads in other cities at this time were sometimes cobbled or paved with stone slabs, but these operations were expensive and were not tried in Chicago before 1830 because of the depth of mud which afforded no satisfactory base for any conventional road paving system.

2.5.3 SERVICES AND COMMUNICATIONS BEFORE 1830

There are no early records of how Chicago was served with water in the pre-1830 period except for the well point shown on the Fort Dearborn map (Fig. 5) but it is assumed that the lake was both water supply and sewerage outfall for the Chicago river "sewer system", which was to give rise to health

Fig. 5

problems in later years. Although water-borne sewerage, using pipes and water closets in a primitive way had been developed by Bramah in 1778,(19) and a water filtration plant had been developed and constructed at the Chelsea waterworks, London, by 1829, (20) services in the early town of Chicago in 1830 were of an extremely primitive nature, and remained so for some time.

Ref. 19

Ref. 20

Communications were by word of mouth or by letter carried by hand, horseback, coach, ship or carrier pigeon. Emergency messages could be sent over relatively short "visual range" distances by means of fire beacons, fireworks or pre-coded smoke signals, or by sound signals using canon or drums, all requiring fairly closely spaced relay stations. Often delays of hours or days were involved in the transfer of messages. Delay times depended mainly on the distances and types of obstacles between points of contact (rivers, sea, mountain passes, etc.)

Communication times were to be drastically cut and transmission distances greatly increased with the introduction of the signal telegraph after 1830. This was to be of great importance to the development of Chicago as a centre of transport and commerce with both national and world-wide communication linkages.

2.5.4 CONSTRUCTION TECHNOLOGY BEFORE 1830

As previously stated in Section 2.1, the Chicago area was well endowed with most of the materials required for construction purposes, both in its early history and at later times.

Construction in Chicago up to 1830 had been almost entirely in timber, cut from local forests. Only at later stages were more permanent, less fire hazardous, stone or brick structures built.

Construction techniques elsewhere in America and in Europe up to this time were related mainly to the old craft skills, which had developed over previous centuries. The most commonly used materials were stone, brick and timber for walls and floors, and clay tiles, slate, or sheet metals supported on timber, for roofs. The new material of the Industrial Revolution, cast iron, had been used for bridge building by 1779 (Darby's Severn Bridge) but was not to be used for building construction until the beginning of the Nineteenth Century. Watt and Boulton had designed a seven-storey mill at Salford in Manchester in 1801, using cast iron beams and columns (21), but cast iron was not to be in general use in America until much later. (St. Louis warehouses were built with cast iron as speculative buildings in 1870) (22).

Ref. 21

Ref. 22

Within three years of 1830, however, a system of timber framing using light members, nail jointed, was to be developed in Chicago, which would revolutionise the building of housing for the masses in America. This invention was the "Chicago" or "Balloon" Frame.

2.6 CONCLUSIONS - THE POSITION OF CHICAGO IN 1830

Thus by 1830 Chicago had developed from an Indian portage trail to a small settlement, centred on a fort which boasted a newly established plan to convert it into a town, to serve as a terminal of a proposed canal. At this stage it was no more than a strategic trading outpost, physically unaffected by recent advances in technology. Henceforth its future would be shaped by the forces of "Technological progress", starting with the building of the canal, and followed by the introduction of new means of transportation and communication.

Chicago's first pattern for land subdivision had been established. The trade routes to its immediate hinterland, following the original Indian trails, had reinforced the fan shaped form of the future city's transportation network. The settlement's land use pattern was determined almost entirely by the security offered by the fort in 1830, but was about to change as the hazards of outpost living decreased, and other urbanising forces began to play an increasingly important role in the future city's development.

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3 Chicago 1830 - 48, The Canal Era

3.1 GENERATIVE FACTORS

Whereas the prime generative factors of Chicago's growth in the period before 1830 were its strategic importance and its potential as a transport link, the major factors in the 1830-1848 period were the actual building of the canal and the developments leading to the introduction of the new means of transport - the railroad, and the new means of communication - the telegraph.

The overlapping of these generative factors, in combination with the rapid increases of agricultural mechanisation in these early periods, is significant because the accumulative stimulus resulted in growth rates of urban activities of a compound, rather than simple linear nature. In many cases, as in increases in population, land value, productivity and the handling of goods, etc., the rates of growth approximate more closely to exponential progressions than even to compounded progressions.

The change in growth rate is the main distinguishing factor between the period before 1830 and the periods which follow. The rapid acceleration of growth was unbroken, except for short periods of panic and depression, until 1890, continuing thereafter at only slightly reduced rates.

Another main difference between the first period and the years which follow, lies in the fact that in subsequent periods technological innovation and change exert a much stronger influence on the development of the city.

3.1.1 GENERAL GROWTH STIMULI

Some of the factors which affected the growth of Chicago and which do not fall into any of the more specific categories which follow, are those which relate more directly to the overall patterns of historical development in the U.S.A. and to the general economic and political climate of the times.

During this period from 1830 to 1848 Chicago went through an initial period of slow growth (1830-1832), a following period of rapid growth and wild land speculation, which started in 1833-34 and reached a peak in mid-1836, a panic and depression starting in early 1837 and reaching a bottom level in 1842, and finally a period of slow recovery, until 1848, when the tempo again quickened with the completion of the canal and the introduction of the first railroad and telegraph links.

The slow growth, both in economic activity, population increase and in building activity in the 1830-32 period, is mainly accounted for by the fact that possible in-migration from the East and South was hindered by a hostile Black Hawk Indian tribe, which terrorised the outlying areas and access routes. These marauders were eventually suppressed by a Federal army unit under General Scott in 1832, who took back favourable reports about Chicago's potential for settlement when he returned to Washington. (1) These favourable reports and the removal of fear for the safety of settlers, resulted in an immediate increase in the rate of growth of population, farming settlement and land speculation in the area.

Ref. 1

Land speculation, which pushed up land values at a remarkable rate until 1836, was still primarily stimulated by the prospect of the proposed canal and its anticipated benefits, but was also reinforced by more general, country-wide land speculation, which was attracting finance from even England and Europe at the time. Several other factors such as the opening of a Central Government land control office, the establishment of a state controlled Bank, and the relatively free flow of money and easy buying terms for land, all accelerated the phenomenal rise in land values which reached its peak in late 1836. By this time all the necessary finance for the construction of the canal had been assured and work was begun in July 1836. (2)

Ref. 2

At about the same time as work on the canal commenced, the land speculation boom began to slow down, prices levelled off and within a year began to fall. Financial difficulties which started in the East in New York, spread

quickly to Chicago and from 1837 onwards land values and the general prosperity of Chicago began to fall as dramatically as they had risen, until the very bottom of the depression was reached in 1841-42. By this time the state of Illinois' finances were at such a low ebb that work on the canal was stopped in November 1841. (3) One of the major causes of the State's financial difficulties was the overextension of its resources through a prematurely ambitious programme of internal improvements in early 1837 when financial activity was already on the decline. These improvements included the planning of a railway network which would extend transport links across the entire state with some 1300 miles of track, costing in the region of 10 million dollars. This improvement plan was eventually suspended by the State in 1842, but not before immense debts had accumulated. (4)

Ref. 3

Ref. 4

Suspension of work on the canal was regarded at the time as the deathblow to Chicago. But because investors had such vast sums of money involved in the venture, and because construction was relatively far advanced, it made sounder business sense to finance the remaining work than to abandon it, particularly as labour in the depression period was cheap and the potential value of the canal-owned land remained high. Work was recommenced in 1845 and the canal completed in 1848. (5) (Fig. 17)

Ref. 5
Fig. 17

The wild fluctuations in land values, being artificially stimulated by speculation, should not be taken as the only index for the measurement of Chicago's growth. Many other activities, both in the city itself and in its immediate hinterland, began to grow at continuously increasing rates, almost independently of the land value fluctuations.

The completion of the Erie canal in 1825 had brought Chicago into direct water connection with New York, and by 1831, even before work on the canal was commenced, goods could be brought from New York to St. Louis through Chicago at 1/3 less cost than by any other route (6). This transport cost advantage, particularly to St. Louis, which was regarded as the Gateway to the West, meant that more and more maritime trade began to be diverted through Chicago. As the immigrant farming communities began to develop to the south, west, and even to the north of Chicago, more and more of their produce flowed out through the city. At the same time, increasing amounts of sawn timber, farm implements, tools, clothing, etc. went inland by wagon to the new towns and farming communities, and these were all imported from the East through Chicago. The port's activities increased even more rapidly after 1832 when the Federal Government appropriated \$25,000 for harbour improvements. A lighthouse was built in 1832. (Fig. 13) and the river dredging completed in 1834, allowing much larger ships to enter the river mouth and giving direct access to the grain warehouses and timber yards which had begun to grow up along the river banks. (7)

Ref. 6

Fig. 13

Ref. 7

The resident population and the number of immigrant travellers passing through Chicago on their way Westwards, increased at very rapid rates after 1832 after the Indian attacks on travellers and settlers had been halted. With these increases in population both in the town and in the surrounding farmlands, the first small industries began to develop to serve the growing community and the travellers who passed through the town. Construction increased at a comparably rapid rate but was, from about 1834 onwards, increasingly unable to meet the demands for the new houses, stores, warehouses, churches, saloons, etc. as required by the rapidly growing population, even though some radically new forms of timber construction were devised in this period (Balloon Frame).

It will be seen in later sub-sections that although land value graphs for this 1830-1848 period fluctuated greatly, and fortunes in property speculation were made and lost overnight, the growth rates of population, trade, industry, farming, goods forwarding, construction and other activities, were set at a steady, if less steep, incline, and when the depression lifted, began to gather momentum even before the economic boom of the railroad era which followed. (Graph 1)

Graph 1

3.1.2 TRADE AND COMMERCE

As outlined previously, with the influx of settlers to the lands around Chicago, and to the town itself, and with the advantages of cheaper transport costs for goods in transit to and from the Eastern Seaboard and the Midwest, after 1832 trade and commerce in the area began to grow more rapidly.

In 1832 there were still only twelve houses around the base of Fort Dearborn. By the end of 1835 there were approximately 150 to 200 new buildings in existence (8), by 1837 there were some 450 buildings of which an abnormally high proportion were stores. There were 29 dry goods stores, 5 hardware stores, 45 grocery and provision stores, 10 taverns and 19 lawyers offices. (9) Even though this was at the time of peak land speculation, it must be assumed that these new trade and service facilities must have been aimed more at the trade of the hinterland and visitors than at the 4,000 residents. The fact that most of these stores were grouped along the banks of the river and the incoming roads, tends to support this argument.

Ref. 8

Ref. 9

Maritime trade increased rapidly after 1830, particularly after the dredging of the harbour in 1834. At first most of the visiting ships brought in stores, goods and farming equipment from the East Coast and timber from Michigan, taking only sand ballast in return, until about 1842 when the hinterland first began to produce surplus crops which could be exported. The value of the wheat trade passing through Chicago grew at a remarkable rate from then onwards, mostly because of the new technical advances in mechanical harvesting. In 1838 only 78 bushels of wheat were exported. Exports increased to 40,000 bushels in 1841, 587,000 in 1843, 1 million in 1845, and two million bushels in 1847. (10) (Graph 1) It must be remembered that this wheat had to be transported overland to Chicago in wagons as the canal had not yet been completed and the first railways were only built in 1848, one year later. It is estimated that there were sometimes as many as 500 wagons in the town at a time, in the period just before the introduction of railroads. (11) The number of ships trading with Chicago increased from a mere 7 in 1831, to 45 in 1832, to 120 in 1833 and to approximately 1500 per year or 4 per day by 1845. (12) By 1845 many of these craft were steam driven passenger vessels, carrying up to 400 passengers each, so that it was quite possible for 90,000 passengers to pass through Chicago in a seven month navigation period. (13)

Ref. 10
Graph 1

Ref. 11

Ref. 12

Ref. 13

Because of these increases in import and export trade, by 1837 (at the height of the land speculation era) Chicago's field of influence encompassed the whole region within a 200 mile radius. It had become a trading centre, an intermediate destination for emigrants, a County seat (and therefore the legal centre for 5 Counties), the seat of the Government Land Office, the site of the branch bank of the State and a distributing point for the Indian trade - all within seven years of the subdivision of the first lots in the 1830 plan for the town. (14) Admittedly these facts were of little comfort to the local population when the depression started after this time, but the economic base of the town was too firmly established to be slowed down in its growth rate for too long. Once the economy was on the rise again after 1842, there was no holding back the city's development, particularly after the railroad era began.

Ref. 14

One last factor which was to set the seal on Chicago as a trade centre of major importance by the time the railroad era began, was the "River and Harbour Convention" of 1847. Spokesmen from all the states of America met in Chicago to protest the Federal Government's lack of assistance to internal improvements (to transport mainly) in their respective states. This event established Chicago as the nation's first Convention Centre, with a population of 16,000 playing host to 20,000 guests who could not but be impressed at the remarkable development which had taken place in the city in so short a time. (15)

Ref. 15

In the same year the Board of Trade was established in Chicago. This organisation played a vital role in the future course of the region's trading activities. (16)

Ref. 16

3.1.3 INDUSTRY

The first recorded industry of any consequence was a tannery which was established in 1831, closely followed by Dole's meat packing plant (1832), a soap factory and a brickyard (1833) and the first timber yard and milling plant for sawing logs into boards (late 1833). (17)

Ref. 17

This timber yard represented only the beginning of what was to become one of early Chicago's most dynamic import activities. The original local forests had been rapidly depleted and the new houses and other structures, almost all of which were made of wood, had to be made of imported boards, brought by ship from the pine forests of Michigan. The incoming timber was mostly

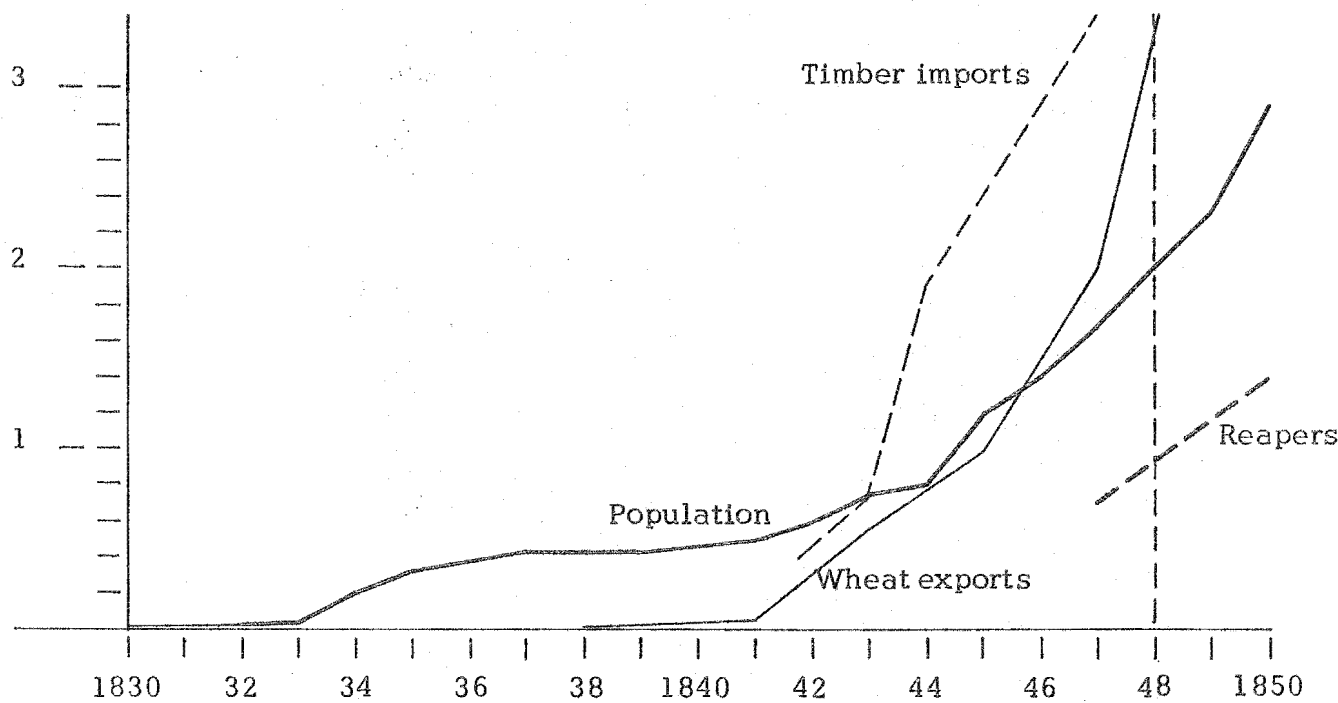
in the form of boards, ready cut to thickness, or in baulks of large dimensions which were then re-cut in local yards.

The timber imports grew at a very rapid rate, increasing from 7 million board feet in 1843, to 19 million in 1844 and to 32 million board feet in 1847. (18) (Graph 1) By 1846 the timber processing mills were well established as an essential industry. Without these sawmills, and joinery works, the great numbers of houses needed by the rapidly increasing population, could not have been built.

Ref. 18
Graph 1

By 1846 other industries such as a shipyard, an iron foundry, a brewery, a flour mill and several waggon works, were in operation. A year later McCormick set up his plant (fig. 15) for the manufacture of mechanical reapers (Fig. 16), which were to be of utmost importance to the increased production and export of wheat from the Middlewest region. It was these early mechanised farming techniques which made Chicago the world's largest wheat handling centre. The McCormick plant, set up in 1847, produced 700 machines in 1848 and more than double that number by 1850. The location of these industries will be dealt with later in section 3.1.5 where their locational influences will be related to general settlement patterns.

Fig. 16



GRAPH 1: GROWTH IN TRADE, INDUSTRY AND POPULATION - 1830 TO 1848

Vertical Unit Values: A. Wheat Exports 1 = 1 Million bushels
 B. Timber Imports 1 = 10 Million board feet
 C. Manufacturing 1 = 1000 reapers produced
 D. Population 1 = 10,000 people

Data Source: Hoyt - "One Hundred Years of Land Value in Chicago".

3.1.4 POPULATION INCREASE

Because of the countrywide westward expansion in America at this time, and as both a cause and effect of rapid local economic expansion in anticipation of the canal development, the population of Chicago increased rapidly in this period, particularly after the removal of the Indian menace in 1832.

By the end of 1832, there were approximately 200 people living in and around the fort area, to the East of the new town. Population increases from 1832 to 1848 were as follows: (Refer also Graph 1) (19)

Ref. 19

YEAR	1832	1833	1834	1837	1842	1844	1846	1848
POPULATION	200	350	2000	4170	6000	8000	14000	20000

A high percentage of this early population were males without families, living in boarding houses, hotels or rented shacks, often in very overcrowded conditions, thus accounting for the relatively concentrated population distributions of the early town. Increased passenger carrying facilities, and more comfortable travelling conditions on ships, (Fig. 18) brought more "in transit" travellers to Chicago, particularly after the start of the Californian gold rush in 1849, and most of these passengers were also single males.

Fig. 18



Fig. 12 Chicago Central Town Area 1834

3.1.5 POPULATION DISTRIBUTION AND SETTLEMENT PATTERNS

For descriptive purposes, in this section where the town/city area is still relatively small, Chicago can be divided into three basic zones, as follows: The area to the North of the main inlet of the Chicago River (North Side), the area to the South of the main river (South Side) and the area to the West of the North and South river branches, (West Side). (Fig. 12)

Fig. 12

In this period the first indications occur of the grouping of people in certain locations in relation to nationality or ethnic group, income level and transport accessibility, and, as will be shown, these factors were indirectly affected by factors which were related to, or influenced by technology.

One major grouping was the result of a large number of Irish immigrants entering Chicago to work on the canal when construction recommenced in 1845. The majority of these workers settled in a large concentration, in a new area called Bridgeport. (20) This area had originally been established in 1836 when work on the canal had first started. It became the north-east terminal end of the canal and was to remain predominantly Irish for over one hundred years.

Ref. 20

Residential population distribution, in relation to income level, changed rapidly in this 1830-48 period, mainly as a result of changing factors in transport accessibility, which established locational preference patterns, particularly for trade, commerce and industry, which in turn affected residential locational possibilities.

In the earlier years of this period, residential and commercial development on the North Side was more rapid than in the other sections to the South and West because most of the warehouses receiving local farm produce for export, and the imports coming in from the lake ships, were located on the North Side.

However, within a few years, the bridge connecting the North and South sides of the river, became unsafe and was demolished and replaced by a ferryboat. The ferry, being a slower, more intermittent form of transport caused delays to traders and merchants and, before long, the South Side river banks began to attract trade away from the North Side. The South had an added attraction for trade and industry at this time, in that the major waggon traffic routes into the city were from the South, thus providing more direct access for the transfer and handling of goods. This had the effect of increasing the land values on the South and decreasing those on the North bank, which in turn resulted in residential development seeking the lower valued North and West side land. The North never regained its former business prestige, and began to become the more fashionable, higher income, residential area of the city, particularly on the Eastern side, opposite the position of the old Fort. (21)

Ref. 21

It is interesting to note that this division of land use, with the business functions concentrating in the South and the higher income residential development concentrating in the North, has remained unchanged until very recently, and is only now being slightly altered by the new "mixed use", sub-central, developments on the North Side such as the John Hancock Centre. It is also of interest that the higher income, North Side residential development did not grow out along the Lake shoreline until later, but concentrated along the river banks, to participate in the activity which the waterway provided.

An added advantage of the North Side for higher income living was that it was further away from the noise and pollutants of industry and the hazards of the mud in the streets which the heavy waggon traffic in the South and West sides caused.

The lower income groups on the other hand, lived nearer their places of work in the peripheral areas of the South and West Sides, where land values were lower, and suffered all the environmental disamenities of noise, mud and pollution, which the higher income areas to the North avoided. The first "slum" and vice areas developed in Northern corner of the South and West Sides, hard up against the new riverside industries, but in an area of low-lying, low valued swamp land.

To avoid the ills, odours and noise of the central areas of the growing town, some of the more wealthy traders and merchants moved further away from the town when building their new houses, usually on large areas of land. These moves away from the city were isolated and should not be interpreted as evidence of tendencies towards decentralisation, which was to become more pronounced when transportation lines became more dominant in later urban growth patterns. It is of interest to note that some of the reasons for the people moving were the same then as they are now, the main one being the deterioration of urban environmental conditions.

The demand for land after 1832, caused partly by the needs of increasing activity in the town and partly by the greed of land speculators, resulted in further sections of ground being subdivided into urban-scaled lots. The first area to be subdivided, in 1833, was the "School Section", a one mile square panel lying directly to the south of the original town layout, on the mile-square ordinance grid (Fig. 12). This land had originally been granted to the School Board by the Federal Government, but when land values began to climb upwards at an enticing rate, the school board was persuaded by speculators to subdivide and sell all the land, except two small areas which were retained for school use. Because of the transport advantages of the South this land was quickly bought up at high price levels.

Fig. 12

Ref. 23

The supply of town lots was further supplemented by the subdivision of the "Kinzie Addition" to the North-east of the original town area, in 1833, and two further areas, the "Wolcott" and "Bushnell" Additions of 1835, which lay immediately to the North of the town, adjacent to the North Branch of the river. (Fig. 13) These additional town lots provided the land which was required for the commercial and industrial expansion which followed and also had an immediate effect on land values in all areas of the city.

Fig. 12

3.1.6 LAND VALUE

In 1833 the town consisted only of a row of buildings along South Water Street, which ran along the southern bank of the Chicago river, the buildings around the base of Fort Dearborn, the Fort itself and two additional buildings, one a house on the North Bank, and the other a tavern on the West Side, across the South Branch river, a total of some 150 buildings in all.

By 1842 the town had grown into a fully chartered city (1837) of some thirteen hundred buildings. By 1848 there were approximately 4,000 buildings housing a population of 20,000.

Generally the rise and fall of land value during this period was disproportionately influenced by speculation, so that the more valid reasons for variations in land value, i.e. transport accessibility, centrality, natural amenity, etc. become slightly clouded.

However, if the extreme fluctuations of land value, as caused by speculation, are discounted, the average increases in value for urban land were approximately proportionate to the rates of increase in population, trade, industry and other activities as outlined previously.

The most valuable land was that which had direct access to the river for the loading and unloading of goods. Less valuable, at this stage, was the land tucked into the southern internal angle of the bend in the Chicago River which became the centre of trade and commerce after the move from the North Side.

The demand for land with access to the waterways, particularly for warehousing, applied equally to the land along the banks of the canal, when this was eventually completed in 1848, although the advantages of access to water were slightly offset after this period by the introduction of railroads.

The detailed internal variations in land value are not of as great interest to the study at this stage as later when technological factors can be seen to have remarkable significance even at the micro scale. What is of interest is that the classic land value cone with its CBD peak, can be directly related to the Chicago urban field at this early stage, but with the peak land values distorted to a "linear peak", or ridge form, running along the course of the more central parts of the Chicago River.



Fig. 13 Fort Dearborn and New Lighthouse 1832



Fig. 14 Lake and Dearborn Streets 1838

Fig. 15 McCormick Reaper Factory 1847



Fig. 16 McCormick Patent Reaper 1846

M'CORMICK'S PATENT VIRGINIA REAPER



77. McCormick's Reaper. 1846. This 1850 order form shows the first model of the 'Virginia Reaper,' as it was still called, of which a series of a hundred was manufactured in 1846. The driver rides one of the horses, while the second man, riding backward on the machine, racks the grain to the ground in piles. (Library of the McCormick Historical Society, Chicago)



Fig. 17 Opening of Illinois Michigan Canal 1848

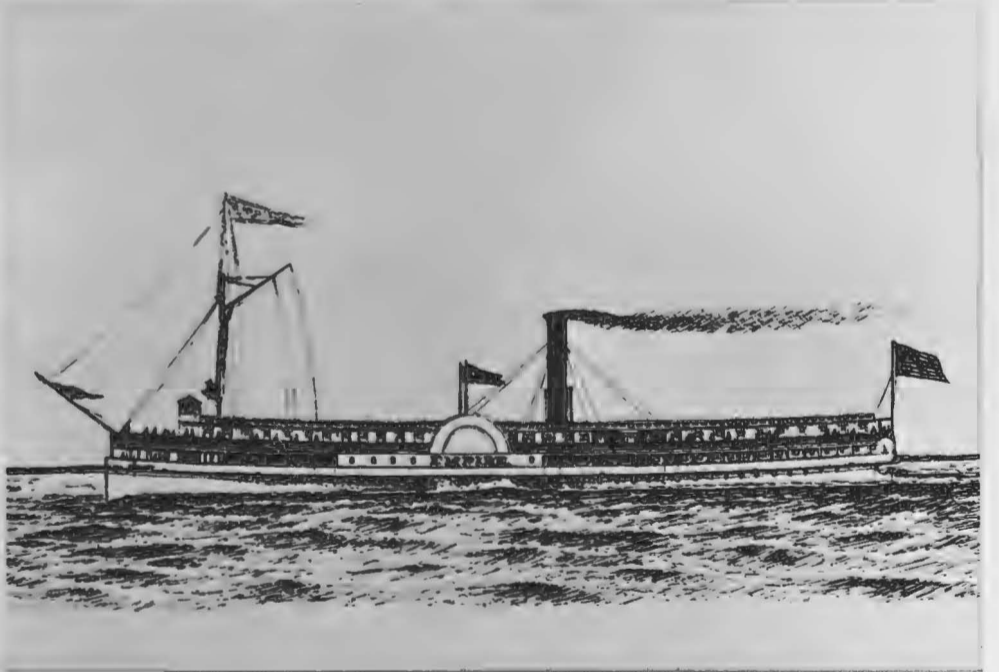
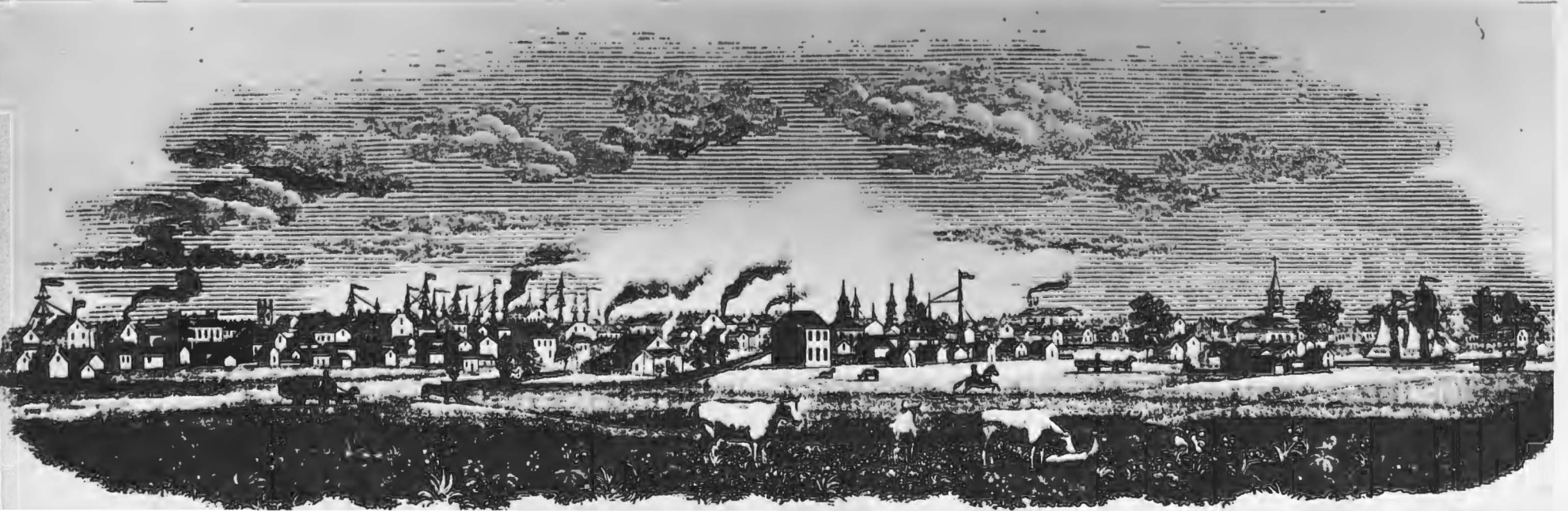


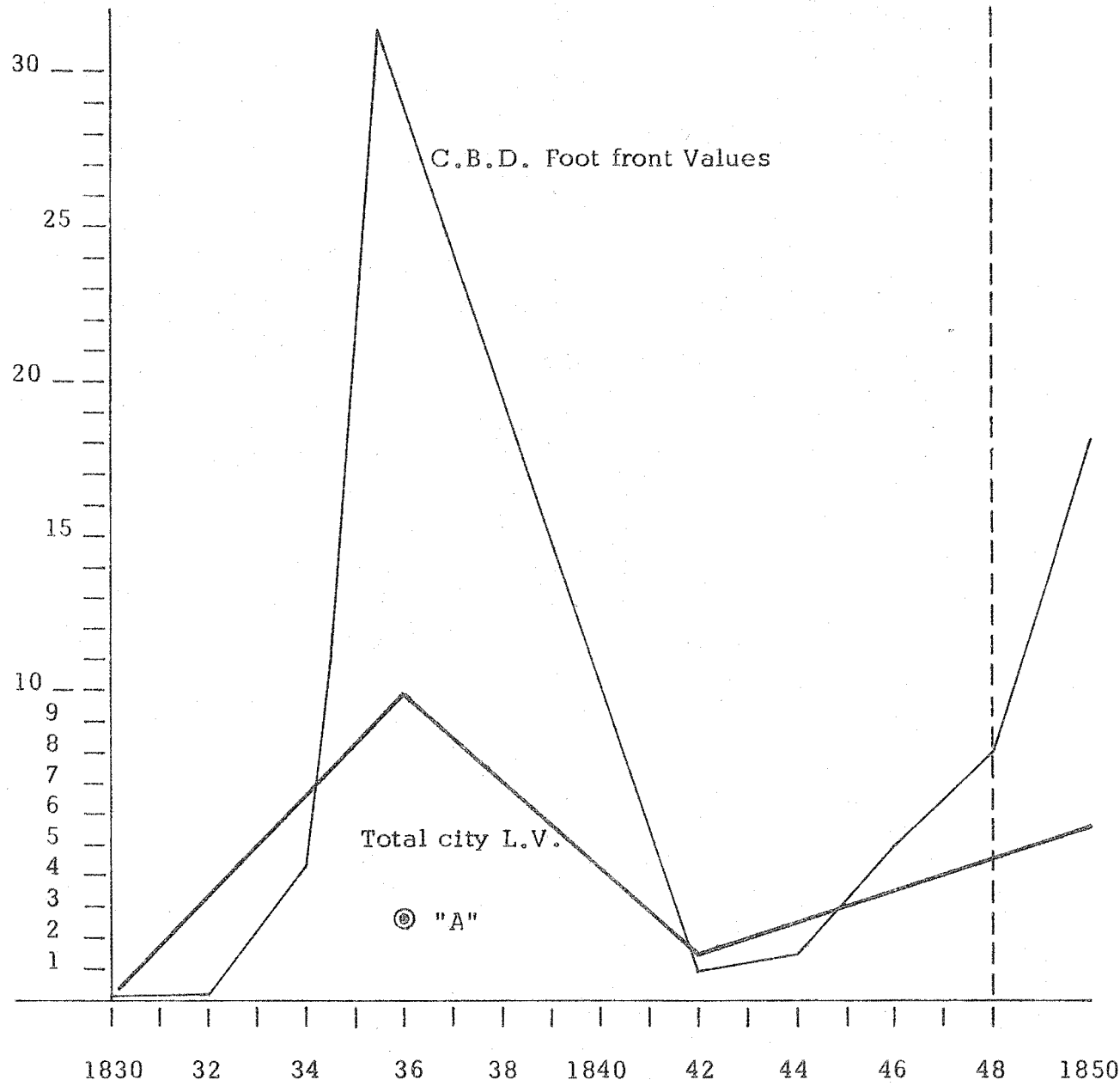
Fig. 18 The "Empire", One of World's Largest Ships 1844

Fig. 19 City of Chicago Looking North-Eastward 1845



At the peak of the speculation boom in 1836, the land values of the central business function areas had not yet matched the land values of the transport-access orientated land along the river banks. (24) By 1848 the two components were almost balanced in land value. After 1848, with the development of railroad and telegraph communication, the Central Business Area land values had surpassed all other land values by large margins and the more classic CBD land value pattern became firmly established.

Ref. 24



GRAPH 2: LAND VALUES - 1830 TO 1848 Data Source: Hoyt - op.cit.
 Vertical Values A. Foot front value in CBD 1 = 10 Dollars
 B. Total Land Value Chicago 1 = 1 Million Dollars

The upper graph line shows the rate of change in value of a centre city lot (80 foot frontage, 180 feet deep) over this period. (25)
 (These values relate to three town lots in the South Side, one block back from the river front on Lake Street between Clarke Street and Dearborn Street, as marked with shading on Fig. 12. - Refer also to Fig. 14 which shows the scale and quality of the area.) (25)

Ref. 25

Fig. 12,14

The second, lower profile on Graph 2, indicates the change in total land value for the 211 square mile area of the present city limits of Chicago. This line shows an increase in total land value from \$168,000 in 1830, to 10 million in the boom time of 1836, a drop to 1,4 million in the 1842 slump, and a steady climb back to 5,6 million in 1850. (26)

Graph 2

Ref. 26

Point 'A' on Graph 2 indicates the total value in 1836 of all the land in the original town area of 1830, being approximately one quarter of the "present city limits" value. Unfortunately this statistical information is not available for other years in this time period. (27)

Graph 2

Ref. 27

The extreme rates of change on this graph are as a result of speculation "fever" and are not as significant as the slower "damped down" overall increases for this period, which thereafter increase more rapidly with the coming of the railroad era. This slower overall increase is more significant when related to the

growth rates of trade, industry and population (Graph 1) where the same progressive increase in rate prevails. All these growth rates reflect, in some way, the anticipation of the potential benefits of the canal, as described earlier, and of the railroads which were foreseen as early as 1837.

Graph 1

In conclusion, the hierarchical land value structure of Chicago at this time was related primarily to the locational advantages of water transportation, as offered by the Chicago River and its branches. Hoyt's summary description of land value conditions at the peak of speculative activity in 1836, vividly illustrates the importance of water transportation. "Thus in the first land boom of 1836, values rose to the peak along the Chicago River and its branches, where land was worth eight to ten times as much as land half a mile back, twenty-five times as much as land a mile away, two hundred times as much as land two miles away, fifteen hundred times as much as land seven miles away, and twenty-five hundred times as much as land ten miles away." (28)

Ref. 28

Although the above refers to a period of extreme land speculation, the general pattern of value gradients, if not the actual values, is similar to that of 1848 when increases were more realistically related to intrinsic value.

3.1.7 STRUCTURING FORCES - CENTRIPETAL - CENTRIFUGAL LINEAL - NODAL

Almost from the beginning the urban form of Chicago has evolved from the interaction of several structuring forces.

In the period before 1830 when the Fort was built, these forces were essentially centripetal, in that the fur traders clustered their huts around the fort for protection from the Indians.

After the first plan for the town was established and the land began to be developed in 1832, a second focal point of commercial and residential functions began to be established at the South, internal corner of the Main and South branches of the river. The reasons for this area becoming the second nodal growth point were probably related to the fact that this point was near the most convenient river crossing to the West and the hinterland regions.

These two focal points were soon complemented by a linear development of stores and houses along the south bank of the main river, and later along the banks of the South Branch. The North Side bank of the main river then began to develop and to assume greater commercial importance than the South Side until the connecting bridge was replaced by the less convenient ferry. After this, commercial activity was intensified on the South Side, the North Side becoming a higher income residential area of the town. Gradually, as the south developed in depth back from the waterfront streets, the importance of the two original growth foci were reduced as a result of general increases of business activity in the central areas. This increase of business activity in the inner or central South zone, began to exert centrifugal forces on the residential components which were slowly displaced into adjacent, more peripheral zones.

However, the overall urban growth pattern, particularly for trade and commerce, remained centripetal in nature, until the railroads began to instigate the establishment of other growth points along the new transportation routes.

The isolated instances of moves away from the city to build new homes at some distance from city limits, should not be regarded at this stage as a manifestation of a dispersive force but rather as a prefigurement of a trend.

3.1.8 OTHER STIMULI

In the same way in which talk of the canal development stimulated Chicago's growth before construction had actually begun, the first proposals for railroad developments made in 1837, although abandoned in 1842, remained a vital stimulus to growth right up to 1848 when the first railroad was actually built.

3.2 TECHNOLOGICAL FACTORS

3.2.1 GENERAL MECHANIZATION AND NEW ENERGY SOURCES

The early development of the Middlewest of America was based primarily on agriculture and only secondarily on the extractive industries of minerals and fuels, and manufacturing.

The fact that agriculture became increasingly mechanised between 1830 and 1848 meant that production could be vastly increased, bringing about a change from subsistence farming to surplus agricultural production, the surplus products being suitable for sale in local and export markets.

The mechanical reaping of wheat allowed much larger fields to be cultivated and harvested with the same manpower; teams of horses being now used to produce the motive power for driving the new mechanical aids.

The introduction of the McCormick reaper in 1831 (29) and, later, their manufacture in Chicago, resulted in remarkable increases in local wheat production, from 78 bushels exported in 1838 to one million bushels exported in 1845, only seven years later (Graph 1). In later periods reapers and threshing machines were so plentiful that they could be hired by farmers who could not afford the purchase price of a machine. (30)

Ref. 29

Graph 1

Ref. 30

At the same time refinements and improvements were made to almost all other farm hand-tools and agricultural equipment in America. American machinery and hand tools were generally regarded as being superior to their British and European counterparts, both in design and in construction. Opportunities for comparison arose at the trade and industrial exhibitions, which came into vogue at this time, such as the Great Exhibition of London in 1851 (Crystal Palace).

It was not only agriculture which turned more towards mechanisation. The first small industries in Chicago followed the general trend towards using steam power to drive the sawmills and the steel forging hammers, and to produce the heat needed in production processes, such as soap making, hide tanning, etc. At first steam was raised in low pressure boilers, and, later after developments by Perkins in 1827, (31) in more efficient high pressure units, using Illinois Valley coal as fuel. It is interesting to note the wide use of steam, as evidenced by the billowing smoke from the chimneys shown in the illustration of Chicago in 1845 (Fig. 19) and in the illustration of the McCormick reaper works of 1847. (Fig. 15)

Ref. 31

Fig. 19

Fig. 15

Another power source, the water turbine, was first developed in Europe during this period (Fourneytron, 1832)(32) but was not to be used in industry until much later, when it was combined with the electric generator, resulting in hydro-electric power. Its use was not possible in Chicago in any case, as there was no level change in either river or lake, capable of affording the working "pressure head" required by hydraulic turbines. However, at a much later date Hydro-electric power generated at the Niagara Falls station was to become a major source of electricity for the National Grid, to which Chicago was connected.

Ref. 32

Another contemporary invention which was to be of great importance to Chicago's meat packing industries, was the development in 1834 of a workable liquid refrigerating machine by Jacob Perkins. (33)

Ref. 33

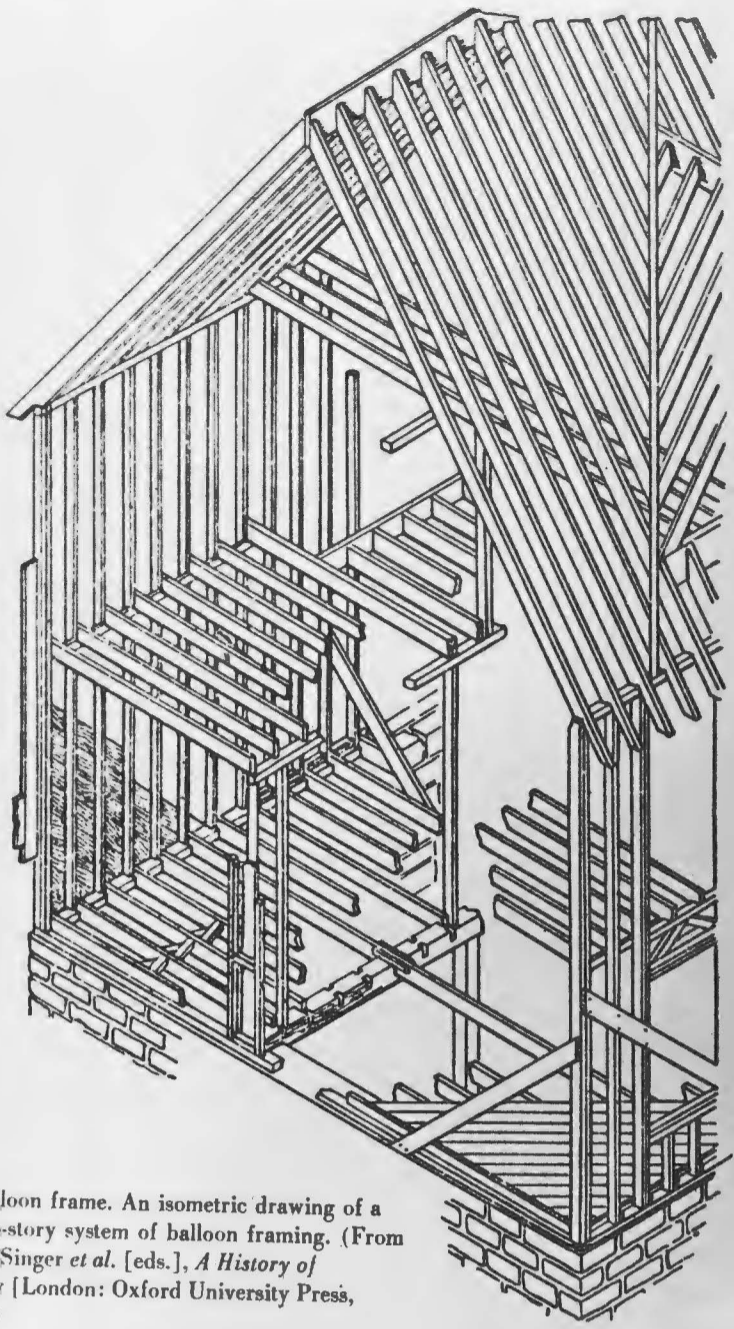
Earlier forms of mechanisation in the cloth industries were taken a step further in 1829 with the first developments of the sewing machine. (Thimonnier) (34) This started the trend towards the mass production of clothing to standardised sizes, a fundamental development for the new Wholesale trading systems which developed in Chicago some thirty years later. (35)

Ref. 34

Ref. 35

In conclusion it should be noted that the time-lag between the invention of a process, device or material, and its general use is becoming progressively shorter. Whereas a century earlier the time-lag appears to be of the order of 50 years, (36) in the nineteenth century it was reduced drastically, especially after 1850 when communication and transport times were greatly decreased, and news and ideas travelled faster. A case in point is that of the reaping machine, invented by Bell in 1826, developed by McCormick in 1831, and widely manufactured by 1847.

Ref. 36



1. The balloon frame. An isometric drawing of a typical two-story system of balloon framing. (From Charles H. Singer et al. [eds.], *A History of Technology* [London: Oxford University Press, 1954-58].)



Fig. 21 Urban Development of Chicago 1848-50

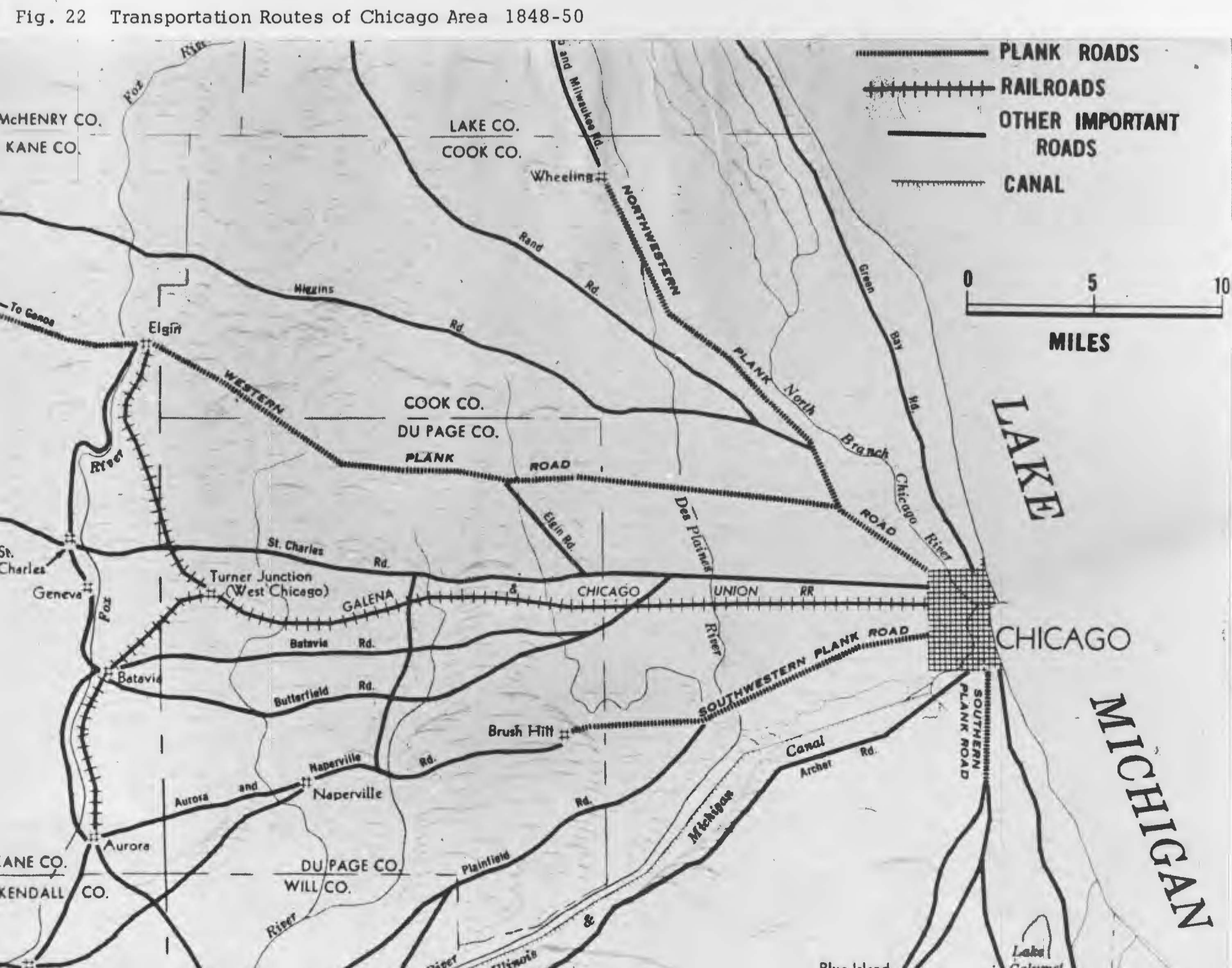


Fig. 22 Transportation Routes of Chicago Area 1848-50

3.2.2 WATER TRANSPORT

Iron and steam now increasingly replaced timber and sail in shipbuilding, although canal barges, small coasters and fishing craft continued to be built of wood. Passenger craft serving Chicago were mostly steamdriven paddle-wheeled vessels, which had the advantage of greater speed and reliability than their sail driven counterparts, essential factors for passenger services (Fig. 18). The numbers of passengers carried to or through Chicago by lake steamer increased dramatically in this period, (as can be interpolated from Graph 3 for total shipping) constituting a vital factor in the city's early growth.

Fig. 18

Graph 3

Heavy and bulky cargoes were still almost exclusively carried by sailing ships, mainly because short voyage times were not of such great importance in the marketing of grain and timber and because capital and operating costs for sail were lower than for steam. Later, however, the cargo sailers were also replaced by steamers. The rapid increases in cargo tonnage carried into and out of Chicago parallel most other growth factors in the period. (Graph 3)

Graph 3

Canal traffic when introduced at the end of this period, consisted mainly of self-propelled or horse-drawn wooden barges of shallow draft, suitable for canal conditions. (Fig. 17)

Fig. 17

3.2.3 ROAD TRANSPORT

Figure 22 shows the extent of the road transport network by the end of the first period of urbanization of Chicago.

Fig. 22

The road transport system began to evolve in the early 1830's with the first waggon routes which followed the original Indian trails. They kept to higher ground and even gradients to avoid the surface water which covered the lower areas in winter.

The pattern formed by the radial road routes converging across the prairies on Chicago, their connections with the city street grid, and their relationships to the river and river crossing points, constitute, at this stage, perhaps the most important influences shaping the city's growth.

The waggon tracks were soon upgraded to wider roads and later, where the traffic was heaviest, to "plank" roads, because of the winter mud hazard. Very much later some of the more important of these original routes were to become the automobile highways and expressways of today.

"Prairie Schooners", (the name given to the early covered waggons), travelled to and from Chicago in increasing numbers, particularly as agricultural surpluses began to be exported from the region. Prefabricated houses, timber, farming implements, stores, etc., were taken back to the hinterland by returning waggons. The waggon trade increased rapidly towards the end of this period. (As many as 500 waggons visiting the city in one day in 1847).

The southern routes were by far the most important traffic carriers in the early 1830's. Most of the immigrants arrived via the "Chicago Road", which was connected to the southern and eastern roads leading to St. Louis and the Eastern Seaboard.

The westerly and southwesterly routes were the next to begin to increase in traffic intensity because of the general growth of settlement, farming and mining activity in these areas. (37) (Coal mining in the south in Illinois and lead mining at Galena in the west.)

Ref. 37

The northern, Green Bay route was the last to develop, with the impetus of iron mining, although the relatively slow agricultural development in the north also generated some traffic, in earlier times.

These three main directions of access into Chicago had by 1848-50 become consolidated through the merging of secondary and tributary routes, into the Northwestern, Southwestern and the Southern "plank roads" which converged on the city grid, as illustrated on Figure 9 (of 1830) and Figure 22 (of 1848-50).

Fig. 9
Fig. 22

Plank roads, which were constructed of flat boards nailed to cross-tie beams, placed on the mud of the road bed, were first used in the centre of the city, (Lake Street) in 1844. (38) It was a more efficient system of road surfacing, in these conditions, than any other technique available at the time, because the unstable mud base slowly swallowed up any other form of cobble or block paving, laid on the surface.

Ref. 38

The roads within the city grid distributed the traffic carried by these three major plank roads as best they could. The main city streets had in fact been progressively "planked" before the external roads were similarly surfaced, because the mud caused by high water table conditions had, at an early stage, made the roads completely impassable, noxious and dangerous under heavy city traffic conditions. Just how bad streets could become in winter can be judged from the following quotation.

"To residents however, the streets were dust traps in summer and a quagmire the rest of the year. They were begot in mud, born in mud, and bred in mud. Residents placed signs reading "No Bottom", "Team Undemeath" (horses) and "Stage Dropped Through" (Stagecoach) to warn the unsuspecting of particularly treacherous spots." (39)

Ref. 39

Pedestrian sidewalks were "planked" almost throughout the city by 1848.

Bridges which afforded access across the river and its branches for both pedestrians and horsedrawn vehicles, became essential links in the city's transport system. In Chicago the access requirements of water and road transport were in conflict from the earliest times. Tall square rigged ships had to be able to pass through or under the bridges. Waggon and people had to cross the river. The compromise was found in building horizontal swing bridges, pivoted on a central island, which allowed sufficient width on either side for ships to pass when in the "open" position.

Because waggon and ship traffic increased at similar rates, the delays caused by the opening and closing of the bridges, were a constant cause of congestion and inconvenience. The problem was eventually resolved by the introduction of under-river tunnels, during the next period.

Major developments in long-span bridge construction occurred elsewhere in America at this time. Roebling developed high tensile cables, initially for canal haulage ramps (Morris canal 1827) and later in 1840 for the construction of a large span suspension bridge in Pittsburgh. Chicago because of its flat topography, could not make use of high clearance suspension bridges at any stage in its history. However, the city did benefit at a later stage from the general progress in steel technology, stimulated by the development of high stress cables, when the first steel framed skyscrapers evolved in the 1880's.

3.2.4 SERVICES

There are no written records of improvements to services such as garbage removal, sewage disposal and stormwater drainage, during this phase of Chicago's history. However, it is known that water was pumped by steam power to various small storage tanks or reservoirs, from which individual supply lines were taken, or water was drawn by hand and carried to places of use. Sewage was evidently discharged either into the streets or the river in the town area. Pit latrines were used where buildings were located on higher land, or further away from the river banks.

