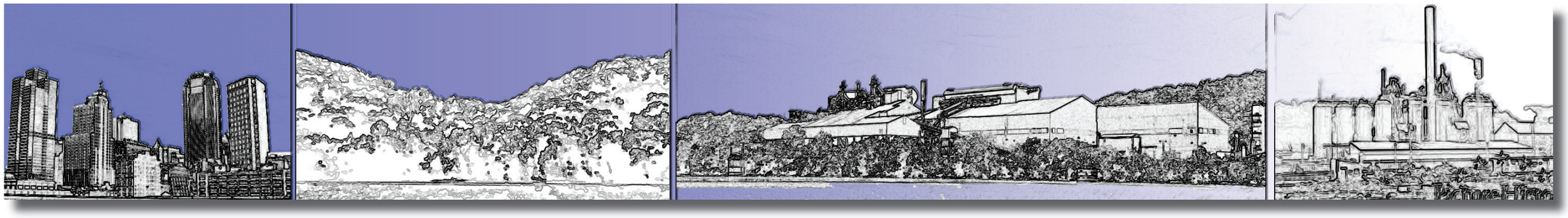
Pittsburgh Urban Waterfront : 1872-1926



History Report:
Phase 5 - 2004

3Rivers 2nd Nature
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The STUDIO for Creative Inquiry
Carnegie Mellon

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Priya Krishna
GIS Coordinator
3 Rivers 2nd Nature

Editors:
Tim Collins & Reiko Goto
Studio for Creative Inquiry Press
In Association with Carnegie Mellon University
Pittsburgh, PA, USA

Authors: Priya Krishna
GIS Design: Priya Krishna
Advisor: Dr. Joel Tarr
Editors: Editors: Timothy Collins and Noel Hefele
Layout design: 3 Rivers 2nd Nature

For more information on work done by 3 Rivers 2nd Nature,
call 412.268.3673 or visit http://3r2n.cfa.cmu.edu

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STUDIO for Creative Inquiry
Room 111, CFA
Carnegie Mellon University
Pittsburgh, PA 15213
www.cmu.edu/studio

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I. Introduction

Photographs of the contemporary Pittsburgh waterfront reveal a montage of built and natural elements. Lush willows and sycamores colonize sections of the most urbanized downtown edges. Upriver, scattered, empty, sometimes broken shells of an industrial past provide the backdrop for a recovering nature. Industrial archaeology, an oxymoronic term, captures the fossil-like quality of these empty structures buried in human memory. hese buildings and the industry they housed shaped the Pittsburgh of today. This paper is primarily an analysis of the urban waterfront of Pittsburgh. It focuses on the changes to the urban waterfronts of the city from the late nineteenth century to the first quarter of the twentieth.

Figure 1: Banks of the Monongahela River

Significance of Study

Cities are both the product as well as the context of human activity and behavior. The built and the natural components of the city control and direct the way people use these places. The historical dimension of this study has considerable significance In this context, given that additions to the built environment last for many decades or centuries. They continue to direct human behavior long after their original use has disappeared.

A case in point is the well-documented occupation of the flood plains of the rivers in Pittsburgh by industry. Gargantuan factories came to dominate the entire waterfront, cutting off public access to the three rivers. This lack of access persists in the postindustrial city shaping the relation or the lack thereof, between people and the rivers.

Sequence of Paper

The inquiry begins with a literature survey of theoretical perspectives on cities in general and geographical and historical studies of Pittsburgh in particular. A theoretical framework paraphrased from *A Theory of Good City Form* by Kevin Lynch then defines the broad skeleton of the study. The criteria of analyses used in the study are directly derived from this broad theoretical framework. The framework situates the growth and development of the waterfronts in Pittsburgh in the larger context of the evolution of industrial cities and provides tools to analyze the same.

The focus of the paper is on three points of time that define the emergence, the development, and climax of the industrial era in Pittsburgh. The next section of the paper analyzes Pittsburgh and its waterfront during these three points of time using the criteria developed from the main theoretical text with detailed maps of the waterfront for the years 1872, 1900, and 1923. The study concludes with an analysis of the present to understand the impacts of the past. The scope of the study is limited to tracts of the river running parallel to the river about a quarter mile deep.

II. Theoretical Background

As the study began, the first two directions for inquiry were the city itself and its most defining identity as an industrial city. The first survey of literature that resulted from this query revealed a large range of approaches, from Stephan Lorant's *Pittsburgh: The Story of an American City* to Lewis Mumford's *The City in History*. A first attempt at categorizing the literature surveyed resulted in the following groupings: theoretical and historical studies, and studies by economic geographers. The section below briefly describes the main thrust of the books under these categories, only touching concepts that seem relevant to the study.

Literature Survey

a. Theoretical Studies

Kevin Lynch: *A Theory of Good City Form*
Lewis Mumford: *The City in History*

Kevin Lynch, respected urban planner and architectural theoretician, was Professor in the department of city planning at MIT. *A Theory of Good City Form* develops a normative theory of the City. Kevin Lynch summarizes all models of the city, categorizing them under theories of form, functional theories, and temporal (time based) theories. One functional theory specific to the study of the Industrial City is the "City as an Economic Engine."

Lewis Mumford, writer, scholar, and architectural historian illuminates the growth of the city and its historical origins over a period of 1,000 years in his book. He traces the growth of the industrial city to Coke town and describes the Zeitgeist (meaning the spirit of the time; the taste and outlook characteristic of a period or generation), with the philosophy of Utilitarianism.

b. Historical Studies

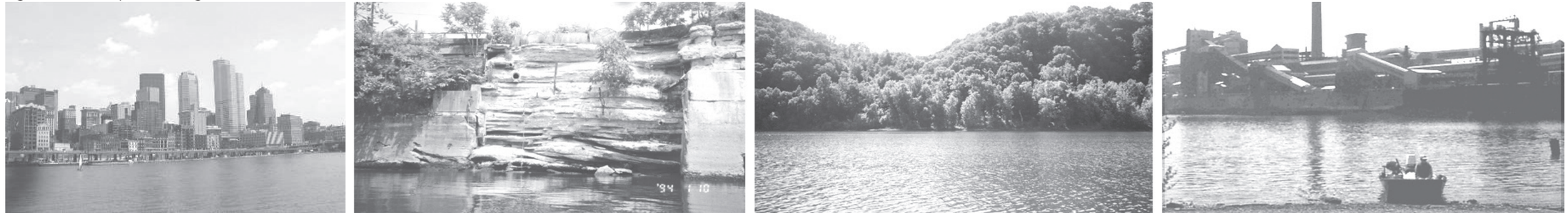
Samuel Hays: *City at the Point: Essays on the Social History of Pittsburgh*
Joel Tarr: *The Search for the Ultimate Sink: Urban Pollution in Historical Perspective*
Joel Tarr: *Transportation Innovation and Changing Spatial Patterns in Pittsburgh, 1850-1934*
Roy Lubove: *Twentieth-century Pittsburgh Government, Business, and Environmental Change*

This set of studies on the city of Pittsburgh offered rich narratives on the growth and development of Pittsburgh from social, regulatory, political and environmental points of view, with a particular focus on detailing the process of development and its protagonists.

c. Studies by Economic Geographers

Kenneth Warren: *The American Steel Industry 1850-1970: A Geographical Interpretation*
Langdon White: *Geography's Part in the Plant*

Figure 1: Banks of the Monongahela River



Cost of Iron and Steel Production at Pittsburgh, Chicago, and Birmingham
Langdon White: *The Iron and Steel Industry of the Pittsburgh District*
Langdon White: *Water, a Neglected Factor in the Geographical Literature of Iron and Steel*

This set of studies focused on explaining the economic and geographic reasons for the location and development of the iron and steel industry in the Pittsburgh and the surrounding region.

Evolving the Theoretical Framework

Theoretical models merely seek to describe and explain the vitality of immediate experience. In the real world, many observers of the industrial city documented the Zeitgeist as one that emphasized economic activity above all other modes of living.

Lewis Mumford observes that any conscious political regulation of the growth and development of cities during the industrial era was done in accord with the postulates of what he calls Utilitarianism. The most fundamental of the postulates of Utilitarianism was the notion that a divine providence ruled over economic activity and ensured, so long as man did not interfere, the maximum public good through the dispersed and unregulated efforts of every private, self seeking individual.[1]

Stepping back from the literature survey, some threads of thought seem to logically belong together in understanding the industrial city of Pittsburgh—the main focus of the study. The historical studies provide rich qualitative insights into the development of the city. Of the theoretical approaches, Kevin Lynch's functional theory of the city as an economic engine is specifically relevant. Studies by Kenneth Warren and other economic geographers analyzed Pittsburgh with geographic and statistical tools using a subset of the theory of "City as an Economic Engine."

The main reference text used in this study is *A Theory of Good City Form* by Kevin Lynch and the supplementary text is *The American Steel Industry 1850-1970: A Geographical Interpretation* by Kenneth Warren.

With this review and main reference texts in place, the structure of the study gains corporeal form and is as follows:

a. Understand theories of the city in general, and the concept of the city as an economic engine in particular.
b. Develop the criteria of analysis derived from this theoretical framework to analyze Pittsburgh visually.
c. Analyze the city of Pittsburgh during the industrial phase of its development from 1875 to 1925 using the derived criteria, building upon the prior works of economic geographers like Kenneth Warren.

The intent here is to first provide an overview of the ways to understand a city, as delineated by a noted urban theoretician, and then use his categorization and summary of prevalent theories to pick out a theory relevant to the analysis of industrial cities. This theory is then used to analyze the city of Pittsburgh. The next section provides this overview of the ways to understand cities.

Overview of Functional Theories of the City

A student of the city might ask, *"How did the city get to be the way it is?"* and the related questions, *"How does it work? - What is it physically made up of?"* These questions address the basic concepts of studying cities: Form and Function. Form, or settlement form, is normally taken to be the spatial pattern of the large, inert, permanent physical objects in a city—buildings, streets, utilities, hills, rivers, and perhaps the trees.[2] Function explains the way cities work and their genesis.[3] As opposed to models of city form[4], a functional model, or theory, of cities relates city form and the functions that gave rise to them.

Kevin Lynch provides six dominant functional theories of the city[5]:

1. **Cities are unique historical processes.** Each city has a unique story that can be told. Primarily employed by historians, this method of studying the city yields rich unique insights into the individual processes and dynamics composing the city, by using a textual narrative.
2. **Cities are ecosystems of human groups** that can be mapped in terms of zones of economic activities and homes of specific social groups. This approach began with the work of Sociologists like Ernest Burgess at the University of Chicago in 1925. Contemporary practitioners like BJL Berry, B Loudon amongst others bring a rigorous quantitative approach to the application of this concept to the city.
3. **The city is a space for the production and distribution of material goods,** the city as an economic engine. Economists and geographers such as Walter Christaller, Homer Hoyt and August Losch used this approach to study the city.
4. **The city is a field of force,** a communication/transport network that transfers knowledge, resources, products and capital. Tools developed to apply this theory are based on concepts from hydrodynamics, graph theory, catastrophe theory and other concepts of topology.
5. **The city is a system (and product) of linked decisions,** a framework that emerges in relation to but not in collaboration with diverse entities. This is models the city as a complex system using computational techniques to simulate decision-making.
6. **The city is an arena of conflict;** diverse actors compete for similar resources in an inescapable and beneficent process that leads to equilibrium or dominance. Arising primarily from the Marxian point of view of the city, the main theorists of this concept include Henri Lefebvre, Manuel Castells and Freidrich Engels.

Many of the theories above arose from the work of a particular discipline proving that the study of cities is inherently interdisciplinary. Each discipline emphasized the use of different types of tools to understand the city according to their perspective. The tools ranged from textual narratives to the visual and graphical or were quantitative and statistical.

Of the theories stated above, the only one that focuses on explaining industrial locations spatially is the city as a space for the production and distribution of material goods or, the city as an economic engine. The concept of city as an economic engine is important because it explains and spatially anchors the economic reasons which led to the growth of industrial cities. In the following section, the main principles of this theory of are stated and explained.

Primary Theoretical Framework

The city an economic engine, according to Kevin Lynch, consists of three major ideas: the economics of space (and resulting locations), the force exerted by existing locations, and properties of space itself (which make it valuable in particular ways). The city as an economic engine is a title used by Kevin Lynch to summarize a series of approaches by different authors and practitioners including Walter Christaller, Herman Hoyt, John Rutcliff among other economists, geographers and economic geographers.

The following paragraphs paraphrase Lynch's summary of their theories and simultaneously derive an analytical framework from them.

Cities are looked at as patterns of activity in space which facilitate the production, distribution, and consumption of material goods.[6] The primary idea is that space imposes an additional production cost because of the time and resources required to move things to it and through it. As a result, economic activities will arrange the built environment to minimize those costs. Space is introduced

as a transportation cost. This idea evolved into the study of the economics of space, or spatial economics. One branch of spatial economics focused on industrial locations, particularly on resource extraction and processing, where bulky commodities must be transported across long distances. In this case, the question is: Where should a plant locate, given the dispersed locations of its various resources, markets, labor, and supporting industries? Analysis leads to determination of a balance point, a most efficient location given the values of different commodities and the various costs of transportation per unit distance.

In order to understand why Pittsburgh developed as an optimum location for industries in the late nineteenth century, the relationships between the following must be understood in detail:

Location of Resources
Location of Markets
Production & Transportation
Types of transportation available
Costs of assembling raw materials and producing the product including availability and cost of labor
Costs of transporting finished goods to markets

The above criteria examine the economic and locational aspects of optimum geographic location of industry.

The theory also explains tendencies for linked industries to agglomerate or gather in some compromise location and for those agglomerations, once established, to exert further locational attractions.[7]

The abstraction of the mercantile city is the idea of foci, or nuclei, a core around which the city develops. With industrialization the city becomes multinucleated. Industry becomes a nucleus drawing and attracting settlement around it. Optimum location of industry is true at the scale of the city encouraging like and interdependent industries to group together to exploit similar cost advantages of a particular location. Technology, especially in the case of the iron and steel industry, reinforces this clustering. These factors are explored in greater detail in following sections.

Properties of Space[8]
Space is a limited resource. Space provides (and limits) the room in which to act, reside, produce, consume, or move. Each space might have particular characteristics that can make it more or less suitable to particular uses, and in turn adjacent uses can affect the relative suitability of use and characteristics of space.

In the former, is the idea of a natural or topographic zoning where topography and slope characteristics can direct and limit use. Suitability of certain characteristics to certain uses can be illustrated with the attraction of industrial land uses to areas with gentle slopes and proximity to natural transportation systems like rivers.

Prior to the development of zoning as a socio political tool to regulate the use of land, certain uses of land encouraged the use of surrounding land in a similar or interdependent manner. For example, building a church in an undeveloped suburb encouraged people to reside near the church. Reciprocally, a particular use of land may affect and alter the characteristics of space.

These characteristics of space, present and produced, are better understood by borrowing concepts and methods of spatial analysis, such as figure ground, from architecture, and land use from urban design and planning. The following paragraphs list and explain the criteria analyzing the characteristics of space:

Topography:
Landforms dictate the growth of cities. Sites with positive qualities such as flatness, good drainage, etc. are developed first. Land with negative attributes such as steepness, swamps, or poor drainage are developed later, if at all.

Street Networks & Public Space:
The technique of figure ground, typically used in the architectural and planning disciplines, is used here in the analysis of street networks and ownership of space (public or private). The characteristics of street networks and space that the technique of figure ground highlights are first discussed. An explanation of the technique itself follows.

For this study, the street network diagram is defined as a plan showing the relationship between block of the city and publicly accessible space (including streets) by presenting the former in black and the latter as a white background. Publicly accessible space includes the streets and the riverbank.

Figure 2: Publicly accessible space & Street Network

Using the technique of figure ground, visual analysis of street patterns reveals the nature of street transportation systems – their connections, orientation, and accessibility.

The figure ground diagram also describes the proximity of space to other transportation systems such as rivers, a characteristic historically vital to the growth of civilization. Transportation networks add to or impede the accessibility of (public and private) space. Railroads, for example, may improve accessibility at regional and suburban levels, but in the case of Pittsburgh impede access to the river at the scale of the city. The visual analysis of the street pattern also reveals the nature of public and private space (Where is it located? What is its distribution?). Land ownership and subdivision of land distinguish public from private space. Land ownership and subdivision also indicate the availability potential sites for development and expansion of the city and industry.

Figure Ground:
A two dimensional map has long been used to show the form and distribution of public space. The earliest example is a map of Rome by Nolli in 1748. On this map the streets and squares are voids and the buildings solid black with the exception of the main public spaces or semi

Figure 2: Publicly accessible space & Street Network

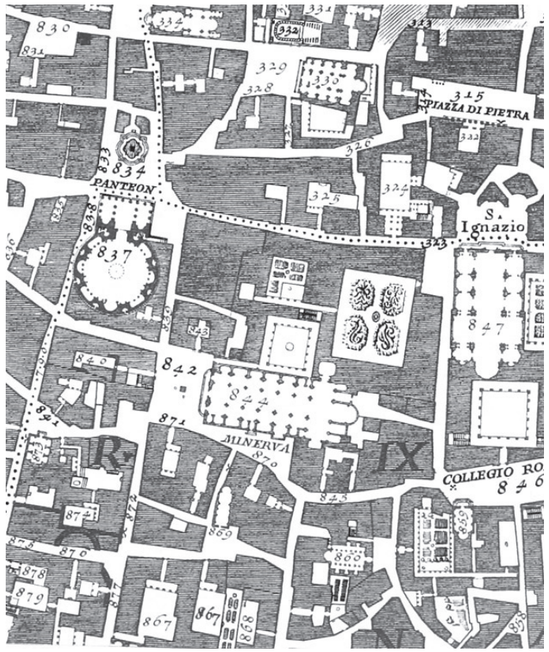


Figure 3: Nolli's Map of Rome

Figure 4: Orientation of building on street

public spaces within buildings, which are also depicted as voids.[9] Nolli's map, therefore, shows the external public spaces and their connection with the main internal spaces of churches and other buildings used by the public. This is useful technique for recording public space in the city and analyzing its distribution and connection. The eye is accustomed to seeing the spaces between buildings as voids and the buildings as solids when reading maps.

Figure 3: Nolli's Map of Rome

Urban Fabric

Visual analysis of the built environment using **the technique of figure** ground reveals additional qualities of space such as density, distribution and orientation of built form. The diagram of urban fabric is constructed by using a figure ground diagram of the built form and all the space around it by representing all buildings in black and all open space – private and public as a void. Density of built form indicates areas of current and potential growth. Distribution of built form is typically measured in planning and architecture disciplines using the concept of urban grain. Urban grain describes the distribution and extent of segregation or integration of land uses. The orientation of built form reveals the emphasis and importance of spatial characteristics. These measures of the built form also reveal weaknesses in the enclosure of public space, points of weak connection and general characteristics of spatial composition. Each of these measures of built form are explained below.

Density of buildings is understood as the number of buildings per each unit of open space. If the number and area of buildings is more than open space, then the built environment is dense and if less, it is sparse.

The grain of a settlement is the way in which the various different elements of a settlement are mixed together in space. These elements may be buildings, activities, building types, persons or other features. The grain of a mix is fine when like elements, or small clusters of them, are widely dispersed among unlike elements and coarse when extensive areas of one thing are separated from extensive areas of another thing.[10] To extend this concept to the footprint of the built form, when buildings of dissimilar sizes are widely dispersed in space, the grain may be called fine. When large areas of buildings of similar sizes are grouped together the grain may be called coarse. The concept of grain is a useful tool to understand the extent of segregation of functions within the city.

The orientation of a building on a street can reveal many features of both the building and the street. For example, a pattern of buildings continuously fronting a street shows the importance of that street as a main street or commercial street.

Figure 4: Orientation of building on street

Land Use

Zoning[11] did not exist in Pittsburgh prior to 1923. In fact the state legislature authorized the creation of the Pittsburgh Department of City Planning only in 1911.[12] The landscape was at the mercy of whoever happened to own it at anytime.[13] The development of the city and use of land was left to private citizens. Land use is simply the use or function of a plot of land. It helps us:

- **Understand how different functions are distributed within a city**

  For example which areas of the city are industrial? What types of industries inhabits certain locations? Is there any clustering or any trend for certain types of industries to be found together?

- **Understand the nature type and numeric strength of different functions in the city**

  For example, are the Industries heavy manufacturing or light? Which industry dominates? What type of Institution is increasing? If the number of boarding houses for women

increase we may draw the conclusion that more women employed outside their home.

- **Interpret these functions qualitatively**

  For example, what are the types of religious institutions in a city? Are they present in greater or lesser number in certain areas? Domination of a particular area by Eastern European Church denominations reveals ethnic clustering of that particular community in that location. Thus, the answers to these questions show the ethnic distribution and residential occupation of districts.

Material

The last criterion is building material, originally used to determine vulnerability to fire. Correlating the age of the ward and the types of material used for construction provides some insight into income levels. The older wards would be more stable in terms of population and use, and would show a greater investment in the quality of building. In more mobile, poorer areas, cheaper building materials would prevail. Some areas might show a preference for certain building materials which maybe the result of fire ordinances for that location.

A correlation of the area of the building with its material used provides insight into the dominant material in building houses as houses have the lowest area.

The three major ideas: the economics of space (and resulting locations), the force exerted by existing locations, and properties of space itself (which make it valuable in particular ways) and their associated criteria for analysis: location of resources, location of markets, production and transportation costs, technological reasons for agglomeration, topography, street networks (and public space), urban fabric (density, urban grain and orientation), land use and building material are used in the second part of the paper to understand the evolution of the waterfront of Pittsburgh from 1872 to 1925.

The next section explains the tools used to arrive at the predominant visual and cartographic methods used to illustrate the above criteria of analysis.

Tools of Analysis

Building upon the precedent of economic geographer Kenneth Warren, this paper uses a cartographic technique based on computer mapping tools to illustrate both the economics of space as well as the qualities and characteristics of space. Because of the interdisciplinary reality of studying cities, Kevin Lynch has said, "If a language particular to cities develops, it is likely that it will be a graphical one, since graphics are superior to words for describing complex spatial patterns."[14] The inherent bias of the study, therefore, is towards using visual and graphical tools to illustrate the growth of the waterfront of Pittsburgh. This section deals with the tools of analysis used in this paper.

Quantitative measures and geographic tools have been used to analyze the city as an economic engine. The quantitative tools usually associated with this theory are statistical in nature, examples are measures such as the bell curve, used to measure the density of settlement as a factor of distance from downtown, or the radial model of rent control and access developed by J.H. Von Thunen and August Losch. Kenneth Warren uses geographic methods of mapping supplemented with tables and statistics to illustrate the study the economics of space for the iron and steel industry in America from 1850 to 1970.

Graphic computer based mapping techniques are used in this paper instead of statistical methods. The mapping technology, called Geographic Information Systems (GIS), orients diverse statistics in common geographical space for qualitative, quantitative, and relational forms of analysis. GIS systems depend on different sources of data.

Sources of Data:

The primary sources of data are maps of Pittsburgh made by the GM Hopkins Company of Philadelphia. Secondary sources of information used in this paper include the Flood Commissioner's map for Pittsburgh 1905, kindly provided by Professor Joel Tarr of Carnegie Mellon University. According to the Digital Library at the University of Pittsburgh, the main focus of the Hopkins maps was documenting properties for real estate and property assessment purposes. Other contemporary map sources not used in this paper such as the Sanborn Maps made by the Sanborn Fire Insurance Company are large-scale plans that contain data primarily used to estimate the potential fire risk for urban structures.

Data Processing:

Image files were obtained from the Digital Research Library, University of Pittsburgh. They are the GM Hopkins maps of Pittsburgh for the years 1872, 1903, and 1923. These images were then converted into vector format. The process of conversion of raster or image data into vector data used by GIS applications is a long drawn manual process of digitizing. This vector format was then brought into a GIS system and populated with data. The data was standardized in extents as far as possible. Accuracy of geo referencing is limited to the qualities of individual data. For the year 1872, larger ward sizes meant that rubber-sheeting accuracy was restricted to a certain degree. The tolerances of deviation however are within reasonable limits.