The condition of the river, and particularly of the streets, was seriously affected by these forms of primitive waste disposal (as described in Payton's description in 3.3.2).

3.2.5 COMMUNICATIONS

The installation of the first telegraph line between Chicago and Millwaukee by Speed and Cornell in January 1848, and the connection of O'Reilly's line to St. Louis later in the same year, thereby giving direct telegraphic contact

with New York and New Orleans, was of momentous importance to the growth of the city in the following years. (40) Within three years Chicago's telegraph links established the city as the world's leading wheat market. The location of communication terminals in the city was to have a far reaching effect on the spatial organization of the commercial components of the emerging central business district. These effects will be fully analysed in the next section.

Ref. 40

The invention, development and first commercial use of the telegraph all occurred within a remarkably short time. The Magnetic telegraph was invented by Gauss and Weber in 1833 and the Electric telegraph developed in 1835. Electric telegraph was first used commercially by Stephenson in England in 1836, for his railway system. The "Needle" telegraph followed in 1837 (Wheatstone) and one year later, in 1838, the Electro-magnetic telegraph was invented by Morse. Within ten years of Morse's invention, the first telegraph was installed in Chicago, (41) (another example of the reduction of "time lag" between the invention and general use of new devices or processes in this period).

Ref. 41

There is evidence of only one other new communication medium being established in Chicago at this time. The first local newspaper the "Chicago American" was founded in 1837. (42)

Ref. 42

3.2.6 CONSTRUCTION

The "Chicago Frame" (or as it was later called the "Balloon Frame") system of timber building construction developed in Chicago in 1833, was a major original contribution to general technological advancement in this period.

The consequences of this development are still evident in American home building today. The use of light timber vertical and horizontal framing, nail jointed, as devised in Chicago in the 1830's is still the most widespread form of home construction in America.

The remarkably large numbers of new houses built across the whole continent during this period of intense settlement, could not have been achieved without some form of highly rationalized, standardised and industrialised building technique. The Chicago Balloon Frame answered the need for such a technique. The claim that "Prefabricated houses can be contracted in Chicago, and put up anywhere within reasonable distance from the railroad in less than 30 days from the date of order" (43), gives some idea of the extent to which the invention affected the everyday lives of pioneer Americans.

Ref. 43

The Balloon Frame was invented by Augustine Taylor, in Chicago, and first used in the construction of St. Mary's Church in 1833. The new method used a system of multiple, light section, timber framing elements, closely spaced and nailed together. The older "New England" frame, which it replaced, was made of fewer, more widely spaced, heavier posts and beams, with all joints hand-made tenons and mortices, wedge fitted, (in the best craft traditions which had been brought to America from Europe).

The external cladding of the Balloon Frame was usually clapboard siding nailed to the stud framing. All skilled handwork was thus avoided. Prefabrication and standardisation made mass production possible and the result was a cheap, rapidly made, easily assembled end product, which represented a major breakaway from craft traditions. (44) (Diag. 20)

Ref. 44
Diag. 20

The balloon frame was made economic by the invention of mechanical methods of making cheap wire cut nails. Wrought iron nails before mechanisation cost 25c per pound. By 1828 the price had been reduced to 8c per pound. By 1833 when the balloon frame was developed, the price was 5c, and this was eventually reduced to 3c per pound in 1842. (45)

Ref. 45

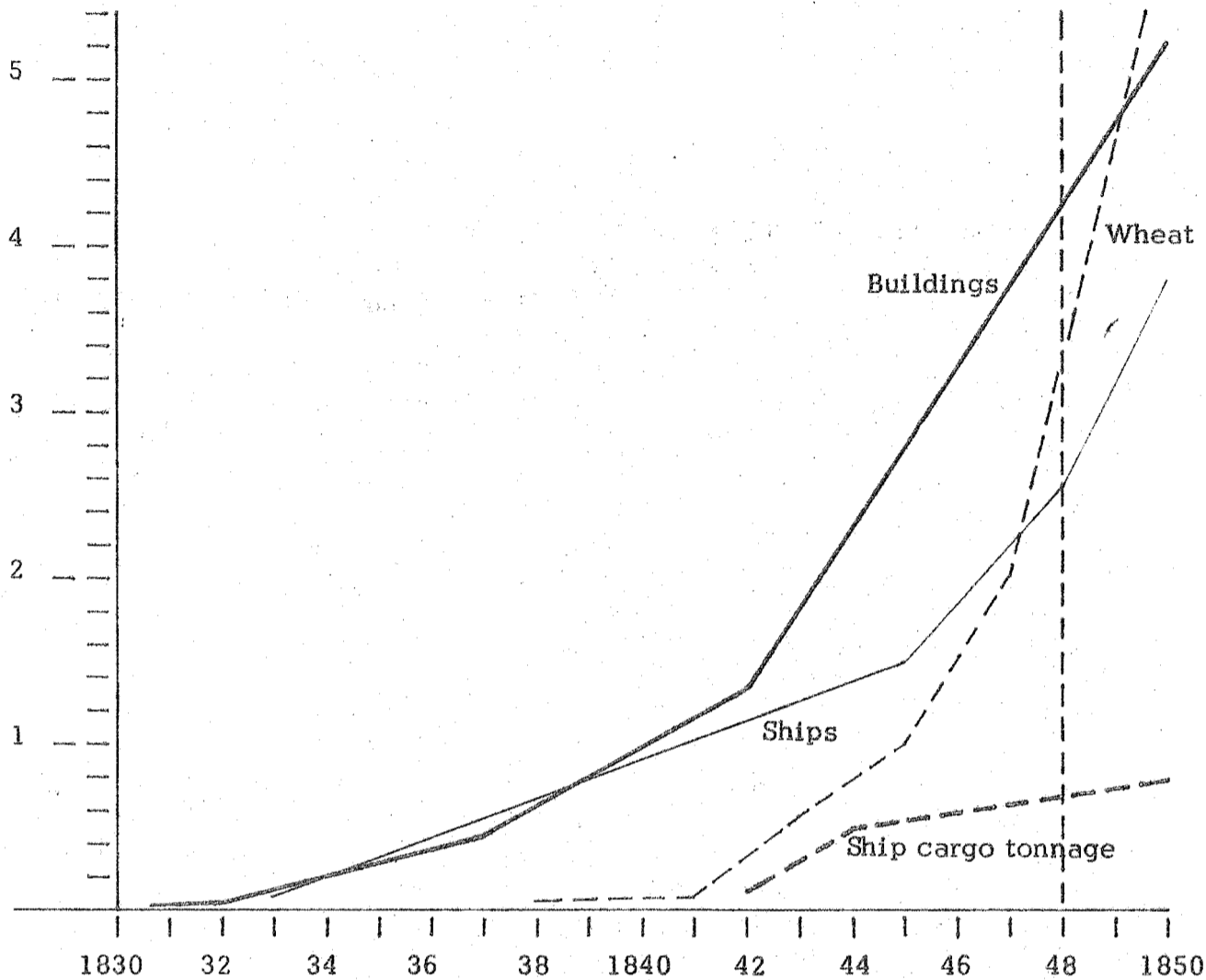
The construction of almost all the houses of the lower income population of Chicago in this and the following periods, was derived from the original Balloon frame. Brick was only used for the better quality houses and for commercial and industrial buildings. A brickfield had been established in 1833.

The remarkable growth in building construction in this period is shown in Graph 3. It is largely accounted for by the new developments in the techniques of house construction.

Graph 3

Among other inventions and developments in building technology elsewhere in America and Europe were further refinements in cast iron building construction (Fairburn's Refinery Factory, England, 1845, and Bogardus' American Factories 1847), the first use of vertical elevators in factories (1830), the first use of corrugated iron roofing (East Counties Railroad Station, England, 1840), the first steel cable suspension bridge (Pittsburgh, 1840) and the first use of compressed air for sinking shafts and tunnels under water (Thomas Cochrane, 1830 and later). (46) These all assume importance in Chicago's later development.

Ref. 46



GRAPH 3: GROWTH IN CONSTRUCTION AND TRANSPORTATION

Vertical Unit Values	A. Construction	1 = 1000 buildings
	B. Ships visiting Chicago	1 = 1000 ships
	C. Shipping tonnage	1 = 1 Million tons
	D. Wheat exports (shown for comparison only)	1 = 1 Million bushels

Data Source: Hoyt - "One Hundred Years of Land Value in Chicago"

3.3 RESULTANT CONDITIONS

3.3.1 GENERAL ENVIRONMENTAL CONDITIONS AS A RESULT OF TECHNOLOGICAL CHANGE

Because the land use activity-components of Chicago such as Commerce, manufacturing and housing, remain at this stage relatively undifferentiated, only a general description will be given at this point of prevailing urban environmental conditions. In subsequent sections each component will be studied separately.

The following description is that by John Lewis Peyton, who visited Chicago in 1848. Some of the effects of the introduction of developing technology on urban conditions, described here, are more easily understood if illustrations 13 and 19 are studied in conjunction with the text. These illustrations show the change in environmental conditions between the beginning and the end of this study period.

3.3.2 PEYTON'S DESCRIPTION OF CHICAGO, 1848

The city is situated on both sides of the Chicago river, a sluggish, slimy stream, too lazy to clean itself, and on both sides of its north and south branches, upon a level piece of ground, half dry and half wet, resembling a salt marsh, and contained a population of 20,000. There was no pavement, no macadamized streets, no drainage, and the three thousand houses in which the people lived were almost entirely small timber buildings, painted white, and this white much defaced by mud ... To render the streets and sidewalks passable, they were covered with deal boards from house to house, the boards resting upon cross sills of heavy timber. This kind of track is called "the plank road". Under these planks the water was standing on the surface over three-fourths of the city, and as the sewers from the houses were emptied under them, a frightful odour was emitted in summer, causing fevers and other diseases, foreign to the climate ...

On the outskirts of the town where this kind of road terminated, the highways were impassable, except in winter when frozen, or in summer when dry and pulverized into the most penetrating of dust. At all other seasons they were little less than quagmires Of architectural display there was none. The houses were built hurriedly to accommodate a considerable trade centering here, and were devoid of both comforts and conveniences ... a kind of restless activity prevailed which I had seen no where else in the west except in Cincinnati ...

Chicago was already becoming a place of considerable importance for manufactures. Steam mills were busy in every part of the city preparing lumber for buildings which were contracted to be erected by the thousand for next season. Large establishments were engaged in manufacturing agricultural implements of every description for the farmers who flocked to the country every spring. A single establishment, that of McCormick, employed several hundred hands, and during each season completed from fifteen hundred to two thousand grain-reapers and grass-mowers. Blacksmith, wagon and coachmaker's shops were busy preparing for a spring demand, which, with all their energy, they could not supply. Brickmakers had discovered on the lake shore ... excellent beds of clay, and were manufacturing, even at this time, millions of brick by a patent process, which the frost did not hinder or delay. Hundreds of workmen were also engaged in quarrying stone and marble on the banks of the projected canal; and the Illinois Central Railway employed large bodies of men in driving piles, and constructing a track and depot on the beach (sic). Real estate agents were mapping out the surrounding territory for ten and fifteen miles in the interior, giving fancy names to the future avenues, streets, squares and parks.

3.4 SUMMARY AND CONCLUSIONS

At the beginning of this period, in 1830, the small settlement at the mouth of the Chicago river had been virtually untouched by the forces of industrialization which were already far advanced in other American cities and in Europe

By 1848 the city's skyline was already clouded by the smoking chimneys of the first steam powered industries which had developed in the city in anticipation of the trade which the canal and railroads would bring.

Technology had already stimulated the growth of the city, influenced its form and patterns and changed the condition of its living environment.

Lake steamers and sailing ships brought the thousands of immigrant settlers to Chicago. They also brought the timber, tools and other goods required by the region, to the city. Local timber yards cut and machined the timber for local use and made the Balloon framed houses required by the city and its hinterland. Mechanical agricultural processes produced surplus wheat crops which were exported. Water transport accessibility determined the city's land use and land value patterns. Industries such as iron foundries, reaper works, meat packing and timber yards located on the river banks, using the river for transport and steam raising.

In 1848 the canal was almost completed, the first railroad tracks were being laid and the telegraph lines were being stretched across the countryside in preparation for the remarkable growth and technological development of the next period.

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4 Chicago 1848 - 71, The Railroad Era

4.1 GENERATIVE FORCES

TECHNOLOGY TAKES COMMAND would be a suitably dynamic sub-title for this section, which covers one of the most remarkably intensive phases of technological development of Chicago's history.

Up to the mid-century, the degree of influence of technological factors on the growth of the city increased steadily but slowly. Suddenly, as a result of the simultaneous adoption of several technological innovations, radical changes in growth rates and fundamental changes in urban form came about; changes which signal the emergence of Chicago as a prototype of the modern technological city.

The simultaneous introduction in 1848 of three major development stimuli of a technological nature, set Chicago on a course of vigorous expansion in all its urban activities. The activity increase rates were so remarkable that within six years the city attained world dominance in the fields related to these particular technological factors.

Firstly, the inauguration of the long awaited canal took place in April 1848. Secondly the completion of construction of the first railroad occurred in October 1848. And thirdly, the first telegraphic links with other American cities were established in the city in January 1848, thus facilitating import and export marketing.

The immediate effect of the opening of the canal was that increasing amounts of the Mississippi river trade, which previously passed downstream through St. Louis, were now diverted northwards through Chicago and the Northern and Eastern trade routes, because of the greatly reduced transport costs. As a result, by 1854 Chicago became the focal point of one of the world's largest inland waterway systems.

Within six years of the introduction of the first railroad into the area, Chicago became the centre of the world's largest railroad network consisting of some ten major trunk lines and many minor lines with over three thousand miles of track, representing an investment of some forty million dollars.

Finally, telegraphic links were progressively extended until, by 1854, Chicago was in direct contact with all the major trading centres of America. By then it had become the world's most important wheat exchange market.

Stimulated by the remarkable growth rates experienced in these fields during the first six years of this period, many other primary, secondary and tertiary urban activities evolved which can be considered to have been directly or indirectly induced by technological developments.

Primary activities such as iron, lead, and coal mining increased rapidly because of the demand by technological development for metals and fuels and because the improved means of transportation facilitated the moving of bulky, heavy products.

Secondary activities such as manufacture of agricultural machinery, railroad tracks, locomotives, rolling stock, bridges, etc. were all directly stimulated by the growth of the new transportation systems and the extractive industries. General developments such as the mechanisation of wheat handling, meat processing and packing, the mass production of building components, clothing and leather goods, all occurred simultaneously and were all based on the advantages of more efficient mechanized production techniques.

The new, more rapid means of transport and communication were directly responsible for new developments in tertiary activity. Systems of wholesale trading were first developed during this period and retail trade activities were diversified to meet a wider range of demands.

At this point new means of secondary transportation were also introduced into the city in the form of horse-drawn omnibus waggons and railcars. More bridges were built to carry increased cross-river traffic, improved street services

were installed when the city's ground level was raised, roads were better paved, gas street-lighting was installed and the city's water supply improved. These improvements, due to technological advances changed the nature of the city from a haphazard urban conglomerate of 20 000 inhabitants in 1848, to a highly differentiated, transport oriented urban complex of 325 000 inhabitants, with additional strings of satellite towns developing along its regional connector routes, by the end of this period in 1871.

Because of the primary importance of technology during this period, the documentation sequence will be altered in this section to allow the most important technical developments to be studied first, and understood as generators of urban activities, which are then studied and presented in the normal sequence.

However, in order to place local development in their wider context, the more general historical, political and economic developments in America and elsewhere during this period are first outlined.

4.1.1 GENERAL GROWTH STIMULI

This period is more readily understood when divided into three sub-periods, each related to a major trend or occurrence in the economic, social and political history of Chicago and America at this time.

The first sub-period, 1848 to 1857, is characterised by remarkable growth rates in all factors of urban development in Chicago, instigated by the new canal, railroad and lake-steamer transportation, increased agricultural production and mass European emigration to America.

During the second sub-period, 1857 to 1863, a general country-wide economic recession set in, resulting in serious declines in Chicago's financial and banking activities, trade and industry, construction and land speculation. Towards the end of this sub-period the American Civil War began (1861), financial stability becoming further affected due to severe losses suffered in Southern-State investments which were widely used in Chicago at this time as bond-backing for local and state banks.

The final sub-period spans from the second half of the Civil War (1863 to 1865) to the great fire of 1871. During this time the financial system of the Northern states, (and, after the war, the whole country) was put on a sound basis as a result of the introduction of the National Banking Act of 1863. With the war running in favour of the Northern states, Chicago began to reap a great deal of commercial and industrial benefit from the increased demand for food, clothing, arms and equipment, generated by the war. In the ensuing peace, with Southern markets reduced to ashes, the emphasis of Chicago's trade and industrial relations changed towards the East and West coast zones of America, Canada and Europe.

From the general, historical background outlined above, three factors of primary importance to Chicago's development can be distinguished.

Firstly, the rate of immigration of new settlers into America and the Middlewest region in particular, increased dramatically at this time. The failure of food crops in Ireland, political unrest in Germany, general poverty in Italy, all resulted in increasing numbers of people leaving Europe to start life anew in America. The 1849 Gold Rush of California added new impetus to the Westward expansion of the continent, and, with the completion of the transcontinental railroad, which in 1869 joined the Atlantic and Pacific coasts, Chicago became increasingly important as a goods and passenger handling terminal, serving the West and Middle Western states.

The second major factor is directly related to the first. The increased settlement of the West and Middlewest resulted in greater quantities of agricultural produce being transported through Chicago, and in greater quantities of timber, prefabricated houses, agricultural machinery, domestic equipment, etc. being exported from the city to country-wide consumers.

The third factor was in turn dependent on the first two, in that with increased immigration and the increased demand for goods which this caused, Chicago changed its role from that of an importer and a trans-shipper of goods to that

of a manufacturer of a progressively larger proportion of the nation's total product requirements.

These factors, in combination with the introduction of the new transport and communications agencies, resulted in the remarkable growth rates in all urban factors, as indicated in Graphs 4, 5 and 6, with only temporary retardations in the 1857-63 period, when general country-wide economic recession prevailed.

Graphs 4,
5 & 6

4.1.2 TRANSPORT AND COMMUNICATIONS AS GENERATIVE FACTORS

4.1.2.1 CANAL AND LAKE TRANSPORT

The opening of the Illinois and Michigan Canal in mid-1848 had immediate repercussions on the urban-field of Chicago as previously outlined. The trade of the Illinois River valley, and even some regions south of St. Louis, was almost immediately re-channeled from the Southern Mississippi route to the new Northern canal route, through Chicago and the Lakes to the East Coast and Europe. Overland road transport of wheat exports and timber imports, to and from Chicago, which in 1847 had brought as many as 500 waggons per day to the city, was reduced to a mere tenth of its former volume. Movement of wheat was either by waggon from farm to canal-stop and then by canal barge to Chicago, or by waggon to railroad-stop and then by rail to the city.

The new means of transport certainly came at an opportune time. It is obvious from the wheat export graph that waggon traffic could not have met the increased demand made on transport by increased agricultural production, nor could the timber and other imports to the hinterland have been met by waggon transport, operating over roads which were often impassable. (Graph 4, page 35)

Graph 4

The canal, from the start, operated in conjunction with the ship transport system of the Great Lakes, and although it was in competition with the railroad companies, it had mutually advantageous connections with the new rail systems. Streams of emigrants going westwards passed through Chicago, making intensive use of the canal passenger steamboat service introduced in 1850. (1)

Ref. 1

Industries which during the previous period were grouped along the banks of the Chicago River and its North and South branches, now began to extend further southwards down river. Eventually they were further decentralised to the loading points along the canal, where small towns soon developed.

By the end of this period in 1871, lake transport had increased to such an extent that on some occasions there were as many as three hundred ships coming and going through the mouth of the Chicago River in a single 12-hour period. (2)

Ref. 2

The increases in quantities of timber brought into the city and of wheat exported, shown on Graph 4, give some idea of the growth in harbour activities and lake shipping during this period.

Graph 4

An interesting development where canal and railroad transportation systems were combined to serve a newly established industrial area, is illustrated in Figure 27 which shows finger-like extensions of the canal, giving water access to peninsulas of land which have railroad branch lines in their centres. This land was quickly purchased for timber yards and associated industries. (3)

Fig. 27

Ref. 3

4.1.2.2 RAILROAD TRANSPORT

Although a railroad system for the State of Illinois was first proposed in 1837, it was not until 1848 that the first line was actually built out from Chicago. The first railroads were at this time conceived more as interlocking sub-systems for the inland waterways than as self-sufficient systems of their own. They were not attracted to the Chicago area until work on the canal was far advanced. (4)

Ref. 4

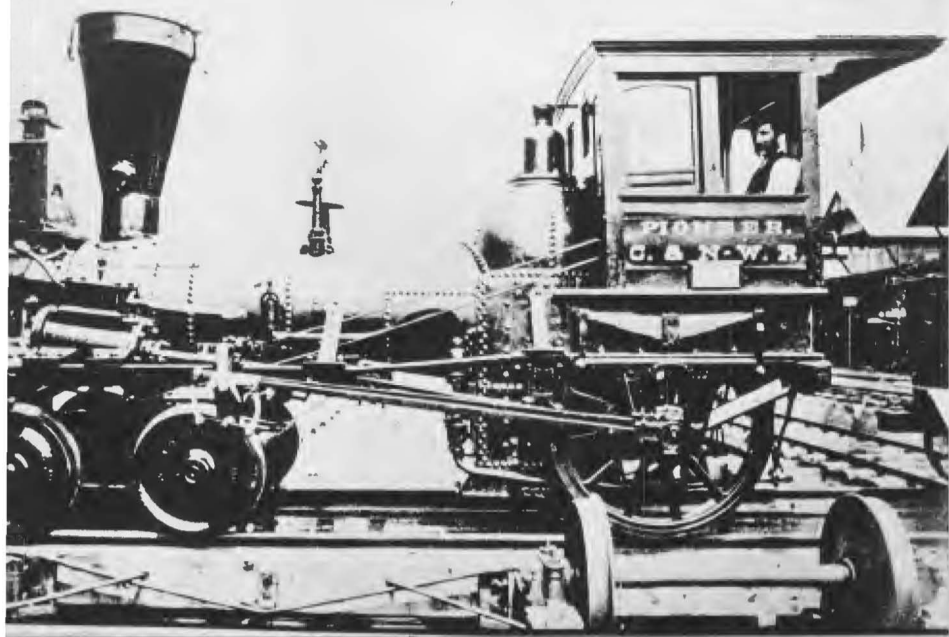


Fig. 23 "Pioneer". First Chicago Locomotive 1848



Fig. 24 First Galena Railroad Terminal 1848-53



Fig. 25 The Railroad System of Chicago 1848-71



Fig. 26 The Chicago River at Rush Street 1869

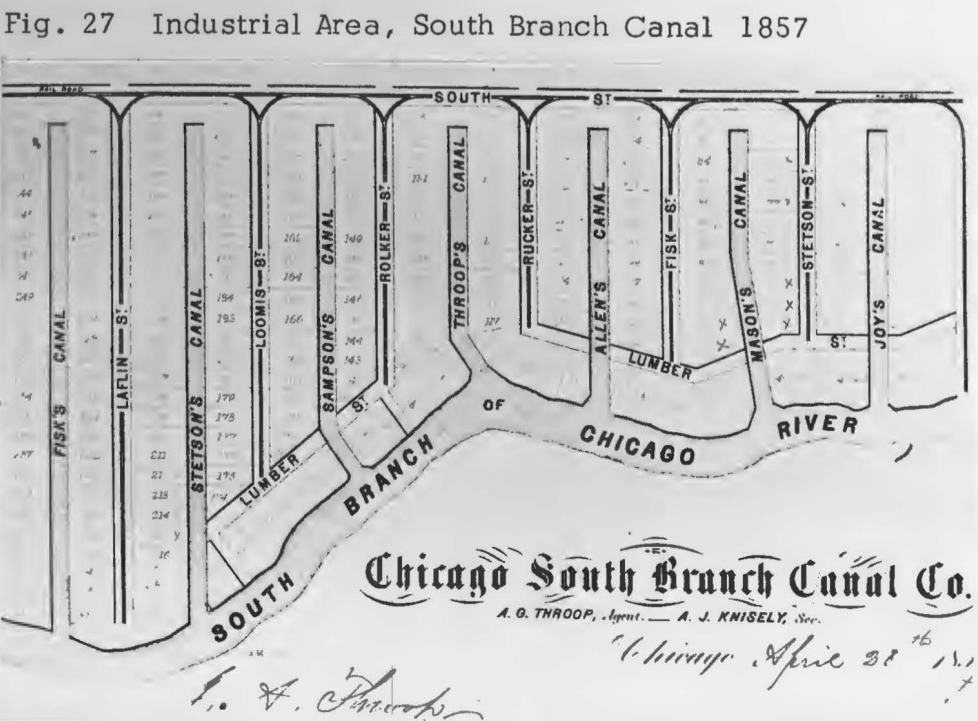


Fig. 27 Industrial Area, South Branch Canal 1857

The first railroad in the region (Galena and Chicago Union) was started in 1848 with a second-hand locomotive (Fig. 23) and six old freight cars, running on a ten mile line, due west of Chicago to the Desplaines River. (Fig. 25) This line was rapidly extended further westwards to connect with other lines from the North and South, thus expanding its service area. The railroad was a success from the start. By 1855 it was carrying 4,5 million bushels of wheat into Chicago and 111 million board feet of timber out from the city to the hinterland. The owning company extended the line into city limits, buying land and rights-of-way along the North Bank of the Chicago River and building a passenger depot on the North East side of the city (Fig. 24) adjacent to the harbour facilities. (Point A on Fig. 28)

Fig. 23

Fig. 25

Fig. 24

Fig. 28

The railroad had made its first impact on Chicago.

Within six years of the opening of the first line Chicago had become the railroad centre of the Middlewest with a network of ten trunk lines connecting it to all the major American cities other than those on the West Coast. By 1856 there were as many as 58 passenger and 38 freight trains entering and leaving Chicago daily.

In the initial stages there was little or no co-ordination between the railroad systems of the various states in the planning of routes or services. There was even less co-operation between the private companies, who wanted to take their lines into the heart of Chicago, and the city authorities, who seem to have granted rights-of-way into the city with little concern for long term consequences.

Wherever possible the incoming lines sought riverside locations for city terminals in order to attract the incoming passenger and goods trade from the lake steamers and to gain proximity to the grain elevators which were all located along the river banks, so as to be able to discharge their export cargoes directly into the waiting ships.

At all stages of the early development of railroads the greater proportion of all the incoming lines was from the Southwest, South or Southeast, with connections to Kansas City, St. Louis, Cincinnati and New York respectively. (6 to 8 lines from 1856 to 1871). Even by 1871, only one line came into Chicago from the North, (from Milwaukee and the Greenbay iron ore mines), one from the Northwest (from Minneapolis/St. Paul), and two from due West (from Des Moines, Aurora and Geneva Junction). (Fig. 25) (5)

Fig. 25

Ref. 5

Because of the difficulties of gaining access into the centre of the city, some lines shared central junctions, or terminal facilities, in the city or on its river edge.

One of the main southern line companies, the Illinois Central Railroad (conceived as part of the original 1837 improvements project) managed to persuade the city authorities to grant it a right-of-way concession to enter the city along a strip of lakefront water from the South, on a piled trestle bridge. This simple fact has had repercussions on the city's lake shorefront development to this day. The present CBD on the South side is isolated from the waterfront by the greatly enlarged system of Illinois Central lines which now stand on reclaimed ground. By 1854 the Illinois Central had established a terminal at the East end of Lake Street (on Michigan Avenue) well placed to intercept the incoming passenger and freight traffic from the lake before it entered the city centre. (Point B on Fig. 28) This line had immediate repercussions on residential development in the South, as it began to operate suburban passenger services between the city and Hyde Park, a satellite settlement some 9 miles south of the city on the Lake shoreline. (6) (Fig. 25) At each stop along the route, small suburban commuter settlements developed, closely linked to the greater urban system. Because the final section of the route into the city was shared by two other eastern railroad companies, this channel became, and has remained, one of the heaviest traffic carriers into the city.

Fig. 28

Ref. 6

Fig. 25

Another southern-approach line entered the southern end of the city but stopped well short of the Central Business zone at a point where it met a cross-city line, running eastwards to join the Illinois Central Line, thus gaining its own access to the east side of the centre city, while affording the Illinois Central Lines a shortcut across the city and river, to the west. (Fig. 25)

Fig. 25

All other lines made their connections with the city from the west side of the South Branch River. Four companies shared one large terminal on Canal and Maddison Streets, completed in 1860. (Point C on Fig. 28) These freight and passenger handling terminals on the west bank, served and also attracted, the timber yards, iron foundries, grain elevators and other transport seeking industries, which progressively extended southwards along the river bank until they reached to a distance of 14 miles from the CBD by 1871. (7)

Fig. 28

Ref. 7

The location of these industries in turn attracted the development of low income housing for factory workers who located in what would later be called the transition zone, on the hinterland side of their factory employment areas.

All these factors combined, induced a more rapid rate of development on the West side of Chicago than in either the North or South sectors during the first period up to 1857. (8)

Ref. 8

The railroads which had to cross a river branch to gain access to their central terminals (Galena and Chicago Burlington) were at a serious disadvantage in relation to the lines which did not cross the river, (Illinois Central, along South Lake front) as services were continually hampered by the passage of river craft through the swing bridges (an average of two ships per minute by 1871).

However, the railroads were an indispensable complement to the lake, river and canal systems of Chicago, providing essential inter-channel connections in the composite transport network. Rail connections were more flexible and a great deal less expensive than canal routes, affording greater speed and simplicity in operation. This reduced transport time and the greater options for cross-connection, made the railroad the natural choice for passenger traffic.

The travel time from New York to Chicago of 30 days in 1836 (by ship and lake steamer) had been reduced to 7 days in 1849 (by rail to Buffalo and then by lake steamer to Chicago) (9) and finally to 36 hours in 1852, when direct rail linkage was made to New York. (10) This accounts for the rapid increase of passenger traffic through Chicago in this period.

Ref. 9

Ref. 10

The major effect of the outward radiating railroads on Chicago was to extend the range of the city's influence through the development of the "strings of beads" of small towns along the main routes. (Figs. 25 and 44) Also of major importance was the "spreading" effect which the railroads had on the use of land within a four mile radius from the CBD. This land was of little value before 1850. With the closer interlinking which the railroads brought after 1848, the value of this land for industrial, residential and other uses, increased dramatically. (11)

Fig. 24

Fig. 44

Ref. 11

The development of the hinterland railroad systems caused complementary developments in inner city transportation. Horse-drawn rail cars were introduced into the city in 1859. These rail cars were more efficient than the earlier horse-drawn omnibus vehicles (which were no more than passenger carrying waggons) because they overcame the problems of muddy streets and deteriorating plank roads by the use of permanent rail-ways. The rail tracks also reduced rolling friction to a minimum, thus allowing heavier loads per horse-power, and per driver, to be hauled. (Fig. 29)

Fig. 29

Rail car service was rapidly extended to the emerging suburbs or satellite settlements thus supplementing the train services where these existed or providing the only public transport where no railroads existed.

Each sector of the city had its own railcar system running down the more intensively used streets, the West side having four routes and the north and south sides two each in 1860. By 1871 these routes were extended to the city limits in order to serve some of the higher income residential areas which were in time encouraged to develop along the direction of the railcar routes in anticipation of future extensions.

The earlier omnibus services had in fact determined the basic routes followed by the railcars at a later stage. Most of these routes were along the plank roads which preceded the paved surfaced roads after the raising of the city level. Omnibus transport eventually declined as plank roads deteriorated and as the more efficient railcar lines were extended.

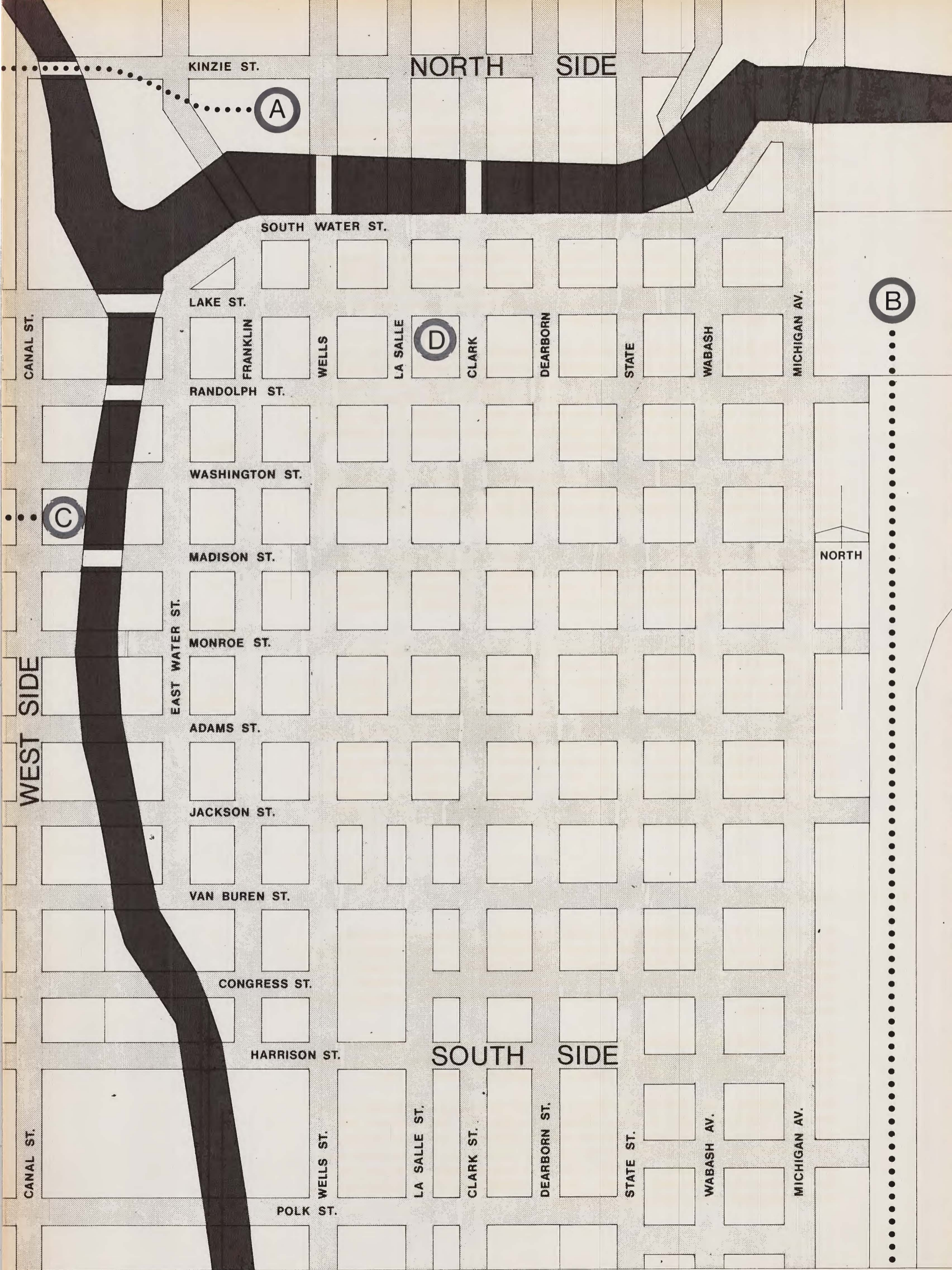


Fig. 28 Chicago Central City Area 1848-71

4.1.2.3 ROAD TRANSPORT

The completion of the canal and the development of railroads had the immediate effect of reducing the volume of waggon traffic. After 1848 waggons were used only for short haul local transportation of produce or purchases to and from canal and railroad loading points.

As a result, the radial road routes to the hinterland were now under less pressure and were able to afford better service.

The internal city roads, however, carried more horsedrawn carts, carriages, omnibus cars and waggons than ever before, and the condition of the city's streets continued to be a major problem until 1856 when the drastic decision was taken by the city authorities to raise the level of the entire central city area by a height of four to fourteen feet.

This meant that every building had to be physically raised on its old foundations and re-set on newly built foundations at levels prescribed by the city. This extraordinary measure will be discussed in detail later. With respect to the street system, the result of the decision was that the higher levels eliminated the high water table hazards and allowed sewers, storm drains, water pipes, gas and other services to be properly designed and built as an integral part of a total system of public provision. (12)

Ref. 12

Up to this point the streets had been progressively "planked", particularly along the main routes. Even after the raising of the city levels plank roads continued to be built beyond the city limits in the newly established residential areas.

Planking techniques of road surfacing were never fully satisfactory. They were eventually replaced by patented road surfacing methods using timber blocks set in bitumen on especially prepared beds. A particularly successful method was the Nicholson paving system first developed in Chicago in 1859. (Fig. 41) (13)

Fig. 41
Ref. 13

The use conflicts involved in road crossings over busy river waterways to gain access to the centre city only began to be resolved when the first under-river tunnels at Washington Street (1869) and La Salle Street (1871) were built. (Figs. 30 and 40) Centrally pivoted swing-bridges and vertically lifting Bascule bridges were then the most common means of river crossing. The degree of conflict between waterway and roadway traffic can be inferred from the fact that by 1871 there were 27 passenger bridges and six railroad bridges to the city which carried 246 000 pedestrians and 45 300 vehicles on March 31, 1871. In that year an average of two ships per minute sought passage down the river. The delays involved constituted a strong deterrent to intensive development of the North side and resulted in preference for the outer zones of the South Side as high income residential areas.

Figs. 30 & 40

4.1.2.4 COMMUNICATIONS

Because the first telegraphic links were installed in Chicago at the same time as the new transport systems came into operation, communication speeds were kept well ahead of the increased transport speeds of the railroad. This in turn allowed the wheat and other trade markets of Chicago to handle the vastly increased imports and exports flowing through the city with great speed and efficiency.

The first telegraph lines were inaugurated in 1848, linking Chicago first to Millwaukee, then to St. Louis (which was in contact with New York and New Orleans) and finally in 1850, to Canada, Detroit and Toledo. (14)

Ref. 14

The telegraph lines had their terminals at the very heart of the CBD, at the corner of Clark and Lake Streets. (Point D on Fig. 28) This location was adjacent to the Board of Trade offices and the financial centre of the city, enabling wheat buyers and sellers to maintain continuous contact with producers and world markets. By 1860, the first transatlantic cable had been laid between New York and London. Almost immediately Chicago became the world exchange centre for grain marketing.

Fig. 28

The locational importance of the positions of the early telegraph offices in the city fell off rapidly as branch lines were built and as telegraphic exchange systems came into operation.

4.1.3 TRADE AND COMMERCE

In the early years of this period between 1848 and 1857, the emphasis of Chicago's trade activity was still on the export of wheat and grain and on the import of sawn timber, farming equipment, household goods, etc., much as before, but at greatly accelerated growth rates. This is clearly shown in the graphs.

More extensive areas of land under cultivation, a larger agricultural labour force and increased mechanisation account for the rapid increases in agricultural production. Meat packing quickly assumed a new importance during this period. By 1871, it had become one of the city's prime income generators, particularly after the development of refrigeration techniques.

As the city grew at an unprecedented rate, its commercial activity base broadened and diversified. Because the new means of transportation and communication instigated vastly increased trade levels, new systems of banking had to be developed. In many cases, at the beginning of the Civil War, these systems failed, but were reframed under the National Banking Act of 1863. Thereafter they provided the vital financial foundation for Chicago's phenomenal trade and industrial expansion. (15)

Ref. 15

Certain growth rates in trade and commerce (eg. timber imports, land value, etc.) suffered serious setbacks during the 1857-63 depression, whereas others were less affected (wheat exports). Towards the end of the Civil War (1863-65) and thereafter, growth rates in all sectors regained and maintained their former dynamism until the great fire of 1871.

The first developments in wholesale trading occurred soon after the completion of the canal and the first railroads. The merchant was able to bring his sample wares to the customer, take his orders and have them delivered within a very short time by railroad. Decentralised buying and trading in grain and imported goods could be conducted at canal or railroad loading points without any significant disadvantage to buyer or seller. Prefabricated houses could be ordered and delivered within 30 days, it was claimed, to any farmer in the Midwest who was within reasonable distance of a railroad.

The "through" trade generated by the ever increasing numbers of emigrant travellers who passed through Chicago on their way West or South to settle, to prospect for gold, or to fight in the Civil War, encouraged diversification in various economic activities.

As a result of new commerce and trading activity levels, new industries were established, and the economic base of Chicago slowly began to change from that of a transport and exchange centre, to that of a manufacturing and production centre.

The implications of the development of telegraphic links, which kept Chicago in close contact with world markets, have already been outlined. The location of commercial activity components in the city is studied in Section 4.3.

4.1.4 INDUSTRY AND MANUFACTURING

The infant industries of the previous period were greatly stimulated and encouraged to grow in scale and in diversity by the new transport agencies and intensified activity in the city and its hinterland. Skilled workmen with diverse trades and backgrounds came to Chicago from the Eastern seaboard and expanding transport links to the West created the markets for the rapidly increasing quantities of locally produced goods.

Heavy industry in Chicago developed in the initial years of this period (1848-57) to meet the new demands of the railroads. Boiler repair works, carriage workshops, bridge building shops, rail rolling mills, etc., were established



Fig. 29 Horse-drawn Rail Car 1860



Fig. 30 The Washington Street Tunnel 1869

Fig. 31 Chicago River Fork, Randolph Street 1871



Fig. 32 Chicago North Steel Rolling Mill 1857-1900



Fig. 33 McCormick Reaper Works 1860

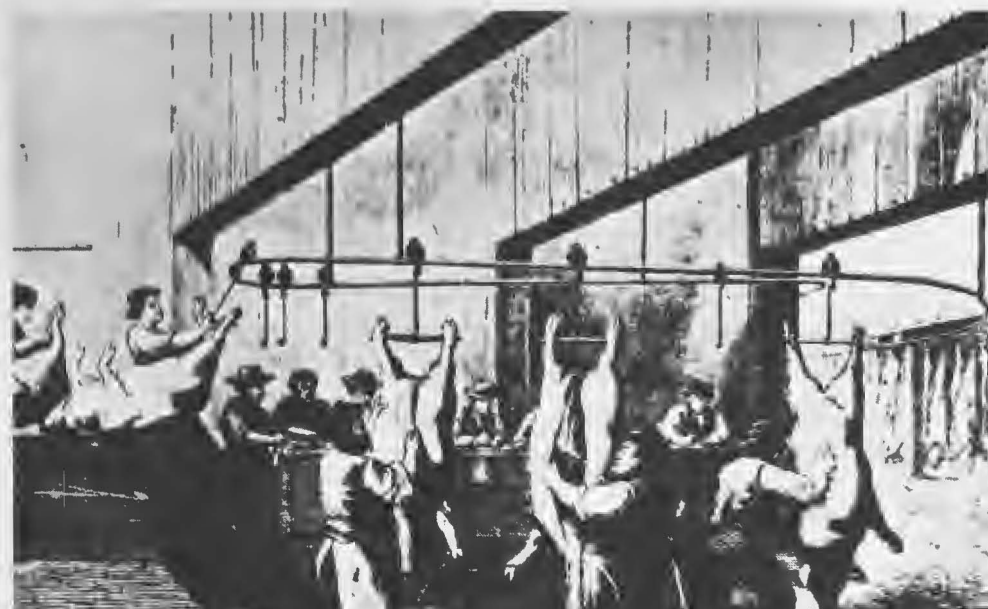


Fig. 34 Manufacture of Meat Packing Cans 1870

Fig. 35 Chicago Slaughter House 1870



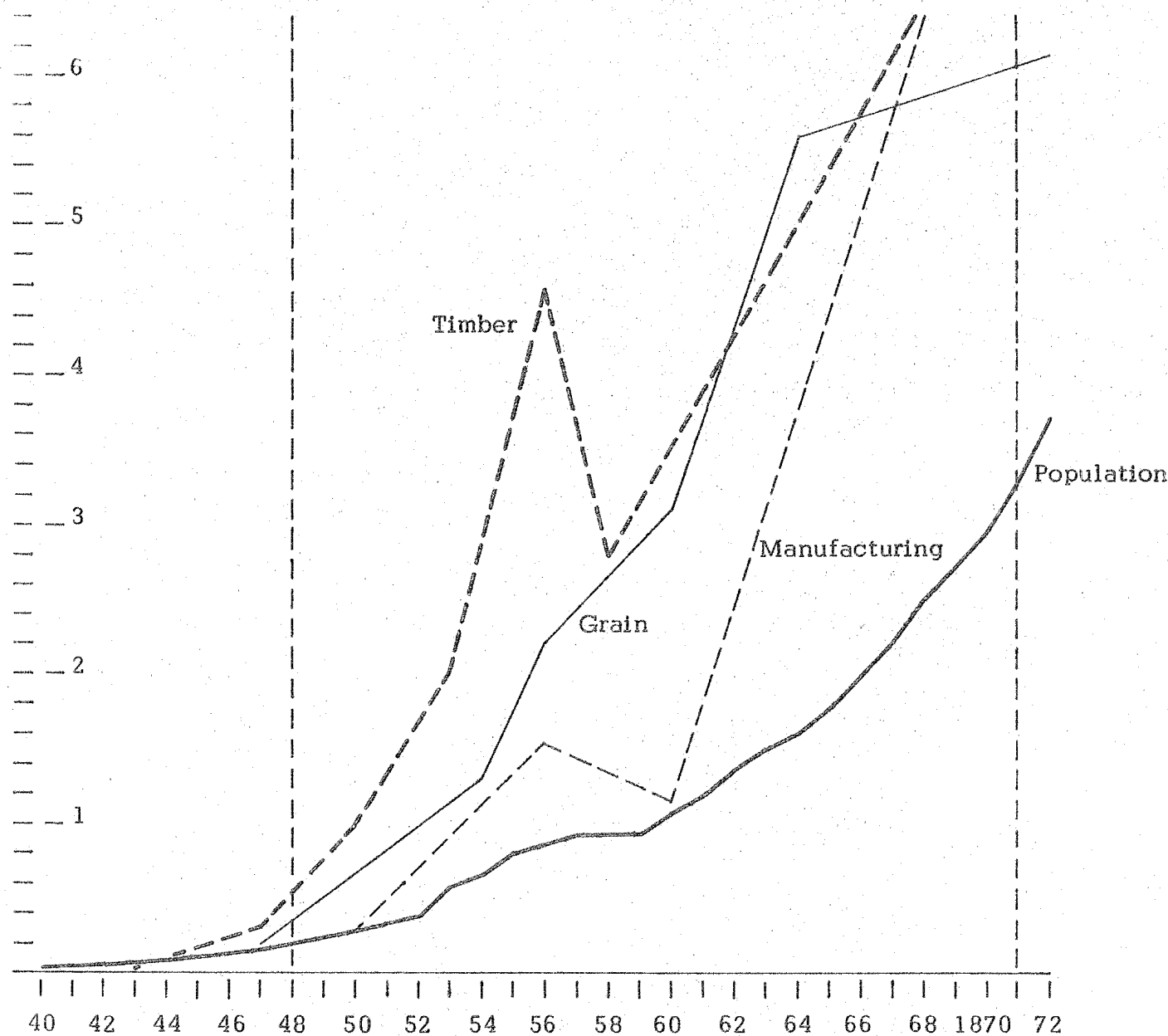
Fig. 36 Production Line Techniques 1870



in the city, usually close to the terminals of the railroads to conveniently service the old equipment and supply the new. (16)

Ref. 16

The rates of increase for Commerce, Industry and Manufacturing are shown on the graph below.



GRAPH 4 GROWTH IN TRADE, INDUSTRY AND POPULATION, 1848 - 1871

Vertical Unit Values	A. Wheat Exports	1 = 10 Million bushels
	B. Timber Imports	1 = 100 000 board feet
	C. Manufacturing	1 = 10 Million Dollars
	D. Population	1 = 100 000 people

Data Source: Hoyt - "One Hundred Years of Land Value in Chicago"

Iron and steel foundries grew in number, particularly after the invention of the Bessemer conversion process in 1855. In the early stages, lake vessels had brought iron from as far away as Scotland. Later the local ores from Green Bay, Iron Mountain and further North were mined and transported to Chicago for steel making. Use was made of Illinois Valley coal and Chicago limestone in the steel conversion processes. (Fig. 32) Steel production was greatly increased after the end of the Civil War when there was a period of dramatic railroad expansion (the railroad mileage doubled between 1865 and 1873) involving the production of some 33 000 miles of track in only six years. (17) The first steel rails were rolled in Chicago in 1865. Within ten years more rails were rolled in Chicago than in any other American city. (18)

Fig. 32

Ref. 17

Ref. 18

Increasing mechanization of production processes encouraged standardization of ranges of products, which was of great benefit to wholesale merchants. Clothing and footwear sizes were standardised for mass production, reducing relative selling prices and also enabling the wholesaler to place his orders for goods in a simple, direct way.

The timber industries grew at continuously increasing rates. Again mechanisation, standardisation and prefabrication were the dominant trends, whether in

The production of houses, waggons, furniture or doors and windows. A visiting historian, James Parton, described the timber industry of 1865 as follows:

"The harbour is choked with arriving timber vessels; timber trains snort over the prairie in every direction." "There is a firm (Lyman Bridges) in Chicago which is happy to furnish cottages, villas, school houses, stores, taverns, churches, court houses or towns, wholesale and retail, and to forward them, securely packed, to any part of the country." (19) (Fig. 31)

Ref. 19
Fig. 31

Previously established manufacturing enterprises such as McCormick's reaper works, continued to expand and to diversify the range of their products. (Fig. 33) New industries sprang up during the Civil War to exploit the need for military equipment, waggons, food and clothing. Meat packing, which had first started in Chicago as early as 1833 (Section 3.1.3) grew rapidly throughout all following periods, but particularly during the Civil War. Armour established his first packing plant in the city in 1867. (20)

Fig. 33

Ref. 20

The growth of the meat marketing and packing industries is related to the development of canning processes, mechanisation of the processing methods of the by-products, and later, the possibilities of transporting meat on a national basis by means of refrigerated railroad cars. The growth was so rapid that in 1865 a new 350 acre stockyard was opened four miles southwest of the centre of the city (The Union Stockyard). (Figs. 51 and 52) In true Chicago fashion, the muddy swamp area chosen, which lay two feet below river level, was drained, laid out on a grid, roads built, housing, hotels, offices, slaughterhouses and vast cattle pens built, all within seven months. The complex was opened on Christmas day 1865.

Figs. 51
& 52

By-product industries attached themselves to the meat packing and slaughter houses which located near the stockyards. Larger and more efficient stockyards were built and the plant and equipment mechanised to such a degree that even the following description seems plausible.

"A cow goes lowin' softly into Armours and comes out glue, gelatin, fertilyzer, celloloid, joolry, sofy cushions, hair restorer, washin sody soap lithrachoer and bed springs, so quick that while aft she's still cow, for'ard she may be anything from buttons to pannyma hats." (sic) (21) Some idea of the scope of these operations can be gauged from Figures 34, 35 and 36.

Ref. 21
Figs. 34,
35 & 36

The mechanisation of grain handling enabled the seventeen storage elevators which had been built along the river banks to handle and dispatch the 60 million bushels of wheat exported in 1870 more easily and rapidly than the one million bushels which had been handled in 1847, by the substitution of mechanisation and steam power for manual labour. (22)

Ref. 22

4.1.5 POPULATION INCREASE

The reasons for the great increases in population of the city have been outlined. The way in which they arrived at Chicago or passed through the city was directly related to the new transport agencies studied previously. The rates of increase are indicated on Graph 4.

Graph 4

The Nationality ethnic origin, income level and general social aspirations of the people, had direct relationships to their patterns of settlement in Chicago and because these patterns were also often influenced by or even dictated by factors related to technology, they will not be studied here as generative factors, but will be integrated into section 4.3 where Resultant Conditions are analysed.

4.1.6 LAND VALUES

The general pattern of change in land values can be studied on Graph 5 and can be summarised as follows.

Graph 5

Between 1848 and 1856 land values rose rapidly in the CBD areas, along the railway, and particularly along the canal routes, but also in the zones between one and four miles from the CBD, due to the improved transport connections offered to these areas by the new transportation systems. (23)

Ref. 23

From 1857 to 1863 land values in all areas, but to a lesser degree in the CBD, weakened and dropped in response to nationwide economic stringencies. Land values were further affected by the almost complete lack of "borrowing money" after the collapse of many banks, through the loss of Southern State securities with the start of the Civil War in 1861. (24)

Ref. 24

Economic activity revived after 1863 as Chicago began to gain direct benefits from war production and supply activity, and after a sound national banking system had been established. By 1871 land values were showing the normal rapid rates of increase. (25)

Ref. 25

The general hierarchical structure of land values was still mainly determined by transport accessibility for the trading and manufacturing components, centrality for financial and retail functions in the CBD (reinforced by the need to be near the incoming telegraph lines), centrality and transport accessibility for wholesale activities, accessibility to secondary and primary transport systems and freedom from environmental disamenity, for higher income residential development, and proximity to place of work for the lower income groups so as to reduce commuting transport costs.

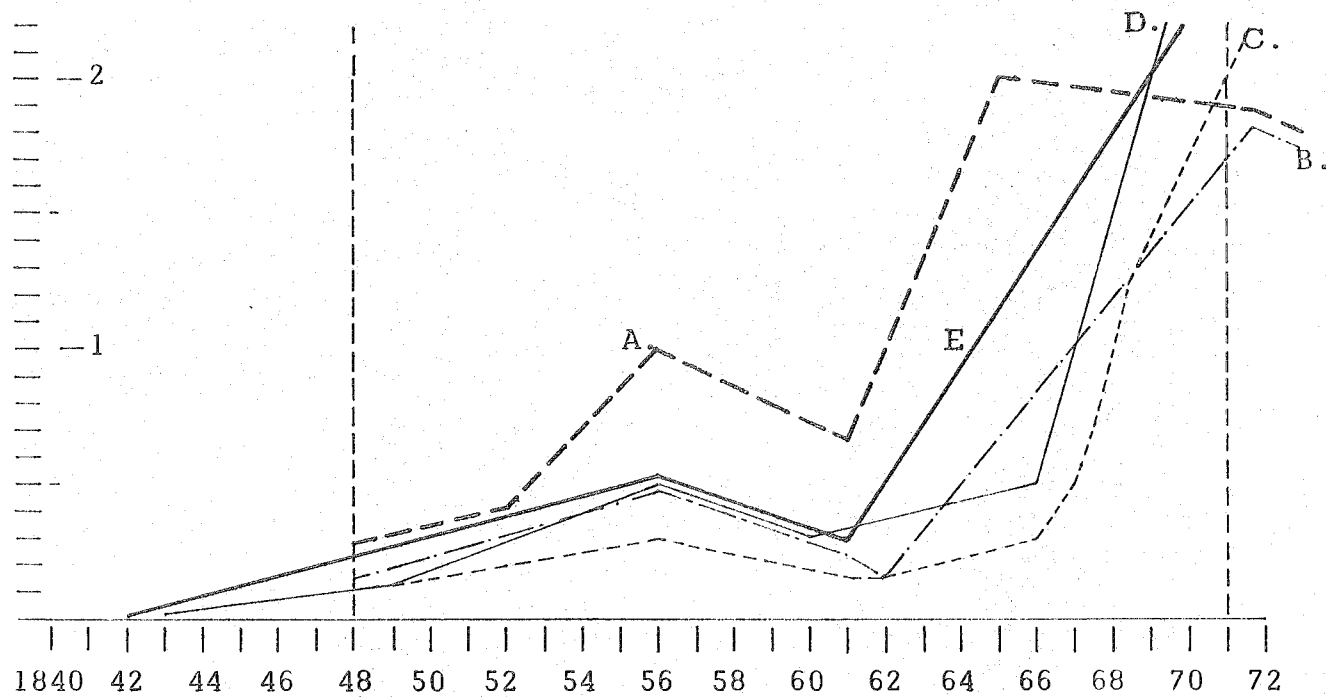
Two factors of major importance occurred in this period which had profound effects on the patterns of land use and land value in the CBD. In 1865 the Board of Trade moved from Southwater to Washington Street, three blocks further South (on La Salle Street) causing many related finance and trade organisations to follow. The second factor was the purchase and development of a three-quarter mile length of State Street by an entrepreneur, Potter Palmer in 1866. Palmer had State Street widened and built several large retail and wholesale stores, an 8 storey hotel, several office buildings and other structures, all to high standards of quality and at great expense. He managed to persuade Chicago's largest dry-goods trading firm, Field Leiter and Company, to move from their Lake Street address to rent a large store which he had built on the corner of Washington and State Streets for \$50 000 per annum. The effect of the Marshal Field organization moving three blocks southwards and eastwards was instantaneous. Within three years most of the retail activity from Lake Street had moved across to State Street, sending land values rocketing upwards (See Graph 6). The voids left in Lake Street by this mass exodus of retail activity to State Street, were immediately filled by the overflowing wholesale activity from South Water Street (one street north of Lake, on the river front). The Field Leiter Company's activities grew and diversified rapidly at the new State Street location, reported sales in 1872 reaching 20 million Dollars.

Just how much this invasion- succession pattern of land use was influenced by the improved transportation linkages offered by the East shorefront lines of the Chicago Central railroad, is not certain, but certainly the possibility of widening State Street sufficiently to take a street railcar line must have been an important factor in Potter Palmer's decision to develop State Street. The street car rail line was built on State Street by 1871. (Fig. 53)

Fig. 53

These changes in land values can be studied in detail in Figure 56.

Fig. 56



GRAPH 5 LAND VALUES 1848 - 1871 Data Source: Hoyt - op.cit.

Vertical Units Values: A. Lake St. B. Washington St. C. Madison D. State St. 1 = \$1000
 E. Total Value of "city limits" land 1 = \$200 million

Inner zone land values were to some degree related to the condition of the streets on which they were located, but the converse also applied in that streets were often upgraded to meet the more intensive activities in areas which stimulated them, and these areas usually stimulated higher land value.

The routes of the horse-drawn rail cars usually stimulated higher values along their lengths, because of the pedestrian activity generated by the more intensive movement routes.

Higher income residential areas developed in the outer Southern zones of the city because of the increasing inconvenience caused to the North Side areas by the transport delays at river bridges and also because of the vastly superior transport accessibility offered by the southern rail links with suburban services (Illinois Central). (26) Outer Southern land values increased accordingly.

Ref. 26

The general trend of increases in value of peripheral land, caused by increased accessibility with railroad and horse car lines is well illustrated by the fact that between 1856 and 1873 the value of land within one mile of State Street had increased by 150%; land from 1 to 2 miles from State Street had increased by 180 to 332%; land from 3 to 4 miles from State Street had increased by 1000%; and land beyond 4 miles, up to present city limits had increased by 1460%. (27)

Ref. 27

4.2 TECHNOLOGICAL FACTORS

The main factors in this category, transportation and communication, have already been studied in detail in relation to the situation in Chicago. Some brief mention should be made of current developments being made elsewhere in America or Europe in these fields so that some predictive situations can be anticipated for following periods in Chicago. The remaining factors which have not yet been studied, such as General Mechanization, Energy Sources, Services and Construction, will follow in the normal study sequence.

4.2.1 GENERAL MECHANIZATION AND ENERGY SOURCES

Reference has already been made to increased mechanization in almost every production process operating in and around Chicago at this time. Agricultural machinery was further developed and mass produced, steam was harnessed to lift, store and dispatch the grain passing through the elevators, tin-plated cans were mass produced for the meat packing industries, cattle and pigs were slaughtered, skinned, carved and processed on overhead conveyor systems, by-products were processed, leather goods and clothing were machine cut to standardised sizes. Timber sawing and planing machines were driven by steam power. Iron and steel products were made to higher standards and in greater quantities than ever before by means of the new furnace processes. All these and many more factors were the result of the widespread use of the new materials, iron and steel, and the new energy sources of steam, coal and coalgas. Electricity which was in its more advanced experimental stages by 1871, had not as yet come into commercial use.

4.2.2 TRANSPORTATION - WATER, RAIL AND ROAD

Iron and steel, and steam power progressively replaced timber and sail as the materials and motive force for ships during this period. Ships increased in size allowing larger cargoes and more passengers to be carried (Great Eastern steamship - 680 feet long). (28) Cargo handling cranes were developed, high pressure boilers increased ship speeds, thus reducing travel times. Paddle wheels gave way to underwater propellers.

Ref. 28

Chicago was to benefit directly or indirectly from all these marine engineering developments.

Speed and carrying capacities of railroad trains increased in like fashion with the use of high pressure, more efficient boilers and with the use of the first automatic air brakes in 1871. (29) Cast iron rails were replaced by long length, higher strength steel rails. Waggon and carriages used steel for chassis construction thus increasing carrying capacities of rolling stock.

Ref. 29

In London the first underground lines had been constructed in 1860-63, the inconvenience of smoke in tunnels being a direct stimulus towards the development of electric locomotives (first developed by Davidson, 1842, Farmer, 1847 and Page 1849) which were finally commissioned in 1879. (30)

Ref. 30

Railroad timetabling and services had been improved by the introduction of telegraph communication systems between control points and outlying stations.

Road transportation remained the short distance, more personal means of transport, either by use of horse, or horsedrawn waggon, trap, cart or omnibus. Speeds did not increase until the motive power changed from horse to steam, electricity or gasoline power much later.

Road surfacing techniques were developed to be more weather resistant, particularly where sub-soils were unstable. Chicago took a lead in this respect, with the development of the Nicholson Paving System, which made use of wood blocks set in bitumen, with a stone chip surface. Asphalt paving (Bitumen and stone chips) was first developed in 1860 but was not in common use until much later. (31)

Ref. 31

4.2.3 SERVICES

Because of its comparatively high population densities and unfavourable site conditions in the central regions of the city, Chicago was eventually forced to come to terms with its service requirements, and when it did, it took no half measures. It rapidly installed the sewers, surface drains, water supply pipes, gas mains, etc. required, using the most advanced available methods, or where these were not suitable for local use, the city developed its own systems to meet its own specific requirements.

The raising of the city's street levels, from 1856 onwards, made it possible to install a comprehensive services network which was sufficiently far sighted in its planning to be able to serve the city for a very long time, some services still being in existence today. Stormwater drainage and improved street paving systems removed the previous mud hazards. A major sewage disposal system was installed with proper outflow control works leading into the lake or the river. The river had been dredged to a greater depth in 1871, making it possible to reverse the flow of the river so that stagnant upstream water could be flushed into the lake.

Coal gas, first used in 1850 for street lighting, domestic cooking, and heating in homes and offices, was distributed in pipes laid under the streets or pavements. Gas street lighting was in extensive use in the central city areas by 1871. (32)

Ref. 32

Because of pollution of the lake waters by the effluents from the tanneries, distilleries, glue factories, chemical plants and slaughter houses, an extensive new water supply and treatment plant was built, drawing water from an intake structure two miles out from the lake shore line and connected with an underwater tunnel. This was completed in 1867, the construction of the intake structure and tunnel was regarded as one of the major feats of engineering skill of its time. (33)

Ref. 33

The efficiency of these service systems was essential for the support of the city's growth. Their installation at this stage marks the beginning of the new era of sub-surface support systems which are such vital components of the contemporary city. The extent to which the services had been developed by 1873 can be seen in Figure 54. This diagram shows that the areas better served by roads, bridges and sewers coincide with areas of greater intensity of commercial and industrial land use, and the higher income residential areas. (Figs. 55 and 45 to 53).

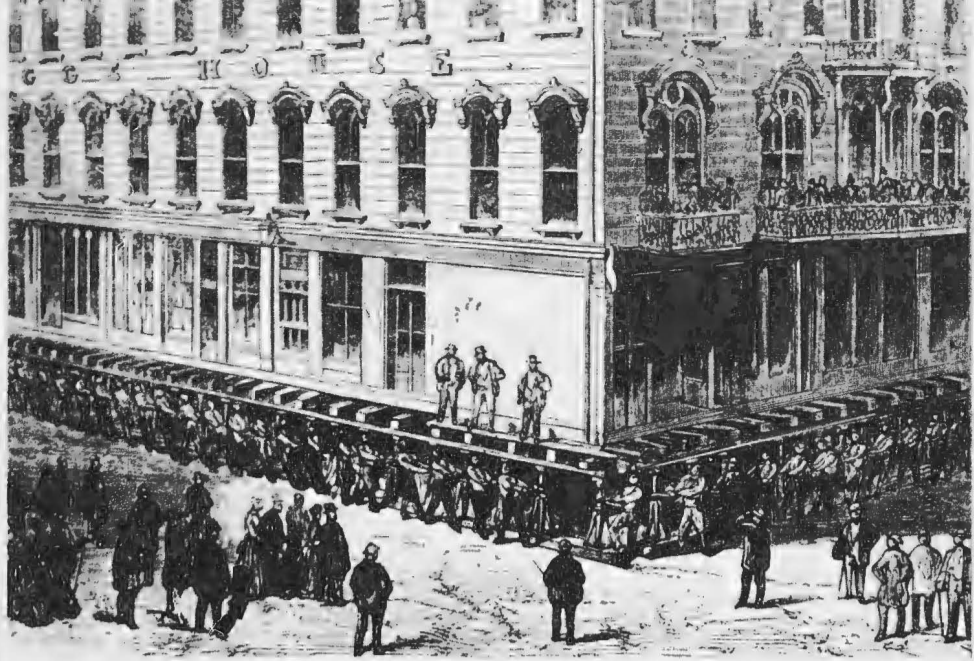


Fig. 37 Raising the Briggs House 1857



Fig. 38 Moving a Building in Chicago 1859

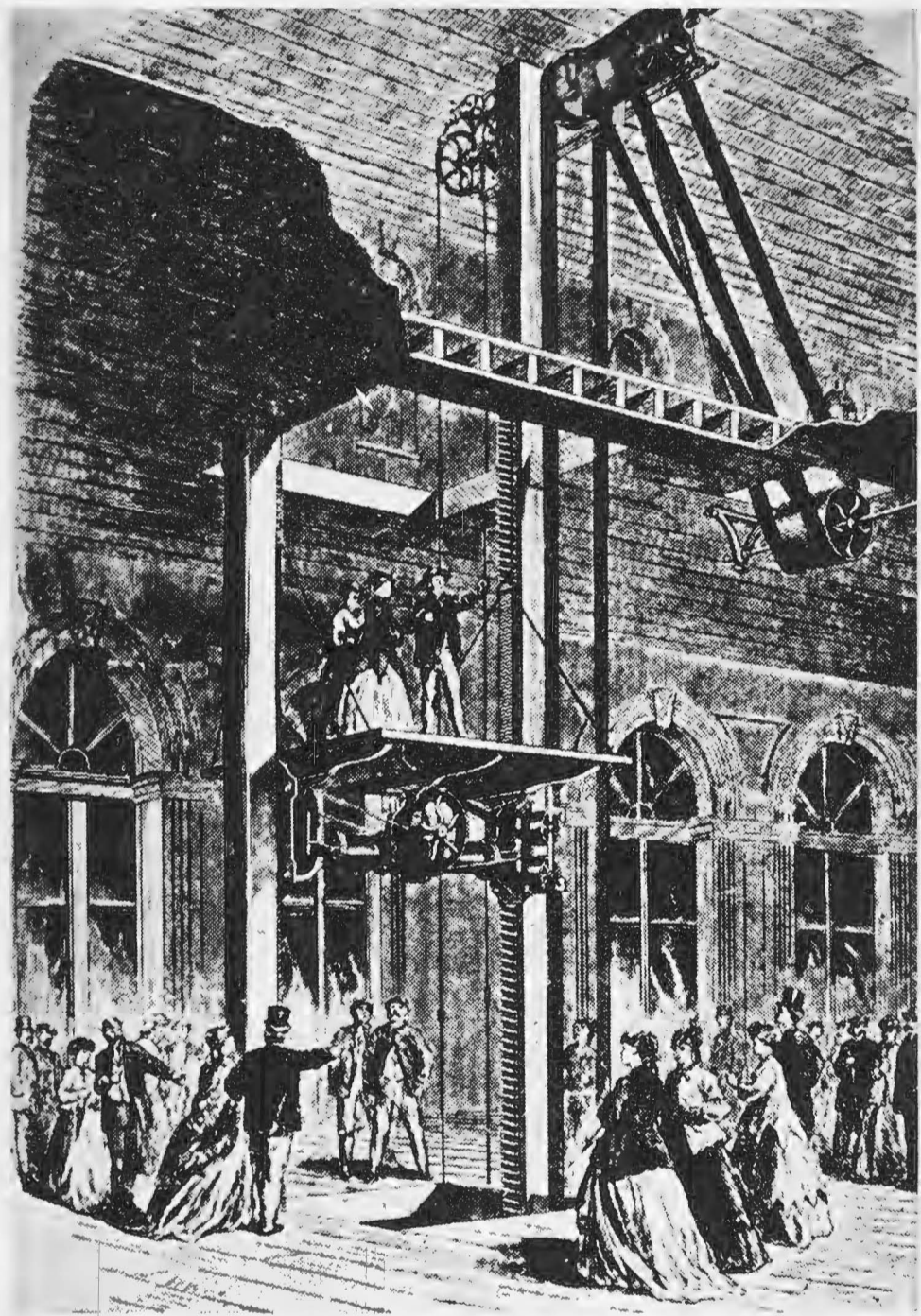


Fig. 39 Otis Passenger Elevator 1861

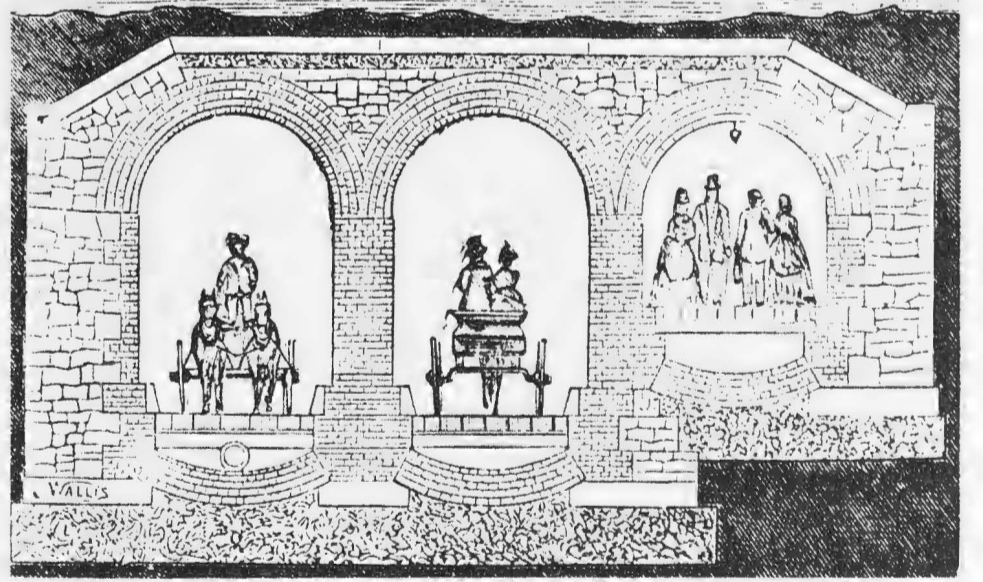
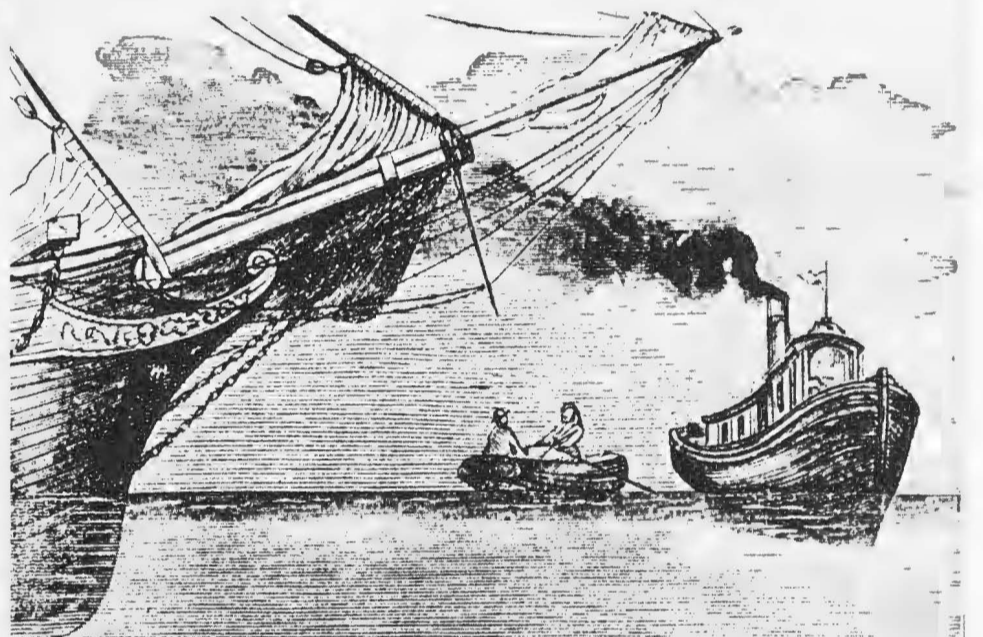
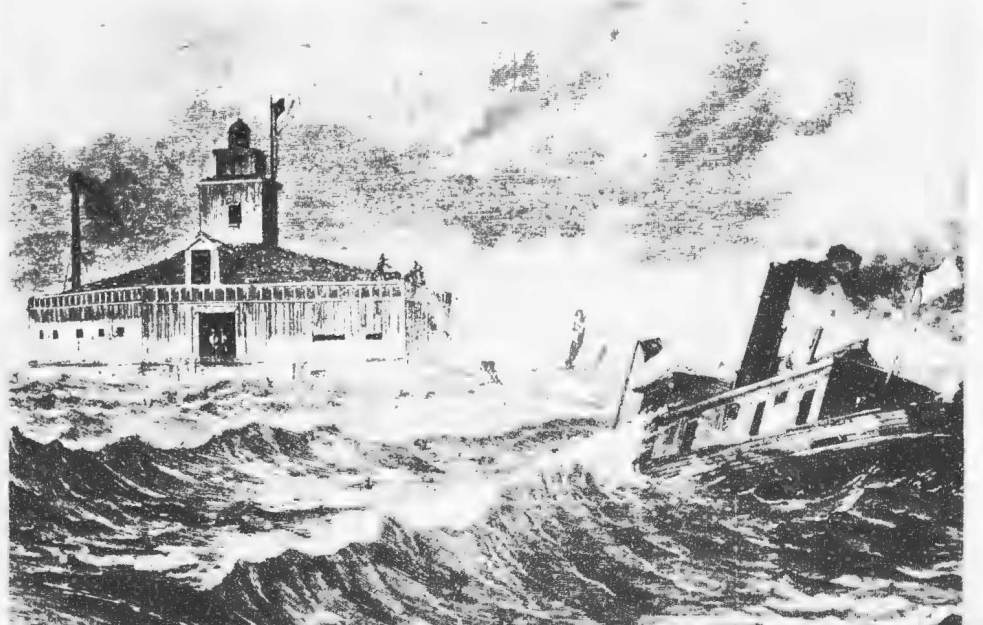


Fig. 40 The LaSalle Street Tunnel 1871

Fig. 41 Laying Nicholson Pavement 1859



Fig. 42 Waterworks Intake Structure 1867



4.2.4 COMMUNICATIONS

The installation of the first telegraph lines in Chicago in 1848-1850 marked the beginning of another era, the "Overhead wire" era which is still very much in existence in America today. The first telegraph lines were strung up on timber poles and stretched across the countryside, connecting the trade centres of America. Later these became the telephone and telex links so vital to every-day communications. The price America pays today for coast to coast direct-dialling is the "wirescape" of millions of miles of cheaply installed, serviced, and extended overhead wires, stretching across the country and through the cities. Only in the more intense urban situations have these wires now been forced underground.

Developments in telegraphic communications occurred rapidly. Multiple signalling on a single wire, was invented by Gintl in 1853 and automatic telegraph recording by Hughes in 1854. (34) The first transatlantic cable was laid in 1866 and the final link, the development of the first telephone, by Bell, occurred in 1876. (35)

Ref. 34

Ref. 35

By 1866 therefore Chicago was in direct contact with Europe through the New York to London cable, an essential link for world wide wheat marketing.

4.2.5 CONSTRUCTION

It can be observed from the graph overleaf that the annual value of new construction work undertaken in Chicago during this period follows very closely the fluctuations of land values as shown on Graph 5. Both are fairly directly related to the availability of money and the degree of confidence in the economy of the country, state or city. Construction almost came to a standstill in 1862 after the start of the Civil War and the subsequent collapse of the state banks.

Graph 5

Unfortunately no statistics are available as to how this value of construction work was distributed throughout the city area, or as to what proportions of expenditure were in low-income timber frame houses, higher income housing, commercial, industrial or other types of structures.

However, from available reports it appears that up to two-thirds of the number of new structures built per annum would have been timber framed, one or two-storey houses, mostly of Balloon Frame construction. The remaining third were either masonry structures or other timber non-residential structures such as schools, halls, churches, sheds, barns, etc. (36)

Ref. 36

Most of the balloon frame houses were built for the lower and middle income families, the cost per house being on average \$1000 even in 1871. (37) Mechanisation had kept costs low and construction on site, by unskilled labour, was so simple that owners throughout America bought these houses, collected them from the railroad halts and erected them themselves.

Ref. 37

Chicago, and for that matter, America, could never have housed the incoming millions of immigrants had it not been for the Balloon Frame.

Technical ingenuity at another scale was also brought to bear on Chicago during this period when it was decided in 1856 (at the peak of the boom in the economy) to raise the street level of the entire centre city by heights (depending on local topography) varying from 4 to 14 feet. Buildings were underpinned on screw jacks and raised by co-ordinated manpower to the required heights while the people inside carried on their daily activities. One structure, the Briggs House, weighing 22 000 tons was raised in this way. (38) (Fig. 37)

Ref. 38

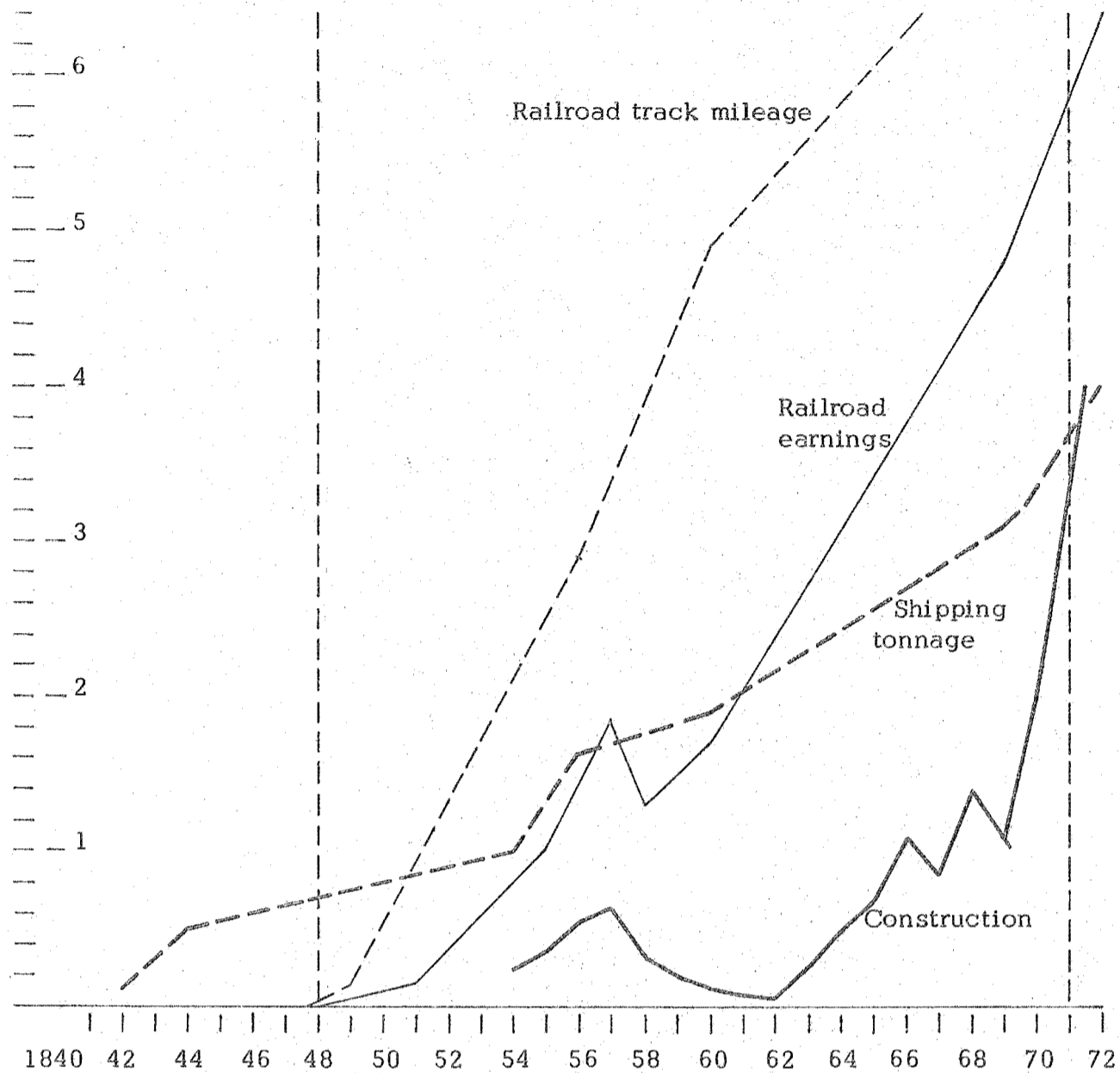
Fig. 37

Other structures were raised and moved in position, by means of rollers or greased "ways", to new locations. As one observer remarked, "Never a day passed, that I did not meet one or more houses shifting their quarters. Usually the people sat casually at the window as their dwelling migrated to a new neighbourhood." (39)

Ref. 39

Until all the structures had been raised pavements had to undulate in height to meet the various front door levels. When all buildings had found their new levels, the new services were installed, the roadway filled to the new levels, and paving surfaces laid.

This direct and ingenious way of the city solving its problems whether at house, street or city scale, is typical of the dynamic attitude which in the following period gave birth to the development of the steel framed "skyscraper".



GRAPH 6 GROWTH IN CONSTRUCTION AND TRANSPORTATION

Vertical Unit Values A. New Buildings Value 1 = 10 Million Dollars p.a.
 B. Shipping tonnage 1 = 1 Million tons p.a.
 C. Railroad earnings 1 = 10 Million Dollars p.a.
 D. Railroad tracks 1 = 1 000 Miles of track.

Data Source: Hoyt - "One Hundred Years of Land Value in Chicago".

The types of buildings constructed in the central business area of the city were generally more substantial than the houses, being mainly four to five storey masonry structures housing retail shops, offices, wholesale warehouses, hotels, etc.

Hand-hauled goods elevators were in wide use by 1850 and by 1853, Otis had demonstrated the first "fail-safe" passenger elevator in New York. (40) Passenger elevators were not however in general use until after 1870, when they were either steam or hydraulically driven. (Fig. 39) The development of the elevator was an essential ingredient for the new high rise buildings which follow in the next period, as was the first use of cast iron and steel in the frames of buildings in this period.

Ref. 40

Fig. 39.

Cast iron was coming into greater use for building construction in Europe during this period, one of the most noticeable of these cast iron structures being Paxton's Crystal Palace exhibition building of 1851.

By 1871, cast iron columns were widely used for warehouses and store construction in Chicago and elsewhere, claims being made by designers that the cast iron was fire-proof. This was proved to be untrue in the great fire of 1871, when

the iron framed buildings collapsed more quickly in some cases, than the conventional masonry structures.

The construction of tunnels under the river for passenger traffic, and under the lake for water supply, was a major engineering achievement in the unstable mud and clay beds underlying Chicago. (Figs. 30 and 40)

Figs. 30 & 40

The construction of the intake structure for the city's water supply, two miles out in the lake, was another interesting feat of improvisation. (Fig. 42) A vast timber "Crib" structure was built on land, made watertight, launched and floated into its position in the lake, and then allowed to sink onto the lake bottom where it was filled with masonry from the inside. In this position it was excavated into the mud until bedrock was reached and work started on the tunnel from a second work face. (41)

Fig. 42

Ref. 41

The ingenuity which was brought to bear in solving problems of this nature is indicative of similar achievements in the next study period where radically new techniques of foundation construction had to be developed in order to support the evolving "skyscraper" structures of the 1890's.

INVENTIONS

In examining changing technology in all periods studied so far one trend has become apparent. This is that during the mid-nineteenth century, particularly in the 1860's, America began to play an increasingly important role in invention, innovation and discovery in many fields where previously Europe had held dominance.

In the early Eighteenth century France had been the testing ground in almost all fields of invention, particularly in relation to mechanical devices. In the later period of the eighteenth century and in the early nineteenth century, England dominated the field with inventions by Hargreaves (Spinning jenny 1767), Watt (Steam engine 1781), Maudsley (Lathe 1797) and Stephenson (Railroad 1825). By 1850-60 America had built on these developments and moved into new fields, to develop advanced techniques of mechanisation in agriculture, wheat handling, meat processing, clothing manufacture and leather goods production. Amongst other things, passenger elevators were invented, suspension bridges built, new machine tools for woodworking invented, all being major contributions to general technology made by several men of great ingenuity. But the spirit of invention and improvisation had deeper roots in America than elsewhere. To quote Siegfried Giedion:

"Invention was in the normal course of things. Everyone invented, whoever owned an enterprise sought ways and means by which to make his goods more speedily, more perfectly and often of improved beauty. Anonymously and inconspicuously the old tools were transformed into modern instruments. Never did the number of inventions per capita of the population exceed its proportion in America in the Sixties." (42)

Ref. 42

Giedion draws attention to the fact that most of these American inventive developments in this earlier period were related to the rationalization and mechanization of agricultural processes and domestic products. Only later did American ingenuity begin to assume dominance in the perfecting of heavy industrial techniques and mass mechanization, (Henry Ford, 1917 and later) but the pattern was set, and further evidence of the trend will be seen in the following section in developments such as the steel framed high-rise building.

4.3

RESULTANT CONDITIONS

Because more statistical, descriptive and illustrative material is available for this period than for earlier study sections, a better and more detailed understanding of the effects which changing technology had on the form and condition of the urban environment and its component parts, is possible. For this reason,

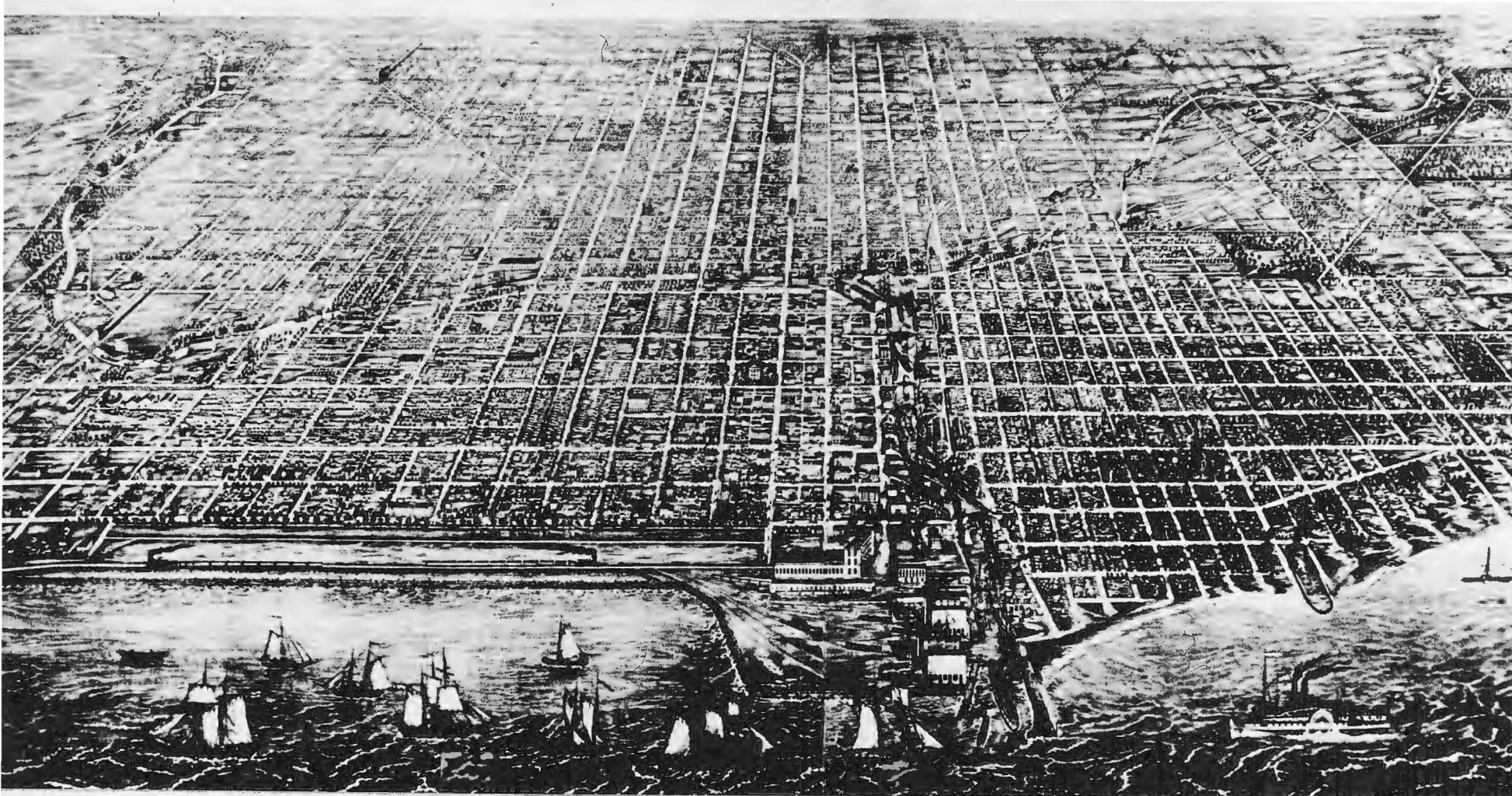


Fig. 43 "Bird's Eye View" of Chicago 1857

Fig. 44 Urban Development of Chicago 1850-71



in this section the form and condition of each of the components will be studied in more detail than in following sections in order to establish a general working knowledge of each component for following periods.

4.3.1 GENERAL MORPHOLOGY

The general morphological pattern of the city can best be understood by studying figures 43 and 44. Illustration 43 shows the overall city pattern of 1857. By 1871 the city pattern had developed by the intensification and spreading of its CBD core and the linear growth and increase in intensity of activities along its river and railroad routes. This in turn encouraged development in the inter-spaces between transport routes and extended the built up area of the city to new limits.

Figs. 43
& 44.

Satellite settlements also developed along the new transport routes resulting in the globular extensions to the city as shown in Fig. 44.

The dominant patterns of growth in this period were Southwards and Eastwards for the CBD core and fringe, and for higher income housing; Southwestwards and westwards for industry and low income housing; and to a lesser degree northwards for higher and middle income. All these growth patterns were directly related to the routes and termini of the new transport agencies.

Building heights in the outlying areas of the city were generally between one and two storeys, particularly in the low income areas of workers' housing, only increasing in height slightly along the new avenues of higher income housing, leading into the city. Building heights increased along the river edges towards the city, terminating in the large warehouses and grain elevators in the centre city area. Commercial buildings varied from 3 storeys in the fringe zone to 8 storeys in the core of the CBD, which by 1871 extended over a large area.

The grid configuration, originating from the mile square ordinance divisions, was further reinforced by outward extensions on the same pattern, the only variation from the rectangular pattern being the river course and the converging plank roads, which entered the city grid at an oblique angle as clearly illustrated in Figure 43.

The internal structure of the city's land use patterns was distorted along radial axes by the railroads into an "octopus" or "starfish" pattern, being a combination of the original concentric growth patterns as identified by Burgess, (43) and sectoral growth stimulated by the railroads, in accordance with Hoyt's hypothesis (44). Because of the lake to the East and the rectangular city grid, this star pattern is one sided (Fig. 44) with three main growth directions to the North, South and East, and with two secondary growth directions, between the main arms, towards the northwest and southwest, clearly shown on Figs. 44 and 54 (the latter being the streets and services map.)

Ref. 43
Ref. 44
Fig. 44

Fig. 54

Other nodal growth points had begun to develop beyond current city limits, such as the Union Stock Yard, which being a specialised land use component, begins to relate to some of the later urban structure theories of researchers such as McKenzie (1933) and Harris and Ullman. (45)

Ref. 45

4.3.2 STRUCTURING FORCES - CENTRIPETAL CENTRIFUGAL LINEAR NODAL

The prime structuring force operating within the city in this period remains centripetal, in that the activities of the city were still focussed towards the core functions of the city, and the population which was attracted to the city grew at a rapid rate. This population was partly immigrant, partly rural and partly urban from other cities, all drawn to the city for the employment, services or possibilities for trade and industry which it offered.

The railroads generated the first centrifugal forces which acted on the city because they stimulated the growth of satellite towns along their routes. These satellite towns rapidly began to attract the upper income residential



Fig. 45 Clarke and Randolph Street. "Newspaper Row" 1851

Fig. 46 Field Leiter & Co. State St. 1871

Fig. 47 State Street Southwards from Lake Street. 1871

Fig. 48 Wholesale District, Southwater Street 1867

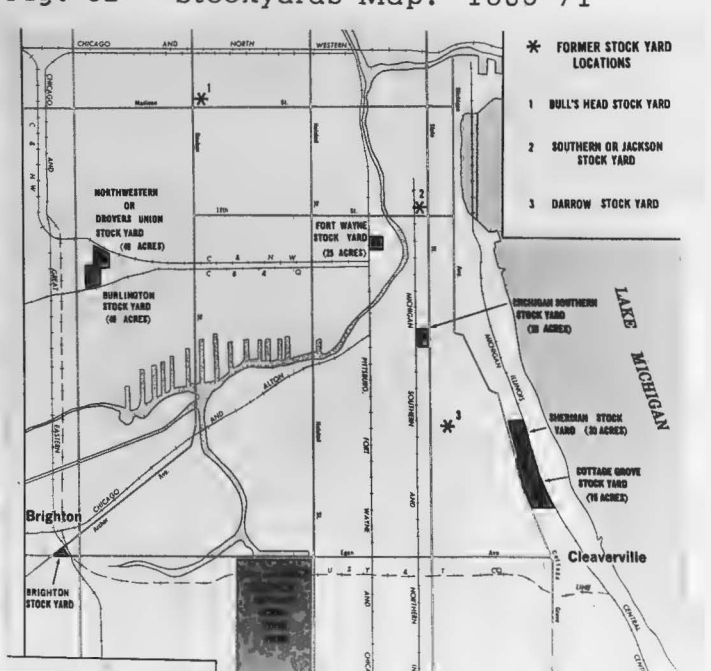
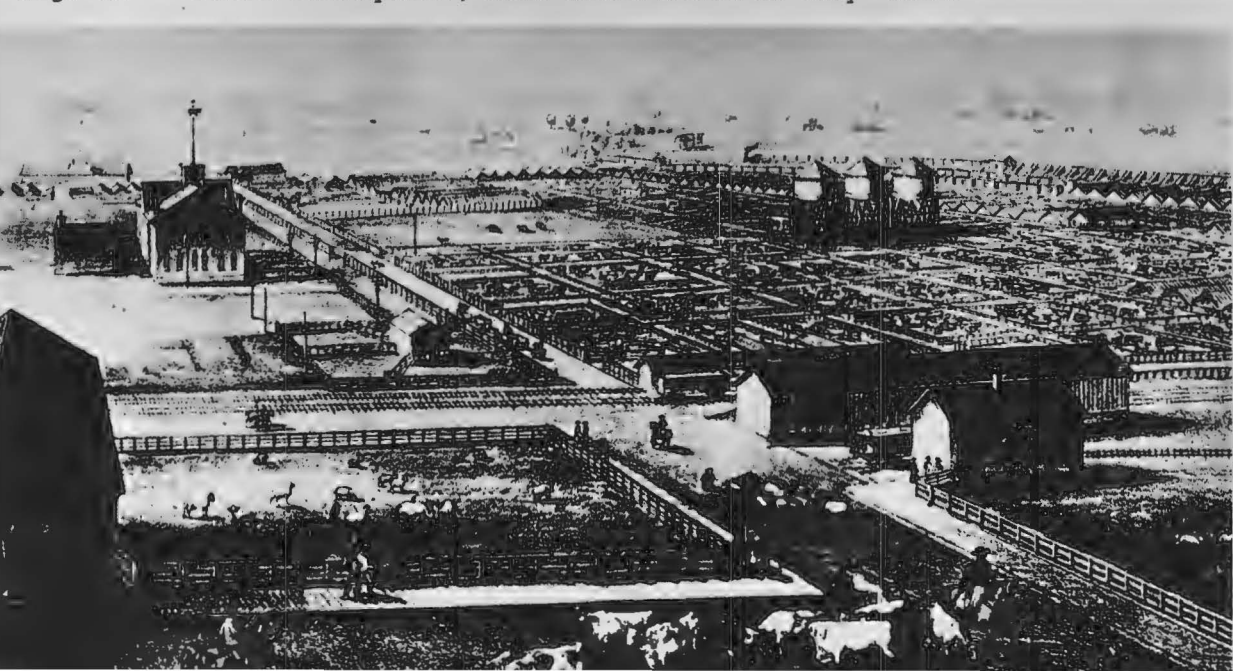


Fig. 49 Grain Elevators, Chicago River, 1860

Fig. 50 Michigan Avenue Northwards 1868

Fig. 51 Union Stockyards, Four miles south of City 1866

Fig. 52 Stockyards Map. 1865-71



groups who sought to escape the ills of the city. This was further stimulated by the introduction of horse-drawn rail car lines (Fig. 45). Another centrifugal tendency was the move towards perimeter land by space intensive activities such as the Stock Yards. This will be further studied in 4.3.4.

The railroad, and more particularly the river and canal, stimulated linear growth along their routes for industry and manufacturing. The river route which allowed ships to stop anywhere along its length, encouraged almost uninterrupted linear growth along its banks. The canal being narrower, permitted stopping only at certain points which had increased width, to allow other ships to pass. These points became small growth nodes which later developed small trading or warehousing facilities. The railroads which only permitted one-way programmed traffic, had even more strongly defined stopping points, spaced further apart generally, than those along the canal. These points generally attracted rapid growth and eventually became the growth foci of suburbs whose populations could commute to the city on the most rapid transport system available at the time.

Sub-central scale nodal points such as the stockyards, had just started to develop but were to become more prolific as more of the space intensive industries moved from their more central, earlier positions to new peripheral industrial sites, where land was cheaper, transport connections better and the effects of noxious operations on adjoining land uses were reduced by sheer distance. This is an example of centrifugal forces resulting in a nodal growth point rather than in scattered or dispersed growth.

4.3.3 THE COMMERCIAL COMPONENT

Figure 45 gives some indication of environmental conditions in the central business area of Chicago in 1848, at the beginning of this period. Figures 46, 47 and 48 show the core of the CBD retail and wholesale district in 1871. The core had extended horizontally with the move of its centre of gravity for retailing to Potter Palmer's State Street development, and southwards following the move of the Board of Trade to Washington Street. It had also extended vertically, buildings reaching 7 to 8 storeys in height by 1871 as compared with 3 and 4 storeys in 1848. (Fig. 45) This marks the beginning of a steady increase in the Total Height Index and the resultant Central Business Intensity Index of the CBD, and these trends were further stimulated by the first use of passenger elevators after the fire of 1871.

Fig. 45

Telegraphic communication had at first clustered activities such as wheat marketing, finance and banking, shipping agencies, etc. around the telegraph line terminals, but the introduction of branch line services quickly reduced the importance of close proximity to incoming lines. Retail shopping became progressively more diversified. Some of the larger firms, such as Marshall Field and Company, divided their shops into various specialised departments in the same building, thus starting a trend that resulted in the large scale department store.

Wholesale marketing was directly stimulated by the opportunities offered by the railroad and telegraph for long distance bulk ordering and selling. The wholesale component grew along South Water Street (Fig. 48) on the river bank and immediately expanded into the space vacated by the migration of the main retail activity to State Street in 1866. These wholesale trading houses were mainly built with masonry external walls, with masonry or cast iron internal columns (cast iron to save floor space) and were generally equipped with hand-pulled or steam-driven goods elevators. Large open floor spaces were essential for this activity, and structural systems of cast iron beams and columns supporting timber floors within masonry external walls, were in common use by 1871. The consequences of this form of construction were to prove disastrous in the great fire.

Fig. 48

4.3.4 THE INDUSTRIAL COMPONENT

Industry located mainly on the West and Southwest side of the city along the west banks of the South Branch River. Here land was freely available and railroad access well developed and efficient, being free from the delays

caused by river crossings. Westward expansion was rapid because industrial production diversified, particularly during the Civil War. Many of the new industries did not need canal access, being adequately served by the railroads, and these filled in the interspaces between the outward radiating railroad lines, thus intensifying land use to the West.

Some industrial development remained where it had started, in the North and Northwest. McCormick's reaper plant was one of the major North Side industries, being established there in 1847. However, after the opening of the canal the next year, very little additional industry located in the eastern sector of the North Side, almost all the additional northerly development being to the West, near the North Branch River.

The space intensive industries, particularly the more noxious types such as the Stockyards, moved outwards from their earlier, more central areas, in a series of jumps until they were eventually consolidated in a major complex in the south west (Union Stock Yard) on cheap low-lying swamp land, unsuitable for most other land uses. (Figs. 51 and 52)

Figs. 51 & 52

Figure 52 also shows the industrial development area with interlocked water and rail access, as studied previously in 4.1.2.1. It is interesting to note that the canal fingers in this development point northwards, into the heart of the Southwest area, which was so well served by hinterland railroad connections.

Most of the larger industrial structures such as the iron foundries, rolling mills, agricultural implement plants and grain elevators, were of masonry construction, some using cast iron columns internally. Smaller sheds, timber mills, etc. were mostly of timber frame construction and with boilers for steam raising widely used, fires were common.

4.3.5 THE RESIDENTIAL COMPONENT

Low income housing clustered near the employment nodes which had concentrated in the West, Southwest and Northwest. Timber frame housing based on Balloon construction principles was almost universal in the lowest income bracket of the population. Physical comfort standards were low, the houses having little insulation against summer heat or winter sub-zero conditions. Very few of the low income houses had any gas heating, sewerage systems, water reticulation or adequate roads. (Fig. 54 indicates the lack of services in these areas) The lack of services led to outbreaks of disease, and generally downgraded environmental conditions. With wood and coal as cooking and heating fuels, fires were commonplace and were difficult to control without adequate water reticulation.

Vice and "slum" areas developed in several places and were only removed when the land came into demand for a "higher and better" land use with the outward expansion of the central zones of the city. When this happened the houses were demolished and the occupants moved to another area further out where usually the cycle repeated itself.

The houses were extremely tightly packed, sometimes two deep on a lot. (Refer Fig. 96 in next section for comparison of ground area occupied by high and low income groups in two sectors of the city in 1886) This accounted for some very high densities, particularly as families in this income bracket were often large.

The people in slightly higher income groups preferred to locate further away from the industrial employment agencies and the lowest income housing, living in areas with better streets and services, with houses less closely packed, but still of timber construction. The horse drawn omnibus and rail cars gave this group a wider range of locational choice for living, as fares were reasonably low.