III. Analysis: Pittsburgh Waterfront 1872-1996

The theoretical framework developed in the last sections of the paper is now applied to analyzing the growth and development of Pittsburgh in general and the waterfront of Pittsburgh in particular. The analyses moves from a larger regional perspective in understanding the optimum location for industry to the scale of the buildings in the analysis of the properties of space. Broad sketches of the evolution of the criteria under scrutiny situate the analyses, but the main timeframe of the study is specifically from 1872 to 1923. The basic hypothesis of the study is that Pittsburgh during the Industrial Phase of its development was the crystallized expression of market forces. The analysis concludes with a brief analyses of post industrial Pittsburgh, revealing the negative legacy of past spatial decisions.

Optimum Location for Industry

Shifting equations between the supply of raw material, location of markets, and transportation technology led to the growth and decline of Pittsburgh as an optimum location for industry. This equation is examined in detail in this section. Technological innovation played a vital role in completing the changing equation between supply of raw materials and shifting location of markets and is discussed in greater detail in a later section explaining the reasons for agglomeration of industries in Pittsburgh.

The concept of supply and demand determining industrial location was crucial enough to capture and dominate the attention of almost all observers of the industrial economy. JP Lesley was one of the earliest to comment upon and document the relations between supply of raw materials and location of industries using maps in 1859. Many others, such as the American Iron and Steel Association (A.I.S.A), were assiduous in collecting and releasing such data as early as the mid-nineteenth century.

Different competing fuels, mainly charcoal, anthracite and some bituminous coal, characterized the initial history of the iron and steel industry. These fuels were used simultaneously, in overlapping time periods until the use of Bituminous coal began in large scale in the late 1860's. By the late nineteenth century the locations of raw materials had stabilized, with iron ore from the Lake Superior ranges and Bituminous coal from Connellsville. The emphasis then shifted to the most efficient methods of production and transportation as factors determining the success of industry. The Pittsburgh Plus, an artificial

Figure 5: Coal Mines in Pittsburgh 1815

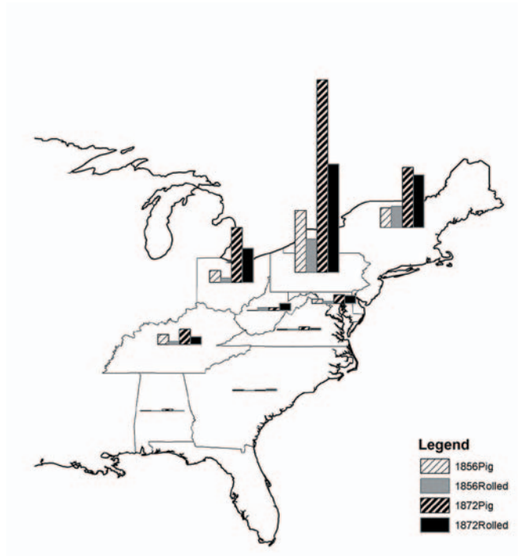


Figure 6 : Pig Iron and Rolled Iron production in the United states of America 1856-1872

method of price control, was used by United States Steel Company to keep industry in Pittsburgh afloat after the city lost its competitive advantage for optimum production of iron and steel. Pittsburgh Plus kept competition at bay for little more than a decade. After the collapse of the Pittsburgh Plus, the iron and steel industry gradually declined, marked only by brief spurts of revival. These shifts in emphasis from fuel, to transportation, to price control structures are delved into with greater detail in two parts. The first deals with the time period from the early nineteenth century to 1860, and the second, from 1860 to 1996.

This section is illustrated with charts developed from data available in Kenneth Warren's comprehensive geographical analysis of the iron and steel industry in America from 1850 to 1970.

Fuelled Growth: Early nineteenth century to 1860
Charcoal:
Charcoal was the dominant fuel used in iron smelting in the United States until the middle of the nineteenth century. According to Kenneth Warren, both the materials and market situation pointed to the advantages of scattered industries. Wood fuel made smelting dependent on extensive use of the land making the industry analogous to agriculture.[15] Iron ore was supplied from local resources. On the demand side most of the outlets were scattered either in rural communities or in small agglomerations. The leading characteristics of the mid-nineteenth century American charcoal based iron trade were its "wide scatter, rapidly changing pattern, and lack of integration".[16]

Raw coal was also used in blast furnaces and rolling mills. In Pittsburgh, Coal was mined from locations within the present day city boundaries, as can be seen in figure 5. Coal was not the major fuel of the time, perhaps because of intermittent production due to lower efficiency and prevalent mining and blast furnace technology.

Figure 5: Coal Mines in Pittsburgh 1815

Anthracite:
The introduction of the hot blast technique in 1840 was the technical prerequisite for the successful use of anthracite fuel in iron smelting. Anthracite is a dense, high carbon grade of coal.

Anthracite was mined mostly in northeastern Pennsylvania and the iron ore came from three main districts; Cornwall in the Lebanon valley, Southwestern Pennsylvania, and the Middlesex region of northern New Jersey. With better transportation techniques such as canals, waterways, and rail transport, the hot blast anthracite furnaces spread outward to the Lehigh, Juniata, and Susquehanna rivers, all east of the Allegheny Mountains. The balance of raw material consumption heavily favored of iron ore rather than coal location. For example, the Bethlehem iron works used 1.21 tons of limestone, 2.24 tons of iron ore, and 1.86 tons of anthracite to produce one ton of iron.

Figure 6 : Pig Iron and Rolled Iron production in the United states of America 1856-1872

The pattern of industry that resulted from the location of resources and their proportion of use was a cluster of blast furnaces using anthracite, east of the Alleghenies. Blast furnaces using charcoal and raw coal, west of the Alleghenies, were located in the valleys of the upper Allegheny River and the Ohio. Pittsburgh was marked by a complete absence of blast furnaces until the late 1860's .[17] This is also seen in the fact that in 1856 Pittsburgh only produced rolled iron.

Figure 7: Pig Iron and Rolled Iron Production in Pennsylvania 1856

The city had a large number of rolling mills, many of which dated back to the early nineteenth century. All were located on the banks of the rivers because water was critical to the rolling process.

Figure 8: Locations of rolling mills 1800-1860

Blast furnaces produced the iron and rolling mills shaped the ingots into agricultural implements, nails, wire, bars, tools, stoves, and other metal products. The development of markets during this time was solely dependent upon development of transportation.

1860-1996: Growth and Decline of the Iron & Steel Industry
By 1860 the factors driving the growth and transformation of industry became clear. The biggest factor was the development of the railroad. It aided the flow of population and markets and in itself constituted one of the biggest markets for iron rails. The main thrust of the expansion of the railroad, population growth, and thereby movement of the market was westwards. Another indicator of the movement of markets and population is the United States center of population. The roles played by the railroad, population shifts, and markets after 1860 are explored and explained in the following paragraphs.

Transportation:
The types of transportation prevalent in mid-nineteenth century Pittsburgh were river transport, and muscle power (horse drawn carriages and buses).

River transportation played a crucial role in the development of Pittsburgh from the times of the flatboat and keelboat in 1750. After 1811, steamboats came into common use for passengers and goods. The Main Line Canal, which involved a mixture of canal, railroad, and portage railway, was built from Philadelphia to Pittsburgh in 1834. Eventually though, it proved to be an economic failure mainly because of the awkward use of railway at Hollidaysburg between the two main canal lines and by 1859 most of it was sold to private interests including the railroad companies.[18] During this time, barges were also developed for the moving of freight and bulk goods. Pittsburgh was a gateway to the deep south, through the Mississippi and Ohio river systems reaching up to New Orleans. The Monongahela Wharf in the city was the focus of this river commerce from the early nineteenth century.

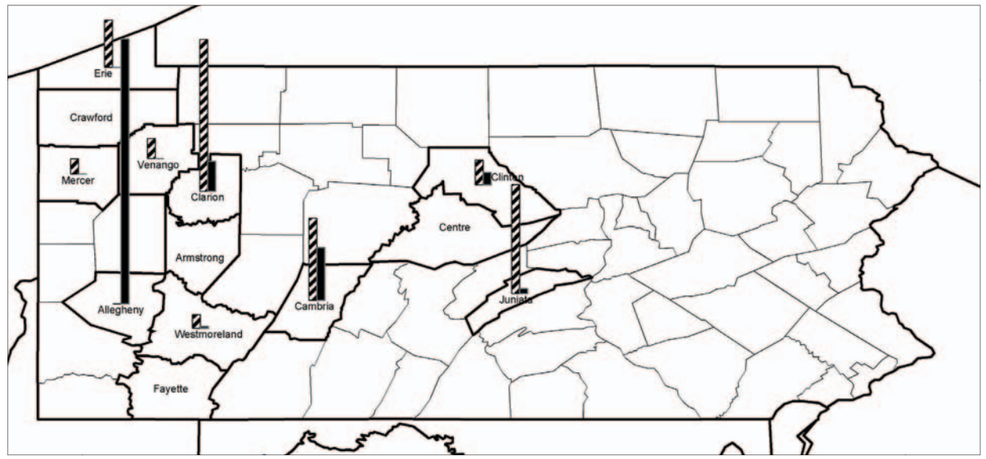


Figure 7: Pig Iron and Rolled Iron Production in Pennsylvania 1856

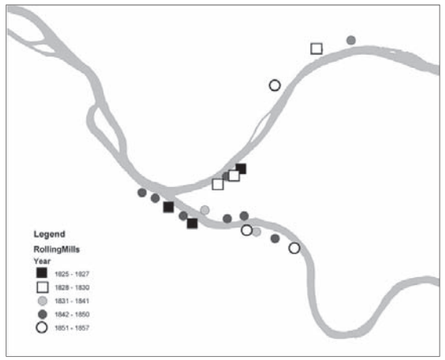


Figure 8: Locations of rolling mills 1800-1860

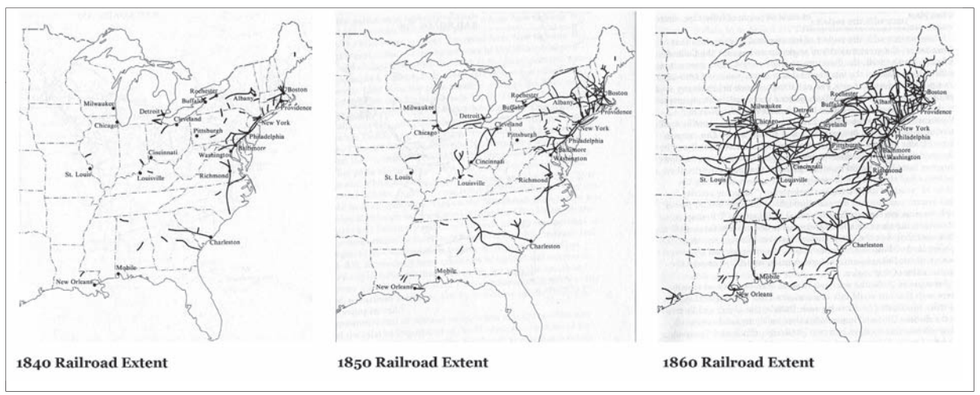


Figure 9: Railroad expansion in the United States 1850-1860

Figure 10: Production of rails in Pennsylvania and the United States 1856-1876

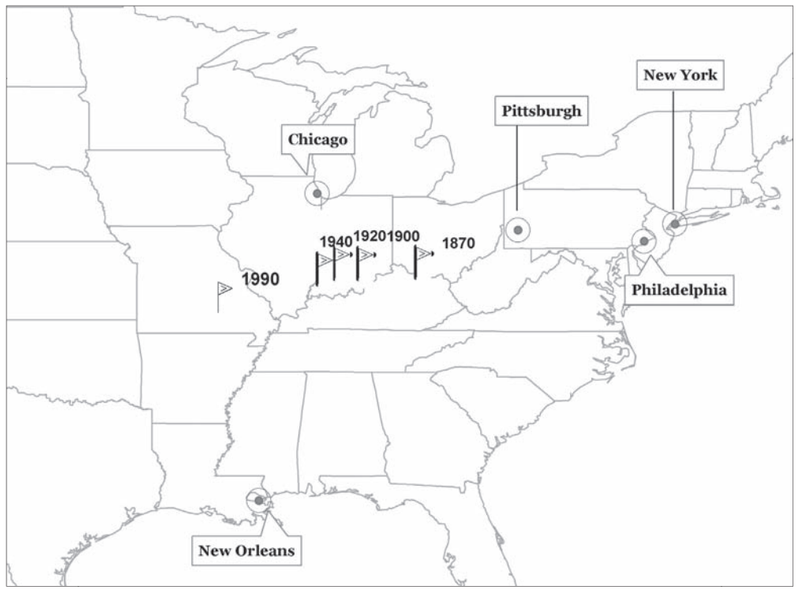


Figure 11: United States Center of Population

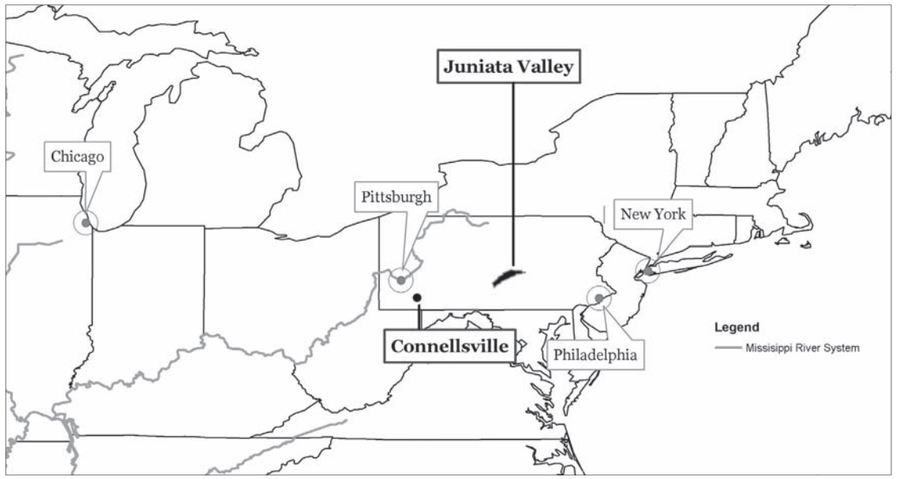


Figure 12: Location of Connellsville and Juniata Coal Supply Areas in relation to major cities

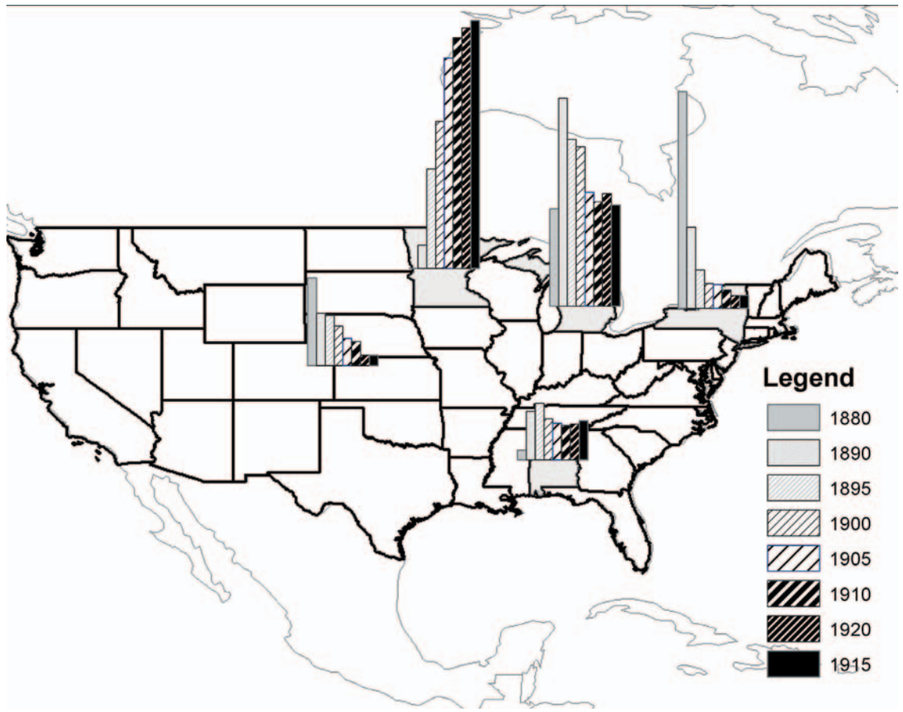


Figure 13: Production of iron ore in the United States 1880- 1920

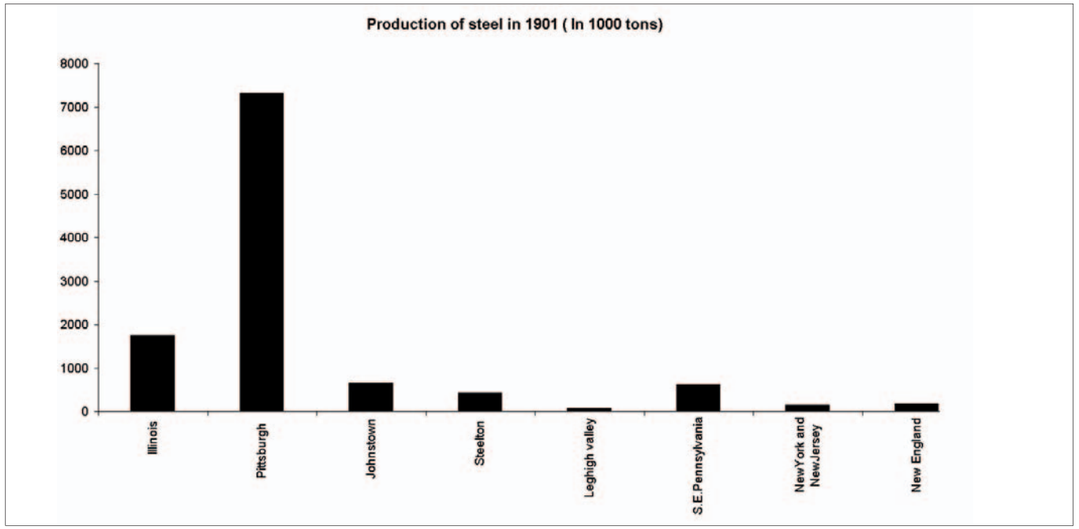


Figure 14: Production of Steel in Thousand Tons 1901

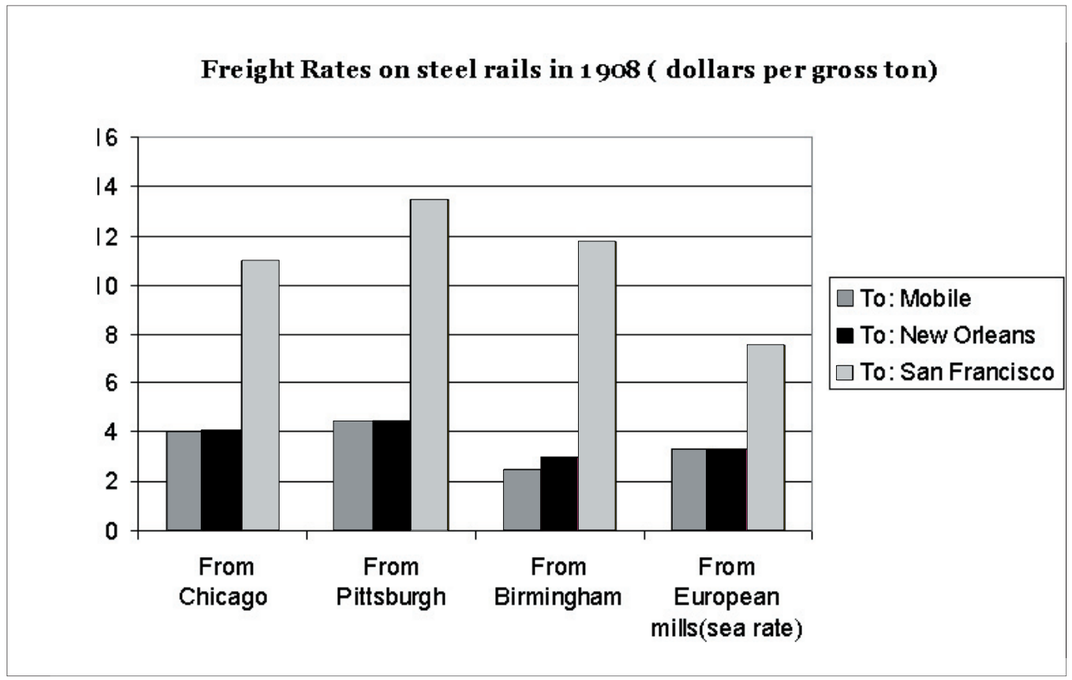


Figure 15:Transportation Costs 1908

According to Kenneth Warren, the key to the whole was the development of railroads to the west. This linked the plants to distant raw materials, opening regional rather than local markets and the railroads themselves constituted by far the biggest single consumer of iron.[19] As the railroads spread west, the production of rails also moved westward.

Figure 9: Railroad expansion in the United States 1850-1860

Figure 10: Production of rails in Pennsylvania and the United States 1856-1876

Railroads were rapidly spreading west, reaching as far as Minnesota by 1860, providing speedy and reliable transportation (See figure 9.) They played an important role in transportation within cities (inter-urban transportation) and suburban transportation (intra-urban transportation), competing and overlapping with the omnibus, the cable cars, horse cars, and trolleys. The railroad served a majority of commuters by the mid 50's and simultaneously served industry by transporting freight and finished goods over a dramatically larger radius of profitability. By the 1860's, regular commuter trains connected the city with towns along their routes. By increasing the ease of travel, it aided the flow of population, which fuelled the rise of large-scale industrialism. Beginning in the late 1850's the railroad also provided a substantial market for domestic production of rails.[20]

The last component of the equation was **Population** or **Labor**. Waves of immigrants boosted the population of Pittsburgh from 1850. The production of iron required a large, strong, skilled labor force. This is revealed in the rise in number of laborers from 18 percent of the total-working males in 1850 to 37 percent in 1870.[21]

This changed first with the introduction of the Bessemer process, adopted in 1865 in the United States, and later with the open-hearth furnace process. Engineers and new machines operated by interchangeable unskilled workers replaced many skilled and semi skilled workers.[22] Cheaper labor helped to keep production costs in Pittsburgh low. In the early autumn of 1884 Pennsylvania Steel Company cut its wage rates by 10 percent. The Steel companies at Scranton and Bethlehem cut wages by 15 to 20 percent. The heat of competition forced wage reduction in the Carnegie mills by 20 to 35 percent in January 1885. Later in the same year Carnegie found a far more effective strategy when the introduction of new machinery at Edgar Thomson, dispensed with 57 of the 69 men on the heating furnaces and 51 of the 63 on the rail mill train. Moving waves of population provided the labor as well as the market for iron and steel goods.

Markets:

According to the United States Census, the center of population has historically followed a trail that reflects the sweep of the nation's brush stroke across America's population canvas. The sweep reflects the settling of the frontier, waves of immigration and the migration west and south. Since 1790, the location has moved in a westerly, then a more southerly pattern. The US center of population[23] was on the west Virginia side of the Ohio near Parkersburg in 1850, but by 1890 it was in the extreme south east of Indiana. As settlement moved west, so did manufacturing and the consumption of iron and steel.[24]

Figure 11: United States Center of Population

The Bituminous Coal Era Begins

The Pittsburgh Bed was the subject of the first geological survey of Pennsylvania in 1836-40. Rogers outlined its detailed form in his final report of 1858. According to Kenneth Warren, geographical ignorance, inadequacy of access, and unsuitable techniques of making coke prevented the earlier large-scale use of coke in Pittsburgh.[25] The Pittsburgh Connellsville railroad was put in place in 1855. Simultaneously, the development of ore mining in the lake ranges was dramatic. In 1873, Pittsburgh depended on ore from Lake Superior for the majority of its ore supply.

Figure 12: Location of Connellsville and Juniata Coal Supply Areas in relation to major cities

In 1860, shipments of Lake Superior ore were still a little under 4 percent of the national production, but by 1879, Michigan produced 22.9 percent of the US total. With the westward movement of mineral production, demand emigrated as seen from the movement of the center of population in figure 11.

Figure 13: Production of iron ore in the United States 1880- 1920

The period from 1860 to 1880 was one of high fuel use per ton of iron.[26] Hence, according to Kenneth Warren, "the structure of rail freight rates made an iron ore port or intermediate location a cheaper assembly point for ore and coke per ton of pig iron than the coke field."