The higher income population groups located mainly in the South and North areas of the city, some distance away from the centre, in houses of timber or masonry, but on larger lots, facing onto better made streets, often "planked", sometimes with gas lighting and generally not far from an omnibus or rail car line. Sewerage and water services were installed in most of these areas. (Fig. 54)

Fig. 54



Fig. 53 Chicago, Streets, railroads, railcars, parks, 1871

Fig. 55 Chicago, Land Value of Present City Limits, 1857

MAP OF CHICAGO
SHOWING
SEWERS, PAVED STREETS AND BRIDGES
1873

PREPARED BY HOMER HOYT FROM MAP OF SEWERAGE SYSTEM IN CHICAGO TRIBUNE - JUNE 18, 1873
AND FROM ANDREAS HISTORY OF CHICAGO VOL. II PP 57-64, VOL. III PP 129-130

LEGEND

- SEWERS
- STREETS PAVED WITH WOODEN BLOCKS OR GRAVEL
- BRIDGES
- UNPAVED STREETS
- TUNNELS

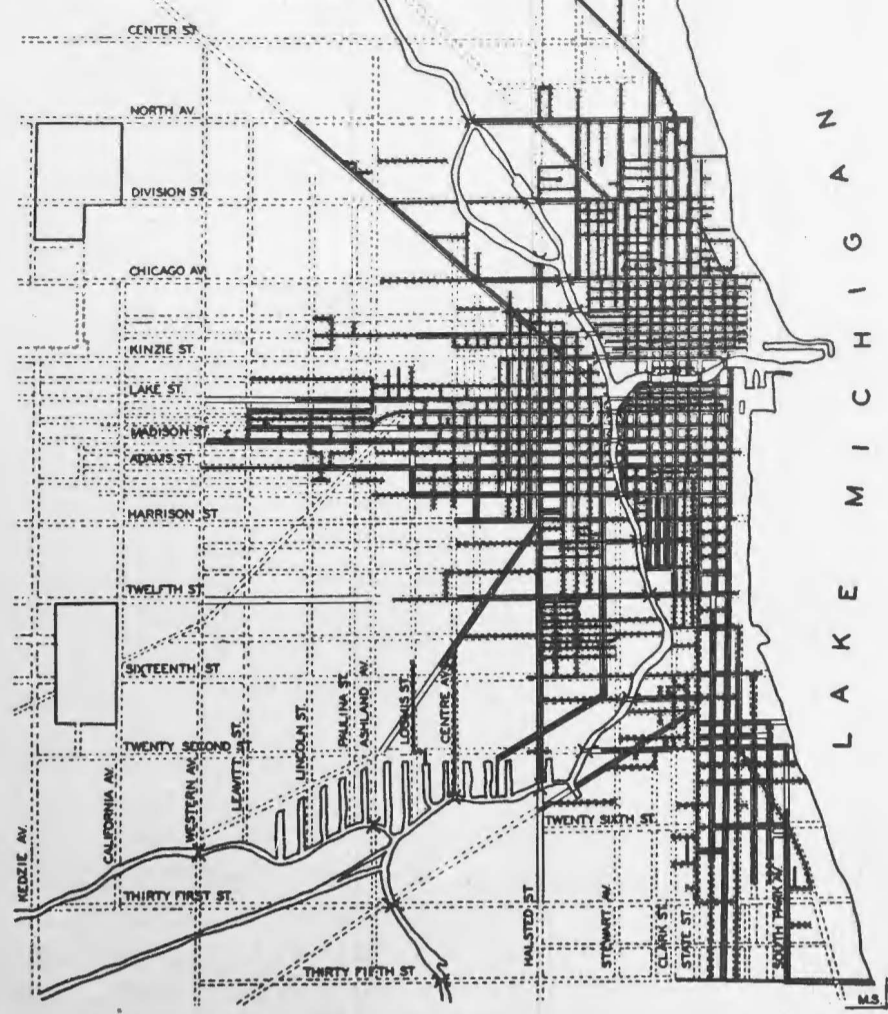


Fig. 16

Fig. 54 Chicago, Streets, Bridges, Sewers, 1873

Fig. 56 Chicago, CBD Land Values 1830-73

MAP OF CHICAGO
-SHOWING-
LAND VALUES - 1857

AVERAGE VALUES FOR EACH SQUARE MILE IN DOLLARS PER ACRE
SOURCE: ACTUAL SALES

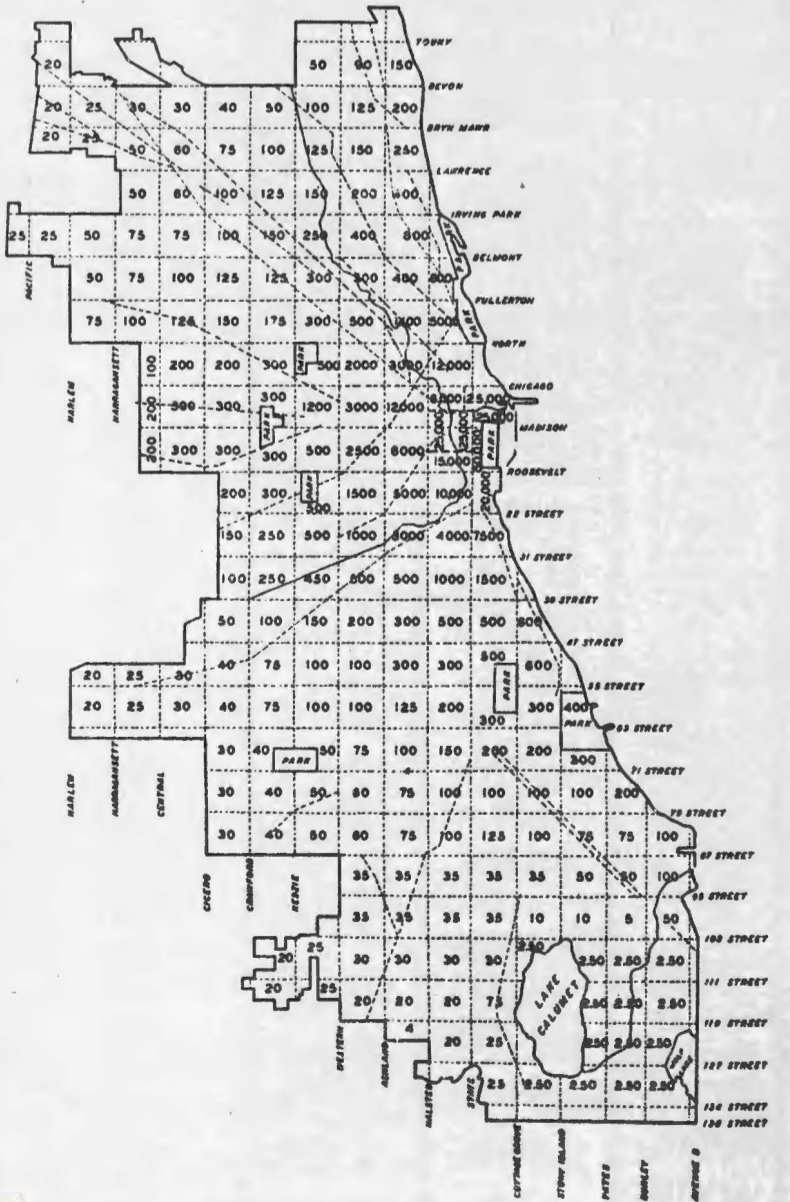


FIG. 13

MAPS OF THE CENTRAL BUSINESS DISTRICT OF CHICAGO
-SHOWING-
LAND VALUES FOR THE YEARS 1830, 1836, 1856, 1873

IN DOLLARS FOR AN AVERAGE FRONT FOOT IN EACH BLOCK INCLUDING INSIDE AND CORNER LOTS WITH A DEPTH OF HALF A BLOCK

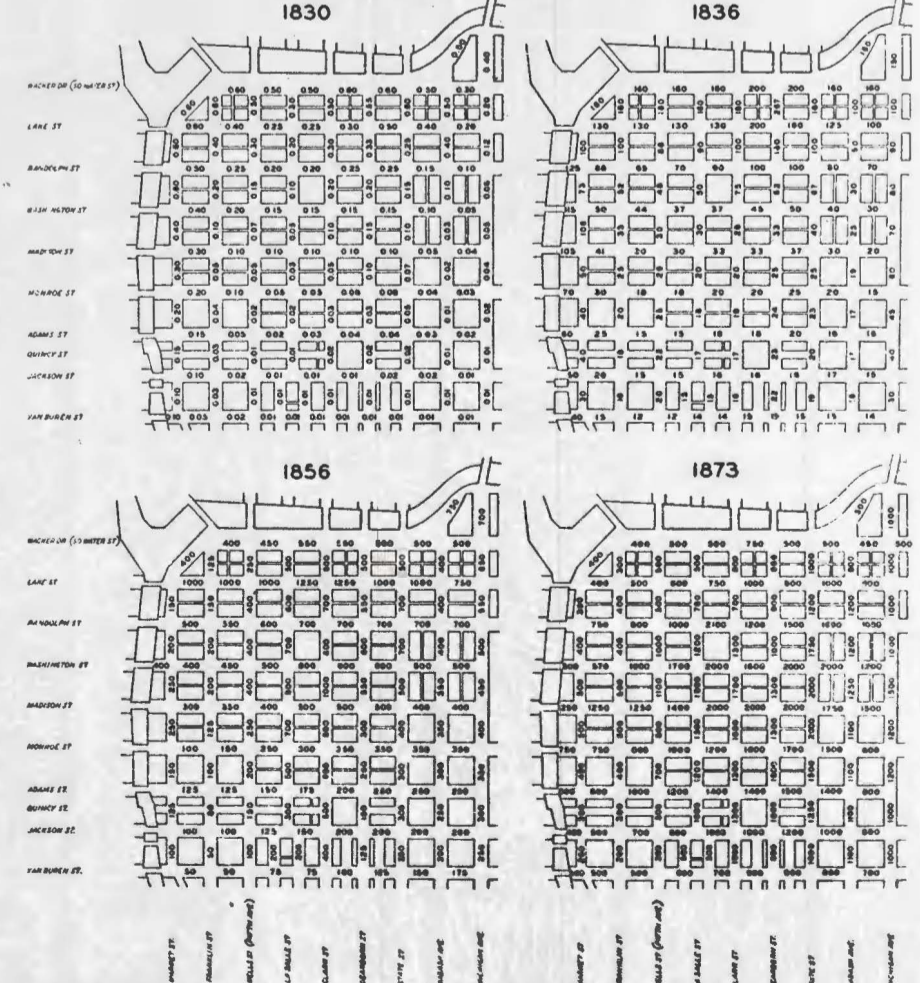


FIG. 73

The highest income housing areas were in select pockets in the North and South sides, more particularly along the newly made Avenues, such as Michigan Avenue in the South. These were tree planted streets with elegant houses, on large lots, or with rows of town houses, looking Eastwards to the lake (across the incoming Illinois Central line as seen in Fig. 52).

Fig. 52

Several new high income housing areas developed in the vicinity of the newly built recreation parks as shown in Figure 53, and in some of the newly formed residential suburbs which grew up along the new railroad and horse car lines, such as Evanston in the North, River Forrest and Oak Park in the West, and Kenwood and Hyde Park in the South. (46) (Fig. 44)

Fig. 53

Ref. 46

The earlier patterns of racial, ethnic or nationality grouping continued in this period as incoming immigrants found settlement easier, happier and more secure in areas where a home language, religion or customs were shared with other people. Bridgeport was still predominantly Irish, German immigrants clustered in the Near North Side sector, Poles in the northwest sector, Scandinavians in the North. Newer arrivals often bought or rented homes vacated by others of the same country of origin who had increased their income and had moved to other higher income areas.

4.3.6 COMMUNITY FACILITIES

Primary educational facilities were scattered through the residential fabric of the early city, in timber frame structures in the lower income areas in timber or masonry structures in the higher income areas. There were very few schools in the lower income areas, provision increasing roughly in proportion to increased income level. However by 1871 the city had established a public school system which was regarded as one of the best in the country. (47)

Ref. 47

Churches had been built continuously in the city from 1833 onwards, most of those in the lower income areas being of timber construction, others in higher income areas being of masonry construction.

Early cultural and recreational facilities were restricted almost entirely to the upper income areas. This being one of the reasons why, when parks were established, they were placed near rail access points so that a maximum number of the lower income groups could have easy access to them.

By 1871, however, several libraries had been built, the Chicago Historical Society had been in existence for 15 years, and the first University of Chicago had been opened (1859).

4.3.7 RECREATION AND OPEN SPACE FACILITIES

Little provision had been made for parks and public recreation facilities before 1866. The land in and around the city was being swallowed up at such a rate for development that it took forceful legislation to assemble the land required, when it was decided in 1866 to establish a green belt of parks and boulevards to encircle the built up area of the city (claimed to have been influenced by Hausmann's park and boulevard system in Paris). At this time only two major parks existed in the city, one being Lincoln Park on the north lake shore, the other, Central Park, of fifteen acres extent, situated five miles due west of the CBD. By 1869, land had been acquired for the South Park System and Humboldt and Douglas Parks. (48) (Fig. 53)

Fig. 53

Ref. 48

Because it made little sense to locate the new parks in areas inaccessible to the general public, all the parks, except Lincoln Park, which was located on the horse car line, were laid out near main or commuter railroad lines. The park development was given priority over other community facilities. "The Parks first, and museums and libraries will follow", stated one civic leader of this time.

By 1871 work on the parks was well advanced and land values in the surrounding areas had risen rapidly, being greatly in demand for high income residential development, particularly as the related areas were so well served by rail transport.

4.4 SUMMARY AND CONCLUSIONS

At no period before or since has the growth of Chicago been more directly affected by developments in technology than in this study period from 1848 to 1871.

The completion of the canal immediately stimulated growth in regional and country wide transportation.

More agricultural exports passed through Chicago.
 More consumer goods were imported through Chicago to its hinterland.
 Grain handling elevators located on the river banks of the centre city.
 Industries grew up on the West Side and extended 14 miles downriver.
 Wholesale trading points developed along the canal route.
 Industrial areas served by a series of canal "sidings" were developed.
 Land values for river and canal bank lots increased rapidly.
 Water traffic increased rapidly.

The completion of the canal attracted railroads which within six years had radically changed the nature of the city.

Ten major railroads had lines radiating out from the city.
 Termini were built in the city.
 Immigrant passengers streamed into and through the city.
 Incoming lines initiated daily commuter services.
 Suburbs developed at stopping points along the lines.
 Residential land values were increased by transport accessibility.
 Secondary rail car transport systems were introduced into the city.
 Agricultural exports were carried to Chicago by the railroads which carried the consumer goods back to the hinterland.
 Industries and manufacturing such as steel mills, rail car works, bridge building, etc., were stimulated by the railroads.
 Other industries such as stockyards, tanneries, clothing factories, etc. were served by the railroads.
 Land values in perimeter zones 1 to 4 miles from the CBD increased.
 Recreational parks were located relative to railroad accessibility.
 Wholesale marketing systems were stimulated by railroad transportation.

The telegraph afforded Chicago a world wide communications linkage.
 Import and export marketing benefited from world wide connections.
 Trade and finance benefited and clustered around the termini.
 Railroad services could be better controlled.
 News travelled faster than ever before.

Mechanization affected every industry to a greater or lesser extent.
 Steam power was widely used to replace manual labour.
 Agricultural processes were mechanised to produce greater crops.
 Meat packing developed as a major industry with mechanization.
 By-products of the meat processing industry diversified.
 Leather goods became standardized for mass production, as did clothing, resulting in mass marketing of cheaper, better products.

Services to the city were greatly improved.
 Street levels were raised, buildings were jacked out of the mud.
 Sewers were installed in a fully developed system.
 The river was dredged to permit "reverse-flow" flushing of pollutants.
 A new water supply system was installed involving major engineering achievements.
 Gas street lighting was progressively installed.
 More bridges were built over the river.
 Two tunnels were built under the river.
 Road surfaces were improved by "planking" and then by paving.
 Improved services and transport routes increased land values causing major changes in urban component structure.

Construction processes were improved and rationalised.
 Inexpensive mass produced, easily erected, timber housing was manufactured and exported across the country.
 Passenger elevators increased the heights of commercial structures in the city centre.
 Cast iron internal framing was used in warehouses and other commercial structures to save floor area.
 Tunnelling and foundation techniques were developed for local conditions.
 Invention and discovery was active in all fields.

All these technological factors had direct or indirect effects on the form and condition of every component of the urban environment.

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5 Chicago 1871 - 93, The Fire and Rebuilding

5.1 GENERATIVE FACTORS

Chicago's growth from 1848 to 1871 had been so dynamic that many people believed that if prevailing growth rates continued, it would only be a matter of time before the city would outstrip New York to become the largest and most important city in America.

In four decades the city had grown from swamps and marshland to become the largest wheat, timber and livestock trading centre of the world, served by the largest inland waterway and railroad systems in the world.

Chicago had achieved in the final twenty years of its life up to 1871 what the larger Eastern Seaboard cities had taken over two hundred years to achieve, and in many fields, Chicago had far surpassed them.

The disastrous fire which struck Chicago in late 1871 was a major setback to growth, and caused the years immediately subsequent to it to be spent rebuilding the structures, and replenishing the resources of the city, before normal growth rates could continue.

The fact that the city did recover, rebuild and continue its development, at even more rapid rates, demonstrates the remarkable durability and resilience of its productive base, of manufacturing, trading and transportation.

By 1893 the city could boast a population of over one million people, world leadership in many manufacturing processes, greatly increased trading activity conducted in one of the most intensely developed central business districts in the world which was served by one of the most efficient rapid transit systems in the world.

Chicago was by that time the second largest city in America. Few would have thought this resurgence possible when looking at the smoking ruins of the city after one of the most disastrous fires in urban history.

Technology played as great a part in rebuilding the city in this period as it had in developing the city in the previous period. The only difference was that technological development in the city was a well established ongoing process in this period, whereas it had been imposed on virtually untouched ground when it was introduced to the city in full force in 1848.

While the impact of technology in the first period was exerted mainly by regional transportation developments, the impact in the period from the time of the fire to 1893, was felt more in the core of the city, where high rise buildings and rapid transit greatly intensified urban activities and changed urban form.

Because most of these more radical technological developments came towards the end of the period, the normal documentation sequence will be followed (i.e. Generative Factors, Technological Factors and Resultant Pattern).

However, because of the degree of interdependence of most growth factors in this period of redevelopment, relocation and change after the fire, the first section (General Growth Factors) will be expanded beyond normal limits in order to examine growth and change in all urban activities in an inter-related way. This should re-establish a comprehensive working base for all following study periods.

Before analysing the factors of urban and technological development in detail, it would be as well to outline the overall pattern of events which occurred during this period.

In the first phase after the fire, rebuilding started immediately and continued at fever pitch until mid-1873.

In the second half of 1873, construction and property speculation reduced in intensity, and thereafter declined rapidly in accordance with general economic trends, which reached their lowest points in 1877, thus following almost exactly the twenty yearly cyclic trends of economic activity in previous periods.



Fig. 57 Fire Damage

Fig. 58 Fire Damage

Fig. 59 Rebuilding of the C.B.D. 1872

Fig. 60 Area Damaged by Fire 1871

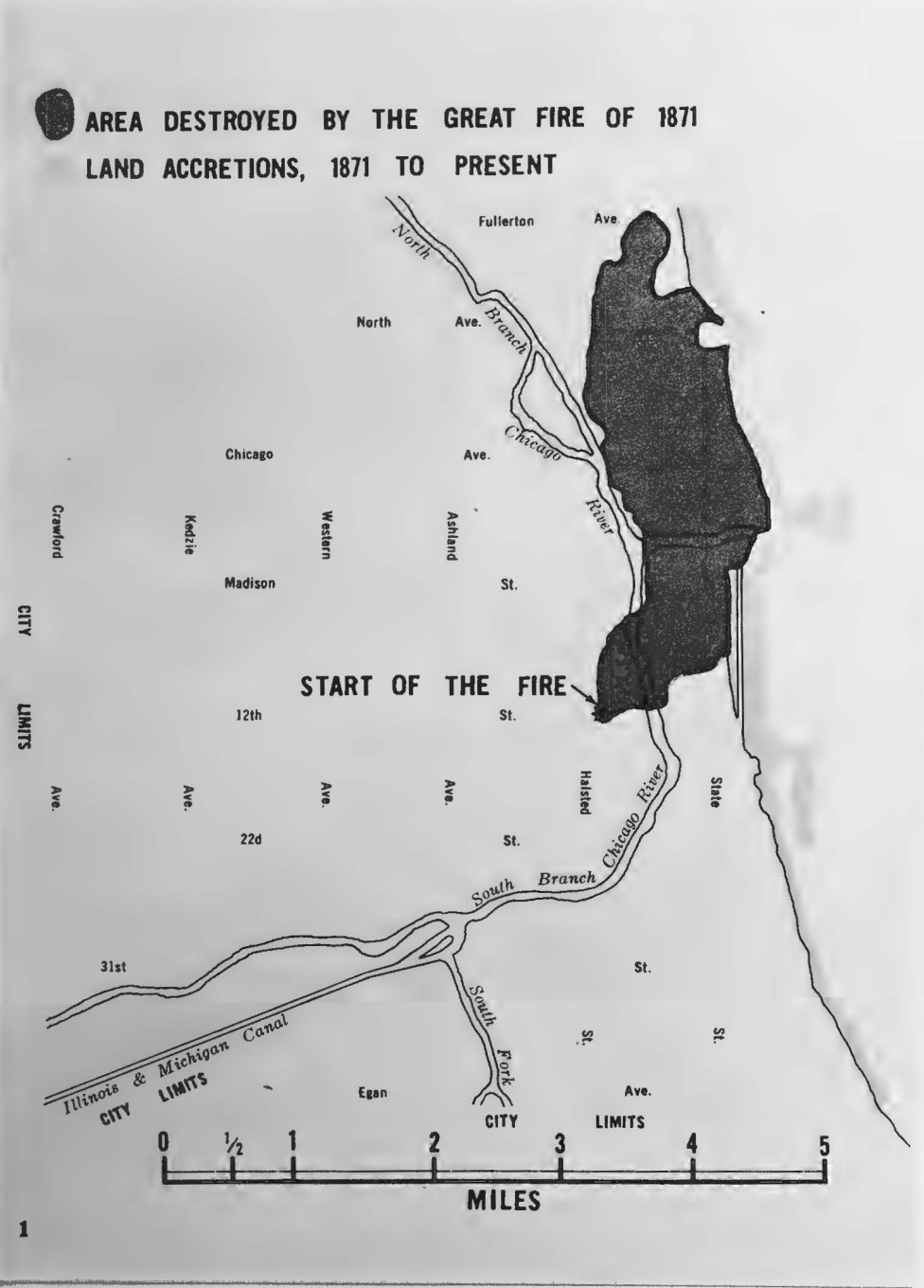


Fig. 61 Rebuilt Chicago River Area 1875

Fig. 63 Exhibition Building 1873

Fig. 62 Entrance to Chicago River 1880



A third phase of slow and hesitant financial recovery followed. Between 1882 and 1884 recovery was well advanced but fell back slightly between 1884 and 1886.

Thereafter in the fourth phase, growth rates in all urban activities increased very rapidly until a peak was reached in 1892, prior to the opening of the World Fair which was held in Chicago the following year.

The study period ends in 1893 on a downward trend, after the closing of the Fair. Although from many points of view the Fair was a great success, it did not have the long lasting effect of boosting urban growth to new heights, as had been anticipated.

However, the Fair should not be blamed for all the financial difficulties which followed. A countrywide recession had developed and this, in combination with local problems, continued to depress commercial activity in Chicago until a slow revival occurred just before the turn of the century.

5.1.1 GENERAL GROWTH FACTORS

5.1.1.1 THE FIRE OF 1871

The Great Fire of Chicago started in a small timber shed in the South of the city, on the West side of the South Branch River, approximately twelve streets South of the CBD, on 9th October, 1871. (Fig. 60)

Fig. 60

There had been several serious fires in the city previously but the combination of a hot dry summer, a gale force southwest wind and acres of bone dry timber houses downwind, caused destruction of an unprecedented scale in urban history. The fire department who were fatigued from a serious fire on the previous day, could not get to the fire quickly enough and within minutes it was completely beyond control. The fire burned for three days spreading with hurricane force through the West Side timber buildings in its immediate path, jumping across the South Branch River, completely razing the buildings of the CBD, spreading across the Chicago River and almost completely destroying the whole of the North Side between the Lake and North Branch River. Eventually it burnt itself out in the graveyards of Lincoln Park, on the North Lake shore. (Fig. 60)

Fig. 60

Destruction was of a cataclysmic scale. The fire had swept across 2 100 acres of city land, had destroyed 17 500 of the city's 60 000 buildings, including all the largest and most valuable structures of the CBD and the North Side, rendered 105 000 people homeless, killed at least 250 people and caused general damage valued at approximately 240 million dollars. (1) (Figs. 57, 58)

Ref. 1
Figs. 57, 58

The South Side residential areas up to Twelfth Street in the West and as high as Harrison Street on the East side, were unaffected by the fire. The major part of the West Side industrial area and all the residential areas to the west of the North and South river branches were also unaffected. This was the operative core from which the city had to redevelop, if it was to survive.

So dynamic was the spirit of the people of Chicago that even before the ashes had cooled, shopkeepers had started to sell their wares, mostly clothing, food and drink, to the homeless, from handcarts or waggons. The West and South sides afforded temporary shelter to the homeless. Temporary business premises were set up in West Side warehouses, in South Side private houses and in the park on the lakefront to the east of Michigan Avenue. Within the first week a start was made on clearing the rubble, restoring the services, remaking the wood block roads, clearing the rivers of collapsed bridges and burnt out hulks, and clearing the foundations of the original buildings so that reconstruction could be started. By the end of the week 5 500 temporary structures had been erected and work started on 200 permanent buildings. (2)

Ref. 2

The sceptics from rival cities who had thought or hoped that Chicago would never regain its former prominence, were swept aside as the city rapidly restored trade and manufacturing activity to former levels and started on the vast rebuilding programme.

5.1.1.2 REPERCUSSIONS OF THE FIRE

Owners of land around the fringe of the burnt out area of the city, particularly on the South and West, did all in their power to retain the business and trading activity which had been displaced into their areas by the fire. However, within the first year after the fire the original land use patterns of the Central Business area and the North Side had been firmly re-established, with some noticeable differences. These were, firstly, the removal of almost all of the residential occupancy from the CBD which had previously involved some 27 000 people, or a tenth of the total population.(3)

Ref. 3

Secondly, the previous timber shack area in the Southwest was not permitted to be rebuilt with timber houses, being upgraded to a higher value land use of "Fringe" type commercial and industrial activity. Thirdly, most of the industries which had been located on the North Side along the river, such as the McCormick reaper works, moved to the west side industrial areas.

By the end of 1872, the CBD had been almost fully rebuilt, mainly with four and five storey buildings and a few higher structures reaching a maximum of eight storeys. (fig. 59) The various components such as banking, retail and wholesale trade, had, with minor adjustments, relocated in their previous positions.

Fig. 59

A major repercussion of the fire was the prohibition of timber construction within certain specified limits of the city. This resulted in a concentration of timber houses immediately outside the restricted area, covering an area some seven miles long and one mile wide, in a radial belt around the west side of the city. This zone developed into the prototype of Burgess' "Zone 3 of the workingmen's homes" in his early ecological studies of Chicago and other cities. (5)

Ref. 5

Because of high wages, caused by the construction boom after the fire, workers' incomes were at least twice as high as they had been before the fire, so that most of these timber houses were privately owned. The inner edge of the housing area ran along the outer edge of the industrial belt with a result that because of industrial pollution, the land values, rents and consequently, income levels were lowest along the areas of contact with industry, and graded upwards as distance from the industries increased. This gave rise to a continual change of occupancy in this zone. Penniless immigrants often started out their new lives in this zone, and if their incomes increased, moved outwards towards the better living areas of the higher income groups, further westwards, towards the open country. (6)

Ref. 6

The western area absorbed most of the people displaced from the centre city and North side; the West side population increasing from 160 000 before the fire to 214 000 in 1872. (7) The lower income groups located closer to the industries along the river branches, while the higher income groups located further out. The highest income groups from the North side relocated in the South Side, either filling in the gaps along the more fashionable avenues, or if transport costs could be met, they located in the new suburbs which were developing along the rail lines further out from the previously developed areas in both the South and West.

Ref. 7

All the inner city passenger transport terminals had been destroyed in the fire and were soon rebuilt on a grand scale. Most of the West Side freight terminals had been outside the range of the fire and were able to continue operations without disruption. (8)

Ref. 8

Within two years of the fire, all the warehouses, sawmills, timber yards, grain elevators and other river oriented structures which had been destroyed in the fire, were rebuilt and fully operative. (Figs. 61, 62) The disadvantage of delays in crossing the river branches, encouraged most of the displaced manufacturing and bulk handling activities to relocate on the West Side where transportation was being continuously expanded. (9)

Figs. 61, 62

Ref. 9

5.1.1.3 THE PEAK OF ECONOMIC ACTIVITY 1873

Several factors acting in combination resulted in great economic activity and prosperity in the three years immediately after the fire.

Fig. 64 Chicago - Urban Development 1893



Fig. 65 Chicago - Regional Railroads 1893

Firstly, there had been a marked upward trend in trade, industry, construction and land values in the years immediately before the fire.

Secondly the manufacturing areas, stockyards, iron and steel industries and regional railroads had not been materially affected by the fire and all increased in activity rapidly after the fire. This meant that the productive base of the city suffered no serious disruption.

Thirdly, the investment potential of Chicago had changed little as a result of the fire. The city's locational advantages, transportation systems, manufacturing output, wholesale markets and wheat trading markets were totally unaffected by the fire.

Fourthly, the immigrants still poured into the city, and the region, generating internal consumer markets for housing, clothing, food and other basic requirements for everyday life. (10)

Ref. 10

Because of these factors, investment finance poured into the city, particularly from the East coast, making building loans freely available, thus creating a building boom. Construction output was more than doubled in one year after the fire. Chicago's building industry prospered as construction costs increased because of the sudden demand. Wages were doubled and workers from other cities were brought into Chicago by local contractors in order to meet contractual obligations, or were attracted to the city to share in the spoils of what had become a highly inflated market.

Property development and speculation in land went hand in hand. All income groups from bankers to bricklayers participated in the speculation fever. The new buildings were built on loan money, at high interest and at high construction costs, thus forcing rentals up, which, providing tenants could be found, encouraged further speculation.

Development projects such as the harbour and industrial facilities established in the Lake Calumet area, twelve miles South of Chicago on the lake front, stimulated the development of peripheral land and further speculation (Fig. 64) Farms were subdivided and put up for sale as prime town lots. Enterprising real estate salesmen organised selling excursions for trainloads of eager buyers who, with crowd reaction, stampeded to sign vague "half-honest" sales agreements for land which was often not clearly demarcated, or in some cases not even properly surveyed. (11)

Fig. 64

Ref. 11

Speculation was closely tied to new or proposed railroad and horse car lines, giving rise to the spread of earlier suburban developments or the growth of new settlement areas along new transport routes. Speculation was so widespread and general in all income groups that there were sufficient urban lots to accommodate more than a million inhabitants, whereas the city's population was just over 380 000 by the end of 1873.

Chicago's city fathers were so proud of their rebuilding achievements that in 1872 they constructed a large glass and iron exhibition hall and held an 18 day fair to show the world their achievements since the fire. (fig. 63) The exhibition opened on September 18 1873, unknowingly marking the end of the reconstruction boom and the beginning of a period of economic depression. (12)

Fig. 63

Ref. 12)

5.1.1.4 A PERIOD OF DEPRESSION 1873 - 1877

Speculative activity began to level off in the second half of 1873 and faltered when cash resources tightened towards the end of the year. Hoyt states that a dangerous climate had developed in real estate and general financial activities in Chicago at this time.

This he believes was caused by factors such as: 1. Municipal extravagance in overproviding services such as paved streets, gas lighting, sewers and water reticulation where these were not warranted, 2. Over subdivision of land, 3. Small downpayments and easy buying terms for land, 4. Certain malpractices in urban affairs, and finally, that CBD buildings were financed at excessively high loan rates and constructed at inflated costs, making rentals dangerously high. (13)

Ref. 13

The bubble burst when the New York and local stockmarkets slumped following the collapse of one of New York's major finance houses in September 1873. Wages dropped, particularly for construction workers, when the building boom came to a rapid end, CBD rents dropped, profits tumbled, speculators found increasing difficulty in meeting payments, and real estate activity halted abruptly, although land values did not fall immediately.

The downward trend in economic activity continued in Chicago as in the whole of America, and became progressively worse until 1877 when land values had fallen to 1865-1867 levels, construction was almost at a standstill, unemployment was widespread and over 20 local banks had failed in the four year period since 1871. (14)

Ref. 14

Serious labour disputes and riots occurred in Chicago and throughout America at this time. Many large and small land owners and speculators went insolvent to avoid personal judgements. Money was so tight and interest in land so apathetic that generally only the mortgage holders attended the liquidation sales, buying in the properties at ridiculous values. Outlying land declined more in value than the CBD areas but rentals generally dropped by 20 to 30 per cent in the CBD causing the property developers who had borrowed money at high interest rates to cut their profits, if they were fortunate, or to succumb to bankruptcy if they were less fortunate.

The very bottom of depression was reached in 1877 when the largest savings bank in Chicago, the "Columbian and Bee Hive" failed. At this stage it was estimated that average land values in Chicago had dropped back to just above half of their 1873 levels. It was of little comfort to the real estate developers of Chicago to know that the depression in land was similar throughout most parts of the United States and very much worse in New York, where land values around Central Park had been even more adversely affected.

5.1.1.5 SLOW AND HESITANT RECOVERY 1878 - 1888

A turning point was reached in 1878-9 when a combination of several factors began to inject new life into Chicago's economic activity. These were:

1. Improved agricultural crops.
 2. Rapid railroad expansion throughout America, which boosted manufacturing.
 3. Greatly increased immigration into America, which increased settlement in the city and the numbers of transit passengers passing through the city.
 4. Increased local manufacturing and retail activity.
- (16)

Ref. 16

As production increased, employment improved and financial liquidity returned, enabling a period of slow expansion and recovery to begin.

Chicago was well placed for the marketing of increased crops. The city was also equipped to make the steel for the railroad lines which the country needed for increasing railroad mileage by 50% between 1879 to 1883. During this time Chicago produced more steel rails than any other city in America. The city's own regional railroad network benefited from this spate of activity in that seven new trunk lines were added to the local system between 1880-82. The meat packing industries, which had not been seriously affected by the depression in any event, now grew rapidly, particularly with the invention of refrigerated railroad cars for meat transport on a nationwide basis. Bank clearings as an indicator of economic activity, increased from \$1000 Million to \$2500 Million between 1878-81.

Several other factors, which were generated within the city itself, assisted in this recovery. These can be categorised under five main headings, as follows:

SOUTH CHICAGO INDUSTRIAL DEVELOPMENTS

South Chicago developments such as the Calumet harbour project, completed in 1873, attracted some major heavy industries to the area. (Circled on Fig. 64) The Baltimore and Ohio workshops and two steel mills were the most important of the early industries established there. The development of this South Side industrial nucleus attracted further trunk line railroad construction and prompted the first plans for a circumferential "Belt" line, to interconnect the incoming trunk lines.

Fig. 64

The first Belt line proposals was planned to start in the Calumet region and to swing around the city in an arc of approximately twelve to fifteen miles in radius from the CBD. Although this early plan came to nothing, other belt line plans followed and further boosted the potential of the outer South Side for railroad and heavy industrial development.

The inner Belt line was eventually built in 1886.

The U.S. Rolling Stock Company established works at Hagemisch in 1883, increasing the population of the Calumet area from 2000 in 1880 to 16 000 in 1883. Further expansion in the area occurred when Pullman established his railroad car shop and model industrial town in 1883. (17)

Ref. 17

By this time four new South Side Trunk lines had been built into the city area, gaining access to a new CBD terminal through one shared right of way and terminal building. The outer Belt Line was commenced one year after the inner line, in 1887. These two Belt lines were a vitally important structuring force in the development of Chicago from this period onwards. (Fig. 65)

Fig. 65

The Calumet region was only one of the peripheral areas which grew rapidly during the period from 1880 to 1890 as railroad trunk lines and horse drawn rail car lines continued to extend into and out of the city.

Most of this development was on the South Side where regional transport had better access into the city than from the West or North (Because of the river crossing problems). The West also had better developed suburban rail services. The services were further improved when the State Street/Cottage Grove horse car line was replaced with cable drawn trams which virtually doubled transport speeds.

These highly convenient transport routes attracted more intensive residential developments such as two and three storey row or town houses and may even have encouraged the prevailing development of 4 to 5 storey apartment buildings which had their origins in Chicago in this period. The more intensive residential land uses along these routes in turn encouraged local retail shops to locate at focal points along the routes, usually at the meeting points of cable car and horse car or railroad lines. These developments have direct parallels in contemporary decentralised retail shopping developments which are usually related to points of confluence of transportation systems. (18)

Ref. 18

SOUTH SIDE APARTMENT DEVELOPMENTS

The first development of apartment buildings led to what was then called "Flat Fever". Flats which offered freedom from maintenance of gardens, buildings, heating plants, garbage removal, etc. had a great appeal for some family types and were an immediate attraction for investment and speculation. (19)

Ref. 19

SOUTH SIDE BOULEVARDS

One final development in residential land use was the conversion of some of the wider, more fashionable South Side streets into tree-lined boulevards. (Again as influenced by Hausmann's Paris boulevard system) Michigan Avenue was the most important of the new boulevards and attracted the industrial tycoons who built large houses, or in some cases, marble faced palaces, in certain of the more select areas along its length. (20) (Fig. 95)

Ref. 20
Fig. 95

THE NORTH SIDE

The North Side, which because of poor transport connections had lagged far behind in rebuilding, began in this period slowly to attract more residential development, particularly along the lake shore line which rapidly became a high income area in the period after 1890. The move of the higher income groups to the North Side was to some degree caused by the fact that Potter Palmer (the developer of State Street after the Civil War) built a vast, \$250 000 "castle" on the North Side in 1884.

During this period of revival of peripheral land the centre city began to respond to certain influences which caused a slow revitalization of its growth.

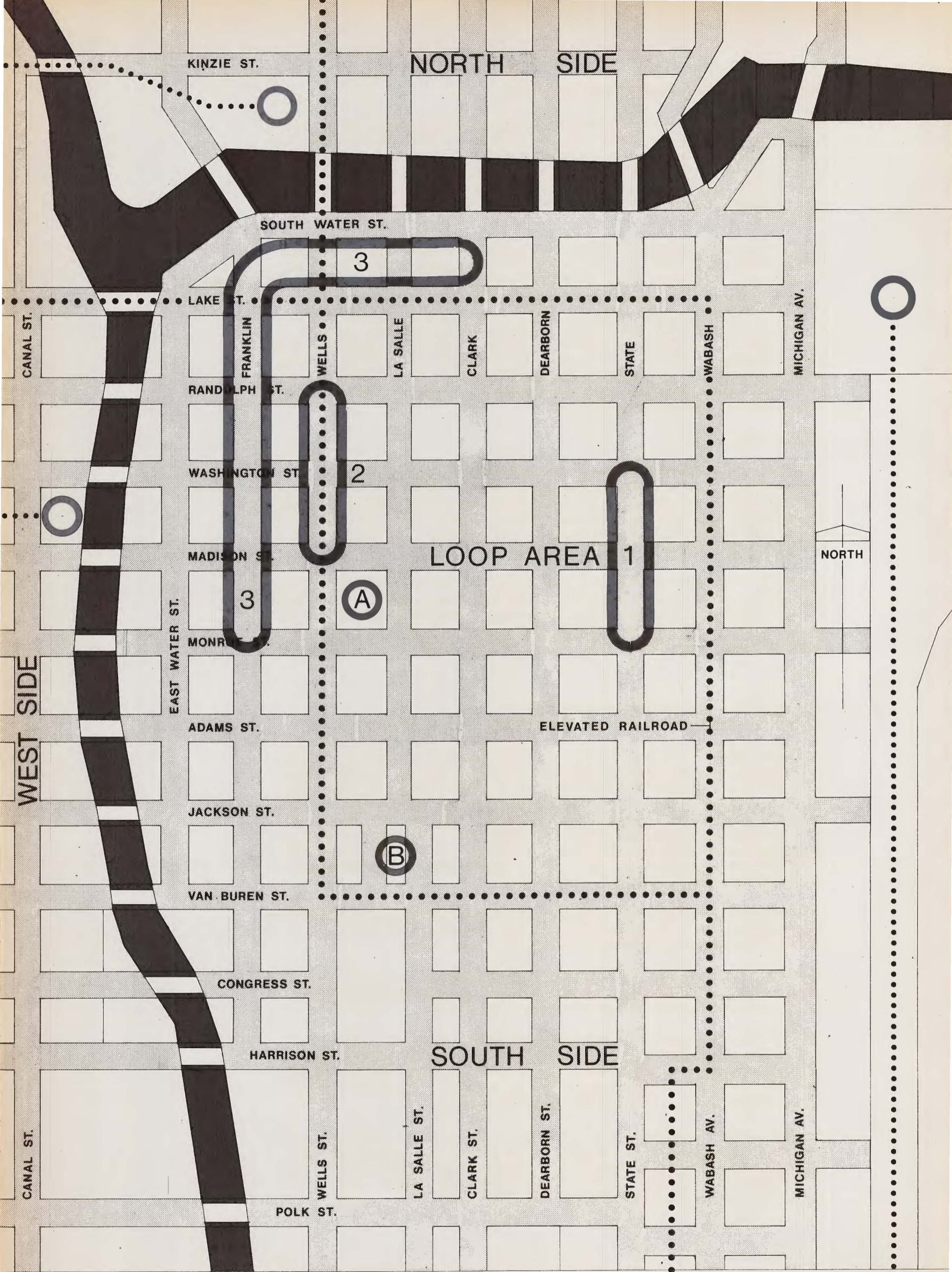


Fig. 66 Chicago Central City Area 1871-93

CENTRAL BUSINESS DISTRICT REVITALIZATION

Money hoarded by the more fortunate financiers and industrialists who were less hard hit by the depression, began to be invested in the development of CBD properties, which had been bought at bargain prices at the bottom of the depression. Many of these properties had been hurriedly rebuilt to four or five storey heights, after the fire, and because of their locational advantages, became sound investments for more intensive development, when the economy became more bouyant after 1880.

This CBD building activity was partly as a result of the rebuilding of the Board of Trade building in 1881, in a new location at the junction of Jackson and La Salle Streets, four blocks to the South of its original location. (21) (From point A to B on Fig. 66) This caused many associated trade and financial institutions to follow the Board of Trade to its new location and to construct new, larger buildings. Some of these buildings reached nine storeys in height and were served with the new electrically driven elevators. Other firms rented offices in similar buildings, built by speculators on the "bargain" land referred to earlier. Construction in this area continued from 1883 to 1889, by which time other areas of the CBD were following the trend and building even higher structures, using new systems of steel skeleton framing.

Ref. 21
Fig. 66

A SHORT DECLINE

As can be seen from Graphs 7 and 10 (Pages 57 and 65) trading, manufacturing and construction suffered temporary setbacks between 1884 and 1886. This was consistent with a general business recession caused by poor markets in metals, manufacturing and retail and wholesale trading. But the decline was shortlived and by 1887 and 1888 the upward trend was re-established. Land values had not been seriously affected by this short term setback. (22)

Graphs 7
& 10

Ref. 22

The focus of countrywide interest in land speculation moved from Chicago during this period, to Los Angeles and Seattle on the West Coast, and to Kansas City, Omaha, Duluth and Minnesota in the Middlewest, where land booms reached a peak in 1887. The focus had returned to Chicago by 1890 however, when the centre city was at the height of its "Skyscraper" and World Fair developments.

5.1.1.6 A PERIOD OF PEAK ACTIVITY 1889 - 1893 NEW CITY TRANSPORTATION, SKYSCRAPERS AND THE WORLD FAIR

The fourth phase of this period is one in which several factors combined to produce boom conditions. Regional railroad development was rapidly intensified. Manufacturing production reached new peaks in 1890. Internal city transportation was upgraded by the introduction of cable car lines, elevated steam railroads and electrically powered railroads and tram cars. In construction technology high rise offices, apartments, hotels and multiple use structures were built and department stores were further developed. Suburbs were further extended and a large land area annexed to the city's limits. Finally, the Worlds Columbian Exposition was held in Chicago in 1893.

Of these factors, the regional railroads, internal city transportation systems and high rise buildings, have already been set into a broad context and will be studied in detail in the Technology sub-section which follows.

The two remaining factors, the annexation of city land and the Worlds Fair, as the Columbian Exposition was generally called, will be studied briefly to complete the overall picture of urban activities in the period.

In June 1889, one hundred and twenty square miles of peripheral land was brought into the defined limits of the city, increasing its land area considerably and adding approximately 200 000 people, to bring the city's total population to well over the One Million mark (1 200 000 by 1890) (23) This made Chicago the second largest city in the United States of America.

Ref. 23

By 1889 speculation amongst some of the larger American cities was rife, as to which would be chosen as the location for the Worlds Fair, to mark the four hundredth anniversary of the discovery of America by Columbus. New York, Washington, St. Louis and Chicago were all contenders. After a great deal of political lobbying, Chicago got the vote in 1890. (24)

Ref. 24

Although there was a delay of over six months before a site was chosen in the city for the Fair, speculation in land began almost immediately as each rumour relating to the chosen site was exploited by real estate agents to sell "hot" land to uninformed buyers.

Eventually Jackson Park and the Midway area, on the South Side Lake Shore was chosen and work started almost immediately on the landscaping and construction of the temporary exhibition structures.

Private enterprise joined with State and City subsidised building activity to construct the hotels, apartments, offices, private exhibition stands and other facilities which the crowds of expected visitors would need.

The Fair did not meet the wild expectations of the city's traders, manufacturers or speculators, who had imagined that the Fair would kindle the bonfire of greater and continued prosperity. The numbers of visitors who came were not as many as expected, they spent less money than expected because the general economy of the country was on a decline, and little property was sold because of the prevailing holiday atmosphere. (25)

Ref. 25)

The result was that when the Fair ended, many of the hotel and apartment block owners were in financial difficulties. Much of the land bought in the area of the Fair decreased greatly in value, resulting in foreclosures and a depression in the property market.

The end result was that with the disappointments in the Worlds Fair, over-provision of high rise offices in the CBD and general countrywide economic recession, Chicago's growth rates in all activities slackened and fell from 1893 onwards until a slow resurgence occurred in 1898.

5.1.2 TRADE AND COMMERCE

The cyclic trends of growth in trade and industry have been outlined and are shown on Graph 7. Here trading activities have been grouped under the basic headings of Wholesale trading and Produce trading. This is done because from this stage onwards the range of trading activities became more and more diversified and their micro-fluctuations less important in relation to technology.

It is of interest to note on this graph (see overleaf) that by 1889 the value of manufactured goods had overtaken the value of wholesale and produce trading, illustrating the trend of Chicago's change in emphasis from that of trading to manufacturing, the first signs of which were noted in Section 4 previously.

After the fire, when the CBD had been rebuilt, the various components of trade and commerce relocated in almost the same patterns as they had held before the fire. Retailing and finance returned to concentrate on State Street, between Washington and Monroe, an area well served by horse drawn rail car services, while banking located in the Washington and La Salle Street area which was slightly more Westwards than their original position. (Zones 1 and 2 on Fig. 66) Wholesale activity returned to South Water and Lake Streets, but later concentrated down Wells and Franklin Streets on the West bank of the South Branch River, down to Monroe Street. (Zone 3 on Fig. 66)

Fig. 66

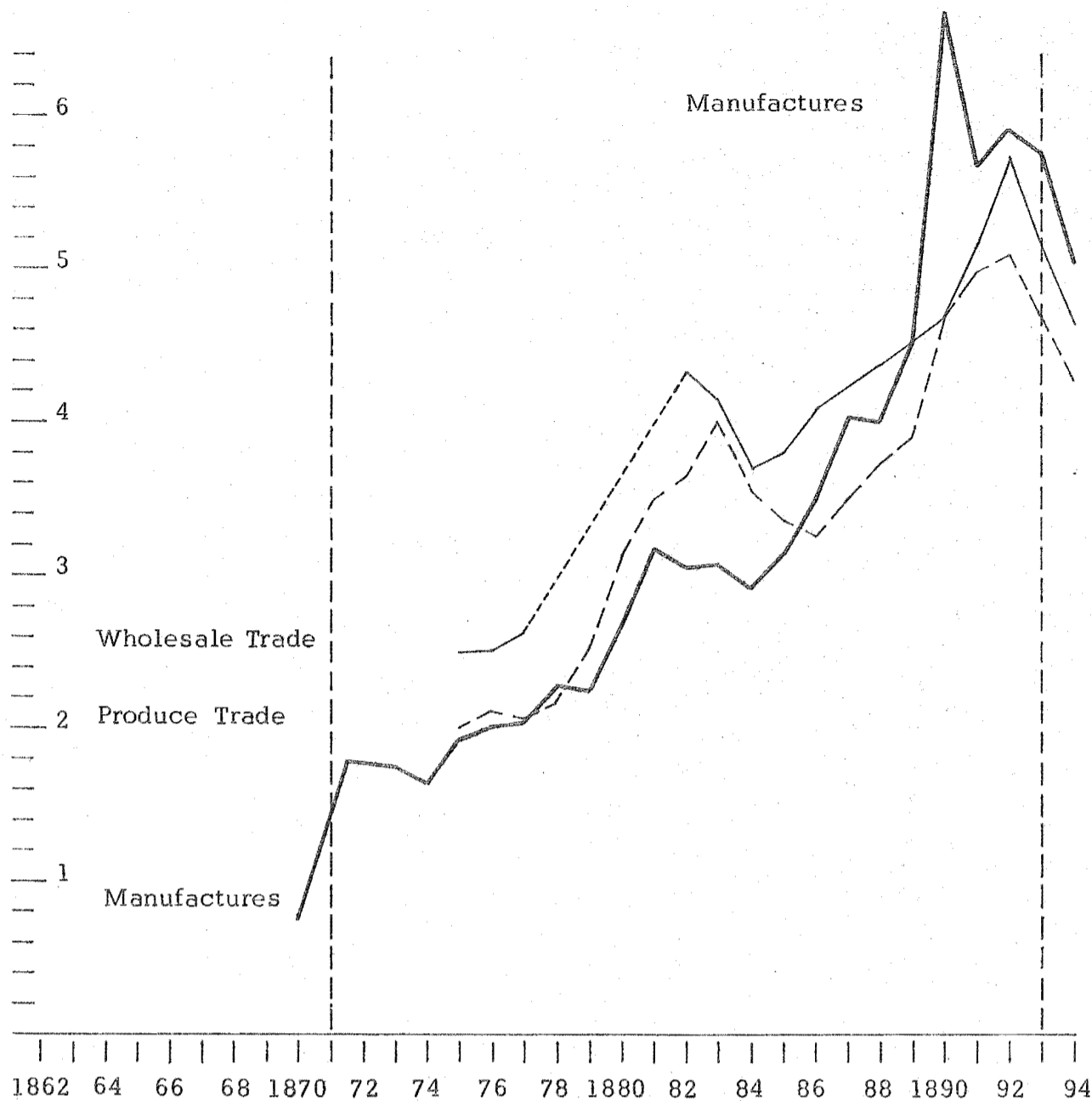
Offices were spread throughout the interspaces at this time. The Board of Trade was located at the corner of La Salle and Washington Streets and attracted the business functions most closely associated with it to the surrounding areas. (26)

Ref. 26)

This pattern remained the same until the Board of Trade moved four blocks southwards in 1881. The associated business functions followed to the new area where the larger, taller buildings intensified land use. This trend of intensification of the CBD continued and reached a peak in 1889-93 when most of the early 'skyscrapers' were built. These tall structures were reasonably evenly distributed throughout the central areas of the CBD, occurring mainly where suitable properties became available for redevelopment.

The next major influence occurred when the cable car lines and elevated electric railroads were installed in the city. The increased pedestrian flows which these transport lines generated at their stopping points immediately made some locations highly desirable for retail activities, particularly for the large departmental stores, which were then firmly established as a major component of retail marketing. (27)

Ref. 27



GRAPH 7 GROWTH IN MANUFACTURES, WHOLESale TRADE, PRODUCE TRADE.

Vertical Unit Values A. Manufactures 1 = 100 Million Dollars
 B. Wholesale Trade 1 = 100 Million Dollars
 C. Produce Trade 1 = 100 Million Dollars

DATA SOURCE: Hoyt - "One Hundred Years of Land Value in Chicago"

The only other important trend in retailing was the further development of suburban shops, along the cable lines on the newly built boulevards, particularly where the more concentrated residential areas occurred due to the building of row houses or apartments, thus creating minor captive markets for local retail activity. (28)

Ref. 28

5.1.3 INDUSTRY AND MANUFACTURING

The trend towards decentralization of certain industries began in 1865 with the relocation of the space-intensive stockyards some five miles southwest of the CBD. The trend continued with the larger heavy industries such as steel mills and railroad car works which located in the Calumet, Pullman and Hegewisch areas between 1873 and 1883. Here the newly made docks gave unrestricted lake access for incoming iron ore and outgoing products, while the inner and outer Belt lines built in 1886-7 provided excellent connections to all outward radiating Trunk lines. (Figs. 64, 65)

Fig. 64,
65

The Belt line developments, particularly the inner line, attracted many of those industries which were not dependent on canal transport away from the river or canal banks to cheaper land with better transport connections than was possible in the inner city zones. This was the start of a vitally important trend of decentralization of the heavier industries, the effects of which are much in evidence today.

Meat packing and processing increased even more rapidly after 1869 when the first refrigerated rail cars were introduced. Firms such as Armour, Libby and Swift became household names throughout the country and even overseas. These industries were also peripherally located, in order to be near the stockyards and to be better placed for regional transportation. (29)

Ref. 29

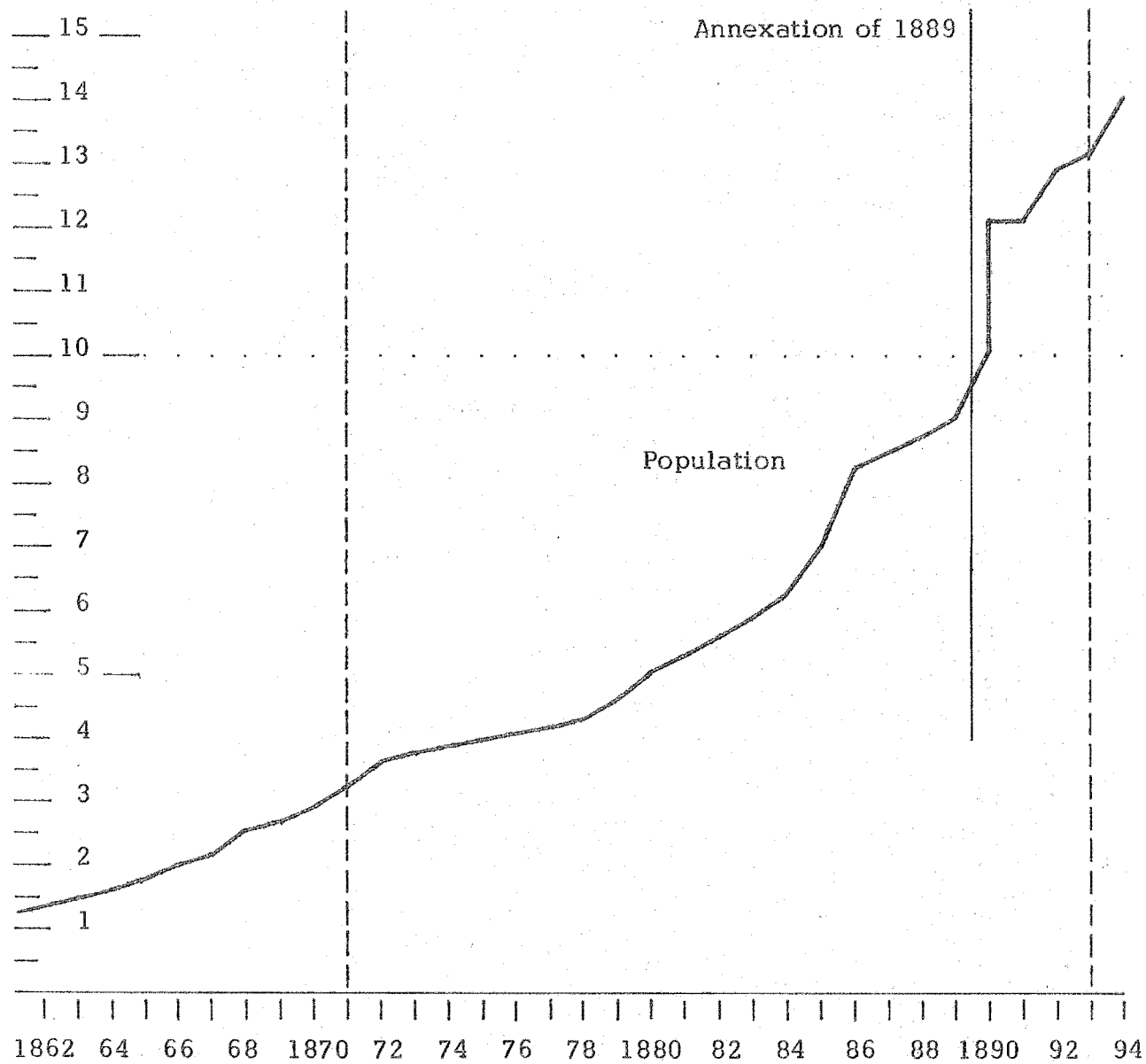
Less space consuming and less noxious new industries concentrated on the West Side, related either to river or canal transport, to railroad trunk or belt lines, or near to established labour pools.

The timber yards, on the inner city river banks, which had been destroyed by fire, initially relocated in the same positions (Fig. 61, 62) but because of the fire hazard and the increased value of centre city river front land, also began to move further out along the waterways to more peripheral locations. The grain elevators retained their former positions along the inner city banks of the Chicago River and its branches. (Fig. 61)

Fig. 61, 62

5 1 4 POPULATION INCREASE

Graph 8 shows the change in growth rate of the urban population for this period, with the sudden increase in numbers in 1890 after the annexation of additional land and towns in 1889.



GRAPH 8 GROWTH IN POPULATION 1871 - 1893

Vertical Unit Value 1 = 100 000 people

DATA SOURCE: Hoyt - "One Hundred Years of Land Value in Chicago"

The general growth rate is mainly related to the sudden increases in immigration into America which occurred at this time, as tabled below. (30)

Ref. 30

Year:	1877	1879	1880	1881	1882
Immigrants:	130 000	250 000	593 000	720 000	730 000

Further increases in urban populations at this time were as a result of increased urbanization of the rural population. People from outlying areas were drawn to cities in increasing numbers, thus initiating the change from three quarters of America's population being rural in 1850, to three quarters being urban by 1950. (31)

Ref. 31

Immigrants and others settling in Chicago tended to find housing in areas which had already been established, in relation to nationality, ethnic or religious groupings. As incomes increased, the original nationality group broke down. Families who had prospered in the new country moved further outward from the industrial contact areas or to the higher income suburbs along the transport routes, while new arrivals took their places in the inner areas.

After the fire the West Side had the greatest proportion of the city's population but this was evened out over the years as the South Side, and eventually the North Side, developed further. In the 1890's the North and West Sides began to rival the South Side in Population growth, as commuter transport services from outlying suburban developments improved, mainly through the construction of several under-river tunnels which allowed cable car and later, electric car services to enter the CBD more freely.

5.1.5 LAND VALUES

The value of CBD land dropped by between 30 to 40 per cent immediately after the fire, but quickly regained its former levels as rebuilding progressed. After the panic of 1873 the values of all urban land dropped as Graph 9 shows, reaching a bottom level by 1887-88. Thereafter values slowly increased until 1890 when a general peak was reached, before the decline of 1893 set in.

During this time land values in certain areas of the CBD showed major fluctuations as various preferences for certain types of activities changed with general development trends such as the relocation of the Board of Trade.

Other micro-scale changes of land value in the CBD were related to the routes and stopping points of the rapid transit, passenger carrying, systems. The more rapid the transport system, the fewer the stops, the higher the land values around the stopping points. This is illustrated by comparing the land values along streets served by horse drawn omnibus cars, with the later land values of the same street when cable-drawn street cars were introduced, and later still, values when an elevated railroad was installed above the street, with stops at every fourth, sixth or eighth block. In this latter case the overhead trains brought many more commuter passengers to fewer stops, resulting in high concentrations of pedestrian activity in the vicinity of the overhead stations. These locations were much sought after for certain types of retail activity, who benefited greatly from passing trade. (32) Hoyt states: "The new elevated railroads were carrying passengers into the downtown area to shop who had formerly patronised stores on West Maddison Street, Twenty-second Street and Millwaukee Avenue. Rents of stores on these streets were lower in 1895 than in 1889 while on State Street near Maddison Street, business rents had tripled." (33)

Ref. 32

Ref. 33

These local transit stop peaks distorted the overall gradients of CBD land values considerably, as did the high rise buildings, which were built most intensively in the 1889-94 period.

Although there were only 25 to 30 buildings of 12 to 16 storeys by 1894 (representing only 7% of total CBD land), land values for the whole core of the CBD went up rapidly because every lot in the area had the potential of generating increased rent, whether it was in fact developed to an increased height or not. However, because there was insufficient demand in the city for offices to warrant the whole core area being built up to 16 or 20 storeys, the early developers had the advantage of more profitable investments, their buildings forming localised peaks within the overall CBD land value patterns. (34)

Ref. 34

In the peripheral areas of the city, the transit routes in the industrial and residential areas also generated higher land values to such a degree that one real estate dealer remarked: "Only let me know six weeks in advance where the City Railway intends building a cable line and I will make an independent fortune every time." "Property along these lines rose in value from thirty to one hundred per cent, and on adjoining and contiguous streets in amounts proportionate to the distance from the cable lines." (35)

Ref. 35

These increases in the value of land better served by transportation were a major contributing factor which caused the land value in the South Side and the CBD to rise so sharply in 1889 and 1890 that it pushed the total average

value of all city land up by 100% in only two years at the peak of the boom. (36) Conversely, the value of land in the West and North Sides which at this stage were poorly served by commuter transport, experienced much smaller increases in average land values than the South Side and CBD.

Ref. 36

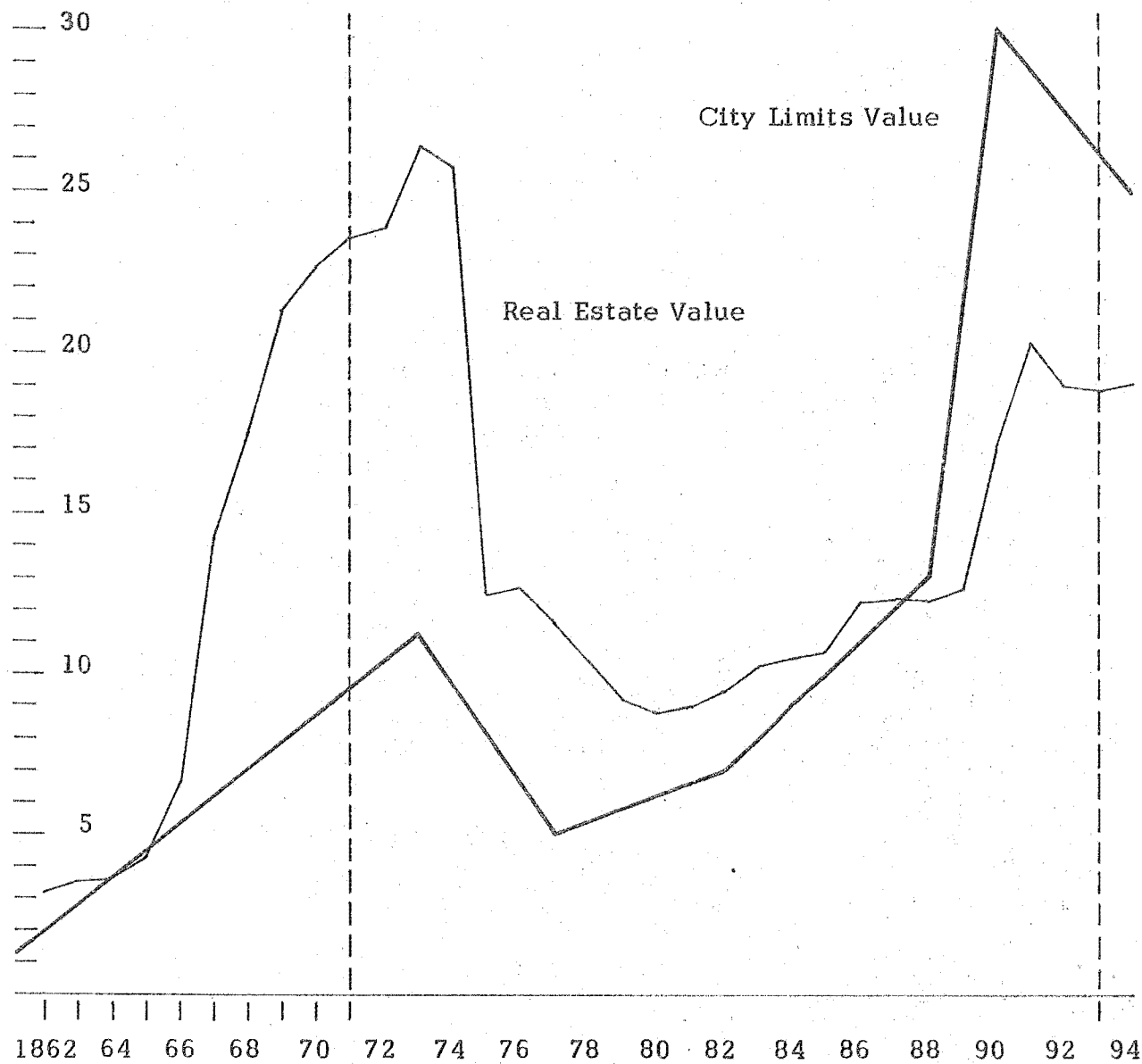
To show how marked the effects of transportation had been on the value of out-lying land, the following change in emphasis should be noted for the first four land value boom periods in Chicago's history up to 1890. (37) (*Note 1890 figures computed by author from Hoyt's statistics)

Ref. 37

	1836	1856	1873	1890*
A. Land value in first mile from CBD as % of total City value	56%	40%	22%	19%
B. Land value from 4 miles to City limits as % of total City value	7%	10%	33%	45%

The combined effects of the introduction of improved transit facilities and the construction of the first high rise buildings in the downtown area increased the value of this area by 700% between 1877 and 1892. (38)

Ref. 38



GRAPH 9 LAND VALUE

Vertical Unit Values:

- A. Value of "City limits 1933" land area 1 unit = 50 Million Dollars
- B. Assessment of Real Estate Value 1 unit = 10 Million Dollars
- (Value of Land and Buildings combined)

DATA SOURCE: Hoyt - "One Hundred Years of Land Value in Chicago".

5.2 TECHNOLOGICAL FACTORS

The influences which technological developments exerted on the city in this period are as profound and evident as they were in the previous period. By 1893 Chicago had been transformed into the transport-oriented industrial giant which was to change only in extent, intensity and pattern (with the advent of the automobile) until after the second world war, when new forces began to change the nature of the city.

5.2.1 MATERIALS, ENERGY SOURCES AND GENERAL MECHANIZATION

Industry and manufacturing became progressively more important to Chicago's growth during this period. Materials used in these industries changed from the simple cast iron, and low grade steels, to high tensile steels and sophisticated alloys using chrome, manganese and other additives to give the characteristics required for an ever diversifying range of products.

By 1870 steelmaking blast furnaces, rolling mills and foundries were well established in Chicago and employed the most advanced techniques available to produce rolled steel plates, beams, angles, etc., as required for bridge, railroad and building construction. By 1875 more steel rails were rolled in Chicago than in any other city in America. (39)

Ref. 39

The basic materials for the developing technologies were therefore in plentiful supply and of the best available quality by 1870.

The sources of energy available to industry and transportation also increased during this period.

Coal was still the main source of heat energy for steamraising and heating, and coal gas for lighting, but crude oil and petroleum products were progressively developed during this time.

The first oil digging and drilling operations had been undertaken in 1859 (Drake), an early gasoline engine developed in 1875 (Marcus) and a four cycle gasoline engine built in 1876 (Otto). The high speed gasoline engine was produced by Daimler in 1885 and finally, the Diesel engine, named after its inventor, in 1893. (40) These developments had obvious repercussions for transportation in the twentieth century.

Ref. 40

Another energy source, Electricity, came into widespread use for motive power, lighting and heating, towards the end of this period, particularly in America where Edison's pioneer work led to the widespread general use of electricity earlier in that country than elsewhere.

Electricity had been developed continuously since the end of the eighteenth century and by the 1870's had already been used for simple electric dynamos (Faraday 1831), electric motors (Davenport 1837), telegraph (Morse 1838), electric arc (Wright 1845) and the electric locomotive (Farmer 1847).

During this study period after 1870, development progressed with the first electric steel furnaces (Siemens 1870), the electric telephone (Bell 1876), the electric railroad (1879), the electric elevator (Siemens 1880) and the first central power station in 1882 built by the Edison company. (41)

Ref. 41

Chicago's first electricity was generated by a private company, The Commonwealth Edison Company, shortly after this date, using a Direct Current system for power distribution.

The development of electricity as the new energy base was of the greatest possible significance to the everyday lives of the people of more technically developed countries. Electricity generating capacity remains one of the most significant indicators of any region's degree of technical development in present times.

From 1893 onwards the amount of electricity consumed in Chicago follows the same exponential growth rate common to so many other urban functions of this most intense period of industrialization. Electricity replaced gas for street lighting and was used for illumination in buildings, for driving tram cars, railroad trains, motors for industry and in many other uses which remain with us today.



Fig. 67 Internal Transit System of the City 1893

The new stronger, harder, more workable steels developed at this time found immediate uses in the plough shears, cutting knives, fencing wires, etc., used in agricultural production. Machines for wheat harvesting became more sophisticated, reliable, durable and efficient, one machine, driven by one man with a span of horses being able to do more tasks than ever before. (Fig. 68)

Fig. 68

Operations in the meat processing industries became more mechanised and efficient. Production line techniques which were first developed in the previous study period were improved to speed up production and increase output per man hour of each worker, for each task. (Fig. 71)

Fig. 71

Meat canning, hide and skin processes and by-product processes, all became progressively more mechanised to increase production output, while keeping costs competitive. Many of the inventions of the 1860's were in widespread use by the 70's.

Further developments in refrigeration made it possible to distribute meat to even wider markets than before. As with so many other fields, Chicago was by 1870, the largest meat handling centre in the nation and the world, mainly because of the mass handling and production techniques developed.

The overhead production line shown in Figure 71 (and Fig. 36 previously) is highly significant in that it is a direct forerunner of the systems employed by Henry Ford in producing his "Model T" some thirty years later.

Fig. 71

5.2.2 WATER TRANSPORT

By 1880 the Illinois and Michigan Canal was handling one million tons of freight annually, (42) much of this being wheat exports which, when trans-shipped in Chicago, could be carried by ocean going craft to any port in the world.

Ref. 42

With the development of the Calumet docks in 1873, another freight handling facility was introduced to relieve the load on the city's harbour facilities, particularly for handling the heavy manufacturing materials and products such as iron ore, coal and finished steel products, such as rails, rolling stock and other heavy engineering products made in the area after renewed development in 1883.

The value of land with river or canal access remained high, being in continued demand for grain elevators, wholesale warehousing and trading in the CBD zones, and equally in demand further away from the CBD for the more noisy, noxious and fire hazardous activities which became progressively prohibited in the central areas.

Canal transport had limitations in both its maximum carrying capacity and the speed of movement in the waterways. These factors caused more of the perishable and urgent goods to be carried by the railroads, thus slowly reducing the effectiveness of the canal until major reconstruction of the Chicago river end was undertaken in 1894-1899 when the new Chicago Sanitary and Ship Canal was built.

5.2.3 RAILROAD TRANSPORT

Expansion of railroad services continued unabated from 1848 until the middle of the twentieth century. After the fire of 1871 and up to 1893, twenty-six regional incoming lines and two Belt lines served the city and its immediate region in combination with countless secondary cross connections to major industrial areas and new harbour facilities on the outer limits of the city. (Compare Figs. 25 and 65 for growth)

Figs. 25
& 65

Increased railroad traffic called for increased marshalling yard and freight classification facilities. These yards required vast areas of land which could only be found in outer city locations. In 1887 the Santa Fe Railroad Company bought the Stickney Tract, a vast area of land in the outer, South-west area of the city. This was the first of many similar yards which were built during this and following periods.

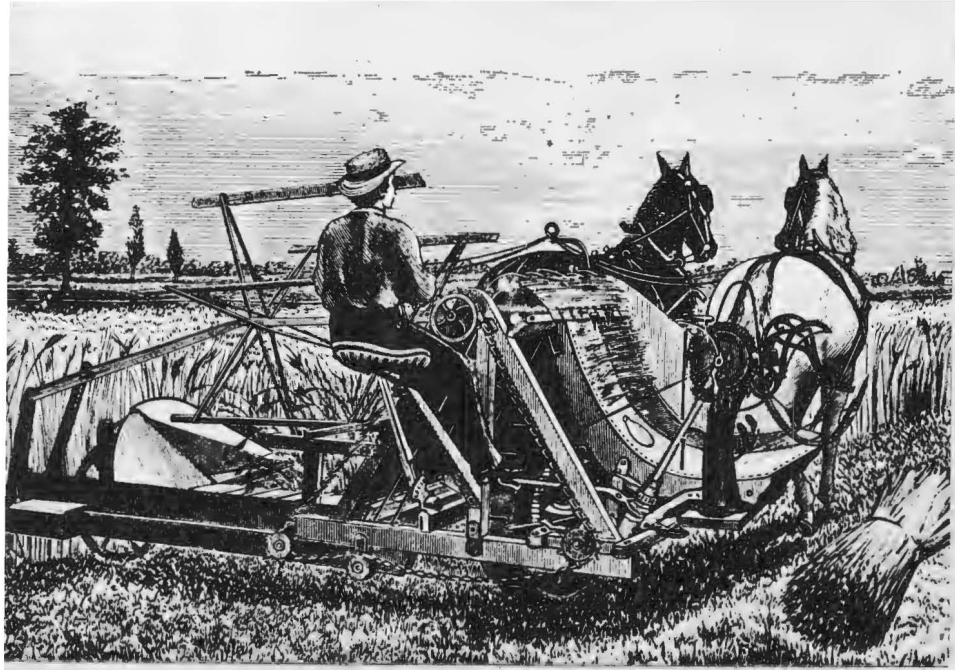
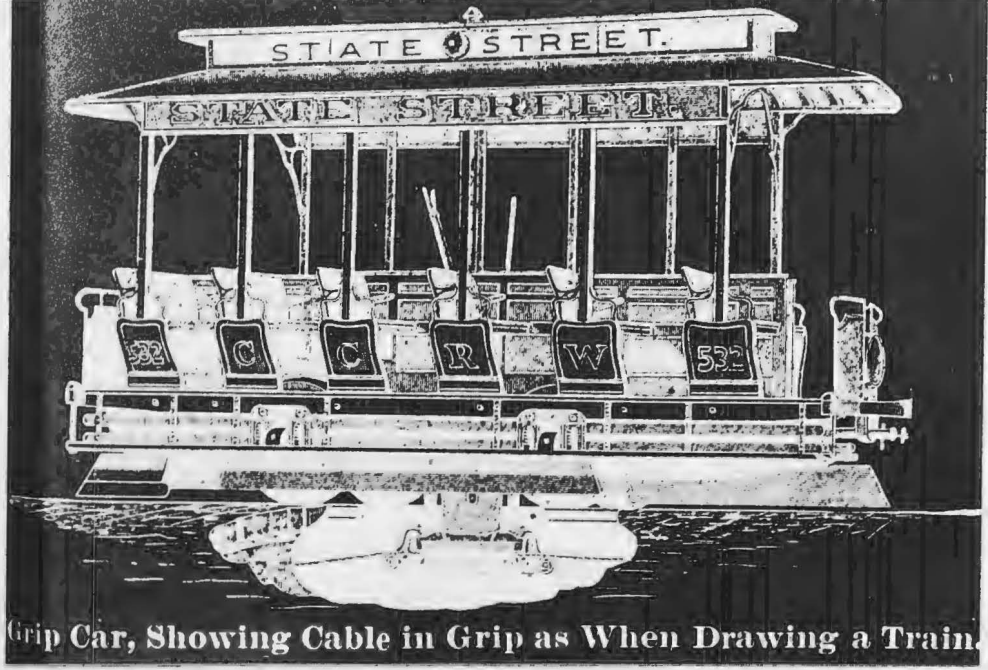


Fig. 68 Self-binding Harvester 1876



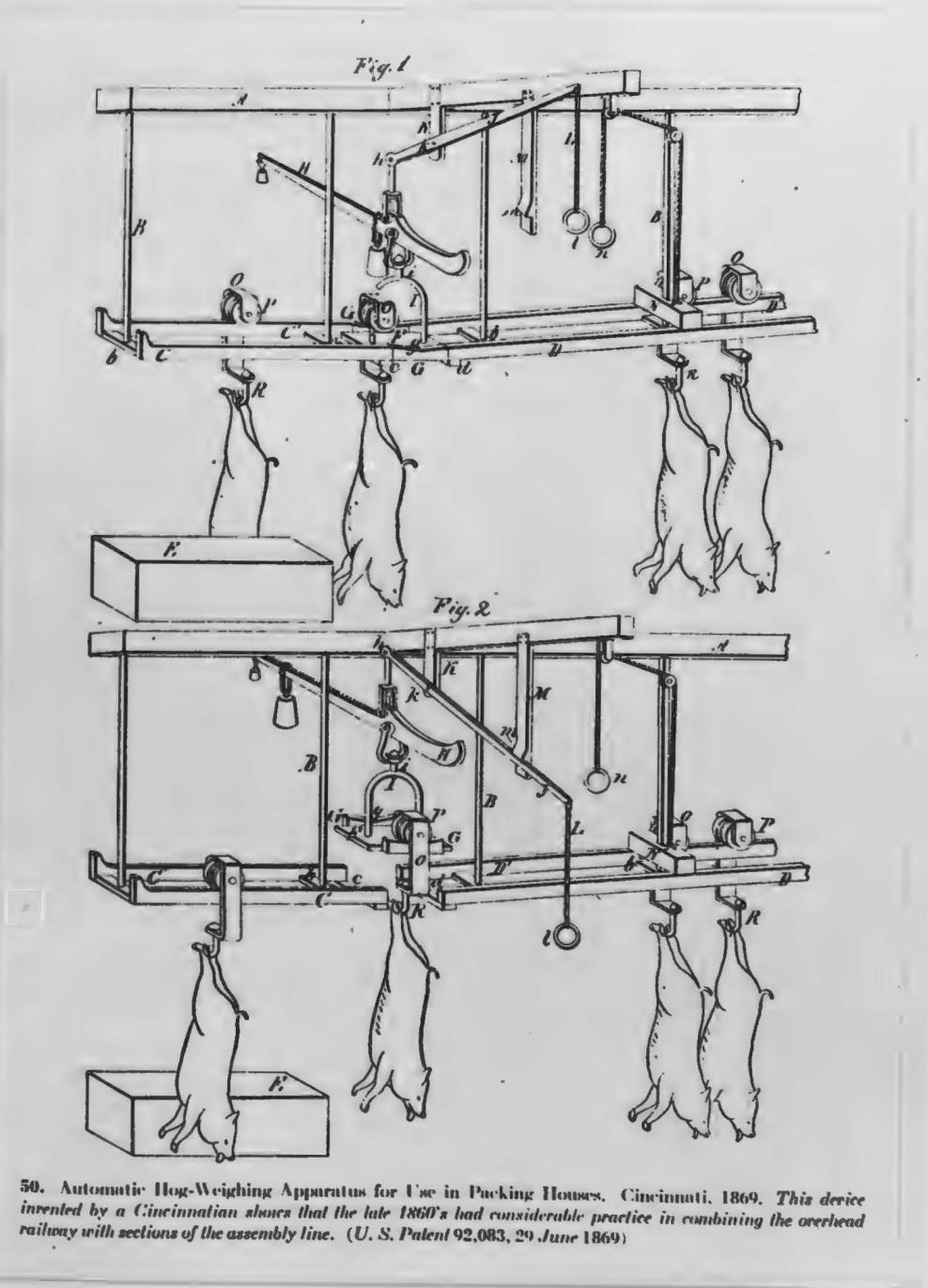
Grip Car, Showing Cable in Grip as When Drawing a Train.

Fig. 69 Cutaway Diagram of Cable Car 1890

Fig. 70 North Western Passenger Terminal 1893



Fig. 71 Meat Processing Production Line 1869



50. Automatic Hog-Weighing Apparatus for Use in Packing Houses. Cincinnati, 1869. This device invented by a Cincinnati shows that the late 1860's had considerable practice in combining the overhead railway with sections of the assembly line. (U. S. Patent 92,083, 29 June 1869)

Fig. 72 Street Railway Cable Cars 1890



Fig. 73 Lake Street Elevated Line 1890's



Fig. 74 Proposals for Broadway New York 1890



Within the city itself cable drawn street cars replaced the previous horse drawn rail cars, but were themselves replaced within ten years in most areas, by electrically driven tram cars. The elevated steam train lines were introduced into the city in 1890, but were converted to electric lines within a further fifteen years. All these changes in the transit system were made to increase speed and passenger handling both in the centre city and to the rapidly growing suburbs, which daily increased the numbers of persons entering the city. By 1893 the 500 miles of interwoven tracks in the city region served to carry 200 million fares in one year.

Figure 67 shows the complexity of the movement network of the city at this period, comprised of: 1. Steam railroad Trunk and Belt lines which connected into the regional system, as shown in Figure 65, with their centre city passenger terminals, goods yards, peripheral repair yards and suburban stations as shown in Fig. 67. 2. The elevated steam railroad lines entering the CBD and terminating at above-street passenger stations. (After 1894 these lines were linked with a loop system to prevent "turn around" congestion). 3. The electric street-railway systems which by 1893 had not yet entirely replaced the cable car lines. 4. The cable-car lines which formed two internal loops inside the CBD. 5. The horse drawn omnibus lines which still remained the small scale, convenience connectors between the more rapid transit lines.

Fig. 67

These various means of transport had different speeds and motive power and consequently different optimum distances between stops. The steam train could achieve 40 to 50 m.p.h. on regional routes with stops at 10 to 15 mile intervals. Speed reduced proportionately to stopping interval distances, coming down to 15 to 20 m.p.h. for inner city elevated lines with stops ranging from $\frac{1}{4}$ to $\frac{1}{2}$ mile apart. Electric street car railways had a speed of 10 to 20 m.p.h. with city stop intervals at 200 to 400 yards. Cable cars had a top speed of approximately 8 m.p.h. and could stop and start very quickly because of continuous motive power from the cable, making stopping intervals feasible at 100 to 200 yard intervals. At the bottom of the speed scale the horse drawn street car varied in speed from 4 to 10 m.p.h. depending on the load being carried and could stop economically at 50 to 100 yard intervals.

Chicago was therefore served by an extremely finely graded system of transportation in its inner city areas. The degree of provision of services to the North, South and West Sides differed greatly.

The South from 1871 to 1890 was better served in all modes of transport, from regional down to local scales, than the West or North. After 1892 the position began to change as first the West became better served and later the Northern area increased its connections to the city, particularly after further tunnels had been constructed under the river. (43)

Ref. 43

The various modes of transport which were phased into and out of service at different times had been brought to Chicago from different sources, from other cities or other countries.

The cable car which displaced the horse drawn rail car was originally developed in San Francisco to cater for the extreme gradients of the city's streets. It was a simple "tram" type car with a grip device which clamped onto a pulling cable set in a slot between the rails. The cable was greased to allow slippage when starting and braking. (44) (Fig. 69 and 72) Installation and running costs were high but the advantages of the cable over the horse for traction, were speed, load carrying capacity and by no means least, the avoidance of "exhaust pollution" caused by horse traffic.

Ref. 44
Fig. 69,72

The electric rail car became feasible with the harnessing of electricity for general use, having the advantages of slightly increased speed, greater comfort of ride while being quieter and pollution free.

The elevated steam train system was the most expensive of all transit systems, the miles of heavy steel viaducts costing millions of dollars. The speed was far beyond that of its rivals but problems of noise of trains, loss of light in the streets below, and other factors had serious environmental effects which remain with the city today. (Fig. 73)

Fig. 73

The obvious alternative was to follow London's example and go underground. Costs of shallow tunnelling (by excavating the roads to a 10 or 12 foot depth, laying the tracks and bridging over to form a new road) were comparable with

overhead bridging. The deciding factor may have been the clay sub-soils below the streets of Chicago, the recently reinstalled sub-surface services and the depths necessary for river tunnels which may have made overhead routes less expensive.

Inventions and ideas for solving internal city transport problems were coming from the boards of designers in profusion.

Many of these inventions had been devised for New York. A moving pavement system had been proposed by Speer in 1874, (45) and a suspended overhead steam driven rail car had been proposed for Broadway in 1850. (46) By far the most farsighted was the vacuum tube train designed for a New York underground rail system in 1890. (47)

Ref. 45

Ref. 46

Ref. 47

Again however, it was in Chicago that the first moving pavement system was developed. It was installed in the World Fair in 1893. (48) In combination with the first overhead elevated steam train line which was extended further south so as to serve the exhibition, the moving platform transit system must have been a very impressive and farsighted statement on future urban transit needs.

Ref. 48

The elevated railroads had considerable physical effects on the surrounding areas through which they passed. Where the tracks were carried on overhead bridges they created noise, smoke, soot at all levels around them, and loss of sun to the streets below. Where the tracks were raised on earth embankments, the surrounding areas were completely bisected and separated from each other visually, often resulting in strange land use, and intensity, anomalies in adjacent areas on either side of the lines.

5.2.4 ROAD TRANSPORT

The horse, horse and cart and waggon remained as before, the main means of transport over land. The bicycle was further developed with the first use of pneumatic tyres in 1890, and this was to have direct repercussions on the early automobiles which were about to begin to revolutionise twentieth century transportation. (49)

Ref. 49

Techniques of roadmaking were improved in urban situations but were still prohibitively expensive for general use in the countryside where dirt tracks prevailed. Earthmoving for road construction, landscaping or reclamation was still by means of horse and cart although large stationary "dragline" type cranes were developed for large scale excavation projects, such as canal or dock building, at this time.

With early experiments in gasoline driven engines well advanced by 1893, the era of the automobile and the importance of road transportation was rapidly approaching.

5.2.5 SERVICES

Most of the centre city and North Side services, such as water pipes, street lighting, gas mains and other services which ran on the surface or just below paving levels, were completely destroyed in the fire. The heat was so intense that extensive damage was also suffered in the deeper drains and sewers underground.

All these services were re-established within the first few months of 1872.

The water pumping station had been one of the first structures gutted by the fire and had to be completely rebuilt. Because many of these services were renewed, more modern techniques were employed in their reconstruction, resulting in the new CBD being one of the best served in contemporary cities, an important factor in future developments of high rise buildings.

Water supply again began to suffer from pollution problems caused by increased industrial effluents and sewage being discharged further out into the lake, near the water intake structures.

Towards the end of the period the problem became so serious that major engineering works had to be undertaken to overcome the health hazards of frequent epidemics of water-borne diseases. (The typhoid death rate had reached the alarming level of 174 per 100 000 people in 1891.) (50)

Ref. 50

The solution was found in the construction of the Chicago Sanitary and Ship Canal which commenced in 1894. The project involved greater excavation than in the Panama Canal and was completed in only ten years. This canal, apart from solving the drainage and pollution problems of the city, also replaced the Illinois and Michigan Canal which by this time had become obsolete due to limitations of width, depth and lock facilities. (51)

Ref. 51

The strength of Chicago's service systems was one of the major reasons why the inhabitants of the areas outside the original city limits were anxious to be annexed into the city limits in 1889.

Standards of services were progressively extended into the outlying areas, main distribution routes lying along the arterial railroad routes, avenues, boulevards or access roads, radiating out from the city.

Electrical services as previously described were progressively increased after 1893 as Graph 15 in the following section shows.

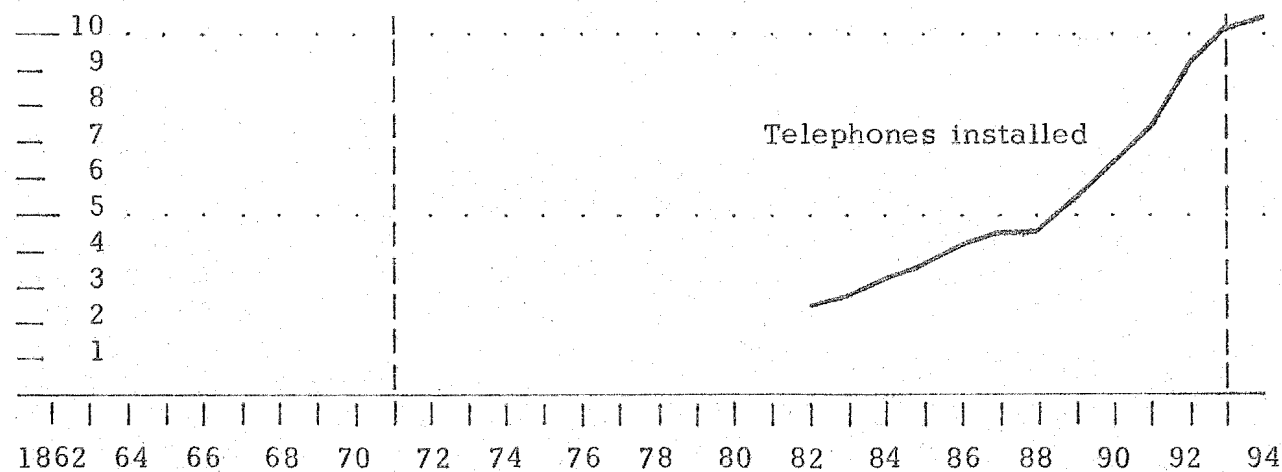
5.2.6 COMMUNICATIONS

The telegraph services of the city were greatly increased with new developments in multiple signalling techniques using single conductors. (Gintl, 1853 and later developments.) (52)

Ref. 52

The obvious advantages of the telephone for communications resulted in a remarkably short time lag between its invention by Edison in 1876 and the first installation of telephone services in Chicago in 1882, only six years later.

The graph below illustrates the trend in development of telephone services in Chicago, the most intensive period coinciding with the peak of "Skyscraper" building. The high localised densities which the tall buildings generated were greatly assisted by improved means of external communications.



GRAPH 10 COMMUNICATIONS - TELEPHONES

Vertical Unit Value A. Telephones 1 = 1000 stations.

DATA SOURCE: Hoyt - "One Hundred Years of Land Value in Chicago".

Extreme long range communications were further extended by the experimental work in radio telegraph by Marconi towards the end of this period, although his invention was not operative until 1896.

Hard rubber phonograph records were first developed in 1889, as a further development of Edison's early phonograph.

New visual communication techniques were pioneered by Marly and Edison who developed the first motion picture cameras in 1882 and 1889 respectively. The first "Moving Pictures" were made in 1893 by Edison, who also produced the first motion picture projector in 1895.

5.2.7 CONSTRUCTION

Two remarkable phases of construction activity occurred in this period, as shown on Graph 11. The first was immediately after the fire when rebuilding caused production to double in two years, reaching a peak in 1872. The second was at the peak of the "skyscraper" building phase in 1892, (53) as shown on Graph 11 below. Here it can be clearly seen that the great increase in value of new buildings per annum in 1892 is spread over a disproportionately small number of additional new buildings (bottom line on graph), which is indicative of the higher cost per building of the new highrise or large scale structures of this period.

Ref. 53



GRAPH 11 GROWTH IN CONSTRUCTION 1871-1893 Data Source: Hoyt - op.cit.

Vertical Unit Values

- | | |
|----------------------------------|------------------------|
| A. Annual value of new buildings | 1 = 10 Million Dollars |
| B. Number of buildings per annum | 1 = 10 000 buildings |

The rebuilding phase has already been outlined, and was as vitally important to the city's growth as the more dramatic development of the high rise and multi-use structures which followed twenty years later.

Certain details of the former period should therefore be expanded before passing on to the later period so that the interim, developmental stages, are understood.

One result of the fire was that stringent fire codes were introduced into the building regulations of the centre city. Timber frame structures were prohibited within certain prescribed central areas, and the fire resistance standards for masonry and cast iron-composite structures were greatly increased.

One of the results of the restrictions on timber structures in the centre city was the seven mile long band of low income timber housing immediately along the restrictive line, adjacent the West side industries.



Fig. 75 Leifer Building 1879



Fig. 76 Home Insurance Bldg. 1885



Fig. 77 Monadnock Building 1889

Fig. 78 Fair Store under Construction 1891

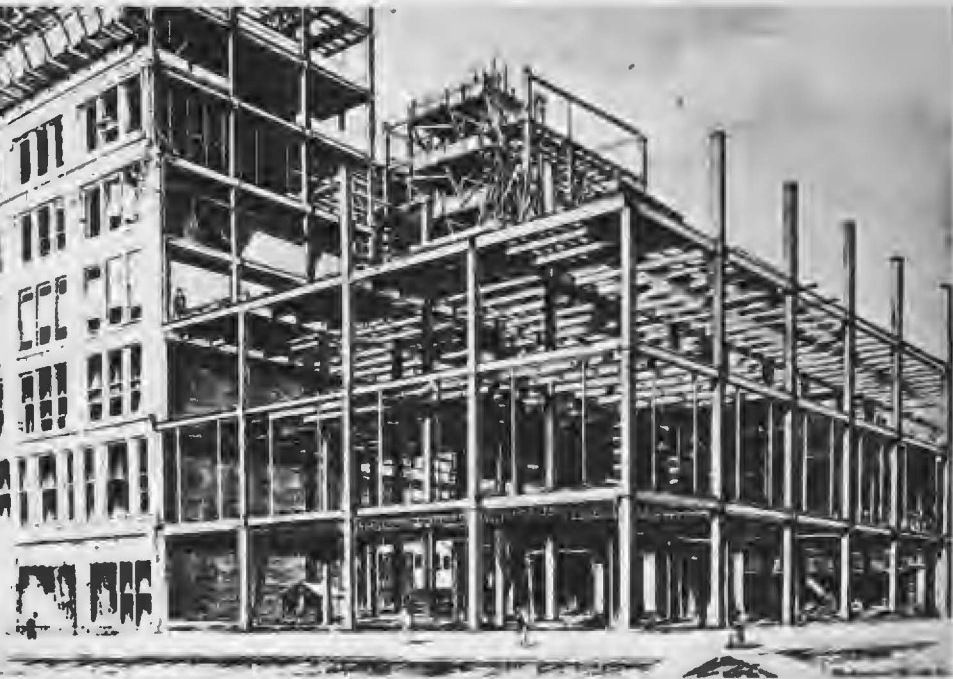


Fig. 79 Auditorium Building 1889



Fig. 80 Stock Exchange 1894



Fig. 81 Randolph St. from La Salle 1892



Fig. 82 2nd Leifer Store 1891



The improved fire resistance codes caused the development and testing of new techniques of fire proofing, particularly for cast iron internal supporting columns of warehouses and large stores which had proved to be so vulnerable in the great fire. (Fig. 86)

Fig. 86

Low income workers' houses in the period after the fire were still predominantly made of timber, the structures being close packed on small lots. (Figs. 96 and 97) Middle income housing was also mostly of timber construction but built on larger land areas, in outlying areas of the South and West sides, or in the rapidly growing structures. Masonry structures were used more for higher income housing, row housing or townhousing, particularly along the boulevards as shown in Fig. 95.

Figs. 96
& 97

Fig. 95

Construction in the industrial areas took immediate advantage of new steel framing techniques, external panel walls still being of brick for durability and fireproofing.

The greatest change in construction techniques during this period was in the structures of the central business areas of the city.

The heights of the CBD buildings increased immediately after the fire with the early development of steam driven or hydraulically operated passenger elevators, eight storeys being the maximum height in 1876.

After the development of electrically driven elevators in 1880 (Siemens), the speed and convenience of elevators increased making greater building heights feasible. However, the general economic climate was so depressed in the 1880 period that few developers wanted to exploit the new potential for high rise buildings at this time.

By 1881 however, a ten storey office building had been erected in the city, the Montnak Building, which because of its increased height had required the development of new foundation techniques to meet the serious problems of building to greater heights on the clay and mud which lay over the bedrock of Chicago. The "Floating Raft" system first used in this building was to be widely used later for the higher structures which followed. (54)

Ref. 54

Parallel with the developments in passenger elevator and foundations techniques was the first use of an iron skeleton frame in a seven storey office building in 1879. This building carried all its floor loads on steel beams, supported on a cast iron frame. The external walls were also partly carried on the frame thus reducing wall widths and allowing much larger window openings than previously possible with fully loadbearing external walls. (55) (Leiter Building Fig. 75)

Ref. 55
Fig. 75

The principles developed in this building were taken further in a building by the same designer in 1885, of eleven storeys where the skeleton frame was even more refined. (56) This structure was the Home Insurance Building, designed by an architect, William Le Baron Jenney, who had received his technical training in the French Army corps of engineers. (Fig. 76) This is significant because engineering techniques were the basis for the eventual development of the steel framed skyscrapers of the next ten years.

Ref. 56

Fig. 76

Jenney had used the iron and steel frame to achieve two important aims. The first was to increase useable floor areas within the building by substituting slender steel columns for heavy external load bearing masonry walls. This also achieved the second aim which was to admit more light into the offices, particularly as buildings on the narrow streets began to increase in height.

The development of the high rise brick loadbearing office building had reached an ultimate level in the Monadnock building of 1889. (Fig. 77) This remarkable building was sixteen storeys high, constructed on an extremely narrow site, entirely of load bearing brickwork. To carry the loads of the floors above, the walls at pavement level were over six feet thick. (Fig. 83) The loss of rental caused by this thickness of wall was heavy when compared to the area lost to structure in a steel framed building of the same height, built some four years later. (Compare Figs. 83 and 84)

At the pavement level of the brick building (left hand plan in Fig. 83) the structural requirements made only small areas of display window available to stores. At the upper levels in the same building (right hand plan in Fig. 83) light entering the offices was severely restricted by the wall areas required

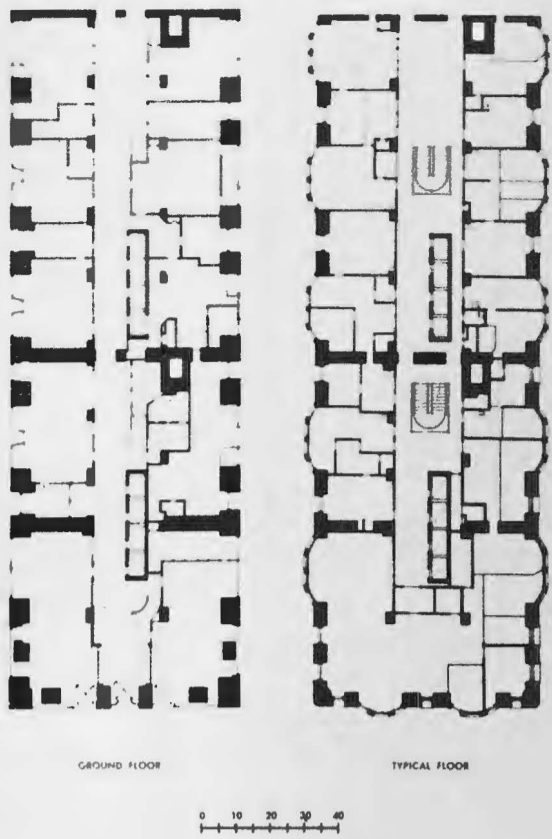
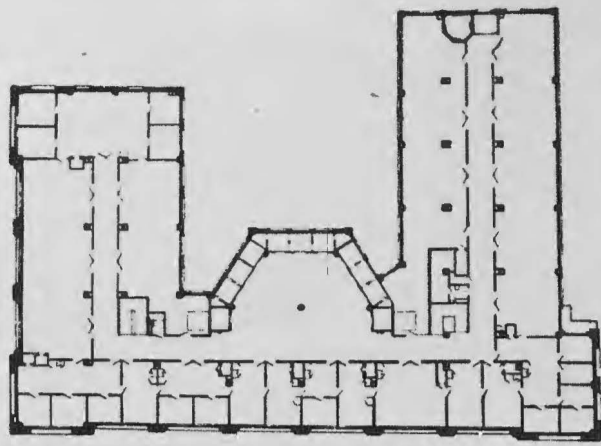


Fig. 83 Plan of 16 storey Brick Office Building 1889



75. MARQUETTE BUILDING, 1893-94 HOLLABIRD AND ROCHE
Typical floor plan. (From J. K. Freitag, *Architectural Engineering* [2d ed.; New York: John Wiley & Sons, 1901].)

Fig. 84 Plan of 16 storey Steel Frame Office Building 1893

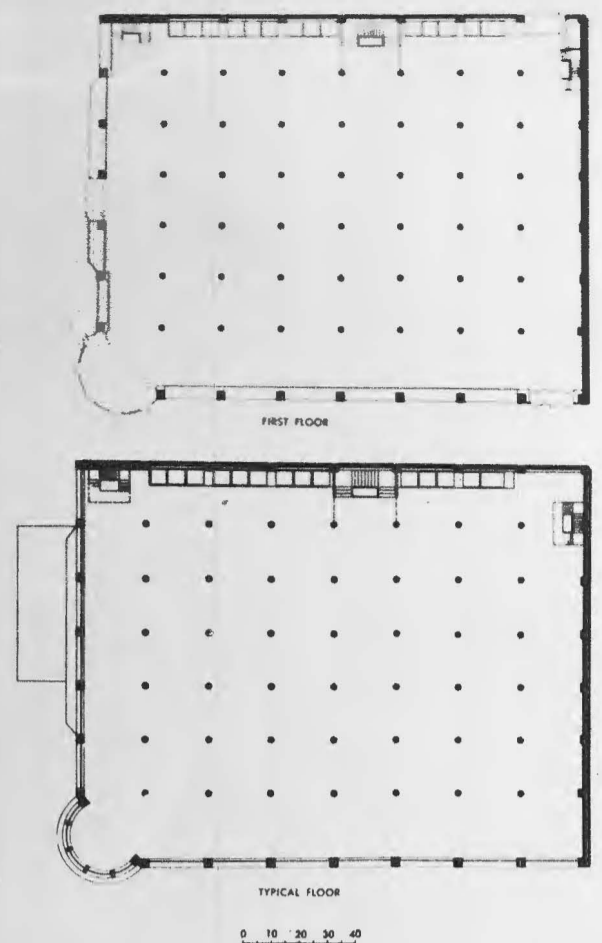
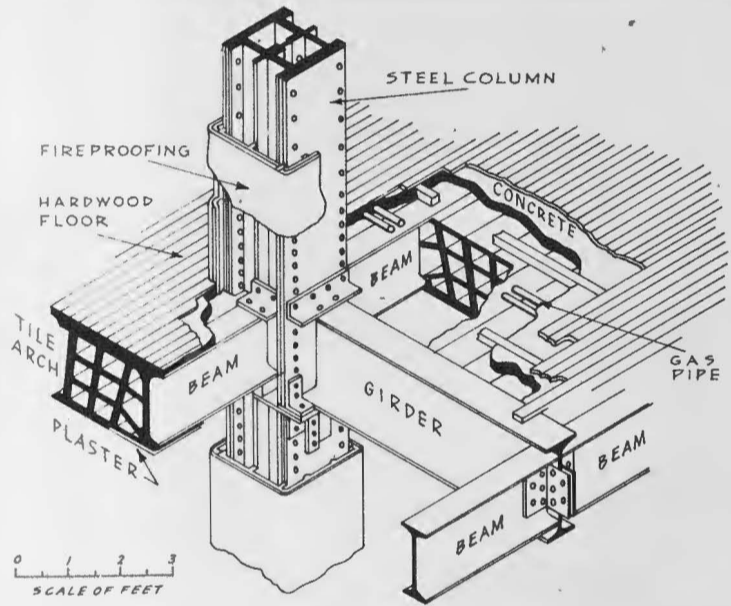
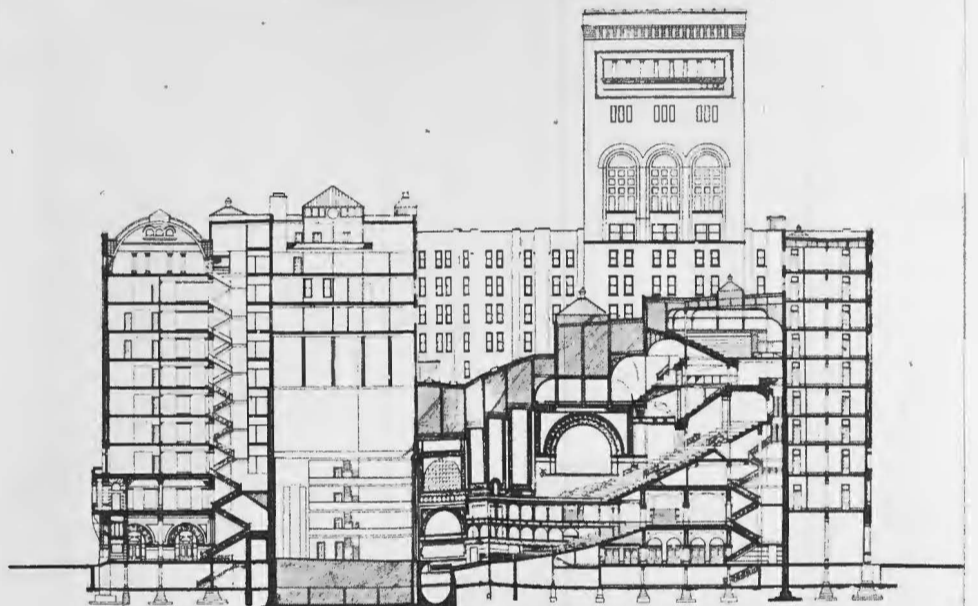


Fig. 85 Plan of 12 storey Steel Frame Department Store 1899



51. FAIR STORE, 1890-91 WILLIAM LE BARON JENNEY

Fig. 86 Construction Detail of Steel Frame Bldg. 1891



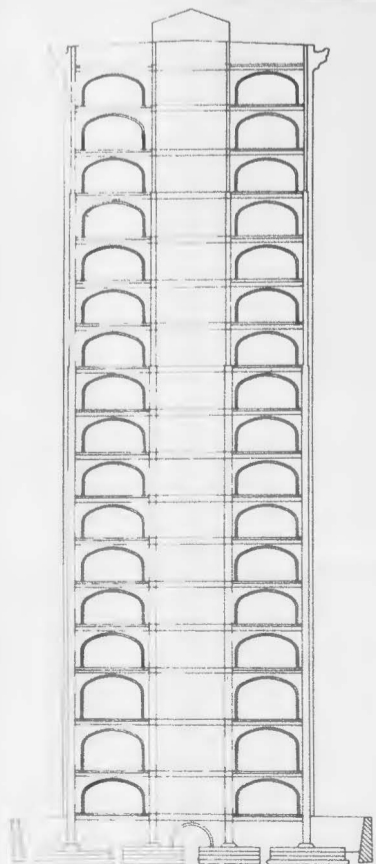
33. AUDITORIUM BUILDING, 1887-89 ADLER AND SULLIVAN

Fig. 87 Cross Section, Auditorium Building, 1889

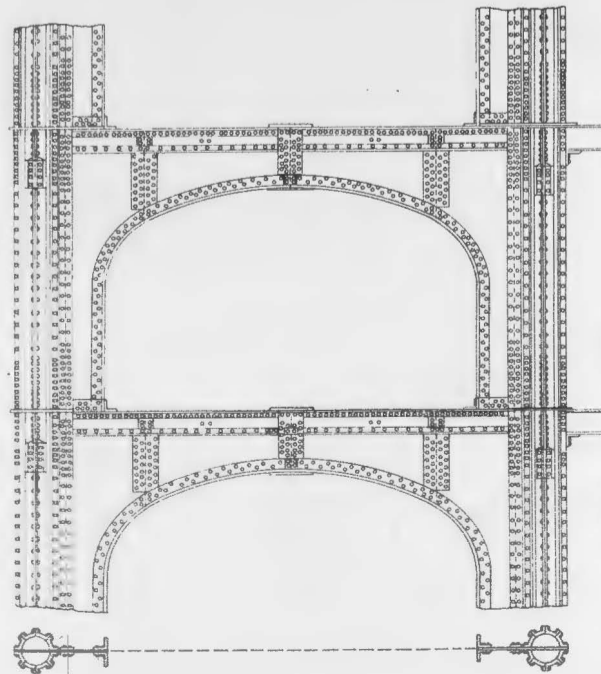
Fig. 88 Cross Section of 17 storey Steel Frame Bldg. 1894

Fig. 89 Detail Section of Steel Frame Building 1894

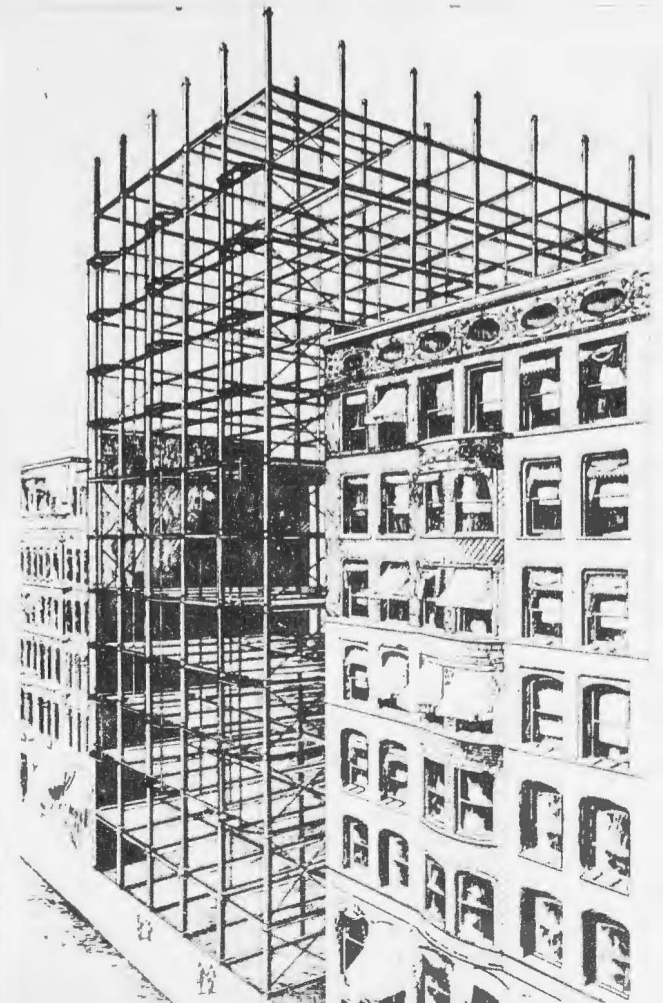
Fig. 90 Steel Frame Building under Construction, 1892



78. OLD COLONY BUILDING, 1893-94 HOLLABIRD AND ROCHE
End elevation of the steel frame showing the portal bracing (From J. K. Freitag, *Architectural Engineering* [2d ed.; New York: John Wiley & Sons, 1901].)



79. OLD COLONY BUILDING, 1893-94 HOLLABIRD AND ROCHE
Elevation of an end bay of the frame showing details of a typical arch. Cross sections of two Phoenix columns are shown at the bottom of the drawing. (From J. K. Freitag, *Architectural Engineering* [2d ed.; New York: John Wiley & Sons, 1901].)



for structural support. Moreover the structural requirements were greatest at the lower levels, thus permitting only the smallest window areas at the lower levels, where light limitation was in fact the most critical. Light requirements and structural requirements were therefore in direct conflict in loadbearing brick structures whereas in steel framed structures windows could be consistently wider, due to the smaller sectional areas of the steel columns. (Fig. 84)

Fig. 84

Many devices were used to increase the lighting to offices in brick high rise structures, the bay window as seen on the Monadnock building being the most common. (Figs. 77 and 83) However the loss of rentable floor area, the loss of display area at ground level, poor lighting at upper levels and the great dead weight of the structure which caused added foundation problems, all combined to reduce the marketability of the brick high rise building, when compared with its steel-framed rivals. The Modadnock was the last great load bearing structure built. After 1890 all high rise buildings used steel structural frames, as illustrated in Figures 86, 88, 89 and 90. (57)

Figs. 77 & 83

Ref. 57

Figures 88 and 89 show the typical constructional system used in the steel framed office buildings of the 1890's. The steel framing is closely related to the engineering techniques as used in bridge building. Steel plates, angles and other rolled sections were riveted or bolted together to build up the required framing members which were then rapidly assembled on the site. Thirteen floor levels of steel framing on one building were completed in fourteen days in 1893. (58) With the advent of electricity, lighting was provided for night shift work on some buildings, so great was the demand for rapid construction at the peak of the property boom in 1892. Methods of using salt in the mortar of buildings to prevent freezing while working in winter were also devised in order to speed up construction. (59)

Figs. 88, 89

Ref. 58

Ref. 59

The speed of construction and the general bustle of the period is well described by Giedion as follows:

"... There is such a demand for business and office quarters that the permit to build a block is no sooner obtained that applications are made for renting apartments and before the building is completed it is all rented and the renters are ready to step in with their implements of trade. Block after block mount up into the clouds overhanging the city from every street and avenue."