1880-1907

By 1890 the locations of raw material supply had stabilized. Iron ore was supplied from the Lake superior range and coke from Connellsville. This stability meant that from 1880 to 1907 the cost of assembly became the crucial factor in determining the price of finished iron and steel. Given this factor, many new centers of iron and steel manufacturing emerged to compete with Pittsburgh. This competition was located mostly to the west of the Alleghenies in cities like Chicago, Duluth and Cleveland. By this time, eastern manufacturing centers had been rendered uncompetitive due to the high costs of transporting raw materials to the east of the Alleghenies.

Figure 14: Production of Steel in Thousand Tons 1901

Detailed analysis of the freight costs of raw material, coke and transportation costs to distant markets are the hallmark of industrial statistics of this period. Production costs, assembly costs, and transportation costs to markets were the elements of the equation that ensured profits when delicately balanced. For example, in 1895, Pittsburgh balanced relatively high costs of transportation from and to the city with a high volume of production ensuring lower production costs over newer centers of production such as Chicago and Pueblo[27].

By 1907 the biggest market was the western seaboard and San Francisco in particular. Pittsburgh lost its competitive advantage with other manufacturing centers matching the price of production of Pittsburgh added with their respectively much lower costs of transportation costs to markets.

Figure 15:Transportation Costs 1908

The steel industry offered strong resistance to locational change when existing equipment was not fully depreciated because new integrated mills required heavy investments in specialized and relatively permanent capital equipment.[28] The conflicting needs of locational resistance by the industry and expensive transportation costs resulted in the pricing mechanism called Pittsburgh Plus introduced by the United States Steel Company.

The single basing point system, known as Pittsburgh Plus, was in force from 1907 to 1924. Under this system, steel was sold at the Pittsburgh base price plus the rail freight from Pittsburgh to the consuming center, regardless of where the producing plant was located. As a result, Pittsburgh producers were able to quote the same competitive prices as companies whose plants were closer to the new market centers. Geographical position was thereby eliminated as a substantial element in competition, and distant markets were opened to producers in the older districts on the basis of an approximate price parity with competitors elsewhere. Production tended to stabilize or expand in the older districts, and the industry was enabled to minimize the potential costs of building new mills in outlying market areas. The single point basing system favored the location of fabrication in the Pittsburgh district and in turn stimulated increased development of the basic steel

Figure 16: National Production and Consumption of hot steel rolled steel products

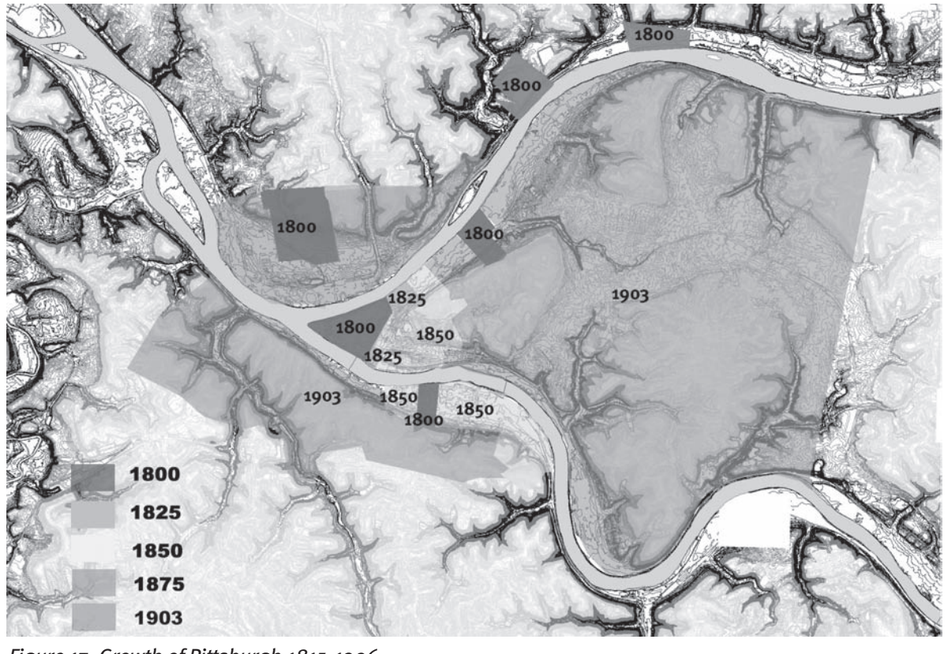


Figure 17: Growth of Pittsburgh 1815-1906

industry there.[29]

Distant producers gained substantially from phantom freight – freight charged the consumer as part of Pittsburgh Plus, but not in fact borne by the supplier near to a consumer. This pricing system ensured larger profits to suppliers away from Pittsburgh and thus fostered growth of new steel capacity requiring great investment at a distance from Pittsburgh. Newer plants were much more efficient further reducing the cost of production, tipping the balance in their favor.

1924-1996

Pittsburgh Plus was declared illegal in 1924. In the aftermath the Steel Industry adopted a multiple basing point system of pricing. Under the new system, the number of basing points was increased and differentials above the Pittsburgh base price were established at these points. This system provided a great incentive for both production and fabrication outside the Pittsburgh district.

Production and Consumption figures for the years between 1920 and 1950 show significant shifts in the relative importance of steel producing districts (See Figure 16). In 1920 Pennsylvania produced half of the nations iron and steel products, by 1948 production declined to one third. The overall consumption of the eastern states of New England decreased and production has been minimal since 1920. New York and New Jersey just managed to close the deficit between production and consumption by 1950. Exigencies created by the World Wars forced the growth of the Western states and by 1948 the Western states were producing two thirds of its requirements.

These shifts were accompanied by dispersion of fabrication away from the older basing point centers. Coal and domestic ore quality deteriorated. There was an increasing dependence on foreign ore from Labrador and Venezuela, replacing the degraded ore from Lake Superior. According to Allan Rodgers, the Pennsylvania Steel Industry was described as prosperous in the early 1970's yet in succeeding years the industry's fortunes waned and plant after plant closed with powerful negative effects on local economies. By 1992 Pennsylvania produced less than one tenth of the national steel output.[30]

Figure 16: National Production and Consumption of hot steel rolled steel products

Agglomeration of Industry

There are three main reasons for Agglomeration of Industry in a preexisting location. The first, economics of optimum location with regard to raw materials, production, transportation and markets as explored in the previous section, worked at the scale of the city, affording room for many industries to cluster in the city.

Secondly, technology dictated agglomeration of industries. The introduction of coke, more efficient than anthracite, changed the scale of production. With a more efficient fuel, larger blast furnaces capable of larger outputs were built. Industrialists chose to expand existing infrastructure rather than develop new locations due to the high cost of new steel production plants.

In mid-nineteenth century when anthracite was used as a fuel, blast furnaces producing the iron ingots and rolled iron shaping the ingots were located separately. Integration was low because the blast furnaces were more efficiently located near the source of iron ore and rolling mills near water sources. By 1900, new integrated plants comprising of coke ovens, blast furnaces, steel furnaces and rolling mills were the industry norm. According to Allan Rodgers, they were "far more clustered than had been the case earlier."[31]

Pittsburgh served as a base for manufacture of different products fashioned from iron and steel production. The early nineteenth century outputs of Pittsburgh were cast and shaped nails, wire bars, tools, stoves and other products largely designed to serve the needs of settlers moving to the frontier. This product mix graduated to steel

rails, then structural and plate steel and other fabrications from iron and steel. By 1900, fabricators were attracted to older districts like Pittsburgh primarily because steel costs were the lowest, but also because location near Pittsburgh meant the widest possible radius of distribution for steel products.[32] This relation of dependency and symbiotic aims between fabrication and production of iron and steel was also a major factor of industrial agglomeration.

Qualities of Space 1872 - 1996

Landforms are the canvas on which cities unfold. Pittsburgh's topography has played an exceptionally proactive role in sculpting the shape of the city. The flat stretches of the floodplains on rivers attracted the first settlements in the county, dictating and limiting the shape of towns like Pittsburgh, Allegheny city, Birmingham and Lawrenceville.

Figure 17: Growth of Pittsburgh 1815-1906

Pittsburgh's grid, first laid out in 1764 around Market Square, stopped at Market Street. It was extended in 1786 until Grant Street. Most towns in Allegheny County, like Lawrenceville, Birmingham, and Allegheny City followed this grid pattern—with a waterfront street called Water Street. This **orientation of the street pattern** towards or perpendicular to the river reflects the high position the rivers had in the consciousness of the city. This street pattern remains mostly unchanged until 1875.

When Pittsburgh was incorporated as a city in 1816, it was a mercantile and trade based city. The street network of the city was a simple grid pattern fronting the two rivers. The urban fabric was dense, especially near the center of commerce, the Monongahela Wharf. According to John Swauger[33] land use was mixed and most people resided at or within two blocks of their place of work.

The only constant of cities is change. Physical spaces in cities undergo change everyday with growth, building, and expansion. The analyses of physical space is restricted by its very nature to representative years that reveal the quintessence of the character of change. The earliest comprehensive map data available for Pittsburgh is from the 1872 GM Hopkins Maps of the city. The analyses of the qualities and characteristics of space is via time series snapshots of the city in 1872, 1900 and 1923 using available GM Hopkins Maps for each year. The following sections analyze the qualities and characteristics of physical space for each of these years using the criteria of analysis of characteristics of space developed from the theoretical framework – street networks and public space, urban fabric, land use and material – for each of these years. The text accompanies the analytical maps for each criterion of analysis of each year.

1872: The Industrial City Emerges

After 1816, the city slowly evolved into Iron City by 1872, and then, Steel City. This development in Pittsburgh proceeded in an incremental, often halting manner, and seldom had a systematic character.[34] The mid-century city displayed industrial form in characteristics such as population size and composition, emergence of large scale goods manufacturing, and embryonic phases of commuting. But the American city was still mercantile in the dominance of commerce and pedestrian movement, persistence of some craft activities and general heterogeneity of land use.[35] This combination of events resulted in urban areas with a geography that was transitional between the early mercantile city and the later turn of century industrial metropolis. The city had been gradually growing by annexing adjacent boroughs, and by 1872, achieved most of its current boundaries except for the Allegheny City.

The following sections examine in detail the street networks and public space, urban grain, and land use in 1872 Pittsburgh.

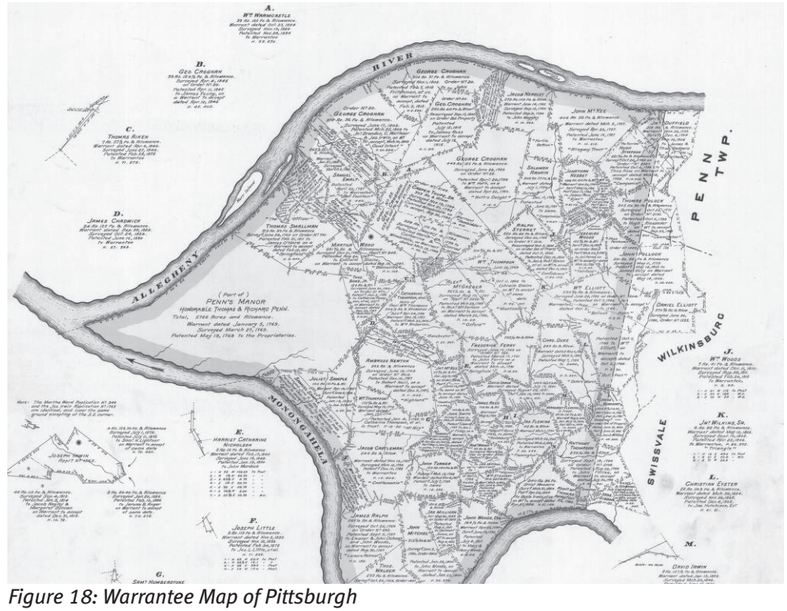


Figure 18: Warrantee Map of Pittsburgh

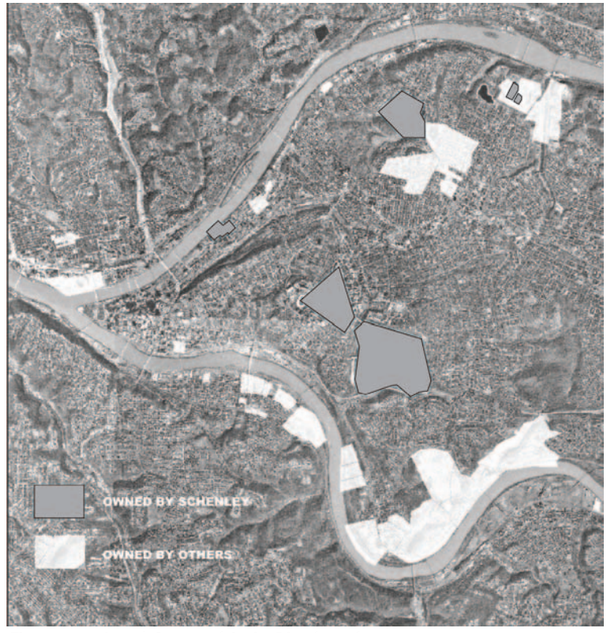


Figure 19: Land Ownership in Pittsburgh 1872

Map 1: Public Space 1872

Legend

Streams

RailRoad

Block

Elevation

0 - 845

846 - 990

991 - 1110

1111 - 1265

Public Wharf

SouthSide Waterfront "Beach" & Orientation of Streets

Map 1: Street Network / Public Space 1872

Street Network:

The map of the street pattern in 1872 highlights the interesting fact that Pittsburgh did not consistently and uniformly extend the street grid in all directions like most contemporary American cities.

Towards city limits, the nature of land division is almost pastoral or agricultural, with large plots having land divisions that follow natural contours and not the grid. This is different compared to a city like New York, which by this time had a uniform grid with uniform plot sizes irrespective of land ownership. The first reason is its terrain; the second, that Pittsburgh's particular form of growth involved the simultaneous growth of several separate urban communities rather than undergoing sequential development. Patterns of land ownership in 1872 Pittsburgh form the last and most important reason. The following section explores land ownership in 1872 Pittsburgh in greater detail.

Land Ownership:

Warrantee maps depict the original land grants that settlers of present-day Allegheny County received from the Commonwealth after William Penn and his descendants vested the land to the legislature as seen in figure 18. The city is surrounded by very large land holdings owned by speculators, farm owners, and the elite. This pattern of large holdings by individuals or families did not change in the intervening half century and was widespread when Pittsburgh annexed the boroughs of its suburbs and neighboring communities – South Pittsburgh, Monongahela, Allen Town, St Clair, Lawrenceville, Temperanceville, Birmingham, Sligo, and Ormsby in 1872.[36] This was a major reason for inflated land values in Pittsburgh because the supply of buildable land was intentionally kept low.[37]

Figure 18: Warrantee Map of Pittsburgh

Many of these large plots had only recently been subdivided into blocks and lots. As a result, in 1872, there was great variation in the sizes of land available. The typical block size in downtown was 78,761 sq ft divided into sixteen lots. A typical downtown building lot was 5,000 sq ft or 0.11 acres. Outside downtown there is a dramatic change in sizes of plots. This is illustrated by the holdings of Captain E.W.H Schenley who, in 1872, owned a large part of Pittsburgh. In the fourteenth ward of 1872 Pittsburgh, he owned a 140 acre property which stretched from Center avenue in the north, including present day Forbes and Fifth avenue, to Boundary street in the south and Desoto street in the east to Bellefield street in the west. Other holdings included the four hundred acre Schenley park and nine blocks in the Strip District between 25th and 29th streets. When Mrs.Schenley died in 1903 her Pittsburgh holdings amounted to more than $50,000,000. It took another half a century to sell such large holdings without undermining the market.[38]

Figure 19: Land Ownership in Pittsburgh 1872

Existing tax systems reinforced large land tract ownership. The system of taxation punished the smaller landowner and rewarded the large landowner.[39] A survival of the pre industrial era, the taxation system divided real estate into three classifications. City property paid the full-assessed rate, rural or suburban property paid two thirds, and agricultural property was taxed at one half the rate.

Public Space:

Access to the rivers was built into the way of life. Ordinances passed by the Pittsburgh and Allegheny City in 1878 declared the riverfronts in downtown Pittsburgh, Southside, and the North Shore fronting the Allegheny, and Monongahela, and Ohio rivers as public wharves.[40] The importance of these wharves can be seen in the extensive supporting ordnances passed to regulate the locations for different types of boats to dock and price of wharfage.

The Monongahela Wharf had been the "focal point of daily life[41]" since the beginning of the 19th century. As Kenneth Warren says, the big event of the day in Pittsburgh was the arrival of the steamboat.[42] The common use of the wharfs and lack of dam infrastructure resulted in a shore line that was entirely natural. The section of the shore was gently sloping and was commonly used to haul goods to the shore and board barges and passenger boats.

Railroad:

Pittsburgh was well connected by railroad networks at the regional scale. In 1872, the following railroad companies operated in Pittsburgh, the Pittsburgh Fort Wayne and Chicago Railroad, the Western Pennsylvania Railroad, the Allegheny Valley Railroad, the Morningside Railroad, the Pennsylvania Railroad, the Pittsburgh Connellsville Railroad, the Pittsburgh Cincinnati St Louis Railroad, and the Pittsburgh Virginia Charleston Railroad.

Railroads in the city were single track except for in their approach to the depot, maintenance facilities, yards, and Round Houses. They carried both freight and passengers.

Figure 20: Directions and Locations of Major Railroads 1872

Figure 21: Round House

At the scale of the city, important to note is that railroads do not blanket the riverbank, but are mostly aligned towards the interior. This is interesting since it runs contrary to the classical argument of the railroads occupying the riverbank or drainage patterns because they were the sole flat lands available.

One reason for this pattern is that railroads during this period were not in direct competition with riverine transportation. Supporting evidence is provided by Kenneth Warren. It was not until 1890 that Jones and Laughlin began a new policy when they acquired the Vesta Mines near the Monongahela and barged coal down

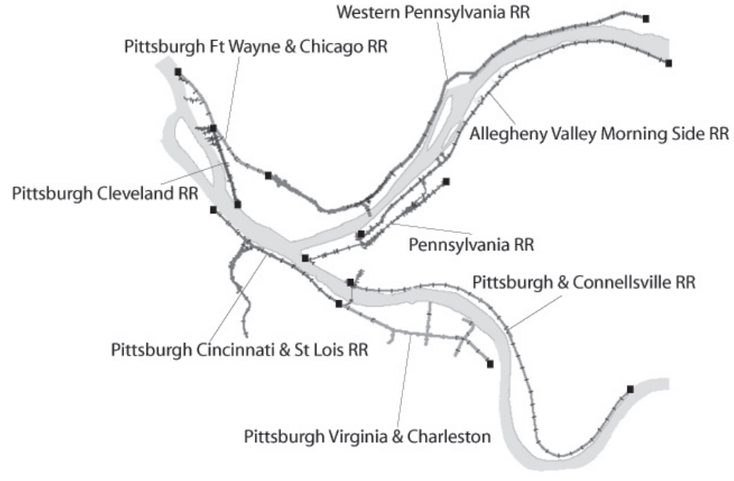


Figure 20: Directions and Locations of Major Railroads 1872

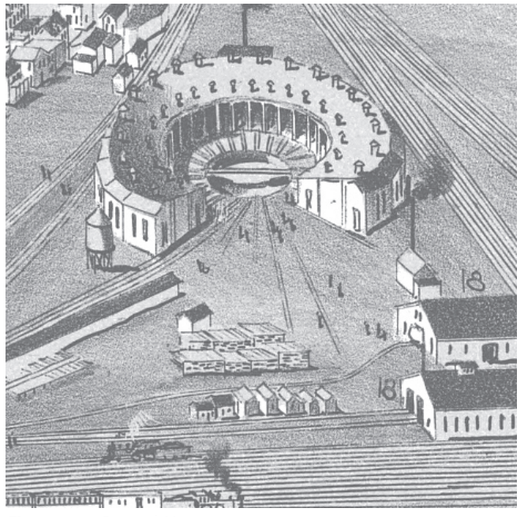
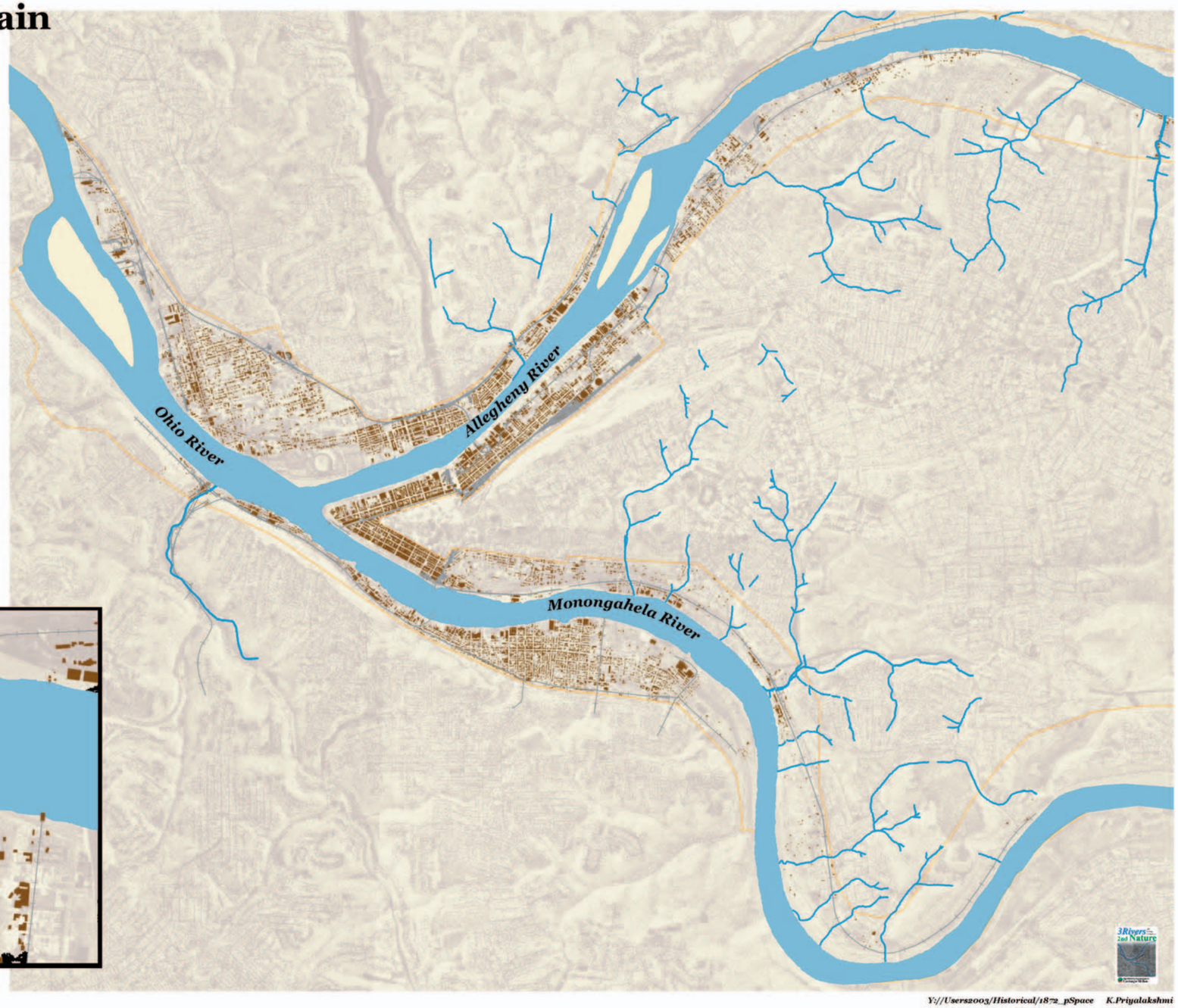


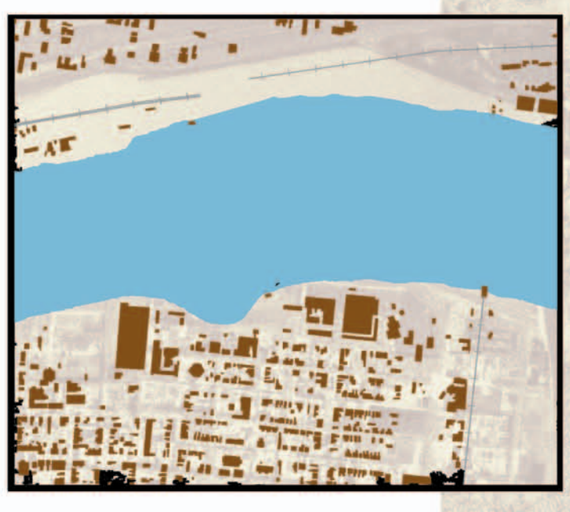
Figure 21: Round House

Map 2: Urban Grain

Legend

- *Streams*
- *RailRoad*
- Limits of study





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to ovens on the north side of the river in the Hazelwood district of Pittsburgh, only a little way above their blast furnaces. In the following year, they bought their first towboat to transfer coal down to the river. By this means, delivery costs were reduced below those paid by other Pittsburgh iron makers, including the Carnegie plants whose coke was made on the coal field and railed to the furnaces.[43] When railroads were built to parallel the river, they caused a fall in river traffic, but were forced by the existence of the alternative route to quote low rates to waterside plants.[44] Proximity to the river was, therefore, a definite advantage. All industry would gravitate to the waterside in the coming decades.

Map 2: Urban Grain 1872

The Army Corps of Engineers imposes upon navigable rivers certain regulations as to harbor lines (within which encroachments are prohibited or regulated), the clearance height of bridges etc, to control streams as public arteries of navigation.[45] These regulations were in force even as early as 1872. So, buildings on the riverfront were built set back with respect to the harbor line. Buildings and factories in the Strip, the Point, and the South Side followed this regulation. The river was not highly engineered or controlled and this would have been a standard building practice at that time.

The population of Pittsburgh in 1870 was around 86,000 people, and although the eastern boundary then was the same as today, the distribution of population was quite sparse as can be read from the map. Correlating the map of urban grain with figure 22 shows that the topography still dictated the areas of settlement by the people. While grain size decreases further from downtown, the differentiation in grain sizes is not very much, or in other words—the urban grain was fine.

Figure 22 : Pittsburgh 1872

The important space and main streets of 1872 Pittsburgh are the Monongahela Wharf and Liberty in the Point, Carson Street in South Side, Beaver, and Federal and Anderson Streets in the North Shore. In Allegheny City specially, most buildings on streets perpendicular to the river face it, suggesting they served traffic that went down to the shore.

Map 3: Land Use 1872

The land use map shows industry already clustering in favored locations along the banks of the rivers, except for a few locations in South Side and North Side. The predominant institutions are churches; schools and hospitals. the nature and location of educational and religious institutions are first explored in the following paragraphs. Details on the type and distribution of industries follow.

Educational Institutions & Religious Institutions:

Schools were located by ward. An example of this would be the fifth ward school of Allegheny city at Fulton and Page. Other types of schools were public schools and Roman Catholic schools – which were usually next to the church. The school most uniquely situated by today's standards was the first ward school at Short and Second Streets. Factories of boiler manufacturers surrounded the school on all four sides.

Land donations demonstrate the intimate relationship between community development and religious organization. Real estate developers offered gifts of land and money to congregations when they put other town lots up for sale, apparently believing that churches and schools would bring in more land buyers at higher prices.[46] This would explain the presence of the Hazelwood Presbyterian Church and St Stephens Catholic church in the then very sparsely populated Hazelwood neighborhood. There were twelve churches in Southside and eight on the North shore and as many as fourteen churches in the study area of downtown Pittsburgh.

Type and Location of Industries:

The types of industries are diverse. A few cloth mills like Beudley's Woolen Mill and Eagle Cotton mills clustered on Robinson Street in Allegheny city. Many saw mills and lumber mills flourished. But the city also had tanneries, salt works, paper mills, glass factories, lead and locomotive works. Largest in number were the iron and steel industries manufacturing and their associated processing industries, such as rolling mills, railway wagons, bolts, and machinery etc. These were clustered around the railway depots to facilitate easy delivery of raw materials and distribution of finished goods. In terms of area of buildings, industries top the scale at an average of 30,000 square feet or more.

The extent of industries on banks of the three rivers is limited to the Strip District along the Allegheny, South Oakland on the Mon, and the North Shore. This shows industry scattered away from the Point.

This study does not reveal the other commercial ventures and trade in Pittsburgh because this study is restricted to data available from the GM Hopkins Maps. Insurance companies and saloons outnumber iron and steel manufacturers by 8 pages to 1 in the 1875-1876 business directory of Pittsburgh and Allegheny City.

Map 3a: Coking Ovens, Gas Companies and Oil Refineries 1872

Coking is the process of removing volatile matter from bituminous coal to make it suitable for industrial purposes.[47] The process produced sulphurous emissions with devastating impacts on the surrounding environment. Coking ovens in the study area were located at the Jones and McLaughlin plant on the Monongahela and the CH Armstrong coking ovens near the Pennsylvania Railroad station in the Strip district. In 1869, a Pittsburgh ordinance forbade the construction of coke ovens within city limits and assessed a penalty of $100 per day for operating an oven.[48] The ordnance was probably not enforced because in 1872 there are two companies in the study area with probably 300 ovens each, 300 being the optimum scale for efficient operation.

The Pittsburgh and Allegheny Business Directory for 1875-1876 shows eight sellers and manufacturers of Coke and seven providers of gas, including Pittsburgh Gas Works on Try and Second Avenue.[49]

Most of the oil industry is concentrated on the Allegheny and near the point because in the 1860's and 1870's small oil refineries relied on crude oil floated down the Allegheny River from the northwestern Pennsylvania oil fields in and around Harrisburg[50]. Some examples of such refineries are the Hutchinson Oil Works on the Ohio, Union Refining and Storage on Herr's Island, Eagle Refiners in Lawrenceville and many small time operators on the Allegheny in Morningside.

1900: The Industrial City

At the turn of the century Industry in Pittsburgh was at the peak of its growth as an industrial city. According to the Chamber of Commerce, in 1903 Pittsburgh District had a greater production of the following manufactures than any other in the world-steel and iron, plate glass, tumblers, tin plate, pickles, petroleum, steel cars, air brakes and electrical machinery, window glass and tableware, steel and wrought iron pipe, coal and coke, corks, white lead, lumber, fire brick and clay. Simultaneously the rapid encroachment of private industries on public space had a dramatic impact on the nature of access to public space. The following sections explore these themes in greater detail.

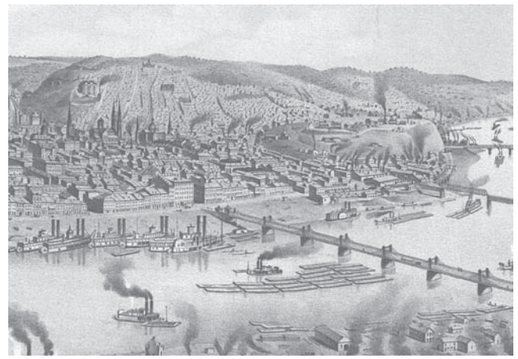
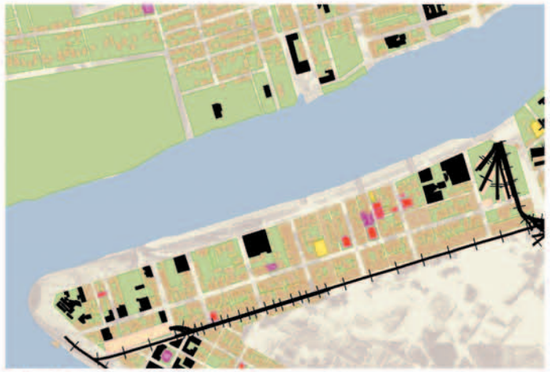


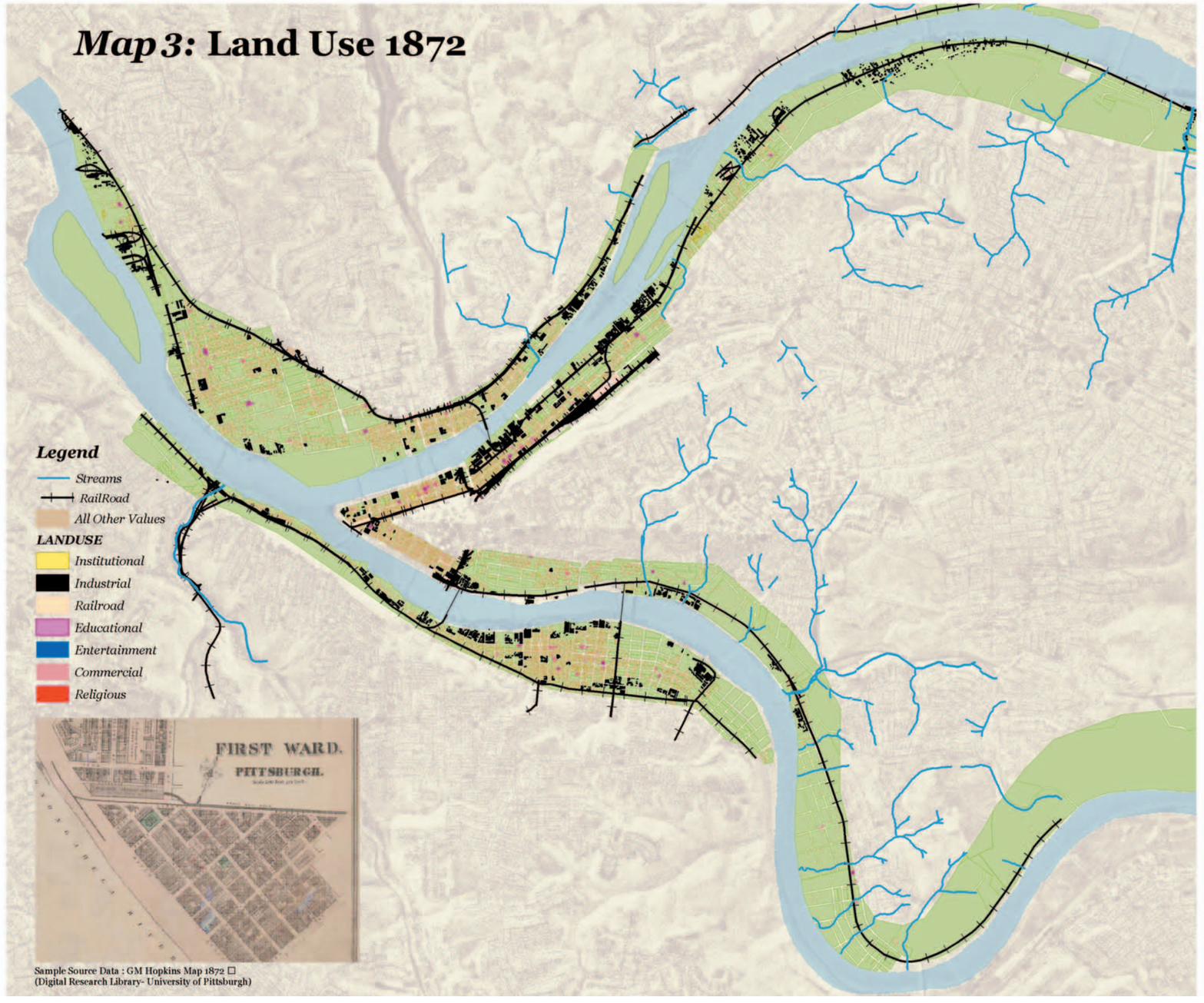
Figure 22 : Pittsburgh 1872



The Point

South Side

The Strip



Sample Source Data : GM Hopkins Map 1872 ☐
(Digital Research Library- University of Pittsburgh)

Map 4: Street Networks / Public Space 1900
By 1900, the street pattern changes subtly but definitely. In Upper Lawrenceville, and the shore of Old Allegheny City opposite Brunot Island, the large plots with scattered buildings of 1872 are now subdivided with streets demarcated , increasing the amount of access available to the river. A similar phenomenon happens at the Allegheny Soldiers memorial in Allegheny City (figure 16), which is now subdivided into city blocks. At the same time, the process of consolidation of plots, especially in areas of industrial land use, also happens. For example, in the Strip District, the very identity of streets leading up to the river is blurred, as they are crisscrossed and encroached upon in countless ways by industry and railroad.

Figure 23: Subdivision of land

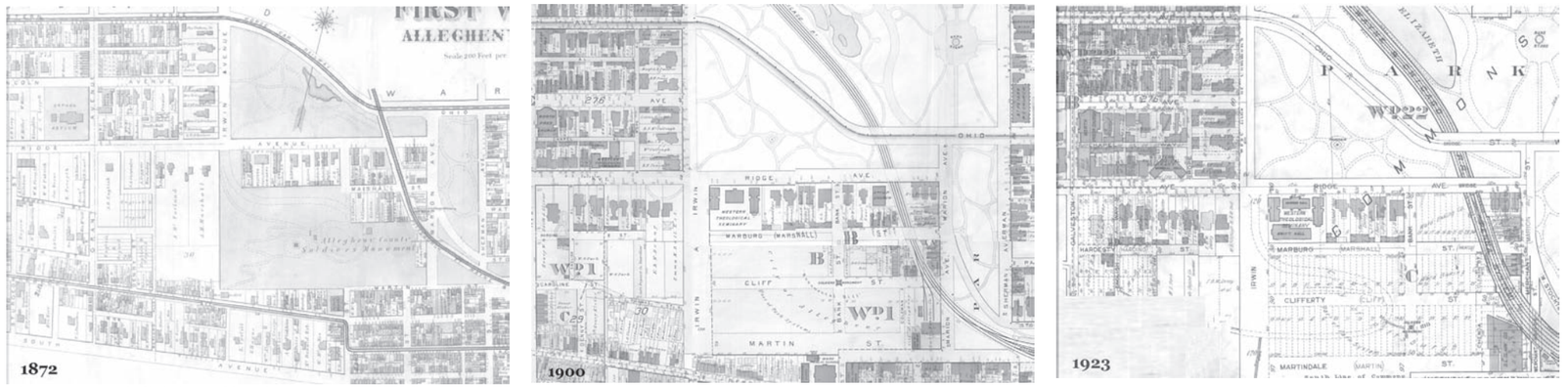


Figure 23: Subdivision of land

The way land is subdivided changes in newer municipalities just outside the city limits, like McKee's Rocks and Braddock. In McKee's Rocks, the large expansive plots of land held by the McKee family along the riverbank are untouched and undeveloped. Just behind these plots, a whole new town is springing up around the roundhouse and maintenance yard of the Lake Eerie Railroad. The orientation of the streets remains towards the river.

Figure 24: Subdivision of land in McKee's Rocks

Railroad:
The connectivity of Pittsburgh at the regional level greatly improves with an increased number of railroads. The total number of railroad companies in the study area rises to eleven.

At the scale of the city, railroads now occupy immediate river banks cutting off access of the streets to the river. According to the Chamber of Commerce, the tonnage carried by rail for 1901 was 64,125,000 tons, but this was far short of the demand for rail transport. Due to the shortage of cars, many orders for coal and coke were unfulfilled in the year 1902. The railroads were thus under tremendous pressure to expand.[51] One result of this pressure was expansion by filling the shoreline. For example, McCullough's island in the Allegheny just across from Herr's Island had a back channel. By 1900 this channel is filled up to provide the railroads room to expand. The tracks which formerly ran a block away from the river beach now snake along the river edge.

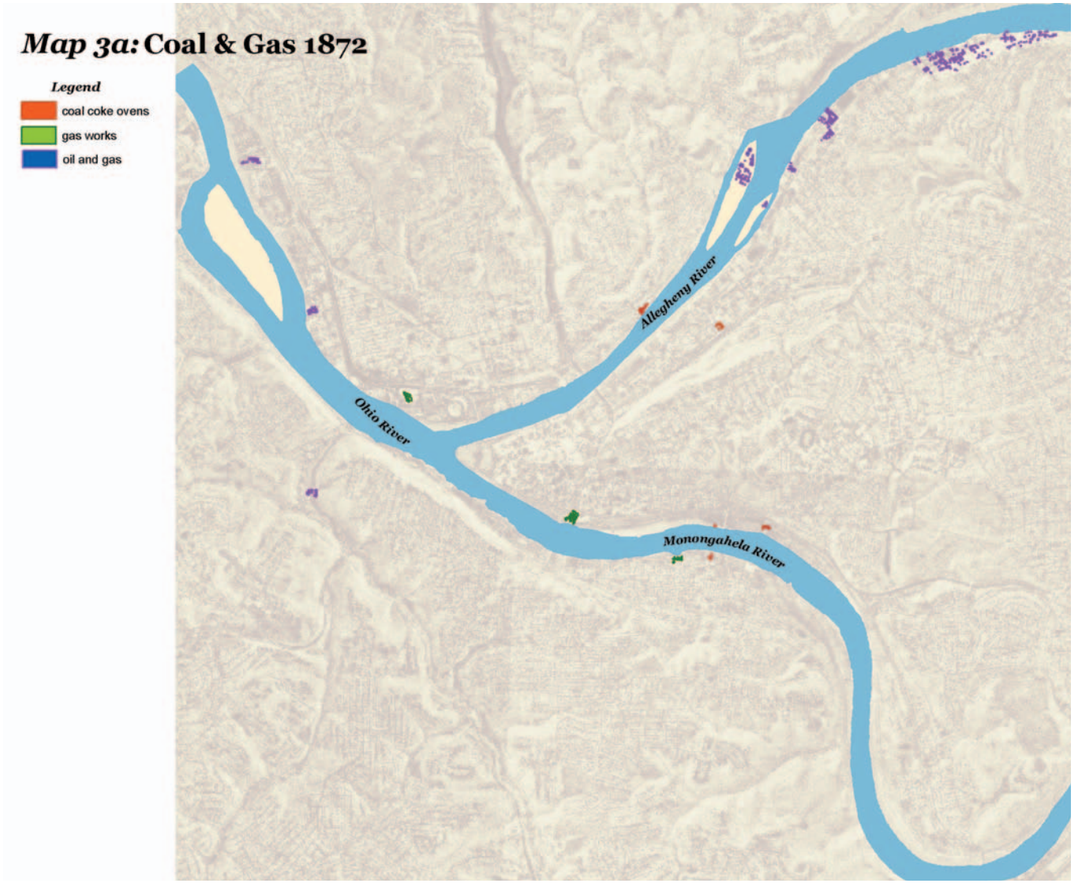
Figure 25a: McCullough's Island 1872

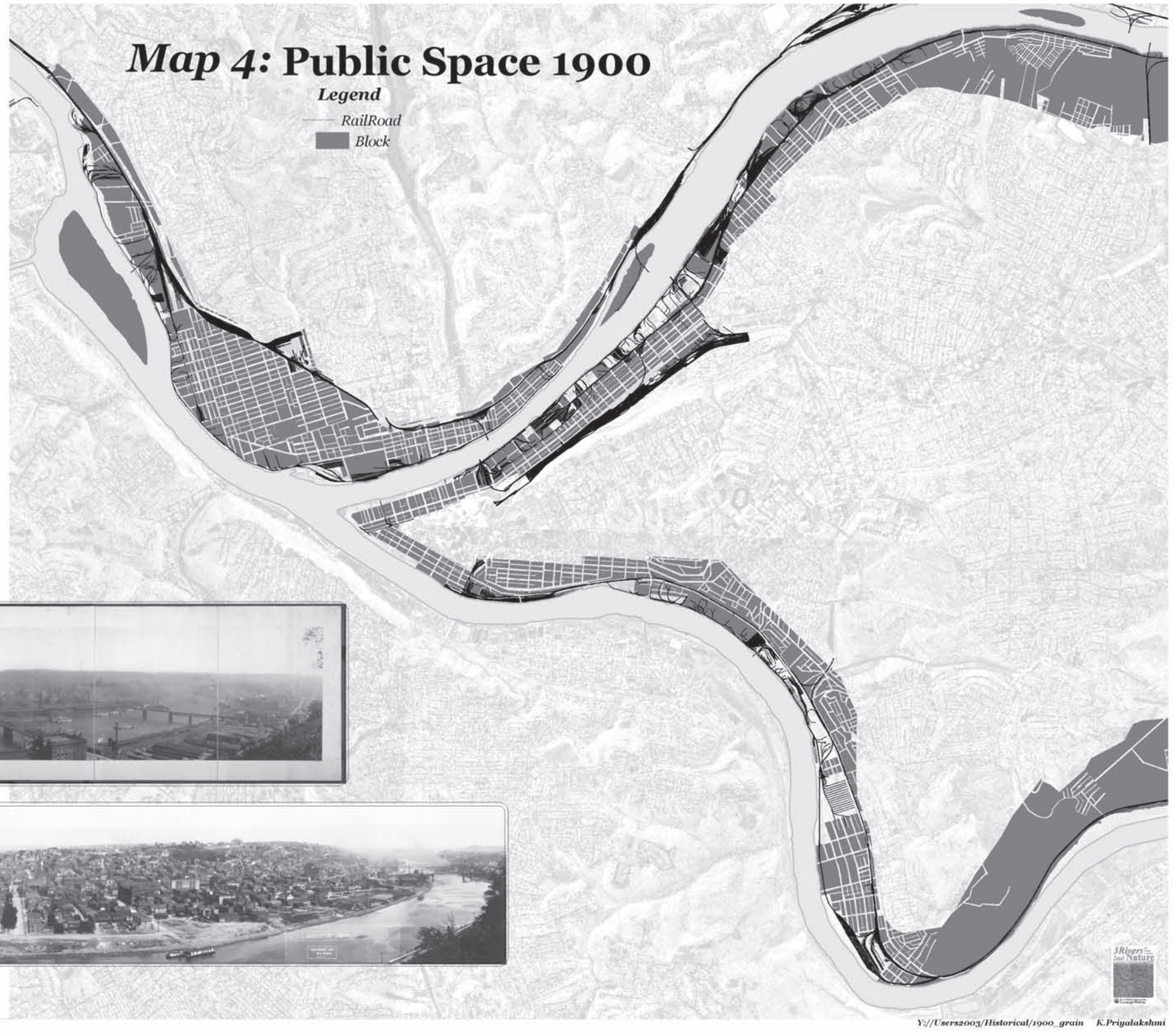
Figure 25b: McCullough's Island 1900

Railroads are integrated entirely into the factory modes of production, not only do they reach towards cities afar, the tracks weave between two parallel tracks – one located on the river bank and one located just after the industrial building to almost form a web in which the industries are contained. In 1872, the Pennsylvania railroad junction in the strip was the one major junction. By 1900, major junctions come up in Allegheny town, Hays, McKee's Rocks each with turnarounds and other facilities to service trains.

Figure 26a: Webbed Rail Road Line

Figure 26b: Railroads 1900





Pittsburgh

McKeesport

Map 5: Landings 1900

Industries used railroad and river barges for transport of raw material and finished goods. Harbor tonnage in 1903 was 10,000,000 tons according to the Chamber of Commerce.[52] The landings on the Monongahela Wharf were split between packet lines such as the Pittsburgh Cincinnati Packet Line, the Monongahela Ohio Packet Line, the MRCC & Co landing etc. Besides commercial landings owned by coal and gravel companies, private boat clubs such as the Columbia boat club on the North Side had their own landings.

Figure 27: Independent Packet Line Landing

By 1882, the dumping of blooms, metal, and railroad iron discharged on the Monongahela Wharf were regulated for the time and manner in which they had to be arranged during storage on the Wharf.[53] The Monongahela Wharf was also used for mooring of house boats, club boats and other water craft. Boats were permitted to land without charge for not longer than 24 hours.[54]

The Hulett Ore Unloader was patented in 1898 and by 1900 it was being used in the Cleveland Ohio loading docks to replace manual labor in loading and unloading ore. While it is not documented whether such automation was being followed in Pittsburgh at that time, such automation would revolutionize the riverfront of Pittsburgh in the years to come.

Map 6: Urban Grain 1900

A definite segregation in grain sizes is observed. The grain becomes coarse. This is a result of functional segregation as well as increase in the scale of the industry. Industries located in the older sections of the city tend to be much smaller in size, limited by the space available in cramped quarters. In terms of area, industries evolve into gigantic organisms with single buildings of areas up to 150,000 square feet. This is about five times their size in 1872.

The streets of the newer suburbs, such as Braddock, are oriented towards the river, but the highest density of settlement is on Braddock Avenue and the backs of the buildings face the riverfront. Although the plots of this suburban settlement on the riverside are barely occupied, industry has already staked its claim on this prime land. In comparison, the built form of the older wards at the Monongahela Wharf all face the river revealing the primacy of the river.