"Many times has it happened in Chicago that the morning papers have come out with accounts of the letting of a contract for the largest office building in the city, and the evening papers of the same day have given news of other contracts for buildings far surpassing those told in the morning." (60)

Ref. 60

The steel frame was widely employed for all types of buildings with the same advantages of efficient floor plans, with a minimum of area lost to structure, large windows for upper working levels and large display windows at pavement level.

Departmental stores (Figs. 78 and 82), warehouses, high class speciality shops (fig. 85), high rise apartment buildings and hotels, the Stock Exchange, were all built with steel frames between 1890 and 1894.

Figs. 78, 82
Fig. 85

The first multi-use structures also appeared during this period. The Auditorium building (Fig. 79) comprised of a large and sumptuous hotel, an auditorium seating over 2000 people and an office building and tower was built on the lake shore front, on treacherous foundation soils in 1889. The cross section through the building (Fig. 87) shows the complexity of the structural problems encountered in combining three major functions in one building.

Fig. 79

Fig. 87

New systems of timber piling, caissons and raft foundations were specially developed for this building, drawing on bridge building techniques of the period for structural design solutions.

The technical excellence of the theatre equipment was also remarkable for its time, as were the acoustics of the auditorium.

The implications of the high rise building on the land values of the CBD were such that strong opposition to skyscrapers developed rapidly. (61) Land owners on the edge of the core of the CBD who wanted lateral expansion rather than vertical expansion of the city, opposed further skyscraper development, as did those developers who had already erected them and wished to maintain a monopoly on the new land use form. Owners of older buildings who had to pay taxes on the inflated rate of their land, caused by high rise use potential

Ref. 61

also objected. This resulted in an ordinance being passed in 1893 which limited the height of all future CBD buildings to 130 feet (approximately ten storeys). By this time the economy had started on a downward trend and a surplus of office accommodation existed, so that the restriction had no immediately serious effects. (62)

Ref. 62

Steel frame construction had by now been adopted by other large cities in America, particularly in New York where CBD densities, land values and bedrock foundation conditions made the skyscraper a logical development for this location. (63)

Ref. 63

The vertical expansion of the city with high rise structures had begun in Chicago and was continued throughout the world, to become a predominant feature of the contemporary metropolis.

5.3 RESULTANT CONDITIONS

Because the basic conditions of the various components of the city have been carefully established in Section 4.3 previously, this section will be restricted primarily to study in broad scale patterns of change in emphasis of the influence of technology on the city, between 1871 and 1893, rather than in fine scale detail for every urban component.

5.3.1 GENERAL MORPHOLOGY

The change in urban form can best be studied by comparing Figures 64 and 65 of this section with Figures 25 and 44 of Section 4.

Figs. 64 & 65
Figs. 25 & 44

The most obvious factor in both sets of maps is the spread of the built up areas and the increases in the regional transportation networks.

By 1893 all the suburban towns which had been separate dots on the earlier maps, had been joined and incorporated in continuous "arms" of built up areas, extending further out from the city, up to and beyond the defined city limits. Newly formed industrial development areas in the South Side, Calumet, areas had extended the length of the city's built up area to over twenty miles down the Lake Michigan shore line.

The CBD area had grown vertically more than horizontally during this period, with only minor shifts taking place in the centre of gravity of certain functional components in this area when compared with the previous period.

The fringe area had undergone considerable change with industry encroaching on the earlier West Side residential areas which in turn moved back to meet the new fire restrictive zoning laws. Industry, because of the Belt Line railroad cross connections and increased numbers of trunk lines, intensified in the inner west areas adjacent the original river bank industrial zones.

The same density gradients occur along the main commuter routes and main regional railroad lines as previously, but the stopping points along these routes became more focal with the construction of apartment buildings and convenience shops at the points of higher accessibility.

Outlying industrial areas such as Pullman and Calumet became almost totally self-sufficient nuclei, within the metropolitan system, being fully provided with all the communal facilities required for self-sufficiency.



Fig. 91 Haymarket Sq. Randolph Street 1892



Fig. 92 South Water Street 1892



Fig. 93 Clark Street at Jackson 1892



Fig. 94 Dearborn Street at Madison 1892



Fig. 95 Michigan and Prairie Avenues 1892



Fig. 97 Southwest area Housing

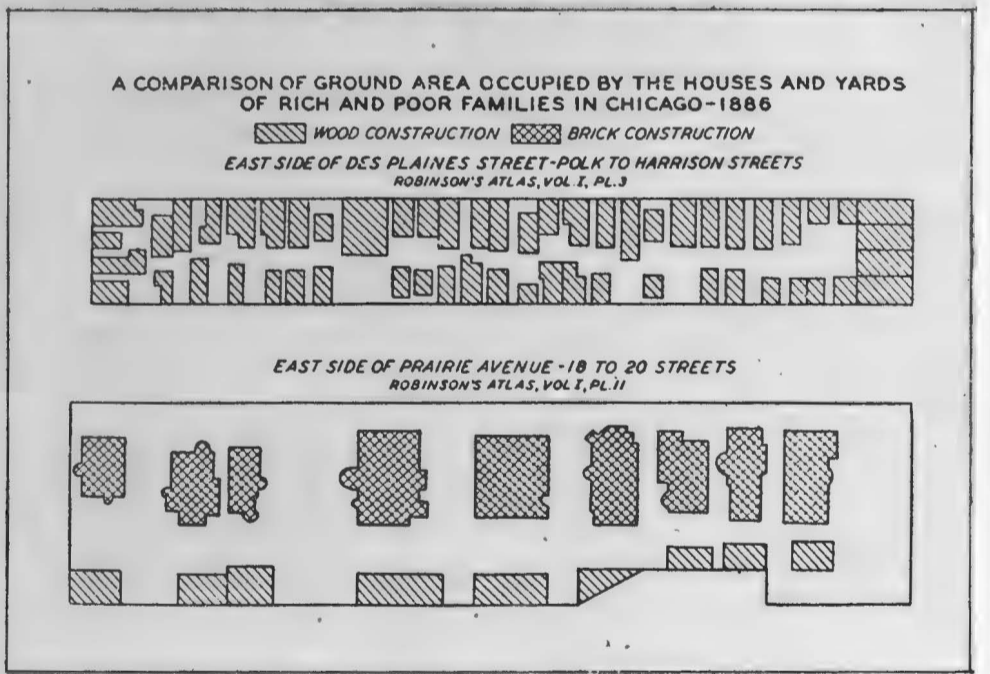


Fig. 96 Comparison of Residential Densities 1886

Figs. 98 & 99 Property Advertisements 1893

Handsome Brick Cottages in Chicago

Price, Only \$1650 to \$1800 each.

EXTRAORDINARY EASY PAYMENTS
BALANCE IN MONTHLY PAYMENTS

See the Height.
Second Story 8 Feet High.
First Story 10 Ft. High.
Basement 3 Ft. ABOVE GROUND

LOOK AT THE ROOMS.

FIRST STORY,
1 Vestibule.
1 Parlor.
2 Bedrooms.
2 Closets.
1 Kitchen.
1 Pantry.

Second Story,
2 Large Rooms

See the Height.
Zweiter Stock 8 Fuß hoch.
Erster Stock 10 Fuß hoch.
Basement 3 Fuß über der Erde.

Siehe Zimmer an!

1 Gang.
1 Vorder-Zimmer.
2 Hinter-Zimmer.
1 Küche.
1 Altwies-Berflüßig-Zimmer.

Zweiter Stock.
2 Große Zimmer.

S. E. GROSS & CO.,
126 CLARK STREET, CORNER OF MADISON STREET.

HOMES - THE NEW LAKE VIEW RAILROAD

JUST NORTH OF THE CITY LIMITS!

WELLINGTON STREET.
GEORGE STREET.

Go and see the HOUSES being built.

OUTSIDE FIRE LIMITS!
You Can Build Wooden Houses!

NO CITY TAXES!

GO AND SEE THEM!
TAKE THE LINCOLN AVE. STREET CARS
Only 3 Blocks from present terminus of Street Cars. One of the most pleasant rides in the city, passing in front of Lincoln Park & along a shady shaded avenue, and away from the streets leading to the cemeteries.

S. E. GROSS & CO.,
Subdividers & Owners of 10 NEW LOTS, 1/2 ACRES EACH, IN THE CITY
126 SOUTH CLARK ST., CHICAGO, ILL.

greatest this, the greatest that. The shouters could not very well be classed with the proverbial liars of Ecclesiastes, because what they said was true; and had they said in the din, "we are the crudest, rawest, most savagely ambitious dreamers and would-be doers in the world", that also might be true." (65)

Ref. 65

By 1893 technological developments, in the form of the highrise structures and the noisy overhead and street level transit systems, had changed the environmental quality of commercial components of the city irrevocably. The changes in the CBD in the following 50 years were to be only in degree, and not the basic nature of the CBD.

Intensification of the same basic patterns and the introduction of the automobile were the only basic changes until 1945, when the first signs of tendencies towards decentralization began to change the nature of the CBD significantly, particularly in more recent periods.

5.3.4 THE INDUSTRIAL COMPONENT

The increased regional transportation systems encouraged further decentralization of the larger industries. Because these new industrial areas were sometimes far removed from convenient residential areas for housing workers, large concerns such as Pullman began to develop fully self-sufficient "model" industrial towns, adjacent the manufacturing areas. (66)

Ref. 66

The motivation behind the creation of these towns ranged between the two poles of philanthropy and the hope for increased productivity. The former was consistent with the model industrial towns built or proposed by Lever (Port Sunlight 1888), Cadbury (Bourneville 1879) and others in Europe, where an attempt was made to plough back some of the profits, generated by the workers, into their living amenities. The latter motivation argued that happier, healthier workers would be more industrious and productive.

In Chicago's Pullman development all these factors were in evidence. The community were made so fully self-sufficient for working, shopping, recreation, education and other day to day activities, that the area developed into a different kind of urban nucleus.

Each component in the town however, was expected, by Pullman, to show a profit.

The Pullman and Calumet area is the example used by Ullman and Harris to illustrate their "Multiple nuclei" concept of the internal structure of cities.

The location of other secondary industries in this period has been previously established in 5.1.3. The quality of the environment was still similar to that outlined in section four. The change to the use of electrical power in industry had only just begun and its effects not yet felt.

5.3.5 THE RESIDENTIAL COMPONENT

Illustrations 95 and 97 show the broad range of environmental quality in the residential areas of the city. Figure 95 shows the fashionable boulevards of the higher income areas with treelined streets, well provided with convenient transport facilities and with gas lighting, water and sewerage services.

Fig. 95

Houses were often of masonry construction, standing on large lots (Fig. 96, lower plan) or of row house type, both offering high amenity living conditions.

Fig. 96

At the other end of the income scale, the workers' houses, in the areas nearest the industries of the West Side, were of timber frame construction, jam packed side by side, often two deep on a single lot, as shown in Figure 97 and in the upper plan of Figure 96. Services in the lowest income areas were usually minimal, except for sewerage which had been progressively installed throughout the city area during this period so as to reduce general health hazards.

Fig. 97

Fig. 96

In the decaying fringe and transition zone areas the first "Skid Row" slums and vice areas deteriorated further to become serious problems in the physical and social structure of the city. (67)

Ref. 67

The property advertisements in Figures 98 and 99 illustrate several points made previously in this section. Figure 98 shows a small brick house, with a simple plan and modest accommodation on two levels. Because it is offered in a development area where a German community has already been established, half the poster is in the mother tongue, the other half being the language of the new world. Thousands of structures of this type were built in the inner and outer residential zones of the city during this period.

Fig. 98

Figure 99 illustrates the "fire limits" factor, the "Proposed early extension of Street Cars", the "Water Pipe" in Lincoln Avenue, the "School and Church" and "Low Fares" on the "Passenger Trains", all the desirable amenities for decentralised or suburban living, used by the real estate agent to promote sales.

Fig. 99

The new central city residential component of high-rise hotels and apartments were usually well provided with services and central heating, the apartments finding great favour with childless families or the older people of independent means who could enjoy maintenance-free living in near central locations.

Suburban living conditions varied from farm scale small holdings to treelined streets with high quality houses as in Oak Park in the West, Hyde Park and Kenwood in the South, and Lake View in the North, to outlying shack areas which grew up in the peripheral, less well endowed, areas of the outer suburbs.

One of the most interesting high income suburbs was Riverside, designed by America's leading landscape architect, Frederick Law Olmsted in 1869. The town was located on a winding stretch of the Des Plaines River, ten miles from the city in the Southwest area. It was planned in a "free form" layout in contrast to the usual rectangular grid, which Olmsted regarded as "too stiff and formal for such adornment and rusticity as should be combined in a model suburb". (58) Olmsted's plans provided for all community facilities including schools, recreational facilities, parks, and public buildings and all services such as water, drainage, gaslighting and paved roads. Building regulations controlled the quality of construction and the position of structures on the lots, which were more generous than usual, being 100 feet on the street frontage and 225 feet deep. These attractions, combined with good commuter railroad transport, made Riverside one of the most desirable residential areas in Chicago.

Olmsted's basic aims in designing the town, to "combine the conveniences peculiar to the finest modern towns with the domestic advantages of a most charming country", (59) were remarkably close to the attitudes put forward by Ebenezer Howard in his Garden City proposals of 1898, twenty years later.

5.3.6 COMMUNITY FACILITIES, RECREATION AND OPEN SPACE

These facilities were further increased, the park building programme of the pre-fire period being extended to new areas and the higher income residences locating along the park edges to capitalise on the added amenity of the open space.

Libraries, museums and schools were provided within the same basic framework as previously.

The University of Chicago had been re-established in the vicinity of the Midway garden area, adjacent the World Fair site, thus stimulating the development in this area of a slightly specialised residential component where students and University staff lived.

The World's Fair had captured the imagination of the whole city and although in some ways it was less successful than had been anticipated, it had great value in bringing to the people of Chicago some of the wonders of the outside world.

Unfortunately the buildings of the Fair, although made out of gypsum and timber framing as temporary structures, harped back to a pseudo classical theme for their architecture. This undermined the raw but honest quality of the "Chicago School" of architecture which had grown out of the skill of its designers, the immediate necessities of the city, and the new potentials of the technology of the time, to become one of the most formative periods of design in the history of the modern world.

The Fair closed at the beginning of the economic decline which was to last until just before the turn of the century.

5.4 SUMMARY AND CONCLUSIONS

Technology continued to play as vital a role in the moulding of the city in this period as it had in the Railroad era previously, the only difference being that in this period it was an ongoing process, not a de-novo initiation.

The fire of 1871 was only a temporary setback to Chicago's growth.

Continued confidence in the city's future caused investment capital to pour in, to create a boom period of reconstruction.

Railroad and canal traffic increased at remarkable rates.

Renewed railroad development resulted in a doubling of incoming Trunk lines and the construction of two interconnecting Belt lines.

The progressive development of regional transportation further stimulated manufacturing activity and greatly increased the value of peripheral land. It also caused the growth of new industrial nuclei on the perimeter of the city.

The transportation routes continued to stimulate the growth of suburban towns, and created new land use patterns within these towns.

The commuter transit routes encouraged the first decentralised retail outlets at their stopping points along routes, where higher intensity residential land uses developed (row and town houses).

Inner city transit systems were greatly increased.

Cable cars replaced horse drawn trams. Elevated steam railroads entered the city and were followed and replaced by electrically driven rail cars.

Commuter traffic increased at rapid rates.

Retail functions sought the trading advantages of transit route halt points, resulting in the doubling or tripling of land values at these points.

Electricity was introduced as the new power source of the city.

The telephone was introduced as the new communications media of the city.

Both had immeasurable implications for the future of the city.

New constructional developments permitted the height of buildings to be increased by means of new foundation and skeleton framing systems.

Development of electrically driven passenger elevators made high rise structures feasible and practical.

Steel framing techniques permitted more efficient floor plans, higher rents, better lighting through larger windows and improved ground floor goods display. High rise buildings had drastic effects on CBD land values and caused the city to grow vertically instead of horizontally and to diversify in land use with the development of the first multi-use structures, vast department stores and high rise hotels and apartment buildings.

Technology had changed the nature of the centre of the city and in expanding its industrial, commercial and transportation base had caused Chicago to emerge at the end of this period as the prototype of the major technology-based metropolis.

Whether this metropolis offered a "better" way of life or an "improved" living environment to its inhabitants is open to question.

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- 12 Mayer and Wade - op.cit. p.122
- 13 Hoyt - op.cit. p.117
- 14 Ibid p.123
- 15 Ibid p.121
- 16 Ibid p.129
- 17 Mayer and Wade - op.cit. p.190
- 18 Hoyt - op.cit. p.138
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- 20 Ibid p.133
- 21 Ibid p.136
- 22 Ibid p.141
- 23 Ibid p.155
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- 48 Richards - op.cit. p.58
- 49 Mumford - op.cit. p.445
- 50 Mayer and Wade - op.cit. p.274
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- 52 Mumford - op.cit. p.445
- 53 Hoyt - op.cit. p.101
- 54 Mayer and Wade - op.cit. p.128
- 55 Condit - Carl "The Chicago School of Architecture" (Chicago: University of Chicago Press p.68)
- 56 Giedion - Siegfried "Space, Time and Architecture" (London: Geoffrey Cumberledge, Oxford University Press. 1953 p.371)

57	Condit - op.cit.	p.69
58	Ibid	p.113
59	Ibid	p.26
60	Giedion - op.cit.	p.367-368
61	Hoyt - op.cit.	p.153
62	Ibid	p.153
63	Condit - op.cit.	p.11
64	Szarkowski - John	"The Idea of Louis Sullivan" (Minneapolis, University of Minneapolis Press. 1960 p.80)
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6 Chicago 1893 - 1917, Automobiles and War

6.1 GENERATIVE FACTORS

In many ways the period between 1893 and 1917 represents a turning point in the urban development of Chicago.

During this period several major changes occurred which altered the structure of the city's economic base, distorted the previous growth patterns and changed the opportunities of individual transport mobility in a most decisive and far-reaching way.

Up to this time the city's basic economic activities had been the exporting of wheat, the importing of timber, the production of steel, manufacturing, and wholesale and retail trading.

After 1893 the emphasis of the productive base moved progressively away from grain and timber handling and concentrated more on steel production, manufacturing, wholesale trading and the generation of electrical power.

These developments had direct repercussions on the growth patterns of the city. What remained of the wheat and timber trade was diverted away from the city centre through the new South Chicago ports of Calumet, Indiana and Gary, which grew rapidly to become new foci in the urban field of Chicago. Their growth was intensified by the concentration of the steel and heavy manufacturing industries in these peripheral areas, which further distorted the previous structural patterns of the city.

The automobile, which had been in its infant stages of development before 1893, rapidly dominated the city's street scene. By 1917 there were 60 000 cars and 15 000 trucks registered in the city. The trend of increased automobile ownership and transport speeds, which started in this period has continued as one of the most important structuring factors of the city today.

It can be seen therefore that during this period much of the old order underlying the city changed, as the new forces of increased industrial development in decentralised nodal locations occurred and the automobile established itself as the dominating technological factor shaping the city.

6.1.1 GENERAL GROWTH FACTORS

This study period does not have the dramatic fluctuations between economic prosperity and depression which had occurred in previous periods.

The depression which followed the World's Fair was slower in onset and in recovery than previously and the improved conditions which followed could not be thought of as boom conditions.

As previously, these fluctuations were most seriously felt in construction and real-estate activity. Manufacturing and Wholesale trading suffered only minor setbacks in what was otherwise a period of dynamic growth. The city's population continued to increase rapidly, reaching 2,5 million by 1917, a 100% increase since 1891.

Two major historical events marked the beginning and the end of the period. The World's Fair of 1893 represented the turning point between great prosperity and the downward economic trend which followed, while the Great War of 1914-1918 marks the close of the period.

Between these two terminal events, there occurred firstly a slow downward trend in general economic activity, which reached a bottom point in 1896 - 1899, followed by an economic revival, which reached a new peak in 1910 and continued with minor fluctuations until 1917 when America joined the European War.



Fig. 102 State and Madison Streets 1911



Fig. 103 "The Busiest Corner in the World". State St. 1905



Fig. 104 Dearborn and Randolph Streets 1905



Fig. 105 Montgomery Ward Warehouses 1964



Fig. 106 Stockyards 1910

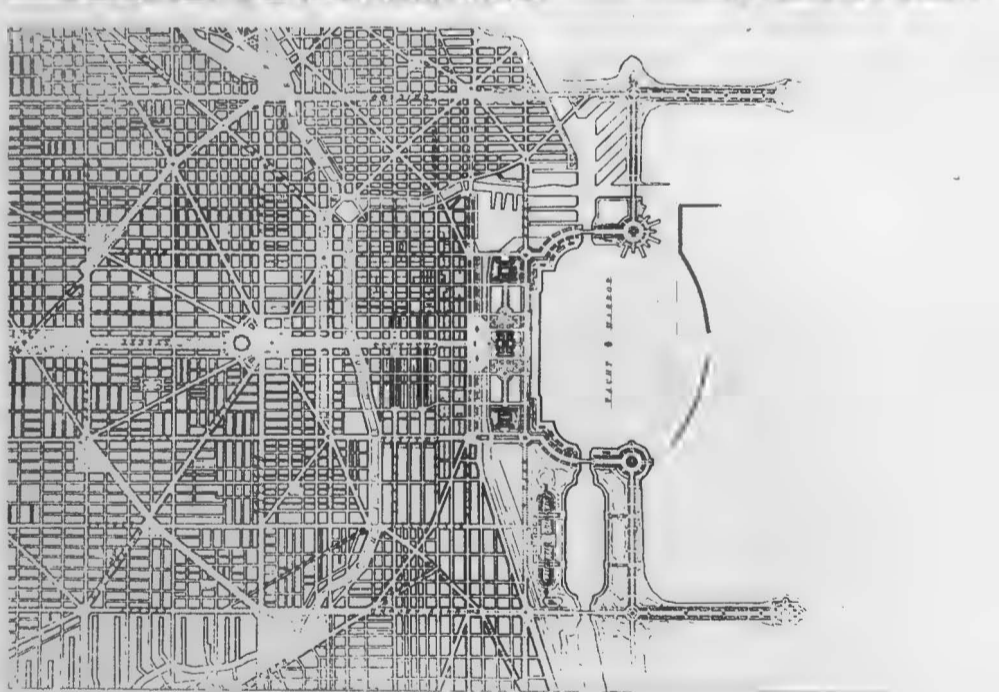


Fig. 107 Plan for Chicago 1909



Fig. 108 Street Market, South Jefferson Ave. 1906



Fig. 109 Back Alley Tenement 1911

A third event which was of great importance to the city but which was not related to any external influences, was the 1909 Plan of Chicago. This was a comprehensive set of planning proposals for the city's future development drawn up by a team of planning consultants, sponsored by a group called the "Merchants Club". The full scope and implications of this plan will be studied later in this section.

6.1.2 TRADE AND COMMERCE

Basic changes in Chicago's commercial activity have been outlined.

Timber imports from local sources were greatly reduced. New imports came from further afield, from the Californian coast and Canada, mainly by railway from the west and northwest, thus by-passing Chicago. Although increasing amounts of timber were used in the city region, Chicago no longer maintained its former prominence as a country-wide timber distributor. (1)

Ref. 1

Wheat exports through Chicago also decreased, as other northern lake outlets such as Duluth and Superior, expanded their grain handling facilities and as more of the produce of the Middlewest was diverted through the Gulf ports. However, because of its well established marketing systems, Chicago did remain the world's primary grain control centre. (2) Graph 12 on page 78 indicates the diminishing importance of produce trading in comparison with manufacturing and wholesale trading in this period.

Ref. 2

The grain and timber which did pass through the city region, was increasingly diverted through the Calumet dock and river system, thus easing congestion on the Chicago river, in the CBD area.

Retail activity in the city also underwent certain changes. In the CBD itself, the area defined by the elevated loop railroad intensified in retail activity until by 1917 almost all the ground floor area in the loop was taken up by shops, selling an increasingly diversified range of goods.

At the same time the number of shop tenants in the CBD diminished although the floor area for shops and offices increased rapidly, particularly after 1910. This was because many of the smaller firms were amalgamated into larger organizations. (3)

Ref. 3

Two distinct trends developed in retail activity. On the one hand the range of goods sold by the gigantic departmental stores was continuously diversifying, to keep ahead of rival concerns. On the other hand in the smaller more prestigious shops, the emphasis was more on specialisation.

Diversification in marketing was further extended into the "Mail Order" system which was pioneered by Montgomery Ward and Sears Roebuck in the first decade of this century. (4)

Ref. 4

The trend towards specialisation in the sale of certain more exclusive goods was common in all cities of the world, but in Chicago, at this particular time it was given more impetus when suburban shopping centres and chain store outlets began to develop. Because the new outlying retail facilities stocked all the generally available "brand name" type of goods, the smaller CBD shops were induced to concentrate their marketing on the more specialised products which could not be purchased in the suburbs. This trend which started in Chicago in the early 1900-1910 period, is much in evidence today.

Figures 102 and 103 give some impression of the increased scale of the structures and the business activity in the loop retail area, particularly on State Street, near Madison Street, which had gained the reputation of being the "Busiest Corner in the World".

Figs. 102
& 103

State Street had retained its dominance in retail activity in the CBD mainly because it was well served by electric car lines and by the elevated railroad line on Wabash Avenue, one block to the east. The incoming rapid transit lines brought over three-quarters of a million passengers into the city every day by 1910, and the retail giants capitalised on the captive and visiting trade on an unprecedented scale.

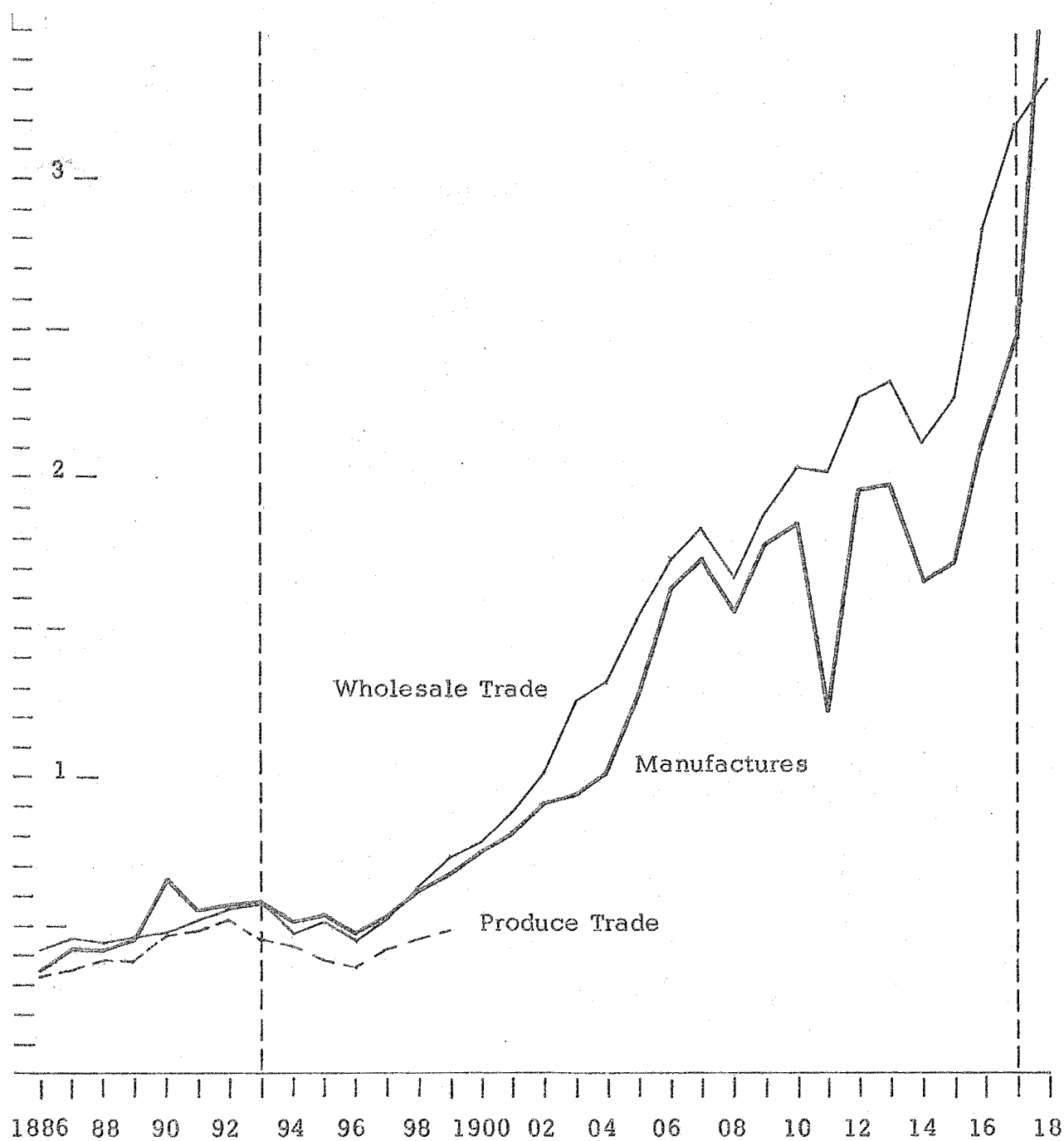
The largest departmental store of this time, the Marshall Field store, had a floor area of over forty acres, and was served by fifty passenger and goods lifts. (5) The range of goods offered was so great that one visitor commented that it was more like a trade exposition than a store. Several other shops in the immediate vicinity were of almost equal scale. Some shops sold more selective goods, ranging from Paris model gowns to the most expensive jewellery.

Ref. 5

This general concentration of retail activity began to exert pressure to displace the more space-consuming wholesale facilities within the loop, to areas beyond the loop on the West side, between the elevated line and the river. Wholesale trading had suffered least in the depression, and by 1904, ten large new buildings had been constructed in this west side area of the CBD. The more space extensive warehouses began to relocate outside the CBD area. The lead was taken by the mammoth new Mail Order Houses which moved to new, decentralised premises between 1904 and 1910. Montgomery Ward established vast warehouses on the bank of the North Branch river (Fig. 105) while Sears Roebuck and Company located in the West Side, in the inner fringe of the transitional residential zone. (6) Transport accessibility was a prime requirement for these nationwide distributors and was much better provided along the river and in the outer zones. The growing importance of wholesale trading in Chicago can be seen in Graph 12.

Fig. 105

Ref. 6



GRAPH 12 GROWTH IN MANUFACTURES, WHOLESale TRADE, PRODUCE TRADE 1893 - 1917

Vertical Unit Values A. Manufactures 1 = 1000 Million Dollars
 B. Wholesale Trade 1 = 1000 Million Dollars
 C. Produce Trade 1 = 1000 Million Dollars

Data Source: Hoyt - "One Hundred Years of Land Value in Chicago."

The produce markets of South Water Street came under the same pressure exerted by the outward expansion of the CBD. These facilities were eventually replaced by peripheral outlets which were better served by transport, but were so far removed from the CBD that they were no longer freely available to city workers for convenience shopping. The moving of these facilities out of the CBD was essential if the congestion and inconvenience of traffic jams such as shown in Figure 104 were to be overcome.

Fig. 104

Banking and Finance remained concentrated in the La Salle Street area, near the Stock Exchange and the Board of Trade buildings. Banking activity intensified in the loop area with the construction of several large new buildings, but also expanded outwards, by providing the first branch banking facilities in the outlying suburbs.

Office accommodation in the CBD had been over-provided in the "Skyscraper" fever of the 1890's, but had achieved full occupancy by 1910, and within the next few years underwent a further rapid phase of development, when building height restrictions were increased to 260 feet.

New types of marketing activity were introduced into the city with the rapid expansion of the automobile trade.

The first automobile shop opened on Michigan Avenue on the South Side in 1902. By 1910 the Avenue was lined with automobile showrooms and small workshops from 12th to 26th Streets. Horse drawn traffic had been almost totally displaced from this part of the Avenue which had been given the new name of "Automobile Row". (7)

Ref. 7

Several major public buildings were erected within the loop area during this period. The City Hall, County Office, Federal Post Office and Court House were all located within three city blocks, thus affording easy access to all the city's administrative and executive functions. (8)

Ref. 8

With the advent of early motion pictures, cinemas joined the ranks of the entertainment component of the city which ranged from the Auditorium, the Opera House and many theatres, down the scale to the "penny arcades", peep-shows, music halls, burlesque palaces, cheap saloons and red light attractions which spread out in that order from the loop to the fringe of the CBD. (9) The Coliseum Convention centre was also well placed in the loop to capitalise on the proximity to the large hotels, which were built in the area and on the major night life attractions in the vicinity.

Ref. 9

Even by 1910 the city's core had been intensified to so great an extent that one city dignitary remarked - "Within an area of less than a square mile there are found the railway terminals and business offices, the retail stores, the wholesale and jobbing business, the financial centre, the main offices of the chief firms of the city, a considerable proportion of the medical and dental professions, the legal profession, the city and county government, the post office, the courts, the leading social and political clubs, the hotels, theatres, Art Institute, principal libraries, the labor headquarters and a great number of lesser factors of city life." He observed that in New York these features were "scattered from the Bowery to 59th Street, a distance of five or six miles and in London from Oldgate Pump to Victoria Station, a distance of four to five miles." (10)

Ref. 10

A visitor to the city stated that: "You take your life in your hands when you attempt crossing State Street with its endless stream of rattling waggons and clanging trolley cars. New York does not for a moment compare with Chicago in the roar and bustle and bewilderment of its street life." (11)

Ref. 11

6.1.3 INDUSTRY AND MANUFACTURING

Manufacturing had maintained almost unreduced growth rates even through the depression years from 1893 to 1897, as indicated on Graph 12.

The decentralisation of the heavy industries continued and became vitally important in this period. South Chicago in the Calumet region attracted sufficient further major industries to warrant the development of a further harbour and industrial land area at Indiana in 1903, and an even larger complex at Gary, some miles further south from Indiana on the Lake shoreline.

The development of the harbour and canal facilities at Calumet were so advantageous for marine trade and heavy manufacturing such as steel production, that whereas commercial traffic on the Calumet River had only been one tenth of that of the Chicago river in 1889, by 1906 it had equalled Chicago traffic and by 1916 it carried five times more traffic than the Chicago River. (12) This growth was directly related to the construction of a large harbour and the connecting canal which joined the new Chicago Ship and Sanitary Canal, completed in 1900. Calumet was also ideally located on the Belt railroad line for distributing its goods to the local area and the country in general.

Ref. 12

Steel production increased rapidly in the Calumet and Gary areas with the establishment of new blast furnaces and rolling mills by the country's largest steel consortia. The region reaped the benefit of being located near to the highest purity iron ore deposits in America, the most easily worked open mined coal seams in the country and the lowest ton/mile transport costs for iron ore in the world.

During this period from 1885 to 1916 the country's total production of pig-iron increased by eight times, and coal by twelve times. Chicago being better endowed with these resources than most other centres in the United States, had more than a fair share in this growth. (13)

Ref. 13

Other large scale industries located on the radial Trunk line railroads or on the inner or outer Belt line. Chicago maintained world leadership in the meat and food processing industries which were well served by ever increasing regional railroad connections, and these connections attracted other allied industries to the outer industrial regions during this period.

Several industrial districts were developed, the most important of which was the "Central Manufacturing District". This was a large tract of land, divided into industrial lots with all services, rail and canal links provided. Lots were available for rental or purchase by the new industries, or the old industries which were relocating away from the city centre.

In the outer zones of the city itself, industry diversified further into specialist fields such as the production of telephone equipment, printing and publishing and the production of electrical fittings, motors and generating equipment. Film making had a brief run in the outer city areas but yielded to the climatic advantages offered to the industry by the Californian coast. The motor industry also had initial impetus in Chicago until Detroit established itself as the automobile production centre of the country.

Company amalgamations were a common occurrence in these times. Several of the old firms which had originated in Chicago such as McCormicks and the Illinois Steel Company, were amalgamated with larger companies or formed larger companies, to become the international manufacturing concerns of today. McCormicks became part of the International Harvester Company in 1902, while the Illinois Steel Company became linked firstly to the Carnegie Steel company of the East and later, in 1901, to the United States Steel Corporation.(14)

Ref. 14

Inner city industries generally continued to locate near the river or canal banks or along the railroad lines, but some also moved into the decaying or blighted residential areas which, in the South Side, had the effect of downgrading some of the adjacent higher income residential areas.

Men's clothing industries grew remarkably during this period, from providing 8 per cent of the country's total production in 1879 to 18 per cent by 1914.

6.1.4 POPULATION INCREASE

As can be seen in Graph 13 the population of the city doubled during this period reaching a total of just under 2,5 million by 1917.

The distribution patterns of this population in the city show rapid increases in population in the outer zones. In the period from 1910 to 1916 the population of the inner city four mile zone remained stationary at just above 1 000 000 whereas the population in the 4 to 7 mile zone doubled, from 460 000 to

1 076 000, and the population in the zone from 7 to 10 miles from the city centre also doubled, increasing from 180 000 to 332 000. (15)

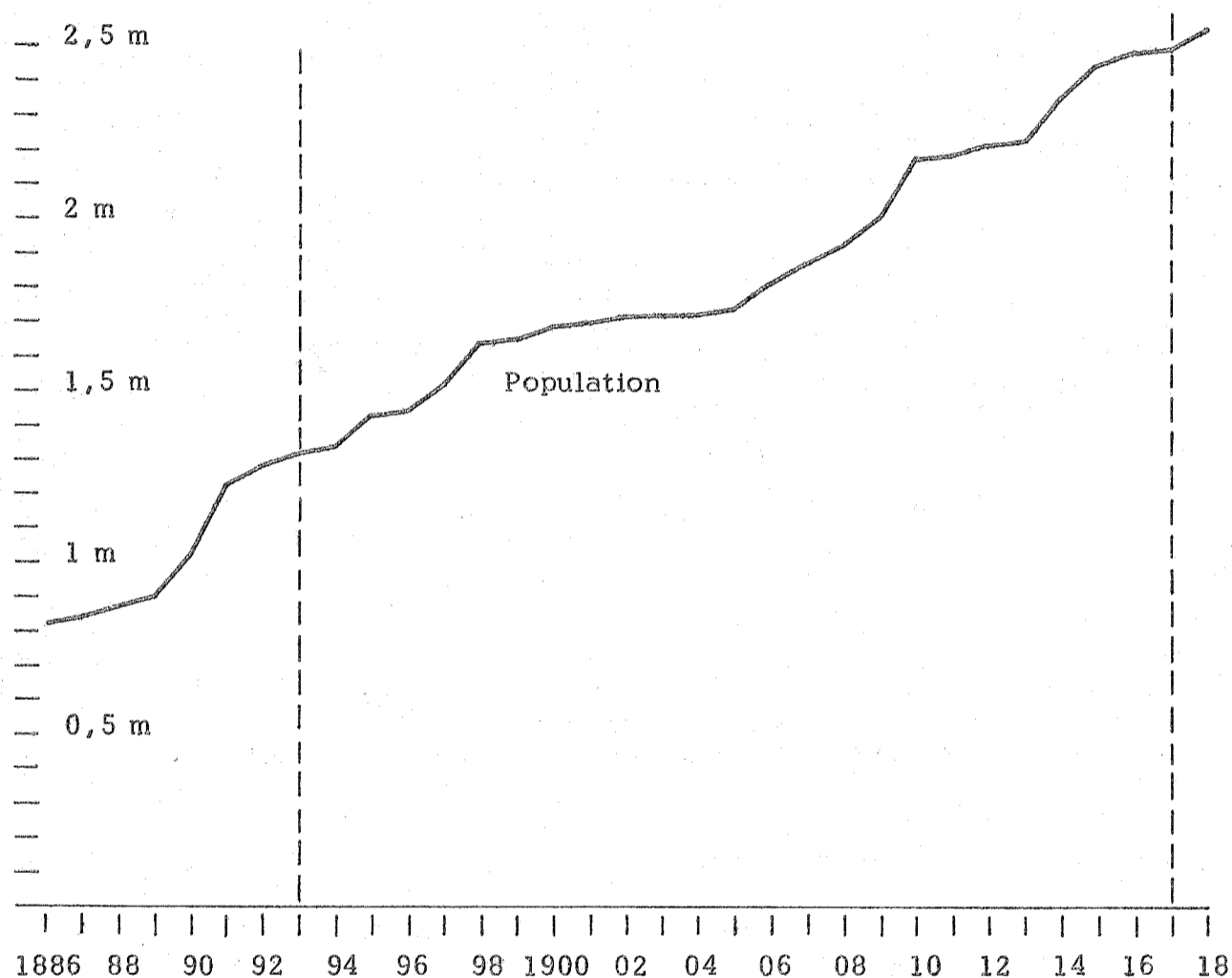
Ref. 15

Employment statistics show that in the period from 1910 to 1930 the number of employees in Manufacturing increased by only 33% whereas employment in other agencies increased by 90%.

This illustrates two important factors. Firstly, employment opportunities were diversifying particularly in the CBD where increasing numbers of people were finding employment as insurance salesmen, advertising agents, school teachers, beauty parlour operators, clerical workers, etc. Secondly, this shift in emphasis indicates that industry became progressively more capital intensive during this period, a point which Perloff regards as the prerequisite of industrialisation. (16)

Ref. 16

The general Westward shift in the centre of gravity of America's population at this time was an important factor in increasing Chicago's regional and country-wide markets for goods and services.



GRAPH 13 GROWTH IN POPULATION 1893 - 1917

Vertical Unit Value 1 = 1 Million People

Data Source: Hoyt - "One Hundred Years of Land Value in Chicago".

6.1.5 LAND VALUE

The general pattern of land values for land within city limits for this period is shown on Graph 14. This shows the land value and speculation slump of the 1893 - 1898 period, the quickening pulse of the city as it regained its strength after the long recession, and the climb to new heights in the 1910 - 15 period.

Fig. 14

Although loop offices and apartments had stood vacant in the 1893 - 1897 period, CBD land values had not in fact dropped to any serious degree, mainly it is thought, because of the continued activity in manufacturing and wholesale trade.

The real estate depression ended slowly as more hoarded money came back into circulation, as rebuilding of apartments along the transit routes continued and as new buildings were constructed in the CBD.

The most important relationships between land values and technology in this period were the same as previously, being the extremely high values of the land in the immediate vicinity of the rapid transit stops in the CBD and the linear peaks of land value along the transit routes outwards along the suburban lines.

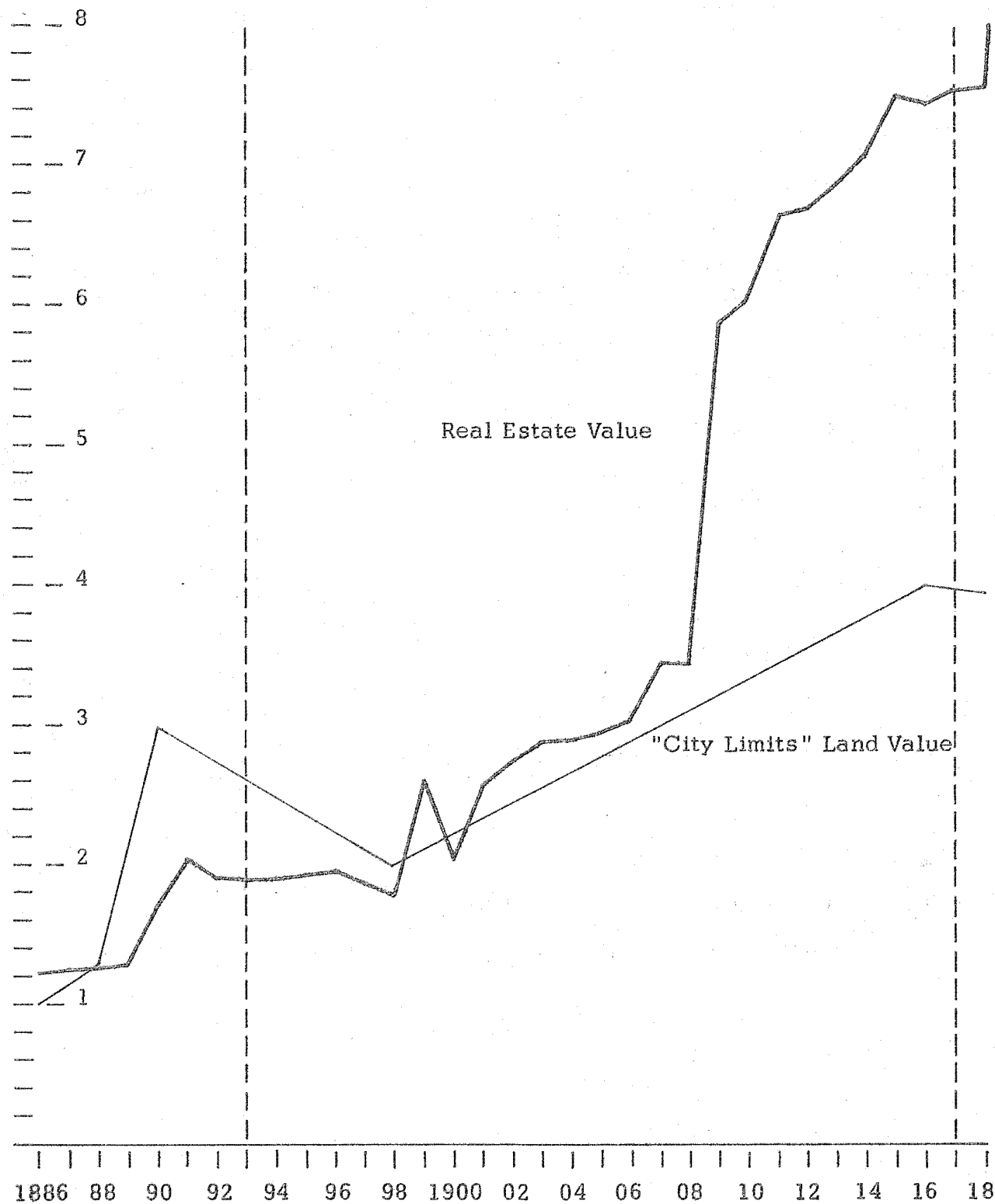
Examples of these transport-generated peak land values in the CBD have been described in the previous period. In the present period the value of outlying land, further from the CBD, was similarly affected, where new transit lines were introduced. An example of this is the increase in value of land at the corner of Sixty-third Street and Cottage Grove Avenue, which jumped from \$8000 in 1893 to \$320 000 in 1920, primarily as a result of improved transit facilities. (18)

Ref. 18

The corner of State and Madison was still the highest valued land in the city standing at \$24 400 per foot front in 1906. (17)

Ref. 17

Land values in the outlying industrial areas in Calumet, Indiana and Gary began to rise rapidly as harbour works were completed and as fierce competition for the available land developed. As in previous times the land value of lots with both water and railroad access were highest in these industrial areas.



GRAPH 14 LAND VALUE 1893 - 1917

Vertical Unit Values

A. Value of Real Estate (Land & Buildings) 1 = 100 Million Dollars

B. Total City Limits Land Value 1 = 500 Million Dollars

Data Source: Hoyt - "One Hundred Years Of Land Value in Chicago".

6.1.6 THE 1909 PLAN OF CHICAGO

In 1909, the Merchants Club, a group of Chicago's more active citizens, appointed a committee to "appraise the physical condition of the city, to discover how those conditions may be improved, to record such conclusions in the shape of drawings, and texts which shall become a guide for the future development of Chicago." (19)

Ref. 19

A design team was appointed under the guidance of two prominent architects, Daniel H. Burnham, who had been the chief designer of the 1893 Worlds Fair, and Edward H. Bennet. After three years' work the plan was completed and submitted to the people of Chicago for consideration and approval.

The planning proposals were of a comprehensive nature, on both a metropolitan and a regional scale, affecting every component of the city.

Emphasis was laid on the fact that Chicago was essentially a transport based industrial city. Particular attention was therefore paid to "the betterment of Commercial facilities; to methods of transportation for persons and for goods; to removing the obstacles which prevent or obstruct circulation and to the increase of convenience." (20)

Ref. 20

The plan also reflected concern for the upgrading of living conditions of the lower income groups of the city's population, and for improved recreational amenities for all population groups, at both local-community scale and on a metropolitan scale.

Requirements for efficient transportation were combined with the planners' intentions to give the city a new and more grandiose scale, by the creation of a system of vast, raised, double-level boulevards. These provided for the free cross flow of traffic at lower levels and multi-lane rapid movement routes at the upper levels which also gave great axial importance to the public buildings planned to be the focal points of the design, at the intersections of these boulevards.

Provision for major engineering works were also made in the Plan. The South Branch river was to be straightened and the Lake Front extended by reclamation, and developed to incorporate a major park, athletic grounds, cultural facilities, a marina and two amusement piers, on either side of the yacht basin, which was aligned symmetrically on Congress Street. (Fig. 107)

Fig. 107

A new Civic Centre complex was to be built on the West Side, along the route of Halsted Street. This centre was intended to become the focus of the outward radiating street and boulevard system shown in Fig. 107.

The pattern which was proposed for Chicago in the Burnham Plan of 1909, had many of the formal relationships of Haussmann's Plan of Paris, implemented in 1853-1869. (21) Both plans laid heavy emphasis on formal, axial, spatial relationships, of monumental scale. In Chicago's case the designers of the plan saw this as a major requirement for a city which would become "within the lifetime of persons now living, a greater city than any existing at the present time." (22)

Ref. 21

Ref. 22

The Plan was accepted by Chicago's citizens and many of the proposals of these times were effectuated in the city during the following years. Among these were: the landscaping of Grant Park, on the reclaimed foreshore to the East of the city; the construction of one of the two piers planned to project out into the Lake, and the Adler Planetarium on a promontary of the newly built foreshore area; the construction of the vast Soldiers Field Stadium in the position designated as "Athletic Grounds" on the plan; the placing of Eisenhower Expressway along the Congress Street alignment together with its major interchange system at the Chicago Circle, which was the original position of the Civic Centre complex in the Plan; and finally, the construction of one of the multi-level accessways proposed for the river front of the Main and South Branch, this being the Wacker Drive complex, completed in 1926.

Most of these developments occurred after the war, at a time of great general prosperity, and will be examined in detail in the following study period.

It is claimed by many urban historians that in general, the Chicago plan of 1909 had more far reaching and long lasting effects on the city than almost any other planning proposals for large occidental cities in this century. (23)

Ref. 23

6.2 TECHNOLOGICAL FACTORS

6.2.1 GENERAL MECHANIZATION AND ENERGY SOURCES

One of the key indicators of increased mechanization in almost all production processes, is the growth rates occurring in manufacturing employment. The fact that manufacturing output could increase from 1,8 Billion Dollars in 1910 to 3,8 Billion Dollars in 1929, an increase of over 108%, with a corresponding increase of only 33% in employment, must be primarily accounted for by the substitution of machinery for manpower and the rationalization of production techniques.

Linear assembly and processing techniques had been progressively developed in previous periods, in meat processing, container manufacturing and packaging, the clothing and footwear industries, and in many other fields. During this period, Henry Ford, and others had further developed techniques of mass assembly and standardization to produce the famous Model "T" automobile, which because of the efficiency of its production, kept the cost of the finished product at a sufficiently low level that millions of Americans could own them.

It was not only in the assembly line processes themselves that mechanization was intensively applied. Every component part was mass produced on increasingly automated lathes, milling machines, boring machines and tolerance testing equipment, so that parts were completely interchangeable with any other similar part, requiring no final "hand fitting" as in earlier times.

These techniques were not new but their application to a wider range of products was perhaps more intensive than at any other time.

Eli Whitney, the inventor of the cotton gin, first used the idea of mass produced interchangeable parts for making muskets for the Government in Connecticut as early as in 1798. He first made his tools, dies, assembly jigs and test gauges and then put each of his workmen at benches in separate buildings to work only on one particular part of the mass produced guns. (24)

Ref. 24

The idea of interchangeable parts developed further in the mid-nineteenth century when New England factories were producing watches, locks, sewing machines and many other products by assembly line methods, using completely standardized and interchangeable parts.

By 1902, standardization had been integrated into automobile production to such a degree that three Cadillac cars were shipped to England, run on a track for 500 miles, stripped to the last bolt, the parts "scrambled" and reassembled using only hand tools without making any fitting adjustments, and the three cars started on the first turn of the crank, and run for a further 500 miles without any further adjustments.

By 1914 Henry Ford was producing 250 000 cars per year at the incredibly low price of \$ 490 for an open tourer. (25) This was made possible only by the full scale adoption of standardization of component parts and rationalized assembly line processes. The quality, comfort and reliability of these products had made enormous advances in the period since the turn of the century.

Ref. 25

Mass production was given even greater stimulus by the advent of the 1914-18 war in Europe. When America eventually joined the war, the country tooled up to produce the flood of arms and equipment which eventually became a decisive factor in the termination and outcome of the war.

Chicago, with its well developed steel industries, heavy manufacturing facilities and a multitude of secondary and minor industries, reaped the same sorts of benefits which had been generated by the Civil War of 1861-65, but on a vastly increased scale.

The processes of automation had social and behavioural repercussions which were as important as the deterioration of the physical environment which often accompanied them. Fears that the machine was "de-skilling" man, in almost all the activities of everyday life, from factory "piece work" to shaving his face with the first safety razors, were reflected in the writings, art and the cinema of the times. Mechanical aids crept into almost all urban activities at this time. The Burroughs Recording-adding machine was used in shops after its early development in 1888, (26) and in some offices, early phonographs were being used as the first office dictating machines.

Ref. 26

The change in the energy and power base of the country, and the world, had already commenced in the previous study period with the installation of the first Electricity generating stations in the early 1890's.

The widespread and ever increasing use of electricity is one of the most important developments in the history of man. The ability to generate great quantities of energy at a central source, and to transmit it through lines, often no thicker than a pencil, to isolated consumers, be they factories, homes, trolley cars or whole cities, was as radical and far reaching a development as nuclear power was to be in the 1940's.