Map 7: Land Use 1900

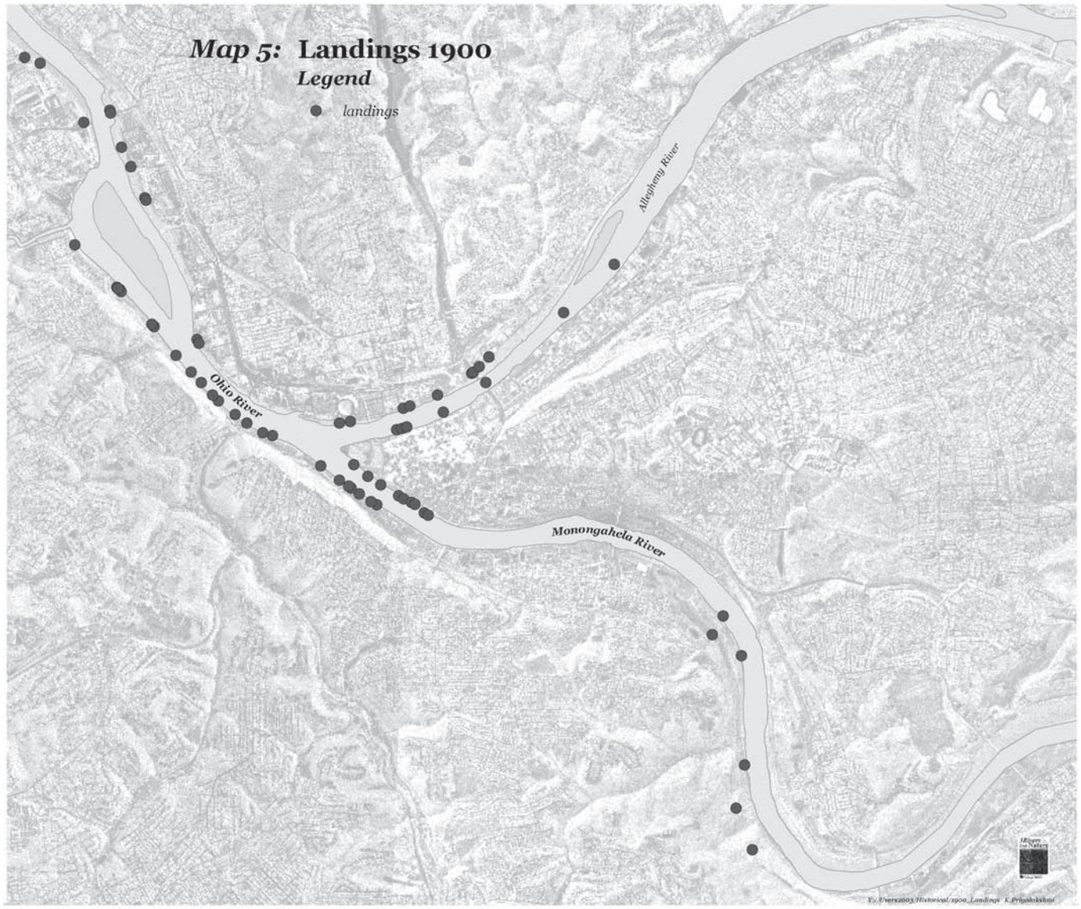
By 1900 there are significant shifts in land use. The main trends are the flight of churches to the suburbs and the rise of newer commercial enterprises in its stead. Industry gravitates exclusively towards the River Bank. This can be corroborated by maps from other sources of the distribution of the iron and steel industry in 1900 Pittsburgh.

Figure 28: Steel and Iron industry locations Pittsburgh 1900

Educational and Religious Institutions:

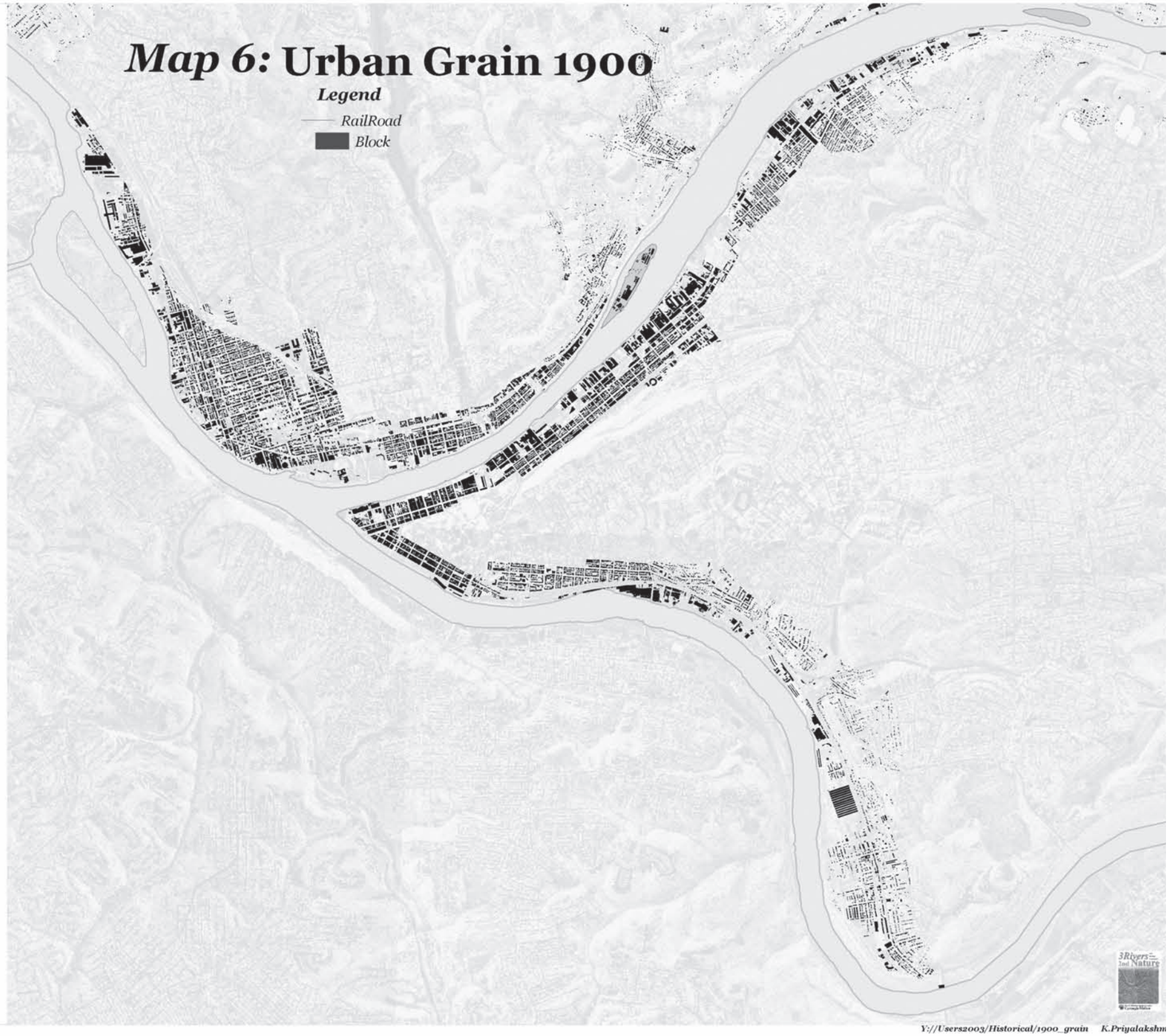
The nature of institutions is still mainly churches and schools, however, this year also shows a rise in boarding houses and institutes for the poor, children, and old people, insane asylums, police and fire stations. Some institutions, like the Home for aged Protestant Women, were located in downtown; other larger and less desirable institutions, such as the Western Penitentiary and Asylum were located outside city limits.

The Central Business district, the location of most of Pittsburgh's churches, lost population rapidly after 1860. Further more, the overall ratio of congregations to population in Allegheny County had declined slightly by 1870.[55] The fifteen Churches in the downtown Pittsburgh of 1872 are reduced to four churches by 1900. Although the congregation to population ratio was thriving by 1900, the newer churches followed the flight of their congregations to the newly developed lands within the city and suburban areas opened up by new means of transportation. In the Strip district though there were as many as seven churches of various denominations, St.




Strip District


Braddock


Map 6: Urban Grain 1900
Legend
RailRoad
Block
Y://Users2003/Historical/1900_grain K.Priyalakshm

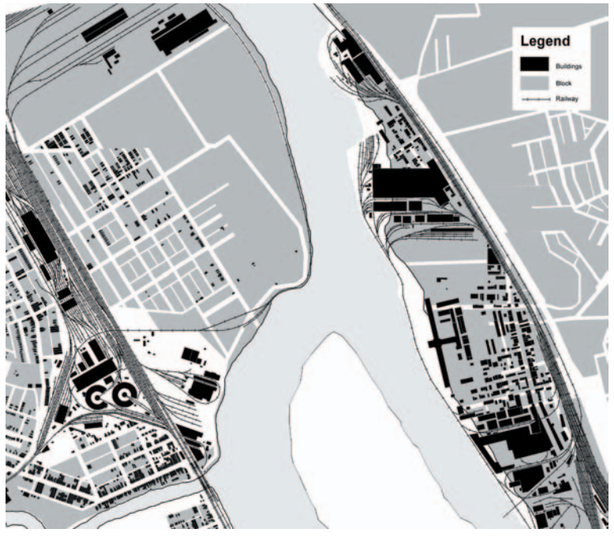


Figure 24: Subdivision of land in McKee's Rocks

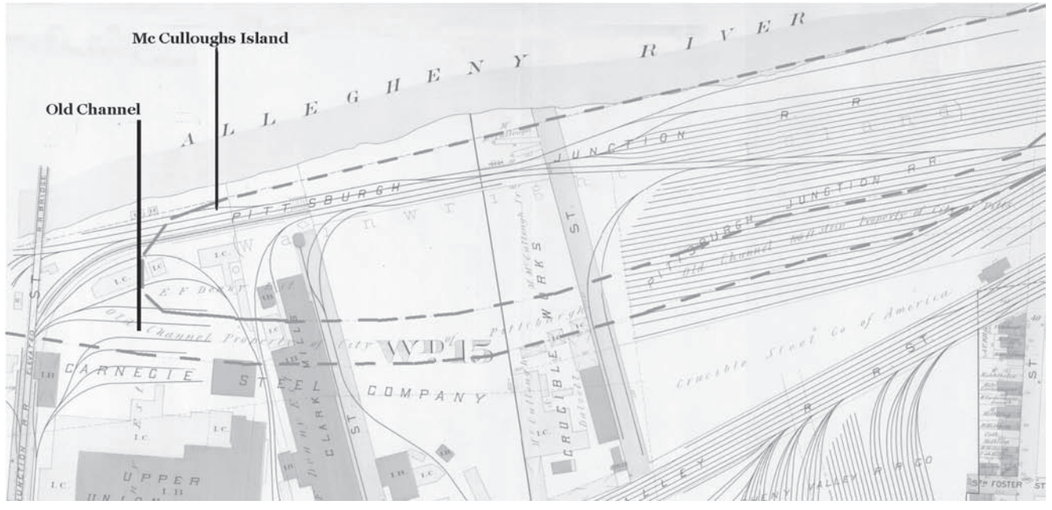


Figure 25b: McCullough's Island 1900

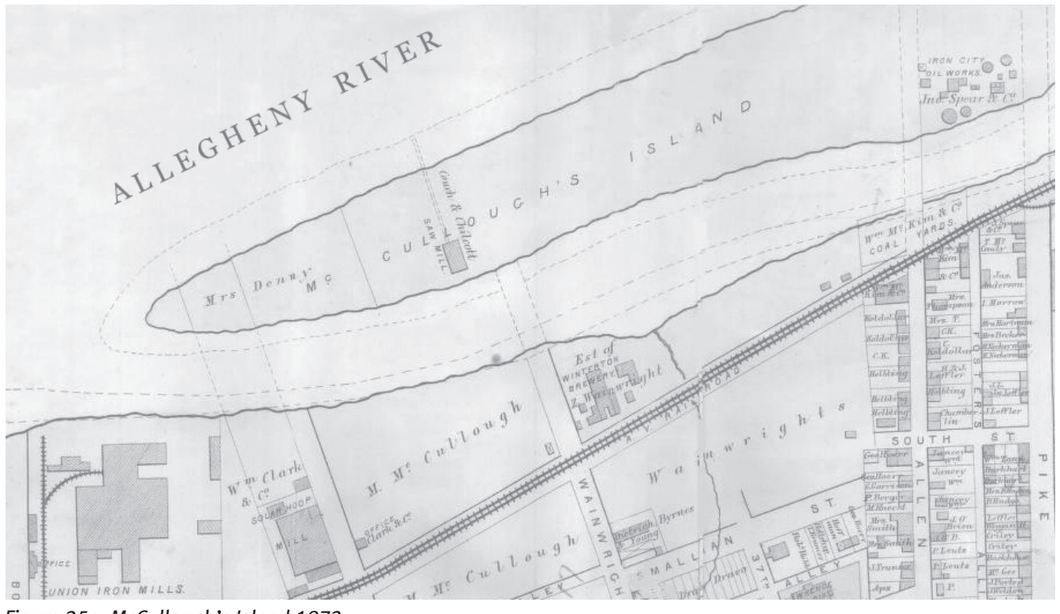


Figure 25a: McCullough's Island 1872

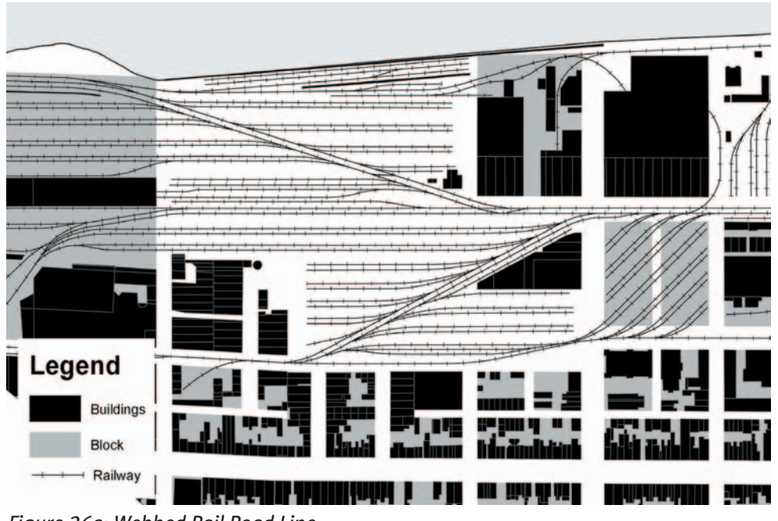
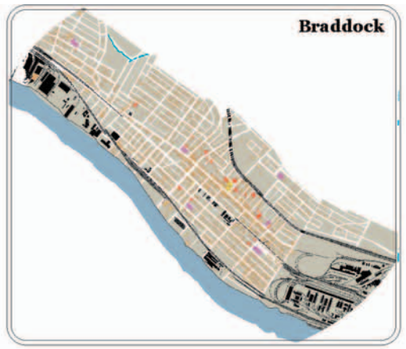
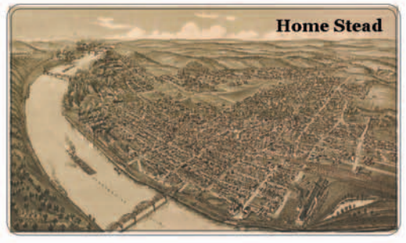


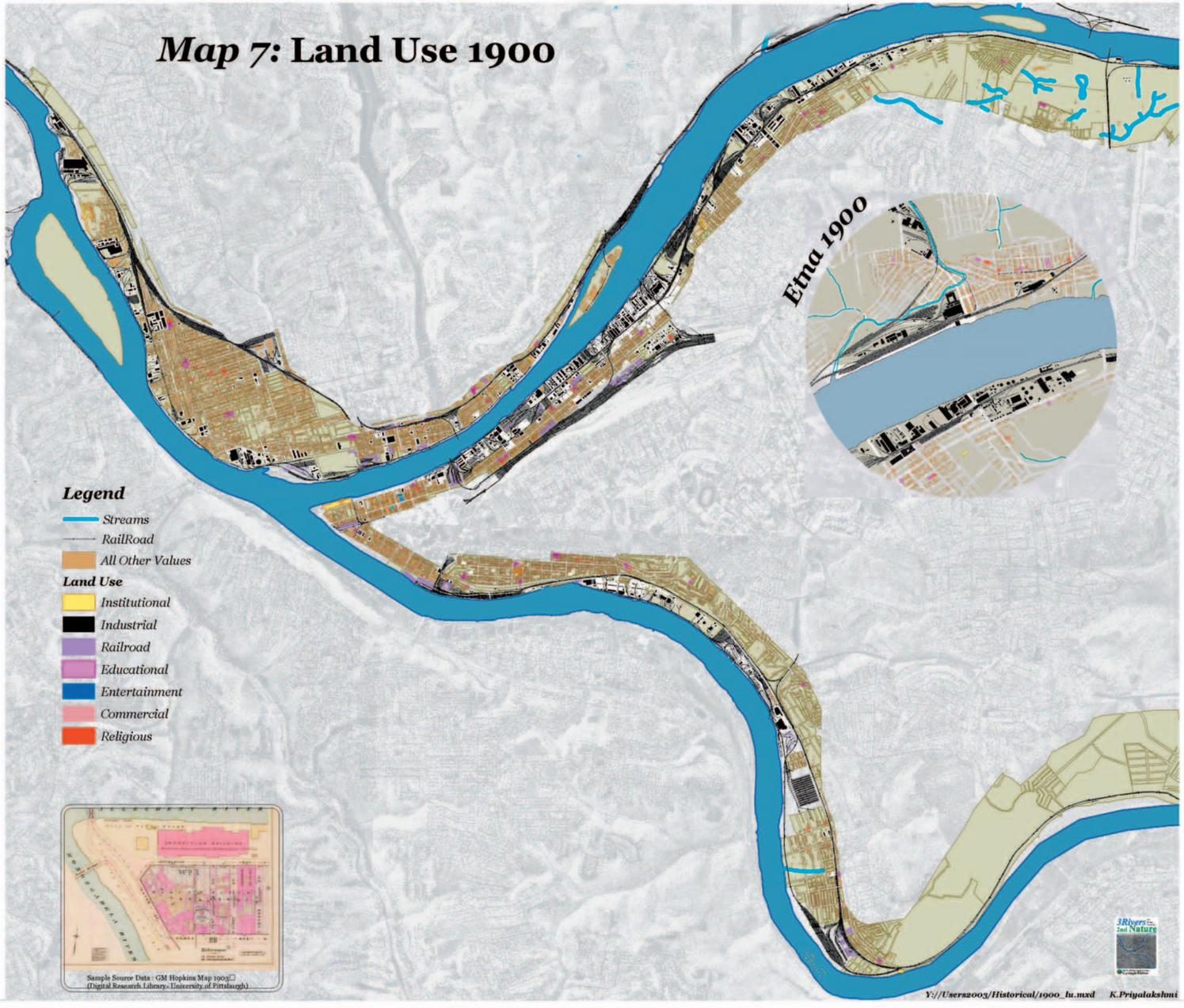
Figure 26a: Webbed Rail Road Line


Braddock


Turtle Creek


Home Stead


Mc Kees Rocks


Map 7: Land Use 1900
Etna 1900
Legend
Streams
RailRoad
All Other Values
Land Use
Institutional
Industrial
Railroad
Educational
Entertainment
Commercial
Religious
Sample Source Data : GM Hopkins Map 1903
(Digital Research Library- University of Pittsburgh)
3Rivers 2nd Nature
Y://Users2003/Historical/1900_lu.mxd K.Priyalakshmi

Philomena the German Catholic church, St. Stanislaus the Polish Catholic Church, and St. Andrews the Presbyterian church, among others. The churches in downtown were replaced by newer commercial enterprises reflecting the changing needs of the city. For example, five hotels (the Anderson, Victoria and Red Lion among others) two theatres (the Duquesne and Bijou) and a bunch of newer institutions - two Christian homes for working girls, a YMCA, and a synagogue replace the seven churches and the lone female college between seventh and ninth streets of downtown 1872.

Industry Locations:

By 1900, Industrialists frustrated by the limited municipal limits of Pittsburgh,[56] coined a new term Pittsburgh District to include the towns of Braddock, Munhall, Homestead, McKee's Rocks, etc. – encompassing the Monongahela, Ohio and Allegheny Valleys where new industry was now rapidly spreading and taking hold. Pittsburgh District was later defined as the area within a radius of thirty miles from Pittsburgh city and county building.[57]

They established new larger works at these suburban towns; the Carrie Furnaces in Swissvale, the Thompson works at Braddock, Duquesne works at Munhall, and National Tube works McKeesport, among many others. This is also seen in the move of industry away and out of downtown Pittsburgh with only a few foundries, warehouses, and light manufacturing left in downtown. This is also reflected in the construction of newer railroad hubs just outside the city in McKee's Rocks and Braddock. Integration and expansion were hallmarks of industry during the period from 1890 to 1900. Scattered, rather small-scale oil refineries in Lawrenceville and Stanton heights of 1872 Pittsburgh, are replaced by large scale Iron and Steel plants. The new Lucy Furnace, the Crucible steel Co, Carnegie Kloman Co at 29th and Liberty expanded and became the Carnegie Steel Co. The second Carnegie steel Co at 36th Street was a much enlarged Union and Clark mills. Similarly, on the Monongahela, the scattered industries on the Oakland riverfront give way to large consolidated industries, mainly National Tube Co, consisting of three large mills, Soho Iron Works, the Eliza furnaces, and Jones and McLaughlin Steel Co. This suggests that Industry consolidates and adds to its existing properties to create large integrated plants at suburban locations.

Map 8: Bank Composition 1900

The other impact of locating industries on the riverbank is the increased dumping of slag on the riverbank, a practice on which this study does not have earlier data, but the physical extent of which can be located in this map for 1900. Besides slag, other industrial wastes, such as cinder ashes are also dumped on the bank. This points to the changed role of the river as the sewer for industries. These are the earliest signs of the growing change in the section of the shoreline.

Map 9: Materials Used in Buildings 1900

The first sky scraper was built in downtown Pittsburgh by the Carnegie steel company. This sky scraper, built with a frame of steel, was left exposed for a year to demonstrate the resistance of steel to corrosion. Downtown is almost exclusively constructed out of brick, as a result of city ordinances restricting the use of any other material, due to fear of fire. The older densely built wards of downtown, the Bluff and Strip district show a tendency to use brick. Wood is more in use in newer more industrial areas.

1925 Pittsburgh

In the first quarter of the twentieth century, Pittsburgh awakens to new forces that now shape it. Foremost is the rising use of planning as a socio political tool to control and regulate the previously unbridled growth of urban Pittsburgh. There were an increasing number of private and voluntary planning commissions, who studied different facets of the city and suggested planning solutions after 1905. One of these was the Citizens Committee on City Plan, "an entirely unofficial band of citizens",[58] who made a careful study of the

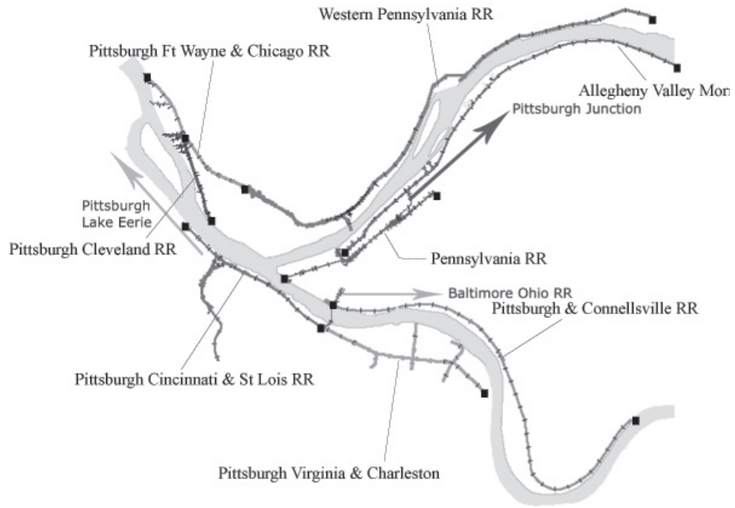


Figure 26b: Railroads 1900

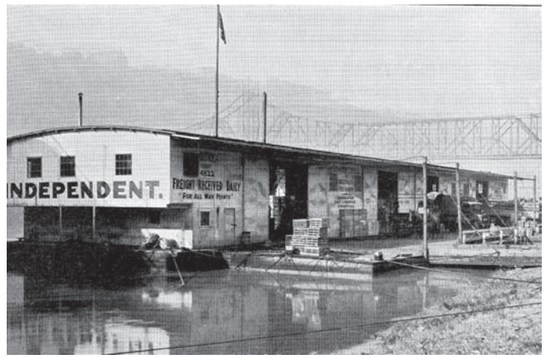


Figure 27: Independent Packet Line Landing

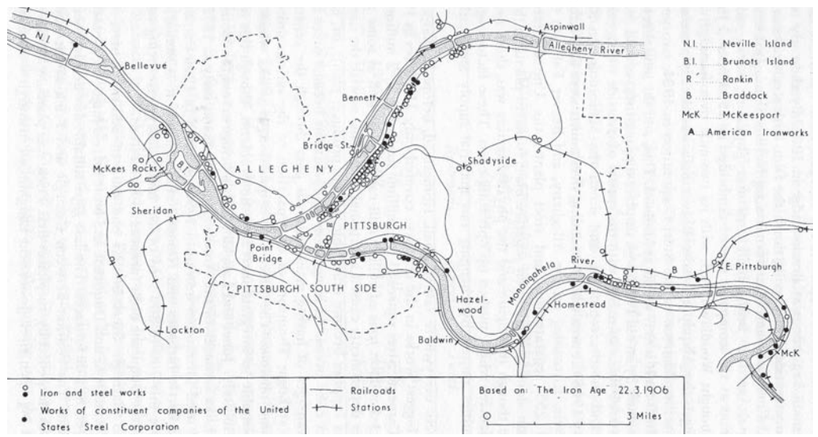
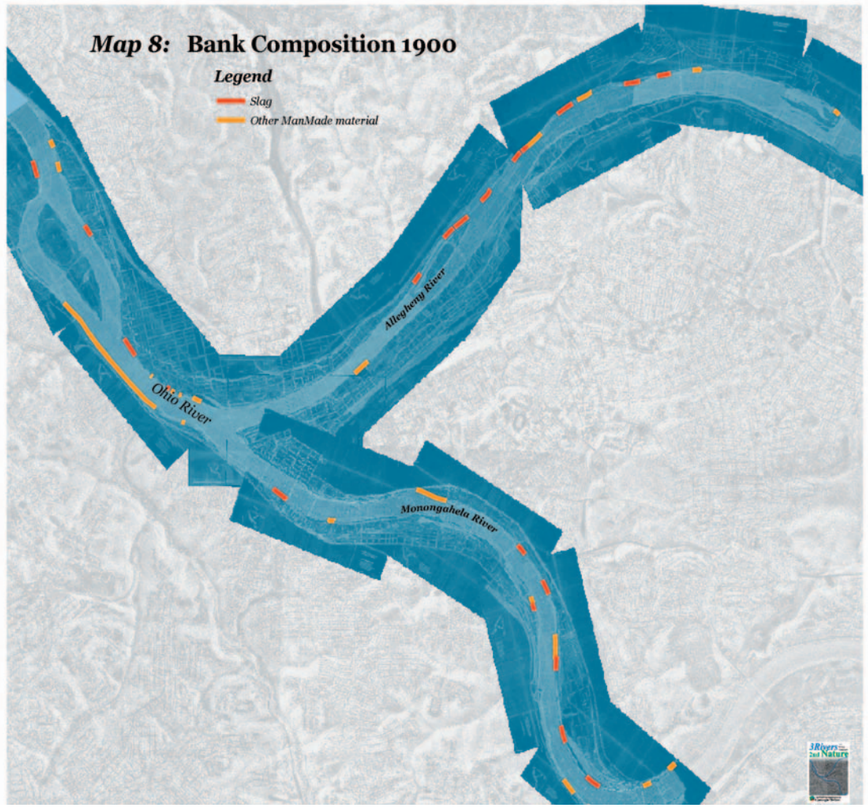


Figure 28:Steel and Iron industry locations Pittsburgh 1900



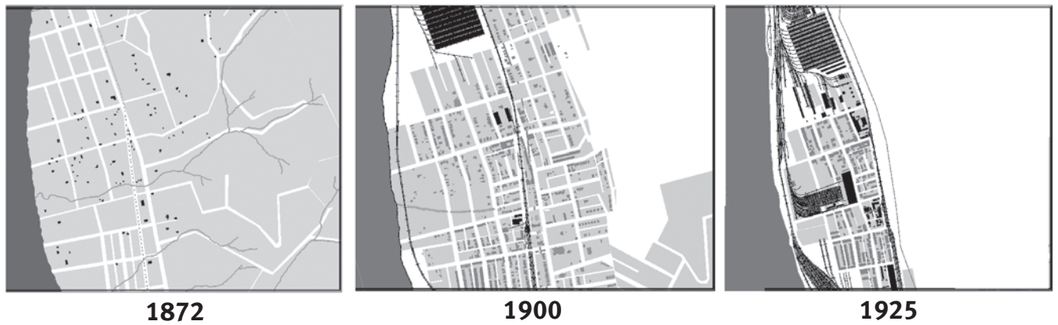


Figure 29:Land Subdivision in Hazelwood

conditions of Pittsburgh and made recommendations on the basis of their studies. The interaction between the process of planning and industrial might would in many ways exacerbate current conditions of urban form and space and skew the future of public space permanently towards industry.

Map 10: Street Networks / Public Space 1925:
Street Pattern & Railroad:
The street pattern reaches the peak of its industrial expression with the river side, or "Water Street", disappearing from most neighborhoods. For example, Duquesne Way in the Point, Water street in South Side, Smoky Island on the North Shore, and the river side road in the former city of Allegheny along the Ohio are all now covered by railway lines, in some cases by as many as nine to ten railway tracks running parallel to each other.

Despite the expansion of industry, many plots of land are still undeveloped. In Hazelwood and Glenwood, large subdivided plots await construction. Indeed, the areas after Hazelwood, are a mixture of large steeper plots, and smaller areas subdivided according to plans approved by the owners. Nine Mile Run consisted of large plots owned by the Hays Family and Duquesne Slag Company surrounded by emerging community Swissvale and an expanding Squirrel Hill.

Figure 29:Land Subdivision in Hazelwood

As late as 1900, Hazelwood was a small community with Baptist churches dating back to 1872. Large estates like the Wilson, Thompson and Holliett estates fronted the banks of the river with a small stream flowing through their property, and smaller houses were built farther away from the bank. The community was nestled between the large Jones and Laughlin Plant and the Baltimore Ohio Railroad yards further upstream. By 1925, this bucolic picture is no more, the stream, churches and houses have disappeared and been replaced by industries and a large railroad yard.
By 1923, major consolidations among railroad companies were over. There were a total of six trunk line railroads and sixteen industrial and connection railroads.[59] The total tonnage of freight carried in and out by the railroads in 1920 was 11,100,000 tons.[60]

Public Space:
By 1925, the handling of river freight in Pittsburgh had matured. River freight handled in Pittsburgh harbor were primarily of two types: bulk freight (coal, sand and gravel) and other commodities suitable for handling with a grab bucket. Package freight arriving and leaving by the standard Ohio river packets boats were accommodated by the public improved wharf slopes along the north side of the Monongahela river, from Grant street to the Point. These two kinds of freight required different types of wharf.[61] River packet terminals , also called Landings, usually consisted of a paved wharf where boats could land.

Figure 30: River Packet Terminal

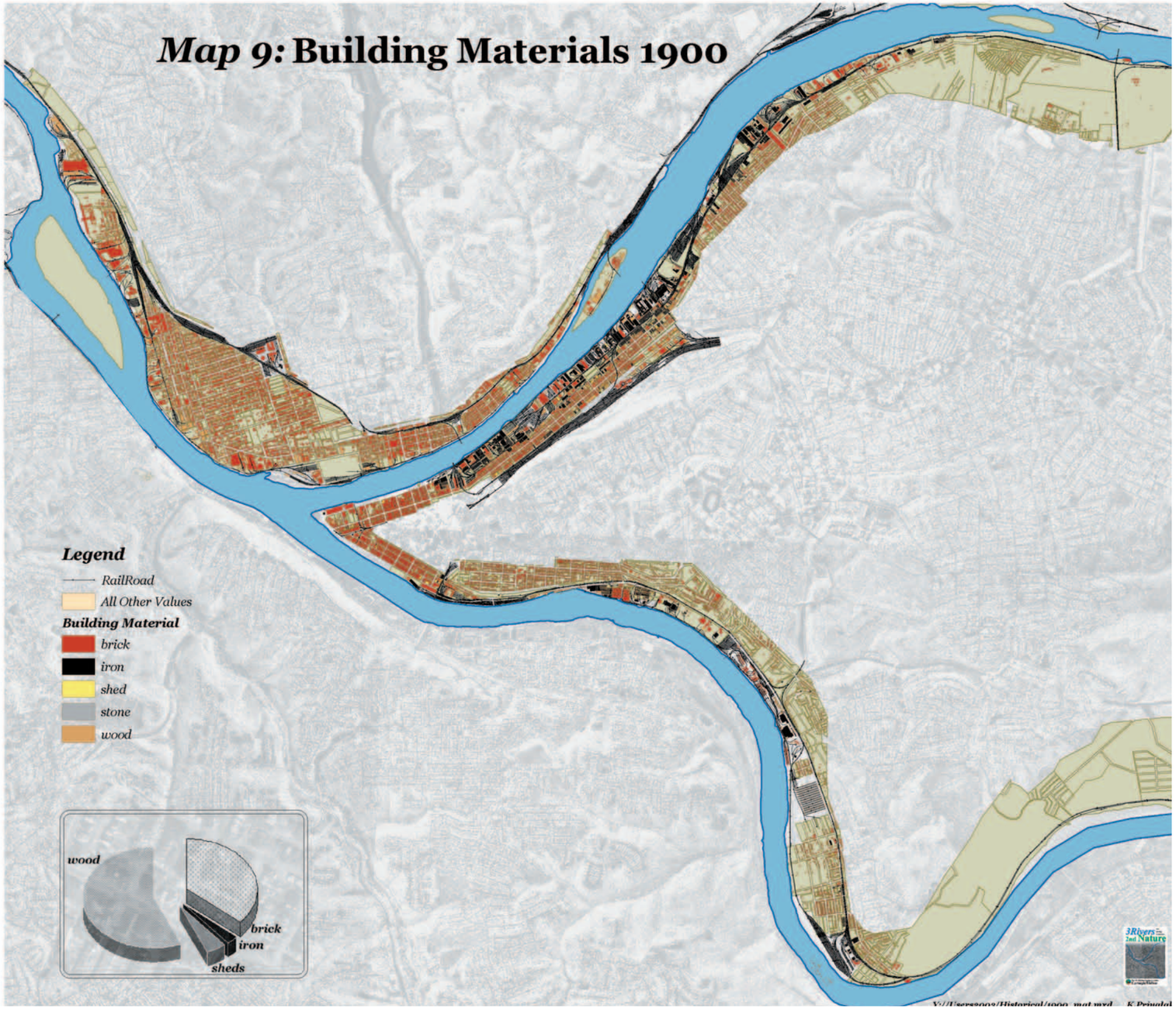
Barge terminals, usually privately owned, were well equipped for transferring bulk material. They were simple arrangements consisting of a pier at the waters edge surmounted by a derrick, or a vertical quay wall along which are located coal and ore tipples, bucket elevators or other devices for manipulating uniform bulk material.

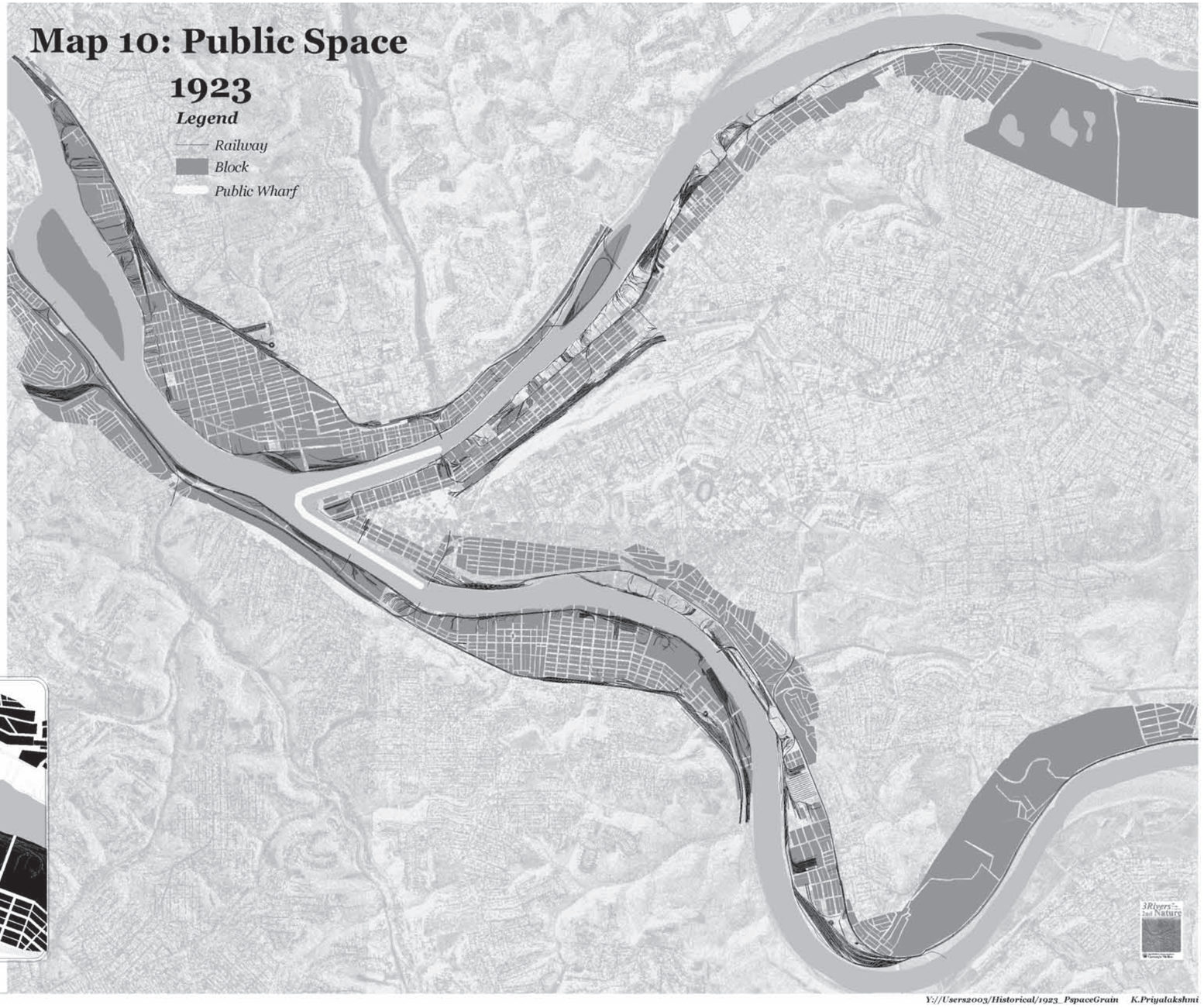
Figure 31:Proposed Barge Terminal at the Duquesne Freight Depot

In 1925, the wharves on the Allegheny and the Monongahela were functioning as packet line wharves. Barge to rail transfer was automated by employing a gantry the East Liberty Freight Depot. The Citizens Committee report on waterways made extensive recommendations making all railway depots in the city of Pittsburgh similarly efficient. The Citizens Committee surveyed and documented existing conditions through plans and sections. The existing bank profile seen in these diagrams is notable for the retention of its natural slope and utility. In their 1925 report, the Citizens Committee of Waterways recommended that


Allegheny City


The Point


Map 9: Building Materials 1900
Legend
RailRoad
All Other Values
Building Material
brick
iron
shed
stone
wood
wood
brick
iron
sheds
3Rivers 2nd Nature



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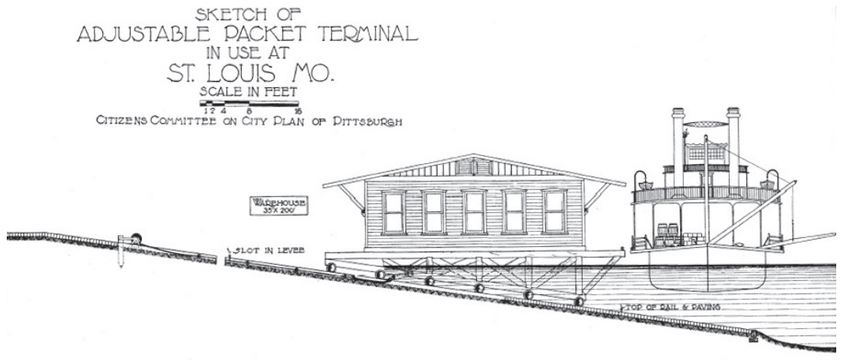


Figure 30: River Packet Terminal

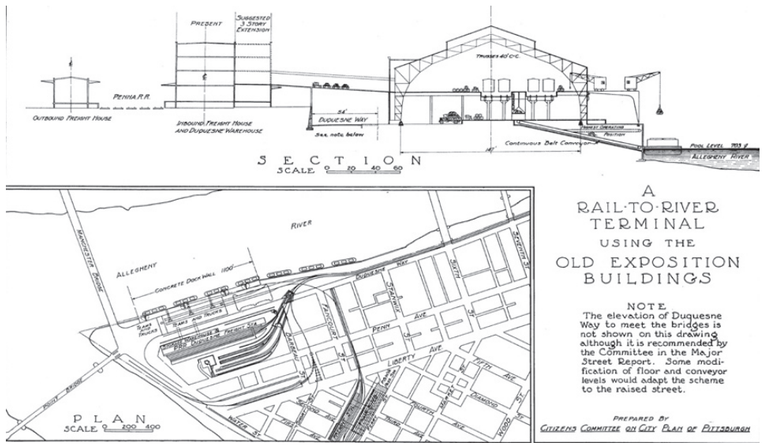


Figure 31:Proposed Barge Terminal at the Duquesne Freight Depot

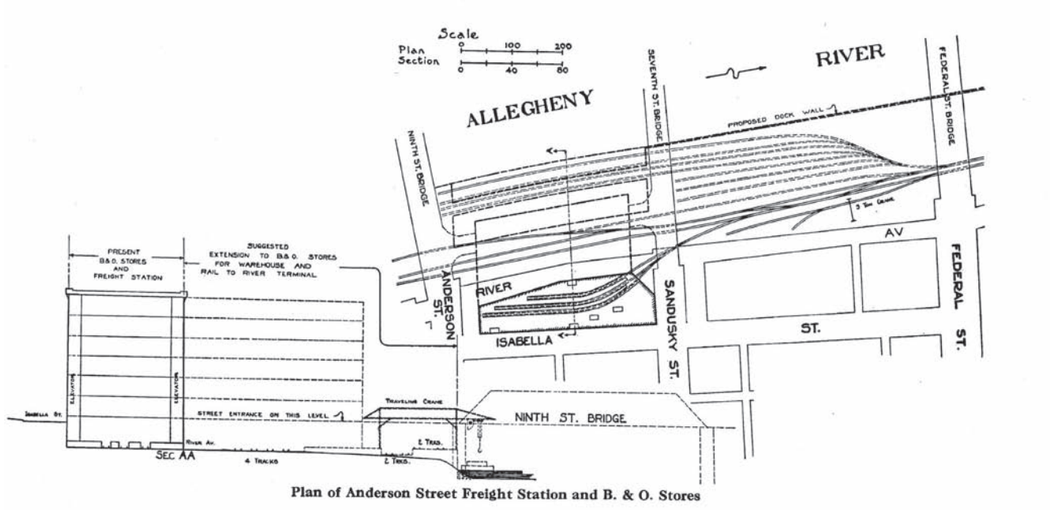


Figure 32: Existing Barge Terminal at Anderson Street Freight Depot

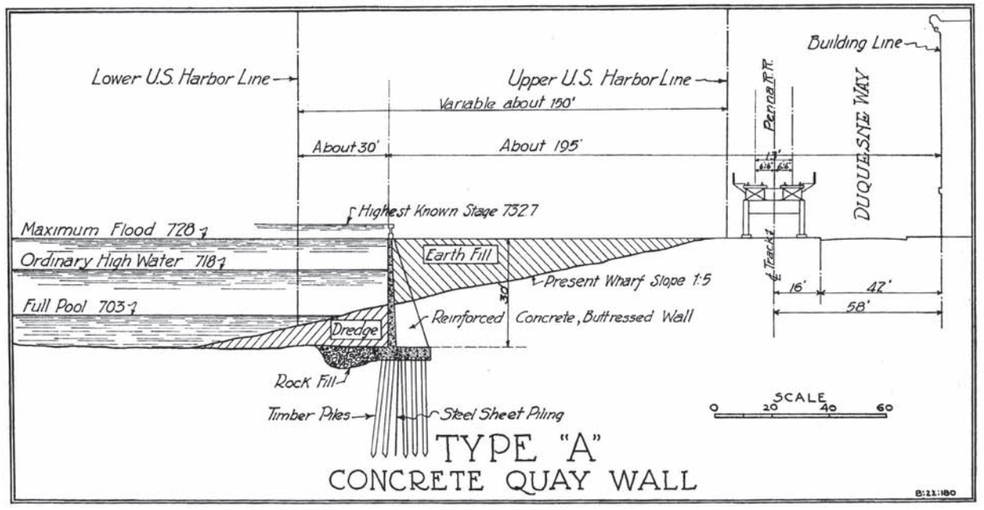
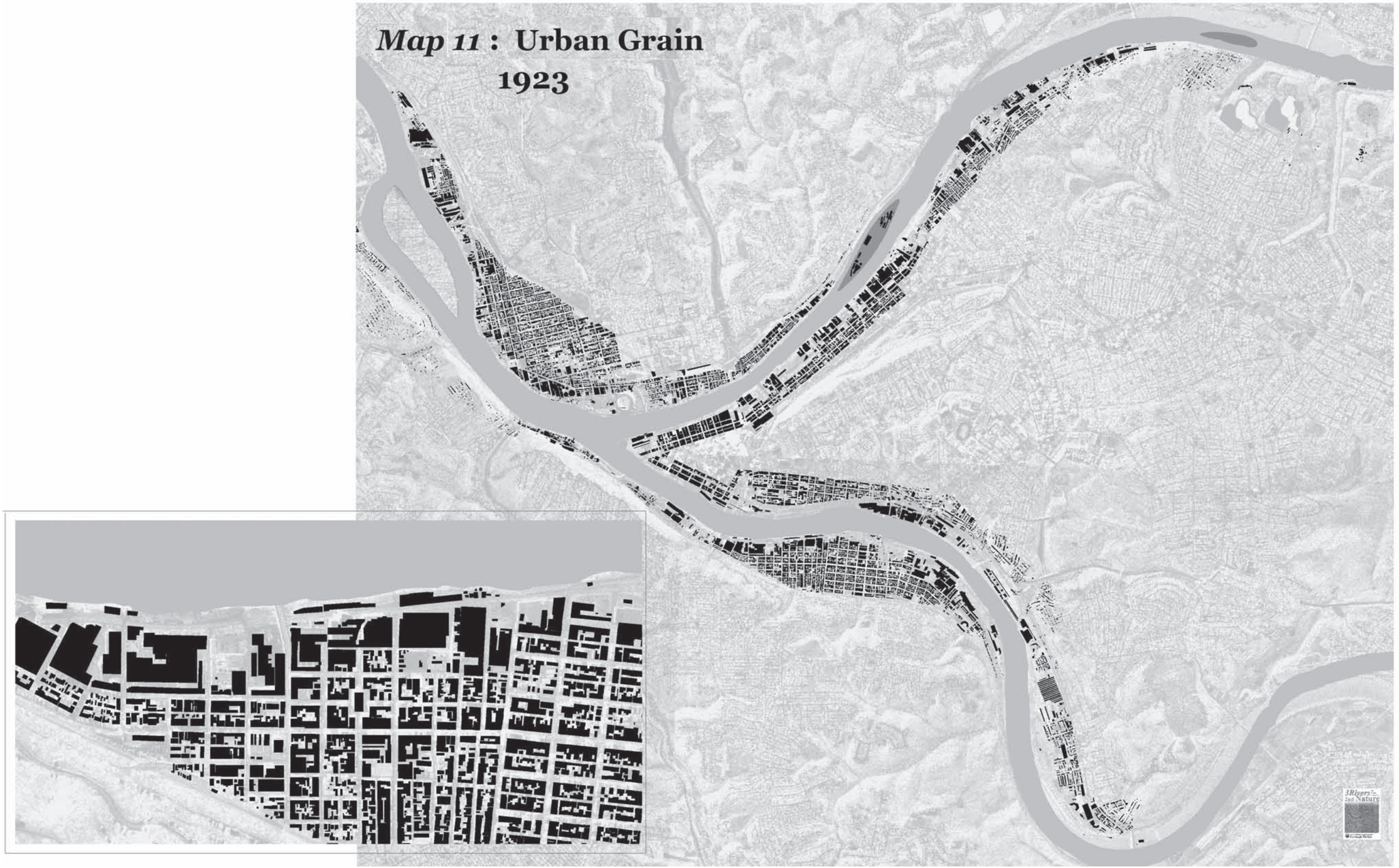
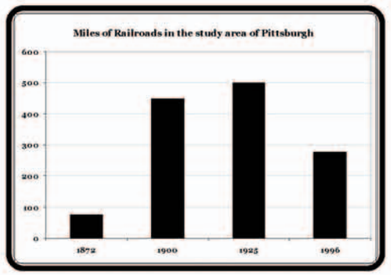
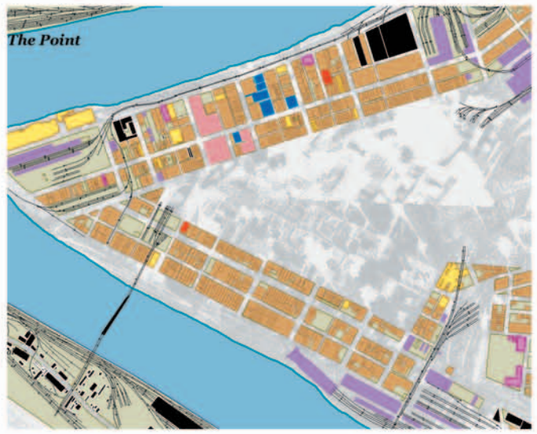
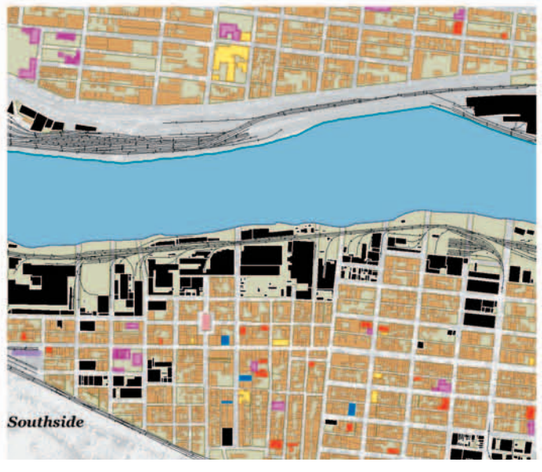