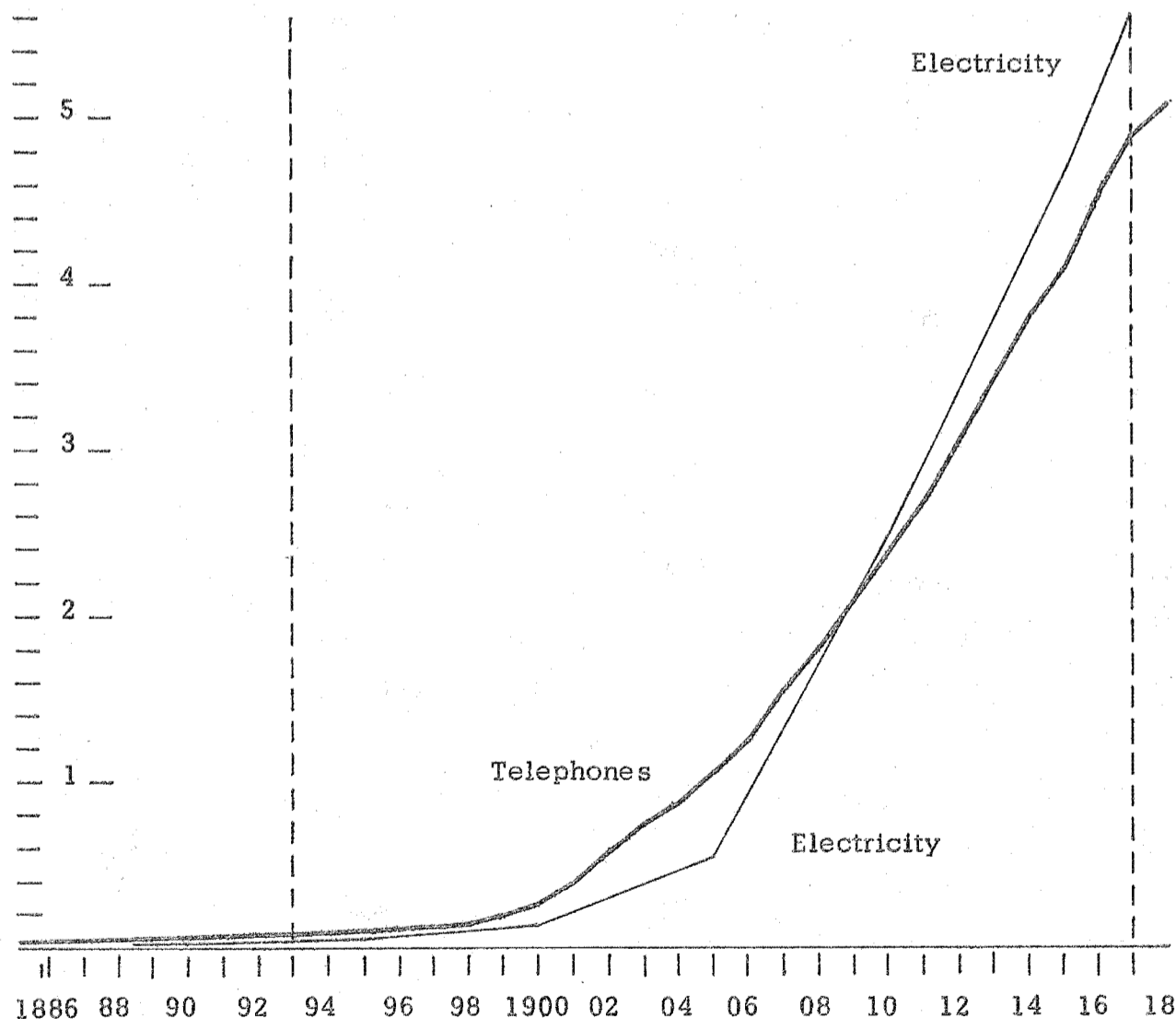
Chicago became one of the nation's largest suppliers of electrical energy during this period because of the abundant supplies of cheaply mined and transported, high quality coal and the lake water supply for steam raising and heat exchange.

After the development of the Polyphase alternator by Tesla in 1887, power generation and transmission changed from direct to alternating current. (27) Incandescent lighting made great advances with the development of the tungsten filament light in 1913. (28)

Ref. 27

Ref. 28

The rate of increase in production of electrical power can be seen on Graph 15 below.



GRAPH 15 GROWTH IN SERVICES AND COMMUNICATIONS 1893 - 1917

Vertical Unit Values A. Electricity generated 1 = 250 Million K.W.
B. Telephone stations 1 = 100 000 phones.

Data Source: Hoyt - "One Hundred years of Land Value in Chicago."

Fuel oil and petroleum products became increasingly used as power sources. Automobiles used petrol and lubricating oils, diesel engines used paraffin, the first oil fired boilers were developed in 1903 (29) and bitumenous products were used increasingly for road making.

Ref. 29

Several synthetic materials and metal alloys were developed in this period. High speed tool steels were developed in 1900 (Taylor and White), the first synthetic resins made in 1906 by Baekeland and Duralumin, a high strength aluminium alloy, was first produced by Wilm in 1909.

6.2.2 WATER TRANSPORT

The importance of water transport to Chicago increased with the completion of the Chicago Sanitary and Ship Canal in 1900 and with the construction of the Calumet Sag Channel, which connected Calumet harbour with the inland waterway system. The construction of new harbour and industrial areas at Indiana and Gary, in 1906, immediately attracted the bulk of Chicago's maritime trade through these ports where water transport did not suffer the continuous delays and conflicts caused by road bridge crossings in the CBD.

Freely available land for miles around, adequate water supply and good rail-road connections, caused prodigious growth around the new industrial lake ports. Indiana harbour was to become the largest petroleum handling harbour in the Great Lakes. In this period, however, Whiting, a third new port between Calumet and Indiana, was the focus of the early petroleum import trade. (30)

Ref. 30

Grain and timber trading took second place to steel production and heavy industry, at these South Chicago industrial ports, but the scale of the former activities can be measured by the fact that by 1907 there were sixty new grain elevators at Calumet harbour alone. (31)

Ref. 31

Ship sizes and speeds could be greatly increased with the larger inland canals and waterways which were of great importance in transporting the bulky and heavy iron ores, limestone and coal required for the basic industries and electrical power of the metropolitan complex.

The Chicago river still continued to carry a large amount of river traffic to the industries along its banks as can be seen in Figure 114.

Fig. 114

6.2.3 RAILROAD TRANSPORT

A comparison between Figures 101 and 65 in Section 5 gives an immediate idea of the increase in regional railroad development in this period, incoming lines being increased to 34 by 1915.

Figs. 101
& 65

A similar comparison of Figures 110 and 67 illustrates the further development of inner city transit systems.

Figs. 110
& 67

In the case of the regional railroad network, more freight traffic began to bypass the city itself, by the use of the two Belt line connections, which had vast freight yards at various intervals along their routes, as shown in Figure 112. The main regional connectors were still more intensively grouped in the South and South West sectors than in the North and North West, mainly because of geographical conditions but also because of the rapid growth of the South Chicago, Calumet, Indiana and Gary industrial areas.

Fig. 112.

In the city itself, the elevated loop railroad around the core of the CBD was completed in 1894. This came into being as a result of an agreement between the owners of incoming elevated lines who realised the advantages of a ring collector system for passengers and the disadvantages of dead-end city terminals which caused delays and congestion when trains had to flow in two directions on the same line. It was realised that each company could not construct its own "loop", as had been the case in the earlier cable car lines, because of the problems of interference in street traffic below, loss of light and noise which the overhead lines caused.



Fig. 111 Elevated Loop Railroad, Lake & Wells St. 1912



Fig. 112 Ashland Ave. Yard, Inner Belt Line 1915



Fig. 113 Automobile Shop, Oak Park 1903



Fig. 114 Chicago River, Michigan Ave. Bridge 1900



Fig. 115 Site Clearing for Steel Works, Gary 1906



Fig. 116 Construction, Sanitary and Ship Canal 1899



Fig. 117 Underground Freight Tunnel 1912

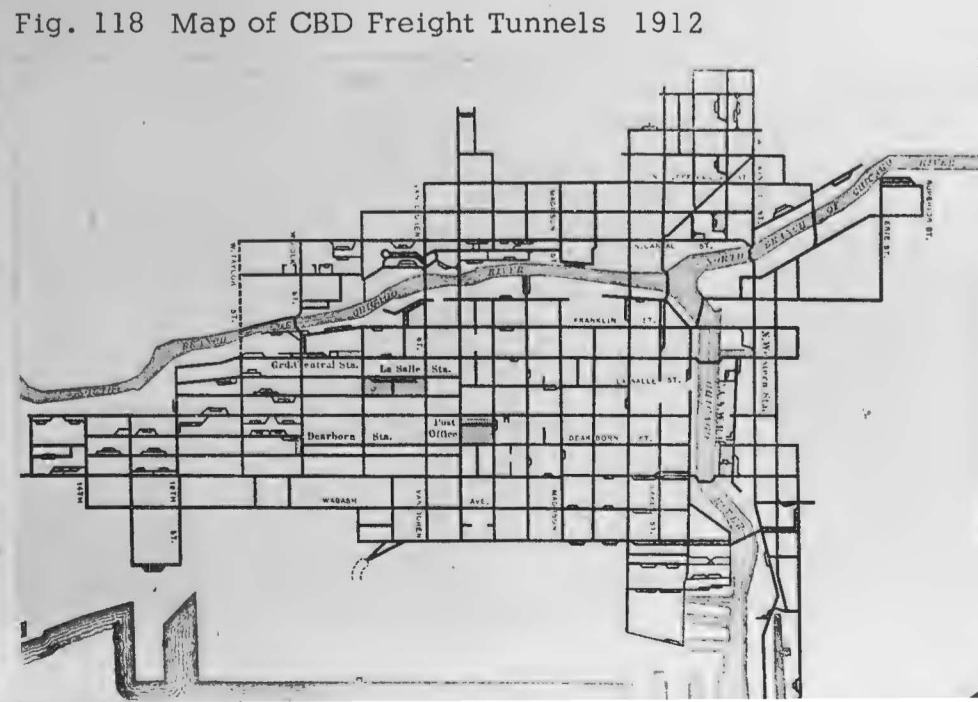


Fig. 118 Map of CBD Freight Tunnels 1912

The effects on land values and on the environmental quality of the streets down which the elevated lines passed were equally dramatic, and have been outlined previously. In this period however, the intensity of use of the loop increased greatly, as can be seen in Figure 111. By 1916 over 100 000 people used the elevated transit lines daily. (32)

Fig. 111
Ref. 32

Both the elevated lines and the street rail cars were progressively extended further out into the surrounding areas, intensifying traffic and the growth of shopping facilities and higher density residential development at nodal points along their routes.

Additional elevated lines were built in this period to the North and West areas, thus balancing out some of the earlier transit advantages of the South and causing some far reaching changes to occur in the residential structure of the city. Three new lines were built in the North Side two in the West and only one in the South. These new lines in the North and West were accompanied by further extensions of the electric rail car lines which caused greater residential development in these sectors than ever before, particularly in the North Side. Here the higher income population sought the Lake shore locations in preference to the older South Side locations which were on the downgrade, while the middle and lower middle income groups settled further back from the shoreline. In the West the higher and middle income groups were able to locate further out, beyond the belt of low income housing, mainly because of the increased rapid transit facilities provided to the West at this time.

By 1897 all steam trains on the inner loop elevated railroad had been replaced by electric driven locomotives. (33)

Ref. 33

While Chicago was developing transit systems in the air and on the ground, new sub-surface freight handling facilities were being developed in a system of tunnels under the city which had been originally excavated for telephone services.

The Freight Tunnel System, as it was called, commenced operations in 1907 and by 1914 had a network of over sixty miles of tunnels under the whole of the core area of the CBD and its adjacent areas on the West and North of the Chicago River and its branches. (Figs. 117 and 118) By 1920 the small electrically driven freight cars delivered over 600 000 tons of packaged freight to the many surface connected terminals which served the city above. The tunnel system also removed the rubble excavated on building sites, the ash from boilers for steam heating, the garbage and other city waste products and delivered coal and other goods to the city centre from external loading points.

Figs. 117
& 118

Graph 16 shows the rapid increase in the numbers of passengers carried daily by the elevated railroads and the surface rail car lines, rising from under 100 000 in 1892 to just under two million daily passengers in 1917.

6.2.4 ROAD TRANSPORT

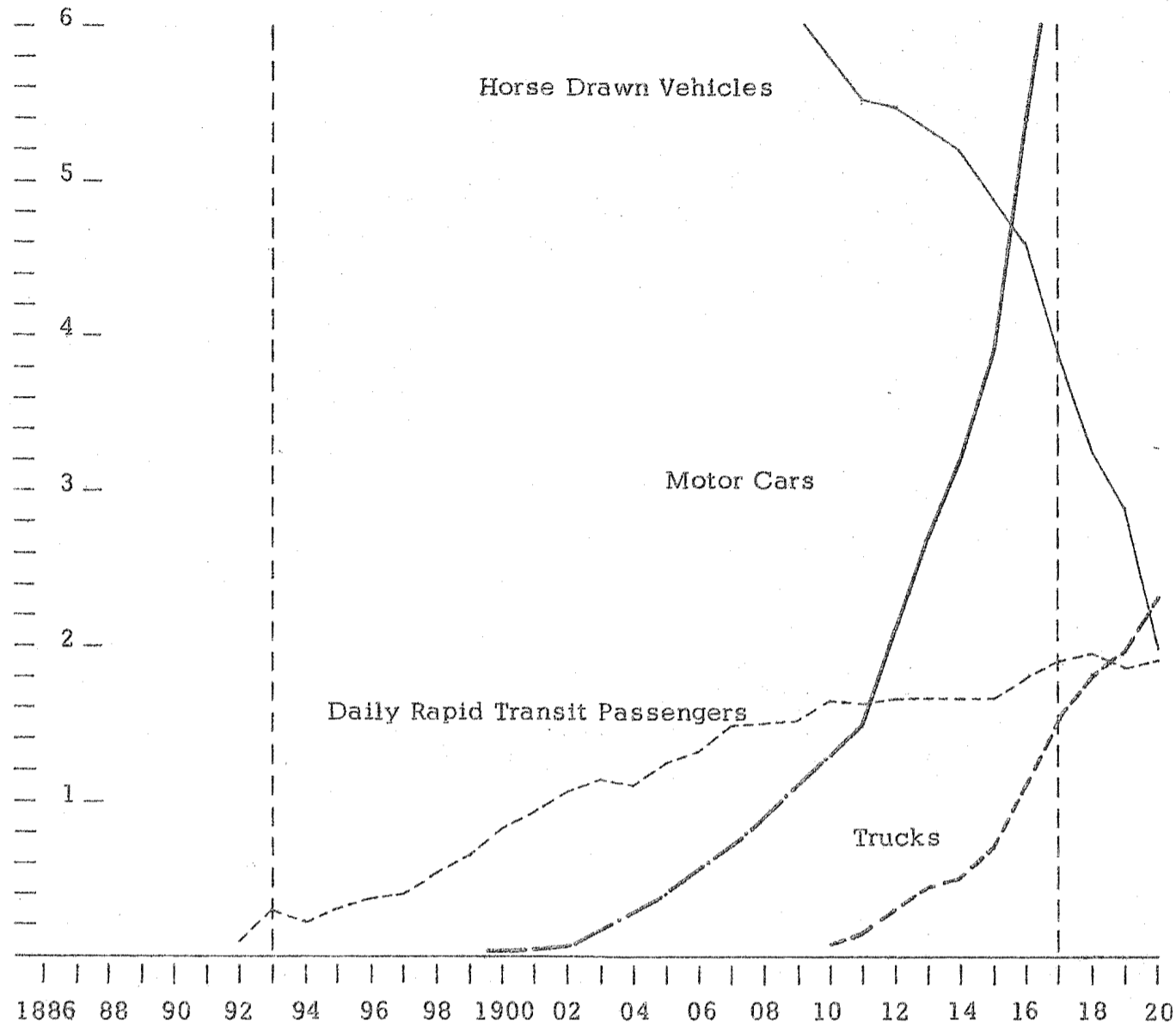
With the increasing mass production of automobiles, the trends in individual scale, high convenience, rapid transportation were well established in Chicago by 1917.

At first the automobile made little or marginal demands on the city system. The first automobiles to be sold in Chicago in 1902 spluttered up and down the cobbled and paved roads amongst the horse drawn cabs, carriages and waggons, in a noisy but unobtrusive way. Country roads were generally unpaved and became rougher as one progressed further along the secondary routes and farm roads.

By 1917 the situation had changed remarkably. As can be seen on Graph 16, horse drawn vehicles were rapidly diminishing while the ownership of automobiles was increasing at a tremendous rate.

Gasoline driven motor trucks were rapidly ousting the horse drawn waggons as the freight carriers of the city and the region.

The early automobiles with hard springing and solid rubber tyres soon began to demand more and better surfaced roads. This demand has continued unabated with increased vehicle speeds and car ownership resulting in the vast systems of inter-state and inter-city freeways and urban access routes of the contemporary city.



GRAPH 16 GROWTH IN AUTOMOBILES REGISTERED AND REDUCTION IN HORSE-DRAWN VEHICLES 1893 - 1917

Vertical Unit Values A. Motor cars 1 = 10 000 Vehicles
 B. Motor trucks 1 = 10 000 Vehicles
 C. Horse Drawn Vehicles 1 = 10 000 Vehicles
 D. Transit passengers 1 = 1 Million passengers per day.

Data Source: Hoyt - "One Hundred Years of Land Value in Chicago."

6.2.5 AIR TRANSPORT

Because of the importance of air transport in future study periods it should be noted that the first flights of the Wright Brothers occurred in America in 1903 and that by 1917 the aeroplane had been sufficiently developed to become an important weapon of war.

Chicago had been introduced to air travel with the balloon race held from the grounds of the Worlds Fair in 1893. The first real impact of aviation on the city however, was when an International Aviation Meet was held in Grant Park in 1911. It was estimated that between three and four million people witnessed the event which, because of the lavish prize money offered, had attracted the world's leading aviators. (34)

Ref. 34

6.2.6 SERVICES

The major service provision of this period was the Chicago Sanitary and Ship Canal which, because it was motivated and commenced at the end of the previous study period, has already been described. Its completion certainly relieved many of the serious health problems which had occurred previously and also provided a much larger and more efficient waterway link to the interior than the Illinois and Michigan Canal, which it replaced.

The subsurface freight tunnel system improved the garbage and waste collection facilities of the centre city greatly, but as in most sea or lake ports of this time, the garbage was then dumped in the lake, where progressive pollution had become a serious contemporary problem.

The freight tunnel system is of great importance because it marked the beginning of the development in Chicago of the great subsurface support system which is common to so many large cities. Unlike London, Paris and New York, passenger transit did not go underground until much later but other subsurface service systems such as the Wacker Drive underground road system, built in Chicago in the following study period are vital arteries of the city.

6.2.7 COMMUNICATIONS

The installation and use of the telephone in Chicago increased at a rapid rate as can be seen on Graph 15, which indicates that by 1917 there were just under 500 000 phones in use in the city.

Extreme long distance communication was further improved with Marconi's development of radio telegraph in 1896. (35)

Ref. 35

The development of the use of the telephone had direct implications for Chicago in that the country's largest manufacturer of telephone equipment located their production plant in the city. This established the basis of an industry which later diversified into radio and finally into electronics, which is one of Chicago's many medium-scale but labour intensive industries today.

6.2.8 CONSTRUCTION

Construction activity during this period dropped to less than half of its 1890 peak production between 1893 and 1900, increased rapidly in 1902 and continued to rise to a new peak in 1910, after which it fluctuated at this level until the sudden decrease in 1916-18 during the war. (Graph 17)

CBD Construction followed the earlier trends towards highrise steel framed office buildings, which reached heights of 19 to 20 storeys when height restrictions were relaxed, and large scale retail and wholesale stores which also shared the advantages of steel frame construction. The trend after 1902 was towards larger, higher, better served and equipped structures as can again be noted by comparing the "Total Annual Cost" line and the "Number of buildings" line on Graph 17.

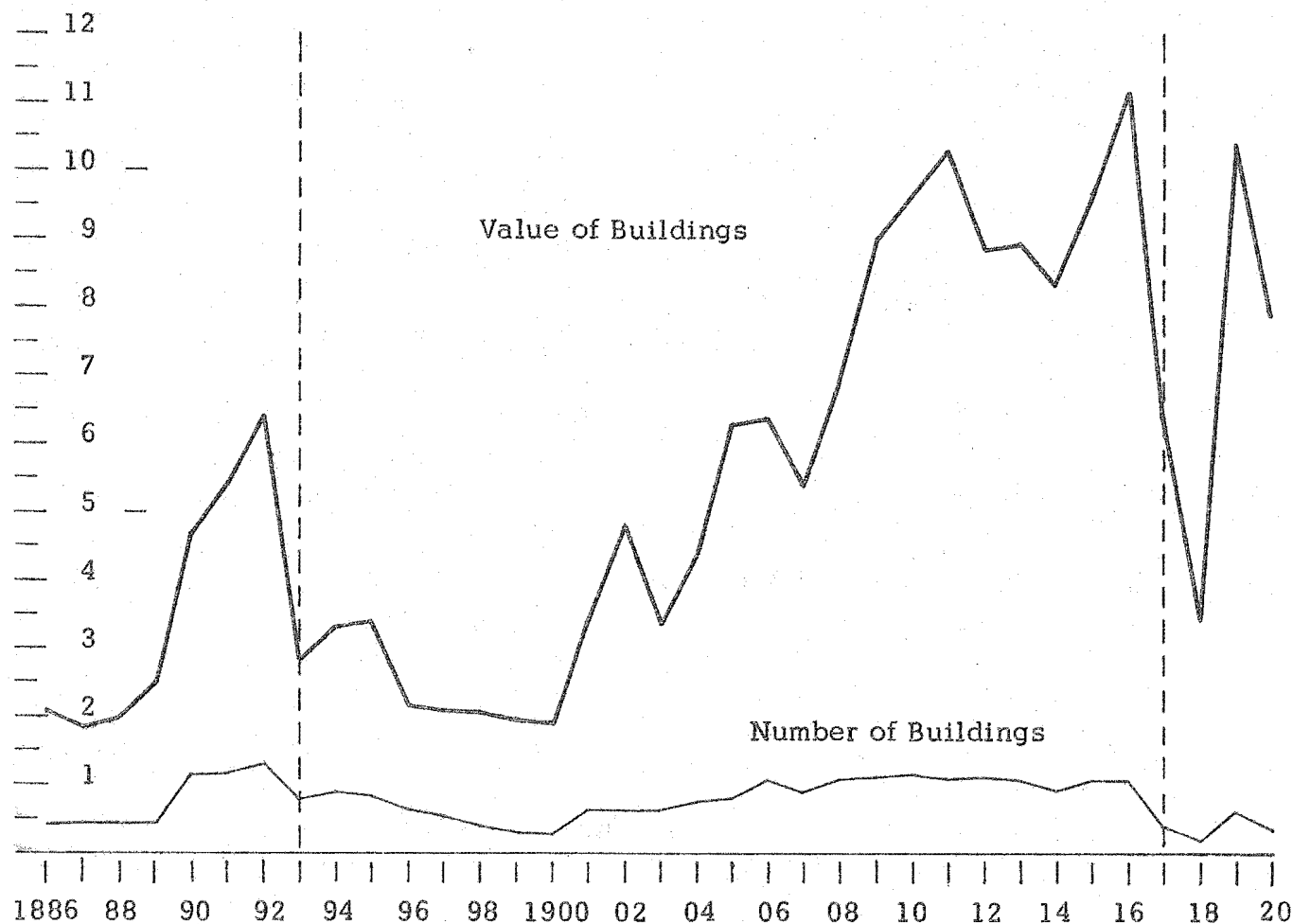
The pattern of residential construction also changed little in this period. Timber remained the universal fabric for low and middle income housing, while brick and concrete continued as the construction system for the higher income single family homes and for the medium rise, row, town and terrace houses and tenements of the period.

Some developments in construction technology which did occur in this period but which were more related to the fields of Civil Engineering than building construction, were advances in earth moving techniques.

Figure 115 shows the clearing of the site for the steel mills at Gary in 1906. As can be seen, all site clearing, levelling and excavation was undertaken by teams of men and horses, the earth being moved in horse carts and loaded and unloaded by hand. By 1917 this work was being done with petrol or oil driven machines using large solid rubber driving wheels or Caterpillar

type tracks which had been developed in 1902. (36) These early scrapers, loaders and the dragline cranes (Fig. 116) were the forerunners of the earth-moving equipment of today which plays such a vital role in the shaping and forming of the contemporary man-made environment.

Ref. 36
Fig. 116



GRAPH 17 GROWTH IN CONSTRUCTION 1893-1917

Vertical Unit Values:

- A. Annual value of new buildings 1 = 10 Million Dollars
- B. Annual Number of new buildings 1 = 10 000 buildings

Data Source: Hoyt - "One Hundred Years of Land Value in Chicago"

6.3 RESULTANT CONDITIONS

6.3.1 GENERAL MORPHOLOGY

The broad scale patterns of growth and form are similar to those established in 5.3.1 previously but because of increased regional and inner-city transportation, the pattern had been spread further afield, intensified in the core and frame areas, and diversified in the outlying suburban and industrial development areas. This can best be studied by comparing Figure 100, which shows urban growth for this period, with Figure 64, which is its counterpart for the previous period.

Fig. 100
Fig. 64

Two major shifts in emphasis in urban development, which were technology based, did occur in this period. The first was the rapid residential development of the North and West Sides, generated in part by greatly improved rapid transit facilities to these sectors and in part by the deterioration of environmental conditions in the South Side. The second and more consequential factor was the remarkable growth of the South Chicago satellites of Calumet, Indiana and Gary. The growth of these centres by the end of the period in 1917, was so marked that it finally transformed Chicago from what could be described as a city, with suburban finger development, to a Poly-nuclear Urban Complex.

6.3.2 STRUCTURING FORCES

The same basic forces which were evident in the previous period were operating in the city at this time but apart from the basic inward attraction which the city exerted on its urban field, centripetal bonds had become less dominant than previously in the individual components of the city.

The retail component of the CBD because of its rapid horizontal expansion, was exerting centrifugal pressure on the more space intensive wholesale activities. Retailing itself was expanding into peripheral, suburban markets and Commerce was expanding vertically and horizontally, causing overspill into other land use areas. Small scale industries were the only activities which moved inwards towards the centre of the city as they intruded into the vacant or decaying fringe areas of the old low income residential zones. Heavy industry was moving progressively outwards to cheaper, better served land in the new industrial areas.

The high income residential component vacated the mid-city South Side zones as industries encroached into its edges, and relocated in the North and West Sides, far out in the peripheral suburbs or along the Lake shoreline.

The new urban nuclei of Calumet and Gary induced further centrifugal forces on the productive components of the city.

The Loop area itself was the only zone which had not yet felt the centrifugal forces which were acting on most of the other urban components. Its turn was still to come.

6.3.3 THE COMMERCIAL COMPONENT

Technology had set its mark on the commercial component in many ways. Rapid transit systems brought the millions of workers, shoppers and visitors into the city, but also congested its streets and endangered its pedestrians with the jam packed, nose-to-tail tramcars which fought for right of way with horse drawn cabs, carts and waggons, and later with automobiles. Overhead the loop elevated railroad generated more noise, dirt and general loss of amenity, both to the sunless streets below and the office workers in the upper floors of the adjacent buildings.

Technology had made the buildings of the CBD taller and larger. Industry made them dirtier with the smoke of its boilers, and the acrid fumes of its chemical processes.

Electricity provided better street and internal lighting while the telephone, cash register, dictaphone and other technical devices allowed more rapid communications, cash handling and business operations.

Sub-surface freight transport systems improved delivery and despatch of both the goods and the waste products of the city.

The centre city environmental condition is best summarised by the illustrations of the area (Figures 102, 103 and 111), and the following quotations by visitors to Chicago in 1910: "The sky is of iron and perpetually growls a rolling thunder. Electric lights are emitting burning sparks; below are waggons of every size and kind, whose approach cannot be heard in the midst of the noise; and the cars with jangling voice which never ceases, cross and recross." "If the most noisy place is Hell - surely Chicago must be Hell." (37)

Figs. 102,
103 & 111

Ref. 37

6.3.4 THE INDUSTRIAL COMPONENT

The outlying industrial areas such as Calumet, Pullman and Gary, were developed as self-sufficient industrial towns. The industries in these new towns grew rapidly, both in number and in scale. The adjoining towns were mostly composed of small, timber framed houses with a few masonry structures such as tenements, community buildings, schools, etc. The worst of these industrial towns were provided with minimum services, were built in monotonous rows, down bare, unplanted and untended streets and rapidly deteriorated into hostile environments. (38) Even the towns such as Pullman, which had been established with

Ref. 38

high hopes, as a model industrial town, were beset by problems when riots and strikes broke out in these areas as easily as in less carefully conceived townships.

The inner-zone industries changed little in this period from the previous conditions. Many of the smaller industries amalgamated with larger concerns and relocated in new, more peripheral locations, their places being taken by other small industries or in some cases by other larger wholesale concerns which had been displaced from the more central areas of the city.

Although the inner zone industries themselves did not change greatly, the surrounding residential areas did begin to change, generally for the worse, as will be outlined later.

6.3.5 THE RESIDENTIAL COMPONENT

The conditions existing in the many residential areas of the city varied only slightly from those described and illustrated in the previous section (5.3.5 and Figs. 95 to 99 inclusive).

Figs. 96
to 99

One of the most important changes was in the deterioration of some of the older inner zone residential areas. As the timber houses aged more, their physical condition deteriorated seriously, particularly if they were owned by a landlord who intended spending a minimum on repairs. In many cases the densities were pushed to intolerable limits by the erection of additional houses, hovels or temporary shelters in the backyard of the already crowded building lots. "Back Blocks", with back alley access, and "Double Decker" tenement houses, pushed densities to levels which could be compared with the worst areas of Calcutta or Tokyo, ranging from 270 to 900 persons per acre in some areas, all in low rise structures!

Ghetto areas proliferated as a result of national, ethnic and social discrimination. Discrimination against Negroes was widespread and when a Negro family did move into a predominantly white area, it often started a mass exodus of the whites to another area. Although Negroes were only 2% of the total city population in 1893, the proportion increased rapidly as more employment seekers arrived in the city.

Large families and low wages in the low income groups only aggravated matters particularly when services such as garbage removal, street lighting and water and sanitation were at a minimum standard of provision and maintenance.

The expanding masses of low income population spread into the older established higher income areas, particularly in the South and caused a major displacement of the higher income families to the North and West Sides.

Vice and red light areas flourished in these conditions, particularly as city law enforcement authorities often turned a blind eye to what was happening; or even assisted in its processes.

These conditions were to grow progressively worse in later periods but their causes remained basically similar.

Some of the less downgraded areas are shown in Figure 108 and 109. No matter what the spirit of the people living in these conditions was, or how they adapted to them, the environmental condition could not be condoned as an acceptable habitat.

Figs. 108
& 109

Bye-laws which were in existence were seldom, if ever, enforced after the buildings had first been built. Conditions in some of the earlier tenement houses were equally poor, only upgrading after much more stringent performance standards had been established for their construction.

6.3.6 COMMUNITY FACILITIES, RECREATION AND OPEN SPACE

One lasting advantage which the Worlds Fair brought to the city was the redevelopment of Jackson Park and the Midway into a major park facility under the guiding hand of the leading landscape planner, Olmsted.

One of the main permanent structures of the fair, the Fine Arts Building, became the Field Museum, and later the Museum of Science.

The Lake front at Jackson Park became a fashionable boulevard. The Midway was later developed into an entertainment complex with a large central structure designed by Frank Lloyd Wright, one of Chicago's most famous architects.

In the city itself libraries, a large auditorium, a Concert Hall, many theatres, cinemas, variety and vaudeville halls, catered for a wide range of public tastes. Centre city entertainment which had been a strong attraction in the earlier periods, was rapidly affected by the new suburban cinemas which showed the same silent movies as the CBD cinemas and avoided the long distance travel which city based entertainment involved.

6.4 SUMMARY AND CONCLUSIONS

The most important technological influence exerted on the city in this period was the advent of the automobile.

The automobile introduced a new freedom of movement for the individual, which the railroad and tram car could never offer.

With the sale of the first automobiles in Chicago in 1902 an irreversible trend was established which remains one of the most potent structuring forces acting on the city today.

As car ownership grew with alarming rapidity, horse drawn traffic in the city was reduced at a similar rate.

However the railroads and street cars remained the mass transit mode for the general public, and increased in passenger-carrying throughout the period.

Additional elevated railroad and street car lines were constructed from the city centre to the outlying areas.

More lines were built to serve the North and West Side zones which grew more rapidly as a result of improved transport accessibility. This resulted in critical changes in land use and land value patterns within the city's peripheral zones. In the core of the city the introduction of the central loop elevated railroad line further intensified trade, commerce and retail activity and caused further distortions in the C.B.D land use and land value systems.

Maritime traffic in the Chicago region was radically changed as the South Chicago ports of Calumet, Indiana and Gary attracted the grain and timber trade away from the Chicago River.

These new towns also attracted the Steel mills and heavy industries to the freely available, cheap, flat, well serviced land which they offered.

The prime attraction of this land, however, was the excellent river, canal, lake and railroad transport facilities which it offered.

These South Chicago harbour and industrial developments changed Chicago from a centrally focussed city to a multi-nucleated metropolitan complex.

The efficient generation of electricity changed the power and energy base of the city and added a new industry to its economic base.

The telephone became the everyday means of mass, long-distance communication while the early aeroplane opened up new horizons in rapid transportation.

This period marks the transition from the old to the new orders in transportation, communication and energy sources, and also marks the change in urban form from a city with satellite towns, to a multi-focal urban system.

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Fig. 119 Chicago - Urban Development 1945



Fig 120 Chicago - Principal Streets and Roads 1945



7 Chicago 1917 - 45 The City in Transition

7.1 GENERATIVE FACTORS

The changes in both the economic base and the form and condition of the city, which became evident in the previous study phase, continued during this period, and in most cases became more extreme.

Manufacturing and wholesale trading became increasingly dominant in economic activity, while the rapid increase in automobile ownership added impetus to the spread of suburban settlements, which in turn caused further decentralisation of retail trade, commerce, services and recreation.

The new industrial nuclei such as Calumet, Indiana and Gary, continued to grow in scale and intensity at rapid rates but also began to specialise in particular production or trade activities. As these areas moved more towards specialisation, other industrial nuclei sprang up in the interspaces between major access routes and, further out, on the periphery of the city.

The dominant technological influence of the period continued to be the automobile, which exerted insatiable demands on the city's road systems, as greater numbers of cars rolled off production lines to meet the increasing demands for car ownership. The influence of the automobile was felt both in the city, where increased street widths, bridges and freeways were required, and also in the peripheral areas where suburban development intensified and proliferated.

Technology made further impact on the form of the city when major reclamation programmes were implemented on the lake front, the South Branch River was straightened and the first multi-level road transport system was built along the waterfront of the CBD.

Underground systems were taken a major step forward with the construction of the first subway railroad lines. Surface railroads met with increased competition from motor vehicle transport and eventually began to turn from steam power to diesel electric power, which in turn brought yet another major industry to Chicago, that of diesel electric locomotive manufacture.

Electronic engineering which had started with the manufacture of telephone equipment, rapidly diversified into radio and television towards the end of the period.

The period closed with the first controlled nuclear reaction, achieved at the University of Chicago in 1942, thus marking the beginning of one of the most critically balanced periods in man's history.

7.1.1 GENERAL GROWTH FACTORS

In this period, the general economic trend reverted to the cyclic "boom" and "slump" phenomena which were so characteristic of the pre-1893 periods.

The war of 1914-1918 had been a great stimulus to the manufacturing and trading components of Chicago. When the war ended the impetus was directed back into local markets created by returning service men, and post-war market readjustment. The result was a period of unprecedented growth in all urban sectors which lasted unbroken from 1920 to 1929.

As in previous periods the country seems to have overstretched itself and to have indulged too freely in the excesses of general prosperity. The economy faltered and a panic in stock exchange dealings (1929) caused one of the most serious depressions of modern times. The depression reached its bottom level in 1933 and the economy never fully recovered until the beginning of the Second World War.

Partial relief from the depression occurred in 1933 when the "Century of Progress" Exposition was held in Chicago. Contrary to expectations, it



Fig. 121 Southwest view of Central Chicago 1936



Fig. 122 Northwest view of Central Chicago 1936



Fig. 123 Reclaimed Land, East of Loop 1947



Fig. 124 Reclaimed Land, Grant Park 1929



Fig. 125 Streeterville, Reclaimed Land 1926



Fig. 126 Straightening South Branch River 1926



Fig. 127 View Northward towards Loop 1940



Fig. 128 State Street, North from Madison 1923

proved to be a great success financially as well as in uplifting the spirit of the people who attended it. (1)

Ref. 1

During the peak periods of the boom of the twenties, the city experienced a major building boom, which greatly intensified the land use of the CBD, and also enabled the backlog of housing, which had developed in the war, in all income groups, to be made good. The intensity of building activity in the CBD experienced at this time was never repeated. After the onset of the 1929 panic, no further structures were built in the CBD until the end of the Second World War in 1945. (2) Even in the late 1960's when major rebuilding did occur, it catered mainly for office-type structures and was not as widespread and general as in this period. Therefore the twenties rebuilding programme established the general form of the existing CBD. Since then it has only changed in degree and in materials in certain isolated areas.

Ref. 2

Returning servicemen caused the suburbs to increase in size, and to multiply, particularly as increased automobile ownership extended the range of home-seekers.

The growth of the new suburbs was so dynamic in this period that many of the larger retail establishments of the CBD opened branches in the main sub-centres thus setting the final seal on the trends towards decentralisation which are the prime forces acting on Chicago today.

In the inner city residential areas, the living conditions of the extreme low income groups, particularly in the rapidly spreading Negro Ghetto areas of South Chicago, became so debased that serious breakdowns in social and behavioural patterns occurred. These conditions, combined with racial friction, resulted in serious riots in 1919. Improvements in ghetto living conditions were extremely slow, even after the attention of the city had been focussed onto them by the riots. (3)

Ref. 3

By the end of the period many of the trends which continue to operate in the city today, were firmly established. Many of the problems caused by overcrowded living conditions and environmental deterioration, had also been experienced at crisis scale for the first time.

7.1.2 TRADE AND COMMERCE

Illustrations 121, 122, 124 and 128 give an indication of the transformation in the CBD which occurred in the peak period of construction between 1924 and 1929.

Figs. 121,
122, 124,
128

Building heights leapt from 18 and 22 storeys to 35 and 45 storeys when the 264 foot height restrictions were modified to permit "tower" type development. (4) These new towers were predominantly office buildings. By 1929 there were 163 "skyscrapers" in the loop area.

Ref. 4

Apart from the towers which gave the CBD a new vertical dimension, several new mammoths were built which were of moderate height, but of vast horizontal dimensions. These structures included the gargantuan Merchandise Mart which occupied two full city blocks of air-right property over railroad tracks on the North Branch waterfront, and was claimed to be the largest building in the world in 1930; the Civic Opera House which catered for an audience of nearly 4000 people; and the Stevens Hotel, which with three thousand bedrooms and bathrooms, was the largest hotel in the world. Several other projects of even larger scale were proposed, but were never completed as the developers could not overcome the restrictive legislations of the city, and the objections of other interested parties. (5)

Ref. 5

The large retail shops of the loop area, built in the two preceding periods were not rebuilt, and have in fact remained almost unchanged to this day.

Two large projects which had been foreseen in the Burnham Plan of 1909, were constructed in the mid-twenties: The first was the West Side Railroad terminal and the second the Post Office.

These two projects and many others of a major scale, were undertaken within the development programme known as the Wacker Improvement.

Charles H. Wacker, a dynamic organiser of the 1893 Worlds Fair was appointed by the City to gain support for the implementation of the 1909 Plan. He achieved this by a well organised public relations campaign involving the showing of films on the proposals of the plan, the production of a universal handbook on the plan, which was printed in millions for mass circulation to Chicago's citizens, and by arranging demonstration lectures and meetings for the public, in support of the planning proposals. So successful was the campaign that the public even agreed to the increased taxes required to implement certain improvements specified in the plan. (6)

Ref. 6

The Post Office and new railroad terminal, the Union Station, were some of the earliest proposals implemented. The Post Office which was the largest mail transfer facility in the world, was conveniently located near the new railroad station for mail dispatch. It was built to meet the requirements of the 1909 plan which had proposed a main traffic artery passing under its central section. This eventually occurred some twenty years later when the Eisenhower Expressway took this route to provide access to the centre city freeway connections. (Fig. 145)

Fig. 145

Another major engineering work undertaken in the CBD in accordance with the 1909 plan was the construction of Wacker Drive, a two level road system along the CBD banks of the Chicago river which was intended to give service access to warehouses and wholesale facilities at the lower level and to improve street access at the upper level for perimeter traffic in the CBD.

The Foreshore reclamation scheme was also undertaken in accordance with development principles established in the Chicago plan.

As most of the facilities provided in the southern area were of a cultural, educational and recreational nature, they will be described in 7.3.6. The effect on the CBD of the northerly reclamation work (Fig. 125) was important because the new land extended the East side of the city considerably, particularly when the lines of the Illinois Central Railroad were depressed below ground level and the service electrified in 1926. (7) Figure 124 shows the extent of this reclaimed land.

Fig. 125

Ref. 7

Fig. 124

The land in the foreground of Fig. 125, to the North of the Chicago River was developed as a Northeast extension of the CBD. This land, called Streeter-ville, had previously been held back from development by the legal wrangles involved in establishing ownership of the mud flats on which an old shipwrecked sailor had built a hut and laid claim to the ground. It had taken Chicago's shrewdest lawyers some twenty years to dislodge him. (8)

Ref. 8

For the first time since Chicago's earliest history, commercial development was re-established on the North Side, mainly in the area flanking Michigan Avenue. Although several large commercial structures were built on the North Side during this period, it never vied for importance with the older loop area, for retail activity, or for the more central business functions of banking and finance. The development of the North Side of Michigan Avenue was as a direct result of a major street widening and bridge building project on the Avenue, completed in 1920. This had immediate repercussions on land use and land values in the area, as studied in 7.1.5.

The Wacker Drive area also attracted an intensive spate of new commercial buildings along its route on the South Branch riverfront. This included the civic opera house, which had forty floors of offices above the auditorium, and several other office buildings and wholesale trade facilities. (9)

Ref. 9

Apart from these new developments, the land use and land value patterns of the CBD did not change a great deal from those of the previous period. The extension of the CBD in a southerly direction was hindered by the railroad tracks in the area from the South Branch river to the edge of the lakefront, so that Northerly expansion across the river and Easterly expansion into Streeter-ville were the only options open for horizontal extension of the CBD.

The central southern area of the CBD continued to be occupied by low-rise, loft type structures which were used either as warehouses or for small-scale specialised industries, such as furriers, fashion clothing workshops and manufacturing jewellers. (10) (Fig. 127)

Ref. 10

Fig. 127

In the peripheral zones of the CBD, beyond the river branches and extending through the low income housing into the nearer suburbs, miles of small scale commercial buildings grew up along the major section-line streets. This type of development was encouraged by successive zoning ordinances under the title of "ribbon development". This commercial use zoning was greatly over-provided and resulted in over-dilution of commercial activity, which in turn caused many of the businesses in the less accessible areas to fail, and the buildings to fall into disuse. Most of the structures were low rise, with apartments or small offices provided above the ground floor commercial facilities.

Further out from the city in the middle and higher income suburbs, these commercial facilities were more viable, because they were grouped in more concentrated areas, which were generally related to major road or street crossings or to rail halts and main road intersections. These areas continued to grow as in previous periods, but with increased car transport accessibility, the growth rates were much more rapid. The potential for trade in the larger suburbs was so great that several of the larger CBD retailers such as Marshall Field, Sears Roebuck and Montgomery Ward opened regional scale shops in the prime focal areas of the periphery. (11) As previously, chemists, banks, restaurants, cinemas and many other associated facilities, gathered around the main departmental stores to form the nucleus of the first regional shopping centres. By 1939 there were six of these major regional shopping centres in the Chicago area with market areas extending for miles around. (12)

Ref. 11

Ref. 12

The emphasis in transport accessibility for these centres changed from the suburban railroad to automobile access, and thus from railroad stops to main streets, avenues or boulevards. Large parking areas became essential components of these shopping centres.

This development is probably one of the most vitally important factors in the change towards the general decentralization of urban activities which followed in the years after the war.

7.1.3 INDUSTRY AND MANUFACTURING

The trends towards decentralization in industry continued in a similar way as previously, in this period.

Industries continued to move outwards into the many new Industrial Districts which developed in the periphery. These areas offered larger building lots which were more advantageous for linear or production-line processes, which demanded vast single storey plants in contrast to the earlier multi-level lofts which were originally used in the city.

This tendency further reduced inner city manufacturing which became more specialised, using production processes which needed smaller floor areas in order to keep the higher city rents within reasonable limits.

Several new industries developed in this period, while others which had started before the war grew rapidly. Most of the country's diesel electric locomotives were built in the new General Motors Plant at La Grange. The manufacture of electrical equipment of a range of types increased and the telephone equipment industries diversified into the production of radio, and later, television equipment. Three of the electronics giants of American industry, Admiral, Motorola and Zenith, established works in Chicago. (13)

Ref. 13

Calumet grew further in this period until by 1945 it was a continuous mass of blast furnaces, rolling mills, ore, coal and limestone stockpiles, grain elevators, chemical plants and other secondary industries.

Other industrial ports such as Whiting, Indiana and Gary tended to specialise in certain functions. Whiting and Indiana continued to be the petroleum handling ports while Gary became the centre of the vast United States Steel complex.

New manufacturing activity developed in dozens of other new areas along the inland edges of Chicago and along the North Lake shore at places such as Waukegan and Evanston.

With the added stimulus of two world wars, by 1945 Chicago's manufacturing base was one of the most powerful in the world. During the second world war Chicago's giant manufacturing potential played a vital role in America's war effort. Many existing industries were converted for the production of war materials and equipment. The Douglas aircraft company and Pratt and Whitney, the largest aircraft engine producers in the U.S.A., built assembly and production plants in Chicago. (14)

Ref. 14

7.1.4 POPULATION INCREASE AND DISTRIBUTION

After the 1914-18 war streams of returning soldiers and other work seekers flooded into Chicago. (15) The negro population which had previously been only a small percentage of the total urban population, increased rapidly. The earlier trend of expansion of the original negro settlements in the South Side continued as greater numbers of Southern families and returning soldiers came to the city. The numbers of houses available to these families who were mostly in the very low income bracket, were extremely limited and overcrowding and overspilling into adjacent areas continued. Bitter resentment between whites and negroes festered at the fringes of the expanding ghettos, and eventually burst out into open violence in the riots of 1919.

Ref. 15

Population growth rates reached a peak in 1928 but then levelled out and actually diminished slightly in the period of extreme depression in 1932, thereafter increasing again until America entered the war.

Most of the increase in population was distributed in the expanding suburbs. The suburbs were the receivers of people who were moving up the income scale and came from houses or apartments closer to the city, or the new arrivals who were spread across a wide range of income groups. The same movements, upwards in income, and outwards in location, allowed the poorer immigrants to move into the cheaper inner zone housing, as in previous periods. This was not true in the case of negro families who were at a severe disadvantage in choice of residential location because of racial prejudice, and the extreme shortage in accommodation.

The higher income North Side population grew rapidly in this period with the rapid increases in apartment construction, whereas the older, lower income areas, within a four mile zone from State Street actually reduced in population by 150 000, most of the people moving outwards from the blighted areas on the fringes of the ghettos and industrial zones. (16)

Ref. 16

7.1.5 LAND VALUE

The most important changes in central area land values were caused by the opening of the new double-decked Michigan Boulevard bridge in 1920. Almost immediately the decaying North Side river front area leapt in land value, some areas increasing from 2 to 25 dollars per square foot in only 2 years. (17) This area was quickly built up with high rise office buildings, two major skyscrapers being built on the corners of the Boulevard adjacent the bridge.

Ref. 17

Further reductions in river traffic which had started before the 1914-18 war, and greatly improved bridge facilities, combined to improve access across the river and its branches and to reduce the difference in land values between the loop area and the land opposite it, on the other side of the river. The levelling of land value gradients outside the loop area was further reinforced by the increases in value of the land along Wacker Drive on the North and West of the CBD, and of land at the fork of the river where the Merchandise Mart was built.

Peripheral land values followed previous patterns of high value along main transit routes and peak values at the intersections of main routes, particularly on the one mile and half mile section grid lines. As the larger CBD retail and wholesale firms opened suburban branches in high accessibility areas, the value of adjacent ground immediately increased. The "ribbon" like commercial development which was encouraged by the 1923 zoning ordinance, reinforced higher land value along the main transit routes.

The land values at some of the more important corners where transport routes intersected, increased at alarming rates, some by 300% in only a few years. (18)

Ref. 18

Residential land values showed marked increases along Lake Shore Drive where high, medium and low rise apartments were erected along the shoreline to capitalise on the beaches, views and open vistas which the lake offered.

7.1.6 THE "CENTURY OF PROGRESS EXHIBITION" 1933

Chicago staged the exhibition to mark the first one hundred years of the city's growth on the newly reclaimed land on the South Side Lake front, to the south of Grant Park. It presented a pageant of "progress" in all fields of Chicago's urban activity and provided some respite and inspiration to the city's population in the period of extreme depression in 1933.

It attracted an attendance of over forty million people and more than covered the cost of its construction with gate takings.

This comment from one of Chicago's leading newspaper journalists sums up the overall effect of the exhibition: "It is so bright and so simple. It is new. You go in cynical and sour and you come out convinced that you'll pull through and so will everyone else The people who conceived this fair, and built it, struck just the right note at a time when the rest of us did not know where to turn to next." (19)

Ref. 19

When the exhibition buildings were eventually removed, the city continued to face the long slow process of recovery, which was not fully achieved even by 1939 when the demands of war brought a compulsory resurgence of activity to the city.

7.2 TECHNOLOGICAL FACTORS

7.2.1 GENERAL MECHANIZATION AND ENERGY SOURCES

Earlier trends in mechanization, rationalization and mass-production, were extended into almost every production process, particularly after the added stimulus given to industry by the demands of two world wars.

The energy base of the city remained electricity, which was generated in ever increasing amounts in thermal stations using the regions abundant coal supplies. Even in the railroads the emphasis began to move away from the use of steam locomotives to the diesel-electric system of motive power, mainly because of the waste of energy involved in keeping locomotives "stoked up" and ready for use. Electricity was increasingly used in manufacturing processes, instead of steam, for heating and driving machinery. The first concerns for avoiding the smoke pall so common to all industry based cities, were recorded in the 1909 plan for Chicago and from then onwards became a goal of increasing importance in the zoning of compatible land uses.

It is of some interest that Chicago was the city which witnessed the birth of another radically new power source, that of Atomic energy, first generated under controlled conditions by Enrico Fermi's pioneering team in 1942.

7.2.2 WATER TRANSPORT

Inland water transportation was further revived with the development of increased canal connections for barge traffic between Chicago and the Mississippi river, when the Illinois waterway was completed in 1933. The improved

lock system made regularly scheduled services between Chicago and New Orleans possible, increasing the city's total canal-borne commerce to twenty million tons per year, just over one third of total shipping tonnage. (20)

Ref. 20

The balance of water-borne freight was divided between internal, Great lakes traffic in iron ore, coal, wheat, etc., and overseas services which increased in the early 1930's when regular Dutch and Norwegian services to European ports were established.

The city's satellite ports of Gary, Calumet and Indiana grew in scale to become major harbour facilities in their own rights, far surpassing the traffic handling capacity of the Chicago river port facilities.

The South Branch of the Chicago river was straightened over one section in a major engineering undertaking within the Wacker improvement plan in 1926. (Fig. 126)

Fig. 126

Water transport continued to hold the bulk cargo and inter-ocean cargo traffic but lost much of the short-haul freight carrying to the more rapid railroads and motor vehicles.

7.2.3 RAILROAD TRANSPORT

In the same way in which the railroad had progressively ousted the canal from its position as Chicago's premier transport agency in the 1860's, by 1945, the railroads were beginning to feel the competition of the motor vehicle for short and long haul overland transport. The full force of this competition was not to be fully felt until after the second world war, and was far from the minds of Chicago railroad companies in the twenties when freight handling facilities were continuously extended to meet increased traffic. (21)

Ref. 21

Passenger handling facilities on the West side of the CBD were greatly increased with the construction of Union Station in 1924, which was of sufficient size to handle over 300 incoming trains, 100 000 passengers and 2 000 tons of mail daily.

Elevated railroad and surface car lines continued to carry increased numbers of passengers up to 1926 when the transit load levelled out and began to drop as increased bus services and automobile ownership offered alternative means of commuting. All suburban trains were electrified by 1926.

The last link in railroad transportation in Chicago was provided with the completion of the first phase of the underground Rapid Transit facility in 1943. (22) This was intended to replace the elevated lines over a long period of time, the underground phasing in as the elevated lines were phased out. The first and main CBD station had its surface connections in State Street, further reinforcing its previous position as the retail hub of the city. The second link of the Milwaukee-Lake-Dearborn Street section was only completed after the war, in 1951. (23)

Ref. 22

Ref. 23

As the inner city freight handling yards became progressively less efficient due to lack of proper rail connections, space and equipment, vast new peripheral yards were developed or existing ones enlarged to cater for the increased freight traffic of the region. The Proviso Yard was developed in this period to handle up to 26 000 rail cars on 230 miles of track with sixty odd switching locomotives and an elaborate control system, operated from three observation towers. (24)

Ref. 24

7.2.4 ROAD TRANSPORT

Whereas the regional railroad system of Chicago had from 1848 been based on outward radiating lines, centred on the city, the regional road plan, and city street plan had been determined on the rectangular pattern of the 1830, one-mile square ordinance grid, distorted by the river and the earlier Indian trail routes which became the plank roads of the early town. (Compare Figs. 101 and 120.)

Figs. 101
& 120

These contrasting geometric patterns caused many conflicts at crossing points but also had some advantages in the overall transportation network of the city in that they provided a very fine scale service pattern to the city.

The crossing-point conflicts caused great delays and many accidents until grade separation was more widely implemented. Because the railroad had established its more permanent patterns much earlier, the automobile was generally at a disadvantage when grade separation was established.

However, as time progressed, the congestion caused by dangerous and inefficient junctions, became worse as car ownership increased, and the automobile began to demand better rights of way, better surfaced roads, wider roads and more unrestricted routes.