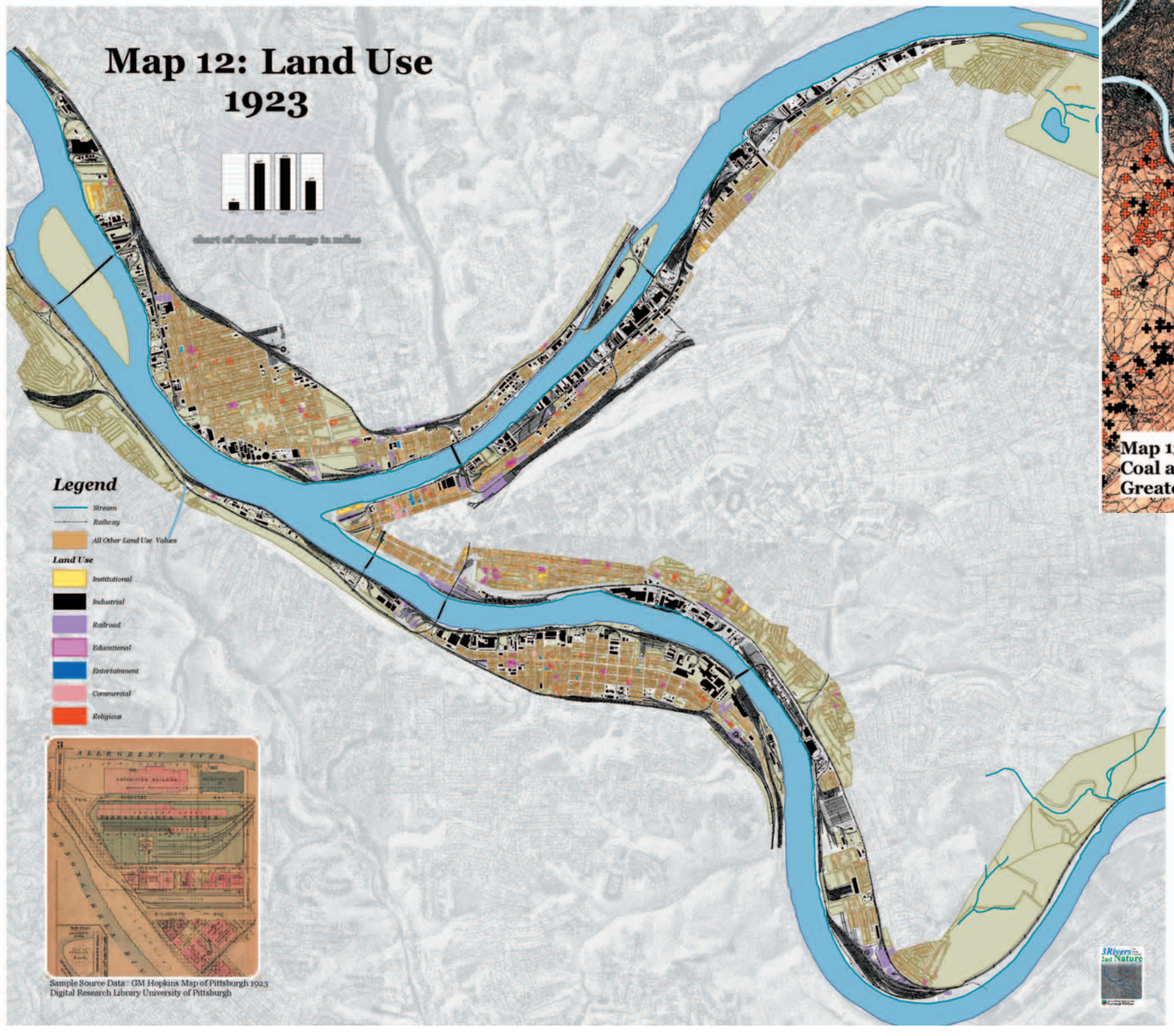
Figure 33: Methods for consolidating the bank

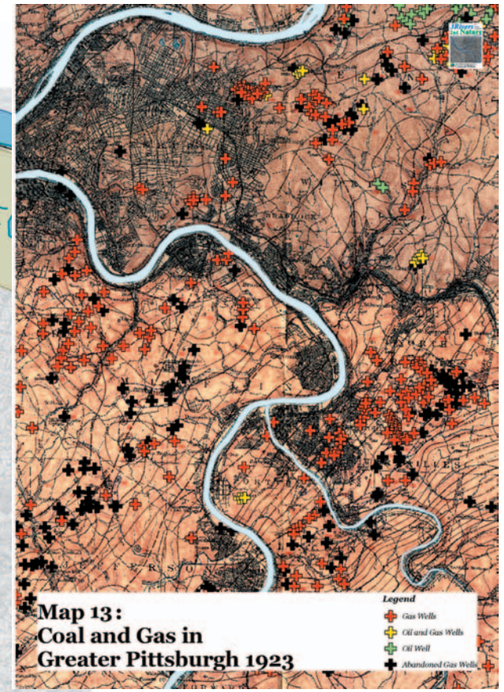

Map 11 : Urban Grain
1923


Miles of Railroads in the study area of Pittsburgh
600
500
400
300
200
100
0
1872
1900
1925
1996

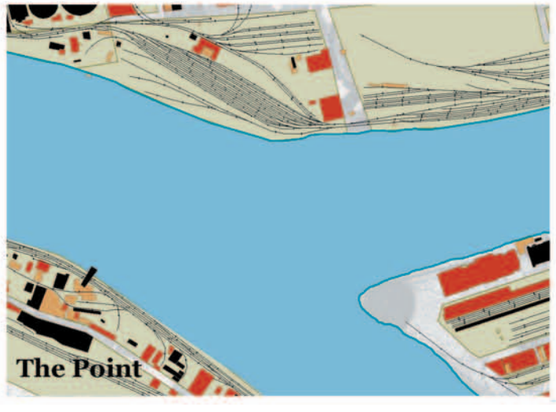

The Point

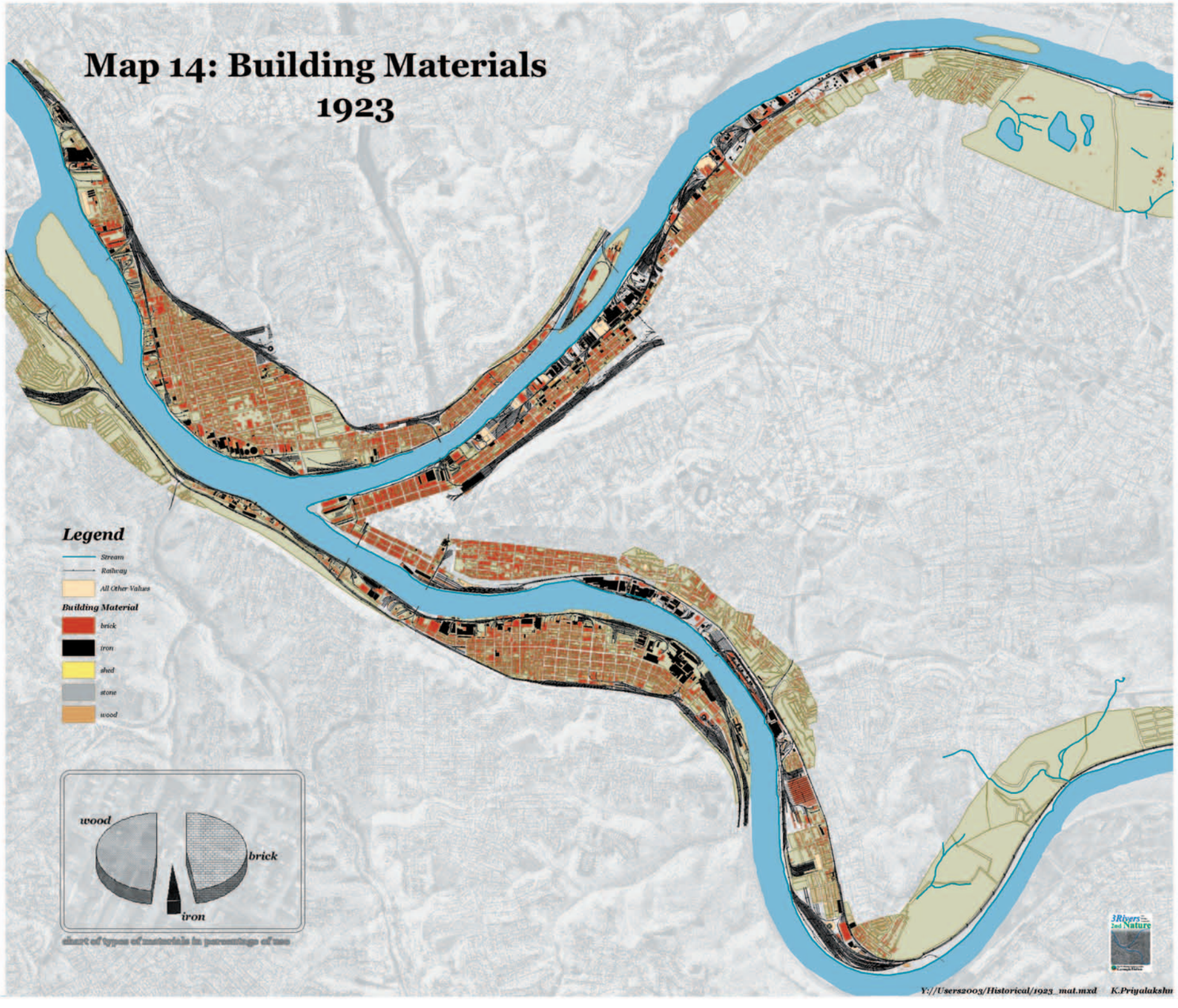

Southside


Map 12: Land Use
1923
Legend
Stream
Railway
All Other Land Use Values
Land Use
Institutional
Industrial
Railroad
Educational
Entertainment
Commercial
Religious
Sample Source Data: GM Hopkins Map of Pittsburgh 1923
Digital Research Library University of Pittsburgh
3Rivers 2nd Nature


Map 13:
Coal and Gas in
Greater Pittsburgh 1923
Legend
Gas Wells
Oil and Gas Wells
Oil Well
Abandoned Gas Wells


Allegheny City


The Point


Map 14: Building Materials
1923
Legend
Stream
Railway
All Other Values
Building Material
brick
iron
shed
stone
wood
wood
brick
iron
chart of types of materials in percentage of use
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K.Priyalakshm

the Duquesne Freight Depot be equipped with a Barge Terminal. The common method of constructing Barge terminals was to build a retaining wall and fill in the slope as can be seen in the figure 33.

Figure 32: Existing Barge Terminal at Anderson Street Freight Depot

Figure 33: Methods for consolidating the bank

In their report, the Citizens Committee for Waterways urge, "It is recommended that the Allegheny river front of the Triangle District be improved by the construction of a vertical wall to a height approximately that of the existing street level…." A similar recommendation is made for the North Side and South Side, "It would contribute materially to the development of this section of the city, in that its construction would result in increased space for the important industries here and for the railroads that serve them."[62] They also include instructive diagrams for the construction of such vertical walls.

The wide spread adoption of these recommendations would have far reaching repercussions seen even today. What gives pause to thought is that even such minor physical changes have a cascading negative qualitative impact on the level of access to the rivers.

Map 11: Urban Grain 1925

After Oakland, the density of buildings drops dramatically and the built form becomes sparse. Large empty plots are owned by the Eastern Railroad and Jones and Laughlin company and the land is used as yard space. The grain of the city remains coarse.

The average size of the industrial building is now 8000 sq ft. just about double the average size in 1900. City blocks, when first purchased and developed by an owner. The owners built houses with generous amounts of front and back yard. With increase in density, land subdivision occurs and the dimensions of the lot of the house change. With increasing density the lot gets further subdivided and buildings sit cheek by jowl, forming continuous surfaces. In most places in the city, the double fronted lot is common. However, in south Oakland and Hazelwood, as well as certain areas of old Allegheny City, density is low enough to show the first stage of land division.

Map 12: Land Use 1925

By 1925, the transformation in the character of downtown Pittsburgh is complete. The old Monongahela Wharf and the buildings are entirely abandoned by new development. The last remaining industry in downtown is the lone boiler works of Jas Rees and Sons near the Pennsylvania freight depot. Most of the new commercial ventures such as hotels , entertainment, and Institutions are built along Liberty avenue and Duquesne Way. The focus of commerce now becomes the Allegheny waterfront of Pittsburgh.

Religious Institutions and Educational Institutions:

There are only two churches left in the study area in downtown Pittsburgh, the Presbyterian Church and St. Mary's Roman Catholic Church. There are twenty-four churches in South Side and an equal number in old Allegheny City of various ethnic denominations including Ukrainian, Polish, Croatian and German churches.

Between 1904 and 1921, a new church was founded in Pittsburgh every thirty days. Most were ethnic parishes organized by Poles, Slovaks, Hungarians, Croatians, and Italians.[63] Parochial schools (catering to specific ethnic groups) proliferated at the turn of the century because Southern and Eastern European immigrants wanted their children educated in the mother tongue and values of their culture as well as the skills of the new land.[64] Thereby a dramatic increase in educational establishments accompanied the rapid increase in churches.

Many institutions of higher learning were established in the city. Working class neighborhoods such as the Strip and the South Side, had more practical educational institutions such as the Ralson Industrial Public and the John M Conway Manual Training School in North Side. Other common commercial institutions included banks, hotels, private schools, etc.

The mix of drastically incompatible land uses is characteristic of this period. For example, even well heeled neighborhoods like Oakland (with the Children's hospital and a sprinkling of elite apartments such as the Leland, hotels like the Hilton, Walton, and the Milton) suffered smoke and soot emissions from the Jones & Laughlin's Steel Co, situated at the foot of the neighborhood.

Industry:

The land use of this period continues in the vein of 1900 with complete segregation of industry from other functions. The rise of the automobile is reflected in the number of gas stations that come up, especially in downtown Pittsburgh. Despite the various textile, liquor, lumber industries, the iron and steel industry composed a whopping 80 percent of the total value of all production in the Pittsburgh District[65] in 1925.

Industry Type and Location:

Jones and Laughlin owned the entire former borough of Ormsby on the South Side. There were a variety of industries on the South Side- breweries, glass, lumber, engine, and machine works. On the North Shore, towards Herr's Island, one sees a mix of various industries ranging from small scale basket and stamp making to the largest food processing company then, Heinz. Herr's Island itself is mostly a stock yard for Pennsylvania Railroad, other companies on the island include the meat packing company, Provision and Packing Co. The North Shore towards Brunot Island, is characterized by lighter industry. In contrast, industry along the Allegheny river and the Monongahela, in the Strip District or even Oakland and Hazelwood are uniformly devoted to iron and steel. In the North Side, heavy industries are clustered on riverside locations with only small scale industries near the Pittsburgh Ft Wayne railway depot. One can therefore distinguish locations where certain types of industry cluster.

Map13: Coal mines and Gas Drills 1925

Many individuals and companies discovered gas pools in the Pittsburgh quadrangle between 1875 and 1900. Some of these locations were Homewood, the American Steel Iron and Steel Drills in Southside, Sandy Creek, and Wilkinsburg. While these explorations were going on, the majority of gas for industrial purposes was supplied by three districts- Murraysville, Tarentum and Washington between 1896 and 1915.[66] By 1919, Carnegie Gas and Peoples Natural Gas drilled gas wells in Monroeville.

Map 14: Building Materials 1925

At this time, Iron is in its ascendancy as a building material – specifically in industrial buildings. Some, although not all, of the smaller worker housing buildings now are upgraded to better brick buildings. It would be interesting to correlate the area of the buildings with ward by ward statistics on demographic attributes in the manner of S J Kleinberg,[67] revealing the class structure of Pittsburgh. However such a study is beyond the scope of this paper.

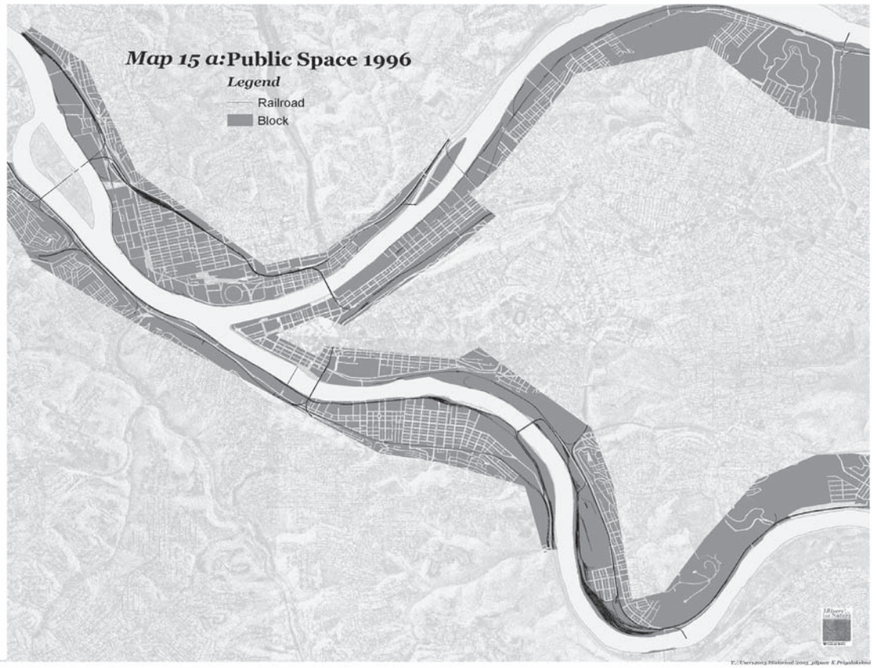
The amount of land available for construction was restricted by the topography of the city. Notable amongst land uses is the rise of worker housing settlements next to the industries. Most worker shanties were constructed out of frames or wood as can be seen from the distribution of small wooden buildings near and around the factories. Conditions of crowding prevailed in these shanties, with the average number of persons per room being five.[68]

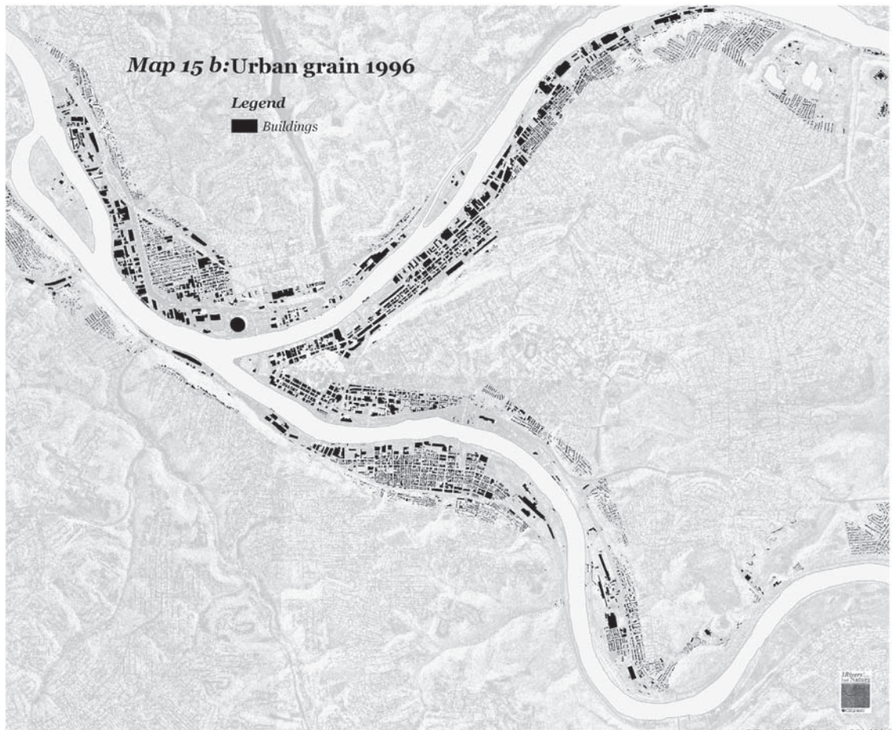
Post Industrial Pittsburgh

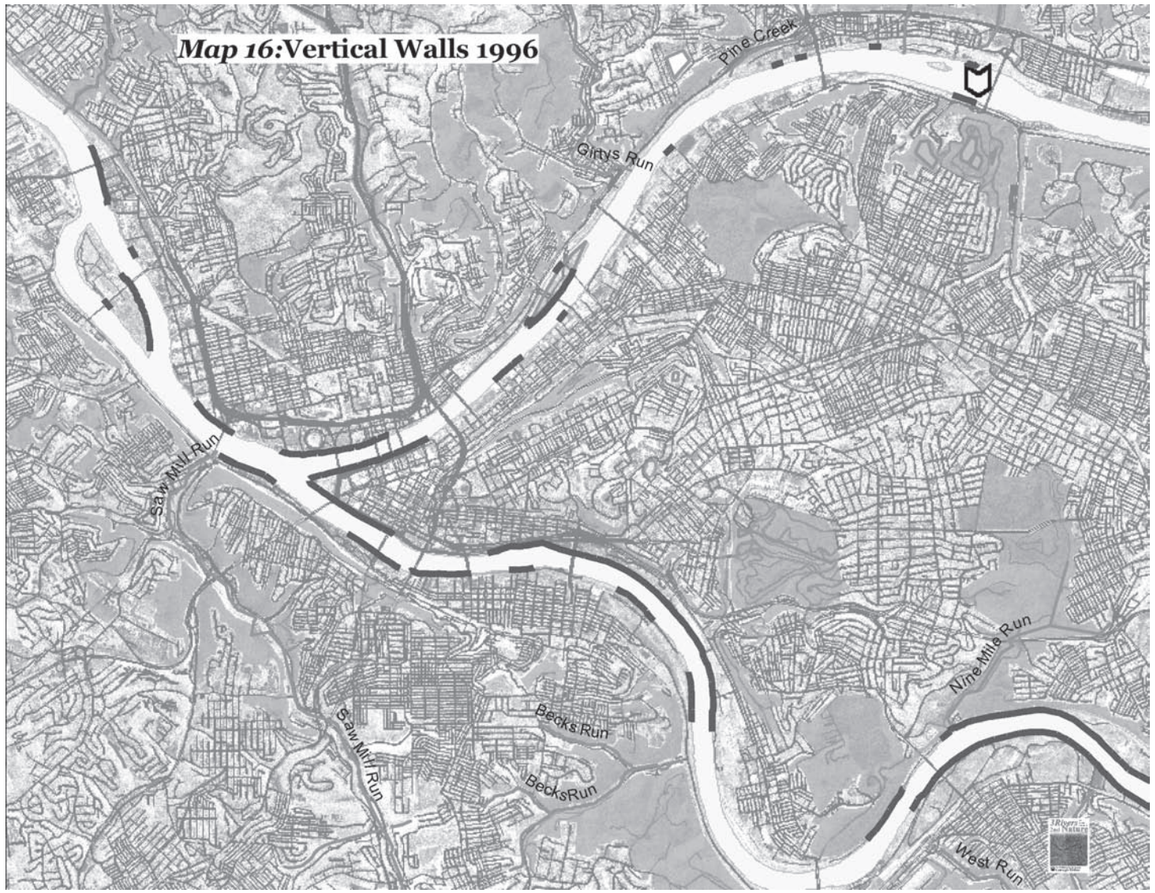
This section briefly looks at the urban waterfront of Pittsburgh today to capture the ramifications of critical decisions made during the heyday of Pittsburgh's industrial past.