The widening of Michigan Avenue, the construction of the double-level "Bascule" type bridge, the construction of Wacker Drive and the first limited access parkway shown on Figure 120, are a direct result of the increased pressures exerted on the city by the automobile. (25)

Fig. 120
Ref. 25

The northern end of the first free access parkway, an extension of Lake Shore Drive, was a major advance in highway engineering, being one of the first roads to use grade separation and cloverleaf intersections. (26) This route was completed in 1936.

Ref. 26

A series of traffic studies were undertaken between 1937 and 1939 and resulted in proposals for a series of subways and super-highways radiating outwards from the city to cater for the future demands of the automobile. These proposals were shelved during the war and were considerably revised before the plan for the eventual freeway system was established. (27)

Ref. 27

7.2.5 AIR TRANSPORT

In 1911 air transport had been first introduced to Chicago with an international air display. By the late 1920's, scheduled air services were operating out of Chicago to both the East and West Coasts and the air mail postal service had been introduced. (28) In the early 1930's Chicago was the largest passenger and freight air terminal in the world. By 1945 the Midway airport was handling 80 000 aircraft and 1,3 million passengers per year. (29)

Ref. 28

Ref. 29

The Midway airport was established on a one mile square piece of land on the Southwest of the city in 1927. It was progressively expanded and developed until by 1949 it had nine operational runways.

7.2.6 SERVICES

The generation of electricity increased further in this period, telephone services grew to support the business trade and daily activities of the city, water supply reached a greater percentage of families than ever before and by 1945 the entire city area was fully served by waterborne sewage disposal systems.

In the centre city the underground freight tunnel service continued to be an essential part of the garbage and building rubble removal system while also carrying and delivering increasing amounts of freight, thus relieving surface congestion.

7.2.7 COMMUNICATIONS

Radio Broadcasting was a major development in communications in this period, the first services being established in 1920, followed closely by the invention of Radio Television in 1927. (30)

Ref. 30

By 1945 these two communication media were in widespread use and together with the telephone equipment industry, became a large manufacturing employment agency in Chicago. At this stage, one quarter of the nation's radio and television production output came from the Chicago region. (31)

Ref. 31

7.2.8 CONSTRUCTION

In the CBD the steel frame remained the main structural system, particularly for high rise structures. Apart from all its other advantages, steel framing offered the advantage of allowing the whole structural frame to be prefabricated under factory conditions, free from the snow and ice of Chicago winters. Erection of the frame on the site could be extremely rapid as every part was numbered and jig drilled to close tolerances for site assembly. The filling in of the frame with floor and wall elements was a slower operation but could be helped by the erection of weather-proof screens over the frame, and around the working areas.

Major engineering works were the dominant factors in centre city construction. These earthmoving projects were greatly facilitated by the use of Caterpillar tracked scrapers, bulldozers, dragline cranes, etc., which were not available in previous periods when prodigious earthmoving tasks were performed by manpower, horses and carts. (Mumford's Megamachine)

As in the previous period the construction of three and four storey apartment buildings accounted for over a third of the total annual value of construction for most years of this time.

Construction activity in the period fluctuated from the peak of activity in 1926 when over 360 million dollars worth of work was completed to the slump period of 1933 when virtually no building work was undertaken at all. (32)

Ref. 32

7.3 RESULTANT CONDITIONS

7.3.1 GENERAL MORPHOLOGY AND STRUCTURING FORCES

Figure 119 gives a broad indication of the patterns of urban development in and around Chicago in 1945.

Although this can only be regarded as a "cartoon" diagram it does show the way in which decentralisation had begun to erode the influence of the city across a greater area than ever before, through the development of residential and industrial nuclei on the radial transport routes.

The distribution patterns of these peri-urban concentrations were still closely related to the original radial railroad transport lines, although the automobile had already radically changed the combined movement patterns of the city. It was only in the next and final stage that the freeway system began to override the general pattern and to cause new focal points to occur.

In the CBD and central peripheral areas the land use patterns remained similar to those of the previous period, but, as previously described, the land value patterns became more evenly graded across the lines of the loop elevated railroad and across the Chicago River and its branches.

Previously formed peripheral, suburban nodes, of both high land value and intensity of use, such as shopping centres or recreation centres, grew rapidly in this period with increased automobile accessibility. They formed higher peaks in the land value and land use pattern, particularly where major transit intersections occurred, as for instance in regional shopping centres.

The emergence of the first regional scale shopping centres can be regarded as the first signs of the city losing its overall powers of attraction for retail and wholesale marketing and mark the beginning of the trend of overall reduction in centre city activities.

7.3.2 THE COMMERCIAL COMPONENT

Technology can be seen to have changed the physical patterns of the CBD in two basic ways. Firstly, the form of the business core of the city had been extended vertically, by greatly increased building heights, while horizontally



Fig. 129 Lake Shore Drive Northwards from city 1928



Fig. 103 Southwest View of city across lines 1934



Fig. 131 "Black Belt" area of South Chicago 1951



Fig. 132 Negro Ghetto 1940



Fig. 133 Squatter in Hoboville 1932



Fig. 134 Saloon in Industrial Area 1915



Fig. 135 Negro Ghetto 1940



Fig. 136 5 Family Shack 1949



Fig. 137 South Side Slum 1954

the city's land area had been considerably extended by the reclamation work along the lake shore line.

Trends in construction technology which had originated as early as in 1893, continued to be used, but at larger scales, for the construction of the newer and higher structures; while improved earthmoving techniques were responsible for the major engineering works of reclamation and river straightening.

At street level the changes in the CBD were not so noticeable. The elevated railroads still rattled overhead while automobile traffic congested the streets at surface level. Below the streets, in the closing years of the period, a new underground environment came into everyday use with the completion of the first tube-train lines.

With the electrification of the elevated lines and rail car lines and the removal of horse drawn vehicles, the city was less dirty and odorous than before but the motor car had brought its own types of air pollutants to foul the city's air.

7.3.3 THE INDUSTRIAL COMPONENT

Again environmental conditions in manufacturing areas varied little from those described in the previous period. Activity certainly intensified in the major industrial areas. More noise, smoke, fumes, waste, pollutants for lake waters and strain on workers was produced by more manufacturing plants covering wider areas of land surface.

Concern for pollution was expressed in the Plan of 1909, but more decisively in 1915 when the Association for Commerce and Industry published a massive "Smoke Abatement" study. (33) The indirect results of the study were the conversion of railroads to electric power, but there was little improvement in industrial pollution until the mid-1960's.

Ref. 33

7.3.4 THE RESIDENTIAL COMPONENT

Trends in the extreme low income residential areas of the city followed those of previous periods in factors such as decay in the fabric of the buildings, overcrowding, health hazards and serious social problems. The extent of these deteriorating areas increased rapidly, particularly in the negro-owned or rented areas in the South, which grew at amazing speed in this period.

Figures 131 to 137 give an indication of how serious the deterioration of living standards had become in the older, more rundown areas of the city. Timber frame structures which received no maintenance, became the crumbling hovels illustrated. But there were worse living conditions than these in the hundreds of packing-case, tin-can, cardboard and old iron shacks which crammed the backyards of the already overcrowded building lots.

Increasing attempts were made by the city to improve these conditions but the conditions were symptoms of more deep rooted problems, such as lack of education, unemployment, racial discrimination and the breakdown of family patterns. The Land Use Survey of 1939 established 76 000 houses as unfit for habitation, but could do little to offer remedies to the situation. (34)

Ref. 34

Public housing projects made little progress because of lack of funds, while the newly formed Federal Housing Authority was oriented more at the lower to middle income families who sought aid to build, mainly in the outlying suburbs. (35)

Ref. 35

Conditions in the middle class suburban areas varied across the same range as previously but with the increase in automobile ownership, settlement was more widespread than previously, when walking distance to a rail line restricted the range for commuters. The possibilities of using a car to get to a local suburban station, to park and to ride to town by railroad were increasingly used, thus initiating a trend which was to become more common after the Second World War.

Apartment living became more widespread in this period. The Chicago zoning authority put the number of people living in apartments as high as two-thirds of the city's population. (36) Certainly three-quarters of the building permits in the peak periods of construction were for apartment buildings. Apartments varied from 6 to 20 storey luxury buildings on Lake Shore Drive, to three and four storey walk-up structures spread throughout the outer city residential areas and even on some of the main suburban streets. Some suburbs such as Hinsdale prohibited the construction of apartments. In other suburbs apartment building was one of the main factors in creating the extremely rapid growth rates of out-lying areas.

Ref. 36

Several suburbs doubled their populations in only ten years. Evanston increased from 32 000 to 63 000 in a ten year period whereas a small town Berwyn, increased its population from 14 000 to 47 000 between 1920 and 1930. (37)

Ref. 37

Much of this remarkably rapid growth can be accounted for by the wider ranges of choice offered to the new home seeker, by the increased mobility afforded by the motor car, particularly in the later years of this period.

7.3.5 COMMUNITY FACILITIES, RECREATION AND OPEN SPACE

The major public provisions of cultural and recreational facilities in this period were related to the waterfront improvements and reclamation schemes which were based on proposals in the 1909 plan for Chicago.

In the North, improvements were made to the Oak street beach along Lake Shore Drive. To the South of the Chicago river mouth the vast 200 acre, fully landscaped Grants Park area provided a "grand respite from the towering buildings". This foreshore to the CBD was laid out with formal gardens, fountains and several cultural, educational and recreational structures. These included the Field Museum of National History, the Adler Planetarium, the Shedd Aquarium and Soldiers Field, a 6 million dollar sports stadium built to commemorate Chicago's war heroes.

These facilities were in addition to the Public Library (1897), the Art Institute (1893), Orchestra Hall (1904), the Auditorium (1889), the Fine Arts Building (1886), and the Civic Opera Building of 1930. (38)

Ref. 38

Certainly in terms of regional cultural and recreational amenities, Chicago was extremely well endowed. The "Green Belt" of peripheral parks, commenced before the turn of the century, were further developed and linked to the new parks which were established in this period.

The only areas which were seriously under-provided in neighbourhood-scale amenities, were the extreme low income residential areas, particularly the negro ghettos. But even these improved as several philanthropists stepped in to attempt to provide some, if not all of the missing facilities. These efforts were progressively matched and exceeded by public bodies who realised the importance of improved library, adult education, cultural and recreational facilities to the underprivileged people of the city.

7.4 SUMMARY AND CONCLUSIONS

The automobile continued to be the dominant technological influence acting on the city, and its region, during this period.

By 1936 the first limited access freeway with grade separation and "clover leaf" intersections had been built in Chicago. Plans for further subway and elevated highway systems followed, but were not implemented until after the Second World War. The outward visible signs of the demands made by the automobile on the urban environment had been firmly established.

Increased car ownership extended the range of mobility for the middle and upper income groups, giving rise to more rapid and widespread suburban development.

Suburban shopping centres, which before had been mainly related to railroad transit lines, now grew to be car-oriented regional shopping centres with market fields extending for miles around. This major trend in decentralization set the pattern for more general decentralization of urban activities in the years which follow.

In the city itself the rapid increases in numbers of automobiles caused streets to be widened, double level perimeter roads and bridges to be built, truck depots to be established, certain land values to increase dramatically and the urban field of the city to be greatly extended.

Technology played an equally important part in the reshaping of the central areas of the city.

The land area to the East of the city was greatly increased by reclamation and shore line improvements.

New cultural and recreational facilities were built on the new foreshore area. To the West of the city a major reshaping of the river front was undertaken with the construction of Wacker Drive and a major river diversion was made in accordance with the 1909 Chicago Plan.

Advances in construction technology allowed building heights in the centre city to double, reaching heights of 46 storeys.

Elevated railroads and street car lines continued to pour three-quarters of a million commuter passengers into the city every day.

Below the streets the first underground tube railroads were built.

By 1935 Chicago had the busiest air terminal in the world.

Railroad lines and freight yards increased to meet new demands.

The industrial and manufacturing base of the region intensified and during the Second World War production was further diversified with the establishment of aircraft industries.

Electronics industries grew to scales of national importance in Chicago.

In a change room, under the University of Chicago Sports stadium, the first controlled nuclear reaction occurred in December, 1942.

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Fig. 138 Chicago - Urban Development and Commuting Field 1967



Fig. 139 Chicago - Metropolitan Expressway System 1966

8 Chicago 1945 - 72 The City in Crisis

8.1 GENERATIVE FACTORS

Changes in the structural patterns and environmental conditions of Chicago and its metropolitan region in this period can best be understood by studying the following three factors:

Firstly, by 1963 automobile ownership in the metropolitan region had increased to one car per three persons. In some suburban areas there were more cars than families. (1)

Ref. 1

Secondly, between 1940 and 1950 Chicago's rate of increase in urban population reduced to 6.6% for the ten year period. Total urban population in 1950 was 3,6 million, while metropolitan population was 5,6 million. By 1960 the city's population had fallen to 3,5 million, whereas the metropolitan population had increased to 6,7 million. The 1970 Census figures show even more dramatic changes in population distribution between the city and its metropolitan region, the city losing more of its population to outlying areas each year. (2)

Ref. 2

Thirdly, increased mobility, given by the automobile and air travel, has changed the living patterns of most Americans dramatically in the last twenty years, particularly in the upper income groups. Many daily commuters travel distances of thirty to sixty miles between home and work in the major American cities. Air services between the cities of the Eastern seaboard are so fully developed that many airlines can offer more frequent flights between cities than the bus companies can offer to housewives who wish to travel to town from an outlying residential area. This increased mobility is also reflected in statistics which show that 40 million of America's total population of 200 million people, move their place of residence every year. (3)

Ref. 3

These three factors reflect a FUNDAMENTAL CHANGE IN THE NATURE OF THE CITY, AND URBAN LIFE in America during this period, particularly in the years since 1950. Developments in transport and communications technology are the prime movers of these changes, which in many ways are as dramatic as the changes which the railroads made in Chicago in the 1850's.

All other factors which follow in this section must be seen in the light of these dramatic changes in the nature and condition of the city. Every component part of the city's fabric and every functional element in its day to day activities, is to some degree influenced by the forces of decentralization which are acting on American cities in general, and on Chicago in particular.

8.1.1 GENERAL GROWTH FACTORS

The adjustments from a wartime to a peacetime economy in America after 1945 were less painful than had been predicted by those who foresaw widespread unemployment and economic depression as the only aftermath of the war. This may have been caused by the slow withdrawal of the occupying forces from Europe and Japan after the war, which gave the American economy a longer period for readjustment than was the case after the 1914-18 war.

Whatever the causes, the general economic climate in America after the war was healthy and unemployment was kept within reasonable limits. Personal income in most income groups increased continuously, allowing more people to own or rent better homes, and to purchase more motor cars, household equipment and personal goods. Even where personal incomes did not increase so rapidly and where living conditions did not improve greatly, the extremely low cost of second hand automobiles resulted in even the lowest income groups becoming more mobile, with ever increasing rates of car ownership.

The increases in car ownership caused greatly increased development in the suburban areas of the city and also stressed the need for improved road and freeway systems within the metropolitan region. To some degree the increases in car ownership were brought about by the greatly increased production of cheap automobiles when the assembly lines of the major firms of Detroit and elsewhere were adjusted to produce automobiles instead of tanks and other war vehicles.

Freeways and housing were the priorities of the immediate post-war period, and both these construction activities were concentrated in the outlying areas of Chicago's metropolitan region. The pre-war proposals for the city's freeways were revised and only implemented later, in the early 1950's. Construction in the CBD only commenced in the early 1960's. The result was that while the outlying suburbs and the peripheral industrial areas flourished with ever-increasing tax bases, the centre city languished and began to lose control of some of its inner peripheral areas, where low-income housing conditions deteriorated to crisis conditions. Federal aid, in the form of major budget allocations for urban renewal only came in the early 1960's. Until this time Chicago, and most of the other major American cities, struggled to meet the ever-increasing demands of more low-income families who came to live in the transitional areas of the centre city.

The shortfall in the provision of housing, educational, cultural and recreational facilities and in welfare programmes, increased until, as in some areas in the South Side of Chicago, the position seemed irretrievable. While the centre city's tax base was being reduced relative to the outlying areas, Chicago was still being called to provide increased Central place services for the Metropolitan region, adding more stress to the already overstretched resources of the city.

The first signs of urban revitalization came in the late 1940's when the Illinois Institute of Technology decided not to vacate its rundown buildings in the South Side negro ghetto area, but to rebuild a new campus on extended land around its former site. This move was followed almost immediately by the decision of the governors of the Michael Reese Hospital to redevelop and extend their facilities in the near South Side.

This vote of confidence in the future of the inner zones of the city was followed by a joint venture between the City, the South Side Planning Board and the New York Life Insurance Company. This involved the development of the Lake Meadows, middle income, racially integrated, housing project, which provided over two thousand housing units on a one hundred acre site, northwards from 37th Street in the South Side, adjacent the Michael Reese Hospital area. The City's contribution to the project was the assembly and the "writing down" of the land cost to the developer, to a level which compared with outlying land values, thus permitting reasonable returns on private investment. The City's School and Parks Board further assisted the project by providing the educational and recreational facilities required. The project was completed in 1953. (4)

Ref. 4

By encouraging private participation, the City could stretch the resources available for redevelopment further to stimulate more widespread revitalization of the older decaying areas of the city. The Lake Meadows project was followed by the Prairie Shores development immediately to the North, and by many other projects in the South Side.

Further revitalization was given to the inner city area with the redevelopment projects initiated by Chicago's dynamic new mayor, Richard J. Daley, who first took office in 1955.

The urban renewal programmes continued in the South Side, moved through to the inner West Side, to the Near North Side and to the North West zones of the inner city. By the time Federal aid for urban renewal on a countrywide scale had been established, Chicago had already taken the initial steps towards meeting its commitments and solving its problems in the centre city.

The CBD was only revitalised in the 1960's when the first rebuilding occurred since 1934. Again a combination of private development, encouraged by City inducements in the form of advantageous rates rebates, land assembly deals, etc., were responsible for major rebuilding projects.

Other major work in the city and the metropolitan region was the construction of the freeways and expressways first proposed before the war, but reconsidered and radically upgraded before construction commenced in the 1950's.

The CBD rebuilding projects of the mid-1960's have ceased in the 1970's and at present only one major project is under construction, the giant Sears Roebuck building which when completed will be the highest structure in the world.

Peripheral development accelerated immediately after the war and has continued unabated ever since. With a viable tax-base, most of the developing suburbs have been able to improve progressively the standards of services and neighbourhood amenities for their residential communities.

The larger suburban communities in turn have attracted larger and more diverse shopping facilities, as well as banks, cinemas, chemists (drug stores) and speciality shops, as in previous periods, but now at ever increasing scales.

The first regional shopping centres which had been developed before the war, grew to become the vast shopping emporia of today, located at highly accessible points near the intersections of major highways, often in relatively isolated areas, with vast areas of parking space around them, being totally automobile orientated.

The growth of these shopping centres has had serious repercussions on the trade of the central city retail outlets as will be studied later.

All these developments in decentralization can be related to the increased mobility of the population caused by increased car ownership.

The region's industrial base also underwent some major changes in this period. Some of the older activities such as meat packing, in which Chicago had held world leadership for so long, began to wane through the decentralization of industries on a national scale, caused by the increased mobility of goods as trucking services developed to supplement and eventually to overtake, railroad transport as the primary transport agency of the continent.

Some of the earlier industrial activities such as steel production, were modernised and developed to even larger scales than previously, while other new industries, both heavy and light, came to Chicago to commence operations, and to grow to become vast international concerns. The reasons for the growth of new and existing industries in the Chicago region, remain the transport advantages and free availability of raw materials from which the area has benefited since its earliest development.

Chicago's overall geographical locational advantages have developed its air transport facilities in the period since the war to a stage where it is today the largest freight handling terminal, and the second largest passenger handling terminal in the world.

Some of the implications of the increased mobility, both of goods and of people, will be studied further in following sub-sections.

8.1.2 TRADE AND COMMERCE

The general patterns of decentralization of retail activity had developed progressively since the beginning of the twentieth century and have been previously described. After 1945 other factors came into play which affected retailing and commercial activity both in the CBD and in the peripheral suburban areas.

Whereas in earlier periods the CBD shops had held their trade by offering a wider range of goods than the suburban shops, or had concentrated on speciality goods of limited turnover, also not offered in peripheral areas, in this period, with the advent of the fully self-sufficient regional shopping complexes, the situation in the CBD changed. Business in most types of retailing activity in the CBD began first to slow down in growth rate, and then in the mid-1950's, to level out, and in some cases to decline. Certainly fewer people from the suburbs came into the city to shop, particularly with the difficulties of parking cars in the centre city. The millions of city workers still continued to do their purchasing of durable goods in the CBD. But with shorter working weeks and the increased use of deep freezers and refrigerators, most of the shopping for perishable goods is now done in bulk at the local or regional supermarkets in the evenings, as a family excursion, or on a Saturday for the week's groceries.

The regional shopping centres have also taken on many new functions to attract housewives and families both to shop and for recreation, education or even cultural activities. Art exhibitions, booksellers, libraries, industrial and recreational equipment exhibitions, news-film shows, high class restaurants, night clubs, almost every facility needed for adult or family enjoyment, are

provided in the larger regional shopping centres. The author has even attended a full scale ballet performance and a boat show on an artificial lake, all in the same structure. Extended shopping hours are specifically aimed at the family's after work shopping outings. For the housewife who does her weekly or monthly bulk-order purchases in the family station wagon, there are the added attractions of beauty parlours, fashion shows or, if required, the dentist, psychiatrist or doctor.

The lower income groups living in the inner zones of the city are equally well served by branches of the larger chain stores and are well placed to do additional speciality shopping in the CBD, either travelling by car or by local bus services.

Because of the proliferation of local and regional shopping centres, and the competition which has developed in some areas where facilities are over provided, specialization has even crept into the marketing systems of these decentralised facilities.

Rebuilding in the CBD since the war has been restricted almost entirely to office accommodation. Large finance, insurance and property development companies have built several large structures in the city, while the new Civic Centre, Law Courts and administrative centre structures have also been office-type buildings.

Two notable exceptions to the trend of office building have been the Marina Towers Complex and the John Hancock Centre.

The former is a complex built on the North bank of the Chicago River, with marina facilities at water level, recreational, shopping and restaurant facilities at street level, with two circular, 60 storey towers of apartments and parking, rising above the street level structures, overlooking the river, lake and the heart of the city. (Fig. 149)

Fig. 149

The Hancock Centre is a one hundred storey tower, comprised of offices and apartments, standing above a major complex of shops, parking and other support facilities, housed in low level and basement structures at its base.

It is significant that both these complexes provide high income residential accommodation and are on the North Side of the river. The Marina Towers complex stands alone on the edge of the CBD, where the only other residential land use is in the old hotels, YMCA (1000 rooms) and the flop houses where tramps and the city's less fortunate citizens live. The Hancock Centre stands between the edge of the CBD and the high income Lake Shore Drive residential area. The types of business organizations using the offices in the Hancock Centre are those where face-to-face contact with other people in the CBD can be replaced by telephone or closed-circuit television contact. Improved communications systems, plug-in linking terminals for centralised data processing and computer facilities, have all assisted the processes of decentralization.

Many of the new business functions, such as the I.B.M., Rank Xerox, Electronic and communications firms which Colin Clarke refers to as the Quaternary activities of the city, are free of most of the locational restrictions which affect other business concerns, and have moved out into the perimeter areas of the high income residential suburbs. In taking their plants and administrative offices to the suburban labour pools, they have inverted the historic pattern where job seekers located nearer places of employment.

Expressway technology, originally intended to allow easier access for people entering the city, has in fact had the reverse effect in recent years, in that it has made escape from the city easier. Retail activity, wholesale trading, manufacturing and more recently, the offices of insurance and other companies, have moved outwards from the city to peripheral areas where population concentrations occur, or where transportation facilities are more convenient, or where environmental conditions are more advantageous.

8.1.3 INDUSTRY AND MANUFACTURING

The differences between the locational requirements of Heavy and light industry have become more emphasised in this period than ever before. The heavy industries such as steel production, locomotive building, boilermaking, car body works and foundry works, have become concentrated in areas of high transport accessibility, well supplied with electricity, water and raw materials, far from residential areas.

Light industries, such as electronics engineering, on the other hand, have been accepted as being compatible with residential land use. The industries have the advantages of proximity to reliable labour while they in turn generate the job opportunities sought by so many newly established suburbs or satellite towns, and assist considerably in increasing their tax base.

In Chicago's case this has accounted for a considerable loss of light industries from the inner city area. Between 1950 and 1965, the inner third of the city lost 400 manufacturing firms which took with them the employment opportunities of 70 000 people. (5) Brian Berry quotes the Chicago Tribune of 7th May 1972, which states that the "industries are fleeing from the city in search of space and safety", and from the "New Republic", which in analysing the "Exodus to the Suburbs", states that 80% of the new jobs in the metropolitan areas of America are outside the cities.

Ref. 5

Industry is another area where urban re-development programmes have been devised to attract light and non-noxious industry back to the city's inner zones which have little remaining attraction for residential development.

Heavy industry continued to concentrate along the Lake shore ports of Gary, Indiana and Calumet, and in the areas such as the Central Manufacturing District. Chicago's steel production surpassed Pittsburg's in the mid-1950's to become the largest in the United States. Steel processes had to be updated and improved to meet continuously increasing competition from other centres and countries such as Japan. (6) High quality cheaply transported raw materials and abundant electrical power, have been the dominant factors which have enabled Chicago to maintain its National Leadership in Heavy Industrial production.

Ref. 6

8.1.4 POPULATION INCREASE AND DISTRIBUTION

The decrease in urban population and the increase in metropolitan population in Chicago referred to in 8.1, is typical of the general trend in many major American cities. The relative drop in centre city population densities first occurred at the beginning of this century. This was caused by the rapid transit railroad and street car lines which stimulated suburban growth. In present times the relative drop in central densities has become an absolute drop because of the increased range of mobility afforded by contemporary transport facilities.

Whereas man's mobility in the earliest cities was determined by movement on foot within a radius of approximately 4 miles, the city of horse drawn vehicles was extended to 7 to 10 mile ranges. The railroad extended commuting distances to 15 to 20 miles while the automobile doubled these ranges. Air traffic has extended man's daily travel range to 100 to 300 miles and communications media such as coast-to-coast direct phone dialling, television-phones, etc. have further extended man's operative range.

All these factors have made the American population more mobile. Even low income families travel more to seek work, to see friends or to take vacation, than ever before.

This increased general mobility has caused a new situation to develop in American cities where there are greater movements between cities than from rural areas into cities.

Admittedly the inter-city movement is greater in the higher income levels but the result is a more transient population than ever before.

The detailed population distribution patterns in Chicago's central and inner zone areas have not changed greatly in this period even with the greater degree of racial integration and assistance to the extreme low income groups which occurs today.

The inner South Side area remains predominantly negro occupied, as are most of the inner West Side areas. The older nationality groupings are rapidly breaking down, even in the lower income groups, as more immigrants take the place of those who move upwards in income and outwards in direction, towards the suburban fringes.

Chicago follows the general trend observed in American cities where the average densities have decreased from 5 400 people per acre in 1950 to 3 300 per acre in 1970. (7)

Ref. 7

8.1.5 LAND VALUE

Central Business District land values have generally remained consistent with previous patterns, the only major distortions being in the vicinity of major development projects such as the Marina Towers or Hancock Centre. In the vicinity of these projects land values have risen considerably. In many cases the main developer had already bought up large areas of peripheral land before the intentions of the main project had been made known, therefore reaping a wider benefit from the overall investment.

The value of the blighted transitional areas around the centre city has generally decreased as they have fallen into disuse. These areas have in some cases been purchased by the city or the Federal Government for projects such as the new Illinois Circle Campus, University complex. (Fig. 142) Because both industry and residential development are not attracted to these areas, the land is well used for these types of educational facilities which require high transport accessibility, and large land areas. They in turn generate some activity in the otherwise dormant transitional areas.

Fig. 142

Outer zone city and metropolitan land values generally follow previous patterns but freeway access routes have further distorted the pattern at some points where intersections have attracted vast regional shopping complexes.

The value of suburban residential land, particularly in the higher income areas is at present more related to the natural amenities of the landscape than to transport accessibility. The motor car has freed the range of locational choice for home seekers to a degree that has never occurred before.

8.2 TECHNOLOGICAL FACTORS

8.2.1 GENERAL TECHNOLOGY AND ENERGY SOURCES

Technological developments in the post-war period include the harnessing of atomic power for the generation of electricity, the development of rocketry for space flight, the development of laser beams for the transfer of energy and communications, and the development of solid state electronics where micro-circuits and transistors have replaced valves and wires in radio, television, computers, cameras, watches and in many other everyday products.

The development of micro-circuitry is one of man's major advances in technology. Pocket size transistorized, portable computers are now able to perform calculations which only fifteen years ago would have required the services of a room-sized computer, using valves and vacuum tubes.

Communications satellites can predict our weather, relay radio messages, warn nations of nuclear attack, or radio back to earth the results of scientific experiments conducted in the atmosphere of a planet, millions of miles away.

Scientific research has unravelled the complexity of the D.N.A. molecule, astronomers can push back the frontiers of space with radio and optical telescopes of unprecedented size and accuracy. Doctors can photograph the intestines of a patient by means of a fibre-optics endoscope.

There seems little that man is unable to do, except perhaps to avoid destroying his own living environment. Even in this field there seems to be some hope that he may harness his skills to prevent his own self-destruction.

8.2.2 WATER TRANSPORT

The opening of the enlarged St. Lawrence Seaway, in 1959, went a long way to re-establish Chicago's importance as a national and international port. Regular, direct-route cargo services with European ports were greatly extended after 1959. Incoming ships were served by major harbour facilities at Gary, Buffington, Indiana, Calumet and Chicago, and by many minor port facilities along the fifty miles of lake shoreline from Waukegan in the North to Gary in the South. (8)

Ref. 8



Fig. 140 Southwest View of Chicago Harbour 1964



Fig. 141 Chicago Lake Front, Meigs Airport 1965



Fig. 142 University of Illinois Circle Campus 1966



Fig. 143 West View across Michigan Avenue 1963



Fig. 144 Dan Ryan South Expressway 1965



Fig. 145 Chicago Circle Traffic Interchange 1961



Fig. 146 Site of Dan Ryan Expressway 1943



Fig. 147 Dan Ryan Expressway 1963

Internal waterway connections to the centre and south of the continent, through the Mississippi river system, were greatly increased by major improvements to the Calumet Sag Channel, commenced in 1955. The new canal system is the primary route for the 25 million tons of goods carried annually through Chicago's ports on the internal waterway system, while Calumet harbour is the main handling port for the 70 million tons of goods carried on the Great Lakes and International routes. (9) Ref. 9

While unable to compete with the railroad or motor vehicles for the transport of certain goods, marine transport still holds almost complete monopoly for the transportation of bulk goods such as iron-ore, limestone and coal, the basic materials for steelmaking and power generation.

8.2.3 RAILROAD TRANSPORT

Since 1945 the railroads have faced ever increasing competition, particularly from truck services, and to some degree from canal-barge and air freight services.

Regional passenger carrying decreased from 95,7 Billion passenger miles in 1944 to 15,2 Billion passenger miles in 1967. (10) Regional freight services have fared better, although truck, pipeline and barge services have made heavy inroads into previous railroad freight figures. "Piggy-back" systems, where truck trailers are carried on "flat-cars", were devised to offset to some degree the advantages of mobility that the motor vehicle offered. Trailers could be loaded at manufacturers' yards, hauled to the railroad siding, loaded onto flat-cars and taken by railroad for the long distance journey to an interim destination, where the trailers are offloaded and taken by road to final destinations. Containerization has increased railroad freight-carrying because the container is in effect a trailer without wheels, and offers the same advantages as the "Piggy-back" system. Ref. 10

Freight classification yards have received the full benefit of modern computer control techniques. Trains are drawn up to the top of an artificial hill at the entrance to the yard, where the freight-cars are automatically uncoupled and allowed to run down into selected lanes by gravity controlled by electronically operated speed-retarders and switch-points. All operations are computer controlled by the train programmers who operate the system from a central control station. Even in relatively small yards, one freight car can be classified every 15 seconds.

Centre city rapid transit rail services have been taken over by a municipal authority and carry between 200 and 250 thousand passengers daily, a level which has been maintained since 1924. Additional sub-surface tube lines are being progressively extended and are intended eventually to replace the elevated lines of the loop. One new double line has been built on the medial island of the Eisenhower expressway, replacing the former West Side elevated line.

Electric street cars have been totally withdrawn from the city and replaced by the more freely moving diesel buses for inner city transportation.

In general Chicago's sub-surface support systems are not nearly as fully developed as in cities such as London or New York, where foundations of new buildings have to thread their way through three or four levels of underground railways before finding bedrock.

8.2.4 ROAD TRANSPORTATION

The patterns illustrated in Figures 144, 145 and 147 are typical of the new urban scale imposed on the city by the requirements of the automobile and increased mass mobility.

The new expressways in the central areas of the city are built to meet the requirements of the ever-increasing numbers of passenger carrying vehicles passing through the city.

The regional freeways, tollways and expressways are provided to meet the requirements of passenger vehicles and also the demands of the freight trucking services, which play an ever increasing role in regional transportation.

Chicago is in fact the centre of the largest freight trucking service in America and is also the National headquarters of the Greyhound passenger bus services, which spread a fine scale network across the entire area of the United States. (11)

Ref. 11

The space consumed by the expressway systems can be seen in the illustrations and assumes even greater significance when the numbers of such freeways are counted on the highway map in Figure 139. In Los Angeles it is estimated that as much as 25% of metropolitan land is occupied by roads, streets or freeways. Chicago's road systems would certainly come near these percentages if current rates of freeway expansion are continued.

Fig. 139

The effect of freeway building on adjacent land areas can be judged from the two photographs in Figures 146 and 147. Figure 146 shows the area before the construction of the Dan Ryan Expressway and Figure 147 shows the completed road system. This particular Expressway has fourteen through lanes, and at one point along its route has nineteen lanes, where side roads join or leave the main system.

Figs. 146
& 147

Figure 145 shows the "Circle" interchange point on the Eisenhower Expressway, adjacent the new University campus, and also shows the roads passing under the centre section of the Post Office building, a provision allowed for in the early 1930's and as originally foreseen in the Burnham Plan of 1909.

Parking problems caused at terminal points along these freeways, where they enter the built up areas of the city, have become progressively more serious. Several large underground systems have been provided where space is unrestricted by building foundations or by underground services. One of the largest of these facilities is under Grant Park, where parking for 4 500 vehicles is provided. Unfortunately most of the land suitable for major underground parking facilities is at some distance out from the core of the city, so that walking distances from parking facilities to city destinations are often long and without protection from Chicago's icy winter weather.

In the loop area itself, freight and "Greyhound" type passenger transport services are provided for by the double level Wacker Drive road system and the vast underground freight depots and passenger terminals which serve the centre city. In fact one's first impression on arriving in Chicago by Greyhound bus is of an "underground" environment with throngs of passengers scrambling around each other to gain access either to the streets above or to the subterranean transit services below.

The motor vehicle remains the most potent structuring force acting on Chicago, and will remain so for a long time in the future if present trends are extended.

8.2.5 AIR TRANSPORT

Shortly after the war the congestion caused by the overloading of air services on the Midway airport, caused a major search to be undertaken for a new site for an international airport in the Chicago metropolitan region. O'Hare airport was eventually built on a disused flight testing ground established by the Douglas Aircraft Corporation during the war. The site was ideally located, only two miles beyond the outer limits of the city and surrounded by open land for future expansion. Vast facilities were built but even these were extended within ten years of completion, so great were the demands for air freight and passenger services.

The present airport has a vast terminal complex with outstretched "finger" accessways for reaching the aircraft. Ten thousand parking bays are provided for commuters and long distance travellers. Hundreds of hotels, overnight inns and conference centres have sprung up around the airport forming a new type of travel oriented "city" within the metropolitan area. O'Hare airport handled 27 million passengers in 1967, and was already reaching the upper limits of its potential capacity. A third airport is at present under consideration and one of the proposals is to construct it on reclaimed land in Lake Michigan. (12)

Ref. 11

A busy, simple runway, small craft airfield is already well established on reclaimed land to the East of the city in Lake Michigan. (Fig. 141) Known

Fig. 141

as Meigs Field, this facility offers the ultimate in accessibility and convenience for commuting businessmen who can be in the loop area within minutes of touching down on the airfield.

Mass air transportation has revolutionised the American way of life as dramatically in the post-war period, as the model T Ford did in the pre-war years.

8.2.6 SERVICES

The demand for increased and improved services is never ending. Before one programme of improvements is completed the next one is being planned.

The most noticeable extension to the city's services is the vast water treatment plant, established on reclaimed land to the north of the entrance to the Chicago river. Water supply has, through all periods of Chicago's history been an ever increasing problem as lake waters become more polluted every year. Fortunately the city has embarked on massive anti-pollution campaigns which should solve the problem at source, but it will be a long time before some of the previous damage has been undone.

Electricity generation has moved from the "coal and steam" era into the "Atom and Steam" era. Over 40% of the city's power is now generated in Atomic stations.

Atomic research is about to cause a major revolution in Chicago's urban settlement patterns with the establishment of a new "Science City" built to serve, and to house, the vast Federal atomic research programme facilities at Weston, in Du Page County. This is the largest nuclear research programme ever undertaken in America, involving an initial expenditure of over 300 million dollars. (13)

Ref. 13

8.2.7 COMMUNICATIONS

The latter part of this century will probably be remembered more for the advances made in nuclear science and communications than for any other technological factors.

Video tapes, closed circuit television, television phones, microwave and laser beam transmissions, multi-signalling techniques on wire conductors, are only some of the advances made in communications technology.

These developments have had profound effects on everyday life in homes and in offices in America, particularly in the last ten years. Closed circuit television or videophones can offer a reasonable substitute for face to face contact in business dealings, head office to branch office communications, banking and in many other fields.

Increased overall communication facilities have added to the increased general mobility of the American population and have reinforced decentralizing tendencies. They have also given rise to new congestion problems in and around the city. The unseen, micro-wave radio and laser beam communications network, above the city, is rapidly reaching a point of crisis in oversaturation. Recent studies in New York have shown that the criss-crossing of beams, rays or communications fields have left few spaces open for the new interference-free signals required in the city. The co-axial transmission cable is already offering vastly improved results in television transmission and may well be the solution to many of the present problems. If it is the long term solution, the problem will revert to its former underground position, where millions of interconnected cables will cause new congestion in the city's sub-surface systems. Certainly a whole new series of tunnels and ducts will be required under the streets and structures of the city to accommodate these services.

8.2.8 CONSTRUCTION

The new high rise structures of the CBD are in most ways similar in construction principles to those of the 1930's, using steel frames and either light weight curtain walls or precast concrete enclosing panels for their external skins.

Many of the new structures are turning to reinforced concrete (the Brunswick Building, etc.) where skeleton frame and outer skin are one and the same material. Several of the largest new buildings have a greatly increased structural scale. The 90 foot column spacings of the vast new Chicago Civic Centre and the 14foot floor to floor heights give the structure an immense scale. The increased bay spacings have only been made possible by improved foundation techniques.

New materials have also been used in many of the new structures, stainless steel, rusting steels, aluminium curtain walls, being only a few of the new materials available to architects for large urban structures.

Standards of air conditioning, lighting and general environmental quality are continuously upgraded, each new structure attempting to draw its new tenants away from the older, less well served buildings.

Wherever possible the new CBD buildings provide basement parking for their occupants, particularly if the sites are large enough to provide open forecourts at street level.

Much of the redevelopment and renewal housing in the inner city areas has been in high, or medium rise apartment blocks, thus preserving large open spaces at ground level while maintaining reasonable overall population densities. These structures are mainly of reinforced concrete construction with brick infill panel walls. Most of them are provided with central heating and all have high standards of general services such as water supply, sanitation, garbage removal, electricity, telephones and television facilities.

Suburban housing remains true to historical trends being mainly of timber frame construction with fully insulated lining walls and with full heating and other services.

Suburban apartments and some of the higher income houses are of brick or concrete construction, but the advantages of cost and simplicity of erection have kept the principles of the original Balloon timber frame alive for over one hundred and forty years.

8.3 RESULTANT CONDITIONS

8.3.1 GENERAL MORPHOLOGY AND STRUCTURING FORCES

Brian Berry uses two phrases to describe the present nature and condition of Chicago and many other large American cities. He refers to the city as a "Multi nodal - Multi Connected Urban System", or as a "Multi Nodal, Decentralised Urban System". (14) Common to both these descriptions is the factor of multiple nodality. In Chicago this first became evident with the development of the Calumet industrial port at the turn of the century. Other industrial towns such as Gary and Indiana have added to the poly-nuclear nature of the Chicago Metropolitan Region, and many more smaller centres have developed recently to reinforce the pattern.

Decentralization of industry, residential development and some retailing activity had first occurred equally early in this century, but has in recent times been extended to include other urban components such as commercial office activity and all components of retail and wholesale trading. The trend of decentralization in the last twenty years has been so strong that central urban population numbers have shown noticeable decreases, while regional populations have steadily increased.

Decentralization has been caused by many factors, but primarily by increased mass transport mobility. This implies Berry's third point of "Multi Connection" in urban morphology. The multi connection is as important in communications as it is in automobile or air travel. Multi-connection has increased between continents, between cities, between areas within the cities, by means of increased highway construction, increased sizes and speeds in aircraft, increased radio, radio telephone and television networks, all extending the contact range of the common man to unprecedented limits.



Fig. 148 Eastward View of Chicago River 1965

Fig. 149 Northwest View of Loop District 1961



For the first time in urban history the original centripetal bonds, which caused the city to grow and to hold together, have been broken and replaced with forces which are dominantly centrifugal.

8.3.2 INNER CITY ENVIRONMENTAL CONDITIONS

Although the general environmental quality of the loop area is little changed from that of previous times, in some areas where large scale rebuilding has been undertaken, a considerable change in both the scale of the structures and the spatial qualities of the street has occurred.

In areas such as the Civic Centre Complex, vast open forecourts or plazas have been developed by concentrating all the office or other accommodation required into super-scale structures, thus releasing part of the street level land for development as carefully designed open spaces.

The greatly increased heights of these structures, such as the Civic Centre and Marina Towers have added a further vertical dimension to the city which will again be extended in the near future with the completion of the 120 storey Sears Roebuck building.

At street level in the older loop and inner CBD areas where no rebuilding has occurred, the fabric of many of the buildings has deteriorated, there being little incentive to improve or maintain the older hotels, commercial buildings and disused industrial buildings.

The elevated railroads still rattle and spark overhead and the noise, fumes and grime generated by the elevated railroads and thousands of motor cars and trucks in the city permeate every corner. Anti-pollution legislation will certainly help, but it is unlikely that the centre city will ever attract the higher income groups away from the North side of the river to centre city living in any great numbers.

Beyond the core of the city, in the near South Side, occupied mainly by low-income negro families, environmental conditions are little better than those shown in the illustrations in the previous section. Renewal programmes are continuously attempting to upgrade the environment, but extremely low incomes, the breakdown in family structure, lack of education and the lack of motivation for self-help remain at the core of the problem.

The high rise redevelopment projects of the early 1950's suffered from problems of social readjustment breakdown in community bonds, increased living costs and other factors not foreseen at planning stages. But on balance they have achieved a great deal in their pioneering attempts to meet the problems of the city square-on.

Redevelopment projects which have followed such as the Carl Sandberg Village on the North side of the city, have gained great advantages in their planning from the earlier South Side redevelopment projects.

The freeway and expressway systems which surround, and in places, penetrate, the city, have given a new horizontal dimension to the city with the acres of space which they consume as they march rough-shod through the outer zones of the city. Older residential areas adjacent the freeways have been seriously affected by the loss of environmental amenity which the roads and millions of cars produce. Some of this land has been so seriously affected by the disamenities of the freeways and the general forces of decentralization, that they have lain vacant for years and have only recently been redeveloped for vast, space consuming Urban University campus projects or for major regional sports and recreation facilities, such as sports stadia.

Mass transportation has, in these areas completely transformed the original land use patterns and the land value gradients of the city.

8.3.3 PERIPHERAL ENVIRONMENTAL CONDITIONS

The older suburban areas, nearer the city have felt the first waves of the centrifugal forces generated within the city, in that the lower, and lower-middle income groups tend to use these areas as first extensions to their inner urban residential fields. The direct effects of this outwards urban explosion have been felt in the older suburbs as far as 15 miles out from the city. (15)

Ref. 15

Some new suburbs such as Niles Park, have grown at such alarming rates that the comment has been made that they have accumulated problems of growth which normally occur over a one hundred year period, in ten years of their early life. (16)

Ref. 16

The attractions of the outlying areas remain the same as before, being the rural or semi-rural surroundings, trees, water, shade, quiet, all the things which are so hard to come by in the city and regarded as so essential for family life by those who can afford them.

8.4 SUMMARY AND CONCLUSIONS

The nature of Chicago, and of many other large contemporary American cities has been completely changed in the last twenty years. The city has been progressively changed from its original form of an inward focussing, centripetally structured, single entity, to a multi-nodal, multi-connected, decentralised urban system where centrifugal forces predominate.

This basic change has been primarily caused by the greatly increased levels of personal mobility offered by the automobile and by improved communications systems.

Mobility at a national and international scale has been greatly increased by mass air transportation, which has further extended commuter distances for business executives, and also caused the growth of new airport-oriented "cities" adjacent the major air terminals.

At another scale, man's mobility has been finally extended into outer space.

The forces of decentralization, caused by increased mobility, and overall environmental deterioration in the city, have affected almost every component and activity within the city and in the metropolitan region. Suburban development has increased at an unprecedented scale. Regional shopping centres have developed in outlying areas, being completely automobile oriented. Large companies have relocated their offices in peripheral areas, and inner zone light industries are progressively moving out from the city to peripheral industrial or suburban - industrial zones.

The city's population has progressively decreased in this period while metropolitan population figures have steadily increased.

The expressways and freeways which automobiles require, completely dominate the land use and land value patterns of the periphery of the city.

Developments in other fields of technology, such as in electronics and micro-circuitry, have been adopted into almost every field of urban activity. Computer programmes assemble trains in the classifying yards, bank accounts are kept in centralised data-processing facilities which can serve many branches with plug-in terminal connections, audio-visual telephone discussions can be held over any distances if required, and news travels on a global scale faster than ever before.

Nuclear power has been harnessed for peaceful purposes, to generate increasing amounts of Chicago's electrical power.

At no time since the advent of the railways in the 1850's has technology affected the form and condition of the city than as in present times where the new forces acting on the city are the automobile, jet aircraft, electronics, and the extended lines of personal communications.

SECTION EIGHT REFERENCES

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|----|--------------------------|--|
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| 2 | Ibid | p.376 |
| 3 | Berry, Brian | Lecture on Decentralization of the City, given at Department of Urban & Regional Planning, University of Cape Town, July 1972. |
| 4 | Mayer and Wade - op.cit. | p.382 |
| 5 | Berry - op.cit. | |
| 6 | Mayer and Wade - op.cit. | p.430 |
| 7 | Berry - op.cit. | |
| 8 | Mayer and Wade | p.436 |
| 9 | Ibid | p.436 |
| 10 | Ibid | p.432 |
| 11 | Ibid | p.438 |
| 12 | Ibid | p.450 |
| 13 | Ibid | p.430 |
| 14 | Berry - op.cit. | |
| 15 | Mayer and Wade - op.cit. | p.418 |
| 16 | Ibid | p.418 |

Chicago - The Future, Trends and Plans

All present planning and redevelopment work in Chicago is being undertaken within the broad principles defined in the "Comprehensive Plan of Chicago", prepared by the Department of Development and Planning in January 1967. This was structured to allow for change over time, in the detailed workings of the plan, while preserving the basic strategies, which are intended to hold good for a long period.

One of the most important goals of the plan is to arrest the trend of decrease in the urban population, by attracting industries and residents back to the city area, or by inducing those in the area to stay. The intention is that by 1980, the city's population will have increased to 3,7 million, a 0,2 million increase on 1960 census figures, representing a growth rate of 6,6%. This is in direct contrast to the figures quoted in 8.1 of this research, where the urban population between 1950 and 1960 had decreased by an almost similar amount. Metropolitan population is expected to increase by as much as 38,6%, rising from the 6,2 million figure of 1960, to 8,6 million by 1980.

This indicates clearly that the outer zones beyond the city will continue to grow at previous rates while the city area remains stable or increases slightly in intensity.

The comprehensive plan establishes development principles for every component of the city; housing, community facilities, open space and recreation, commerce and industry, transportation and educational facilities at all scales. It also seeks to rationalise land use so that adjacent land uses are more compatible and can obtain advantages from their combined effects.

Transportation routes are the prime generators of the plan. Existing expressways and parkways are to be developed as "High Accessibility Corridors", along which industries will be encouraged to develop. This will draw the remaining industries out of the blighted areas to more attractive locations on the transport routes. This in turn will leave greater land areas open for residential redevelopment. The residential areas will be screened from the expressways by the industries which will grade inwards towards the residential areas with progressively compatible land uses.

Residential densities are intended to grade downwards from the centre outwards, and will seek to capitalise on every possible environmental amenity of the natural landscape.

For this reason a detailed comprehensive redevelopment plan for each residential zone has been prepared. The Lake Shore Drive area has its own study and development programme where the potential of the area is being assessed for regional and local recreation, marina development, offshore island development, residential and other land uses. All will be linked with carefully designed parkways and with adequate public transport facilities.

As in the earliest plans for parks and open space, made in the nineteenth century, these facilities are closely linked with public and private transit facilities.

The shoreline area to the east of the CBD has also been the subject of special study programmes. The "Illinois Central Air Rights Development" proposals by the Department of Development and Planning, attempt to plan the use of the space above the Randolph Street railroad terminal for a vast multi-use development project. This should overcome the problem which Chicago has faced since the decision was taken in 1848 to allow the railroad company to bring its line into the centre city area, along the lake front, thus ruining one of the city's finest natural amenities.

Other proposals of the comprehensive plan which are transport-generated, are a series of outlying Regional Business Centres. These centres, together with Universities, Hospitals, ports, airports and regional parks, are all considered as main traffic generators, and are well placed on high accessibility routes so that they can operate, or be used, efficiently.

Residential areas are grouped under three major headings: 1. Major Improvement and Rehabilitation Areas (involving some 21 000 acres, mainly in the inner city zone) 2. Rehabilitation and maintenance Areas (Approximately 12 000 acres, mostly in the middle zone of the "city limits" area) 3. Maintenance Areas (approximately 40 000 acres of the outlying zones of the city area). Each area has its own defined development goals and priorities for implementation. Inner zone renewal programmes, mainly in negro areas in the South Side, are given greatest priority, whereas outer zone areas where income levels are higher, have their own set of defined planning goals, related to the higher self-sufficiency of their populations.

The Centre city Commercial area proposals hinge on upgrading the environment and on encouraging investment back into the centre city and its immediately adjacent areas. Transport accessibility is again the key factor. Parking structures below ground level, the eventual removal of the elevated railroad, the landscaping and planting of preserved open space, are all aimed at revitalizing the city by attracting more activity into its immediate area.

The terms of reference and the scope of the plan are far too broad to warrant a study in depth in all components, but it is significant that in every land use proposal or redevelopment project, the most vital generator is always Accessibility.

The intentions of the plan can in fact be summarised by stating that the development proposals of Chicago are directed at capitalizing on the city's inherent strengths and to develop all other urban components in relation to these strengths.

Chicago's strength has always lain in its transportation advantages, and these are the starting points for the planning of its future.

10 Summary and Conclusions

The study has traced the various influences which technological developments have exerted on the form and condition of Chicago from its earliest history to the present day.

The degree of influence of technology on the city has varied over time. In the earliest years after the founding of the town in 1830, the prospect of the construction of a canal to connect Chicago to the Mississippi waterway system, generated feverish activity in the area. The canal was opened in 1848, at which time the first railroad line was built out from the city to the Galena lead mines and the first telegraph lines were installed to connect the city to the trading centres of the country, and later, the world.

These three technological factors were to have a stupendous effect on the growth of the area. Within six years Chicago was the centre of the world's largest railroad system, inland waterway system and wheat marketing area. Agricultural surpluses were a direct result of improvements in agricultural machinery. Meat packaging became a prime industry in Chicago during this period.

Development continued unabated in the city and its region particularly during the American Civil War of 1861-1865, when manufacturing industries and steel production were greatly increased. Cheap, high quality iron ores, coal and limestone were the basis of Chicago's industrial development.

Regional railroads established commuter services to the city for the residents of the rapidly growing towns which developed along the railway routes. Horse drawn rail cars overcame the obstacles of the mud-begotten plank roads. The whole level of the early city was raised to overcome drainage problems and to install services. Buildings were lifted to raised levels and in some cases moved to new positions.

Development was brought to a sudden halt with the disastrous fire of 1871. The ashes had hardly cooled before rebuilding commenced. Within two years the city centre was almost completely rebuilt. Economic depression slowed progress in the mid-1880's, but by 1890 the city was being rapidly developed to new, higher intensity land uses by means of steel framed, skyscraper structures, and mammoth retail stores, hotels, apartments and multi-use structures. This period also saw the construction of the first elevated railroad in the city, forming the well known loop area of the CBD, and replacing the earlier cable cars.

The arrival of the first motor cars in Chicago at the turn of the century marked the start of a new era. By 1917 there were 50 000 automobiles registered in the city and the motor truck was displacing horse drawn vehicles as the freight carrier in the city. Telephone services, first introduced in this period, marked the beginning of a new era in communications.

Suburban growth increased in the period between 1917 and 1945, as a result of increased motor car ownership. The city's economic base changed its emphasis from the produce trade to wholesale trading and manufacturing and the first large decentralised industrial areas in Calumet, Gary and Indiana began to change the structural form of the city towards that of a multi-nuclear urban complex.

The post-war period, after 1945, marks the final stage of technological influence on Chicago. The increased rates of car ownership stimulated peripheral development on an unprecedented scale, at the expense of the centre city, which actually lost population in the years after 1950. Serious problems of environmental deterioration were only halted by massive renewal and redevelopment programmes. Developments in mass air transit, communications, atomic energy utilization, and developments in electronics are but a few of the technological developments related to contemporary urban life.

The fact that the city of today is a multi-nodal, transport based, decentralised, urban complex is to a large degree due to technological developments in transport and communications systems.

From these developments it can be seen that technology has to a greater or lesser extent influenced the growth, form and environmental condition of the city at every phase of its evolution.

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