Map 15a: Public Space 1996

Map 15b: Urban Grain 1996


Map 15 a:Public Space 1996
Legend
Railroad
Block


Map 15 b:Urban grain 1996
Legend
Buildings


Map 16:Vertical Walls 1996
Pine Creek
Girtys Run
Saw Mill Run
Nine Mile Run
Becks Run
Saw Mill Run
BecksRun
West Run

Today the street pattern is still what it started out with, but there is absolutely no access from any street to the river. In terms of orientation, new rapid road transit systems run parallel to the river in many cases on older railroad routes. Railroads have all but disappeared from the city —most visibly from downtown Pittsburgh, except for a yard at Hazelwood, which today is much larger than it was in 1925.

Map 16: Vertical Walls Along the River

The shore line shows the biggest changes in extent and section from 1872 when the shores at the Point, South Side, and North Side were public wharves. Even though the public wharves dwindled to only the Monongahela wharf by 1925, the section of the shoreline was relatively unchanged. This can be corroborated by contemporary photographs. The shore line today is now man made and vertical for the most part, supporting roadways or remnants of the industry's barge terminal with vertical walls flanking the river. The main reason for this change in profile of the shore is development of river rail transport terminals as recommended by early planning efforts.

Map 17: Slag Banks

The process of making river rail terminals involved not only making the bank profile vertical and increasing bank height but also making the banks inaccessible from the river. The bank profile was made vertical by the use of manmade materials like slag, brick, concrete, etc. The choice of slag as material was exclusive to industrial land uses, as can be seen from map 17, illustrating the direct correlation between industrial land use and slag on the river banks.

Urban grain is coarse, especially since most of the dead, empty buildings of industries long gone still occupy the bank of the river. These brownfields form a bulwark of private space just adjacent to the river. The impact of extractive resource economy is seen in the map of the mined areas in Allegheny County.

Map 18: Coal Mined from the County

Map 19: Land Use

In terms of Land use, a commercial and institutional corridor is progressively replacing Industry along the banks of the river. The only green areas along this corridor are towards Highland Park, and Nine Mile Run.

Summary of Trends Observed

The trends observed in the preceding maps can be graphically as well as statistically summarized.

Considering the **Street Pattern, Access and Connectivity**, it was a losing battle to maintain connectivity to the river. Terrain prevented neighborhoods in the city from providing equal street access to the river. A look at the spatial patterns of the streets graphically there is a distinct downward trend in the number that provide access to the river and an increasing trend for that frontage to be occupied by railroads. The character of the street pattern changes from being perpendicular to the river to now being parallel to the river.

Figure 34: Number of Streets accessing River by neighborhood

Figure 35: Total number of Streets

Land Ownership and Land Subdivision largely followed three patterns. Firstly, large tracts of land divided according to plan surveyed by the owner. Secondly, the process of subdividing large individual blocks introducing streets within them. Lastly the process of consolidating smaller lots to form a larger lot. Consolidation usually occurred between two city blocks, rendering the street in between private property. The early stages of the growth of Pittsburgh until 1872 showed the first pattern of land ownership and subdivision. The latter two methods of land subdivision and ownership are primarily a characteristic of industrial Pittsburgh.

Figure 36: Land Ownership and subdivision

One publicly accessible resource seen in early maps of Pittsburgh were streams. These streams were a part of the landscape as late as 1872. But by 1900, almost of the streams are either lost or culverted and buried.

Figure 37: 37a. Streams in Pittsburgh 1815 ,37 b. 1872 streams

Between 1872 and 1923, the growth of the railroad in total mileage was explosive. They grew in number until a river of steel rails ran parallel to the water. Unfortunately, with each increase in mileage they choked off access to the river. Each increase in mileage also brought an increase in yards and depots that serviced the line and blocked valuable real estate from development. Thus, while railroads increased the connectivity of Pittsburgh at the scale of the region, they choked the human connection to the river.

Figure 38: Total mileage of Pittsburgh Railroads

Figure 39: Shifting pattern of Railroad location

The Wharfs in the city shrank from being available on all three shores of the city to the small, measly, strips on the Monongahela Wharf. During this period, river transportation peaked with steamboats in terms of freight and passengers carried. Unfortunately the maturing of river transportation produced sharp differentiation between its packet and barge freight. Packet freight was composed of the small everyday needs of the city like produce, poultry etc and soon this mode of transport became extinct. This change ultimately led to the privatization of the wharf in the form of many barge terminals belonging to different industries which, in turn, was directly responsible for changing the bank section.

In terms of Urban Grain the pattern of the heaviest, largest grain being nearest to the river and fine, smaller grain away from the river exists even today.

Zoning and Land Use:

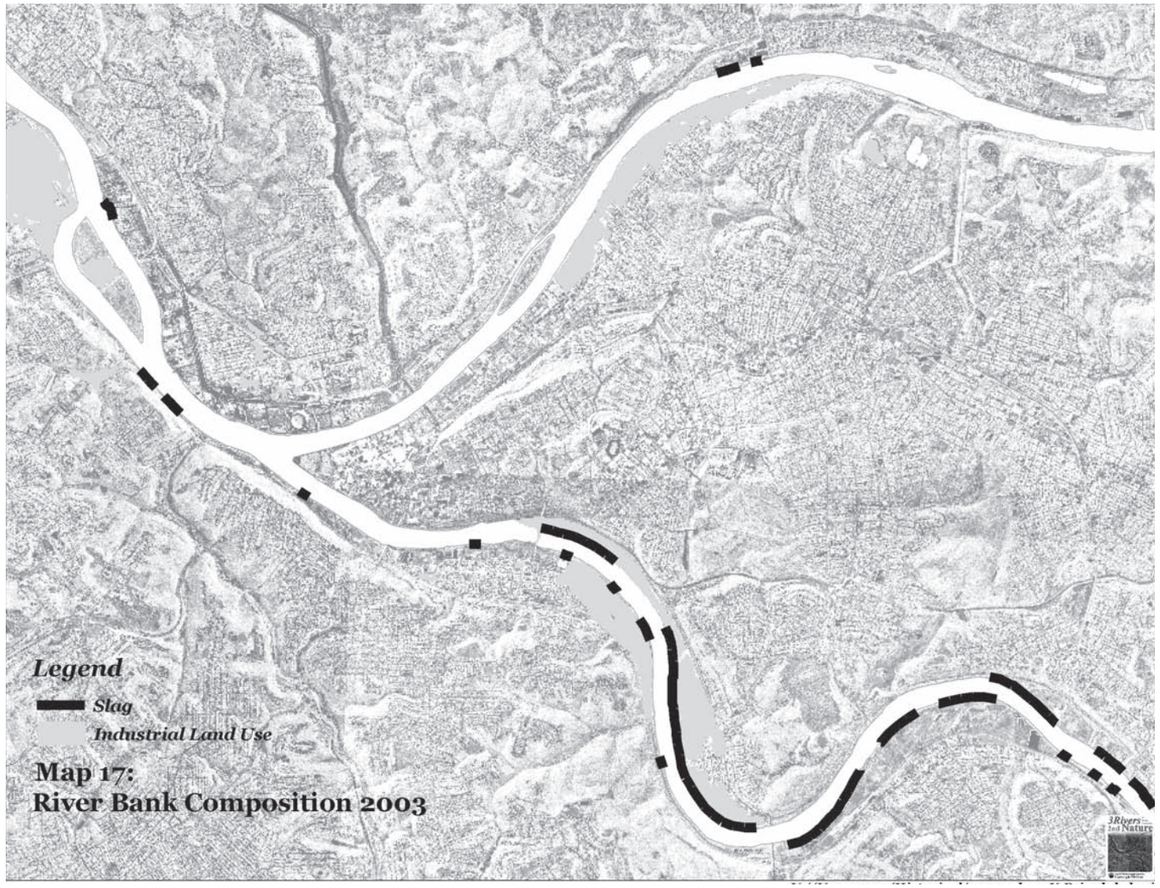
The city grew without any significant land use and environmental control or management for over a hundred years. By definition, land use exists with or without zoning. When functions in a district are uniform, the term zoning is used to describe this uniformity. In areas with a rough topography, such as these valleys of the Allegheny plateau, a certain amount of natural zoning occurred, since only the river bottoms would afford enough space for a big mill to spread. The result was an ad hoc mixture of industrial, commercial, and residential uses crammed into each section of Pittsburgh and surrounding communities. The process of land use regulation solely by market forces led to combative combinations of land use in every part of the city waterfront.

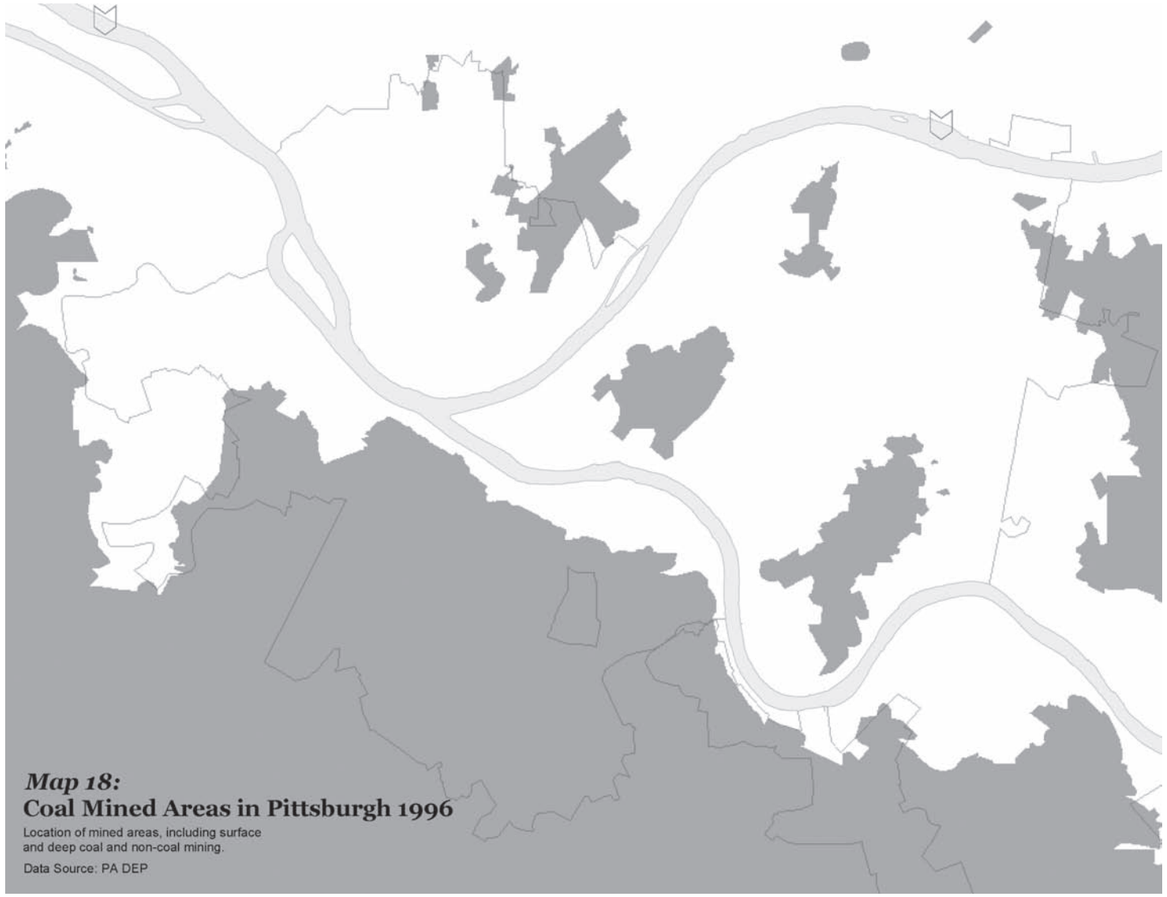
Some significant patterns of land use shifts also emerged. For example the flight of residential population from downtown in the 1870's, followed by the churches that served that population. Downtown was briefly occupied by industry only to be replaced with commerce, entertainment and institutions. Today the process of gentrification—meaning reusing abandoned city cores for residential purposes is creating a land use shift bringing back the original composition of downtown. Understanding land use shifts gives invaluable insights into the dynamics of the city.

Conclusions

Nature of Analysis and Its Limitations

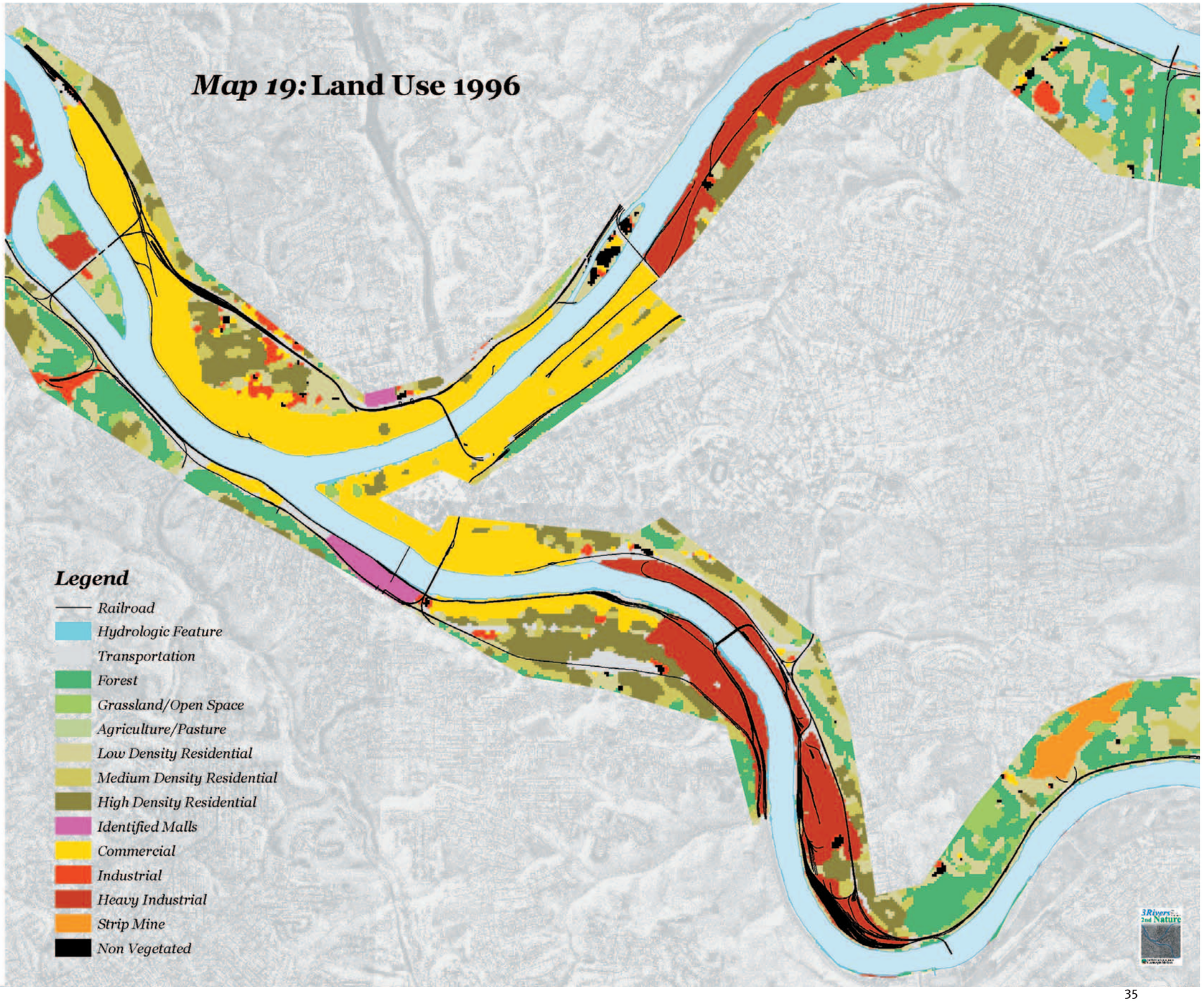
The study ultimately focuses on thoroughly documenting the spatial characteristics of the waterfront during the peak of Pittsburgh's Industrial Era. It only begins to explain the social, cultural, political, and most important of all, the policy and regulative structures which created that urban form. What gets emphasized is the general pattern; for example, land use or street pattern as opposed to the particular details of each space. The emphasis of the general is useful in understanding Pittsburgh because its identity and growth is a coming together of smaller neighborhoods. The heavy emphasis of graphic techniques over the textual narrative better serve the


Legend
Slag
Industrial Land Use
Map 17:
River Bank Composition 2003


Map 18:
Coal Mined Areas in Pittsburgh 1996
Location of mined areas, including surface
and deep coal and non-coal mining.
Data Source: PA DEP

analysis of the general. Future directions could involve extending the same methods to the entire city, correlating available spatial data and data found in directories of the period.

The built form of Pittsburgh during the peak of Industrialization was the purest expression of market forces, the crystallization of demand and supply driven by constant hunger for maximizing profits. The use of the city as an economic engine is a successful model in capturing the ruthless efficiency of this motivation and long lasting spatial impacts in Pittsburgh. Many of the barriers then raised in the access of public space and its use survive into the post industrial city where they hamper new ways of relating and using the river corridor. Thus, this study demonstrates the need for long term sustainable planning approaches for the river city interface at the waterfront.



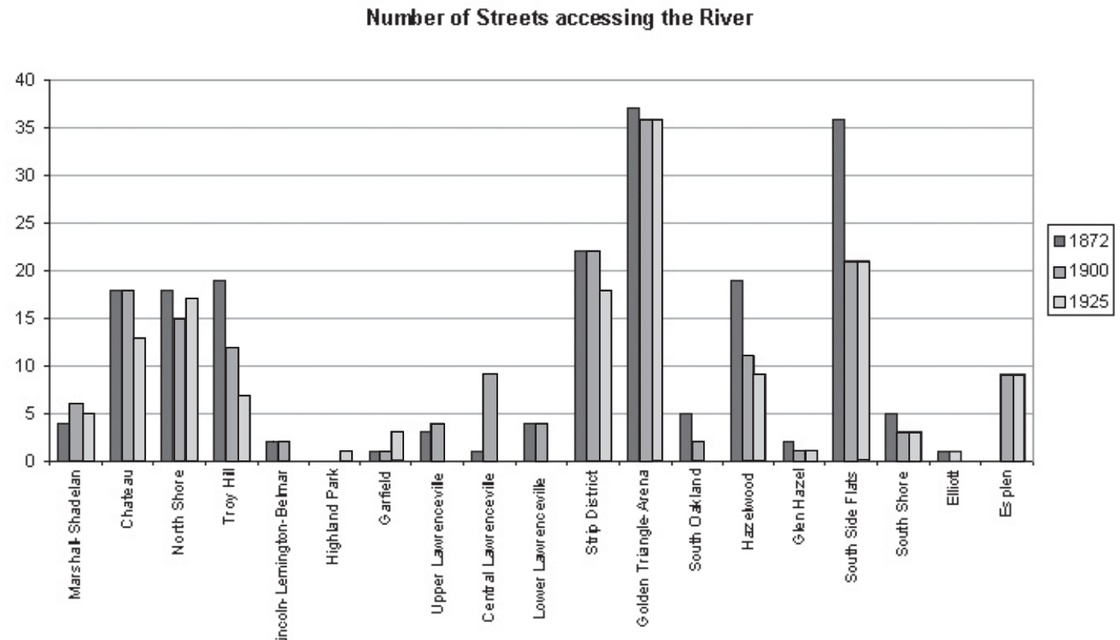


Figure 34: Number of Streets accessing River by neighborhood

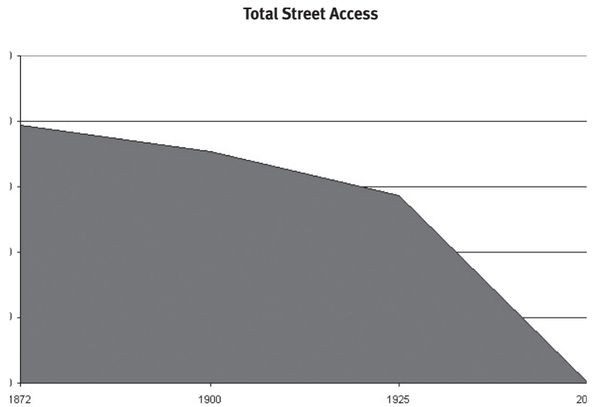


Figure 35: Total number of Streets

Figure 36: Land Ownership and subdivision

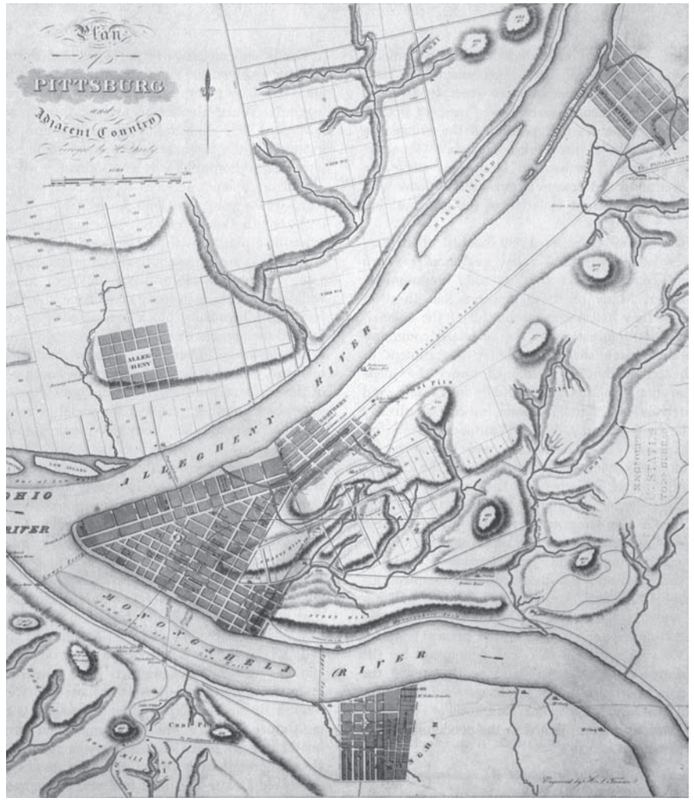


Figure 37a: Streams in Pittsburgh 1815

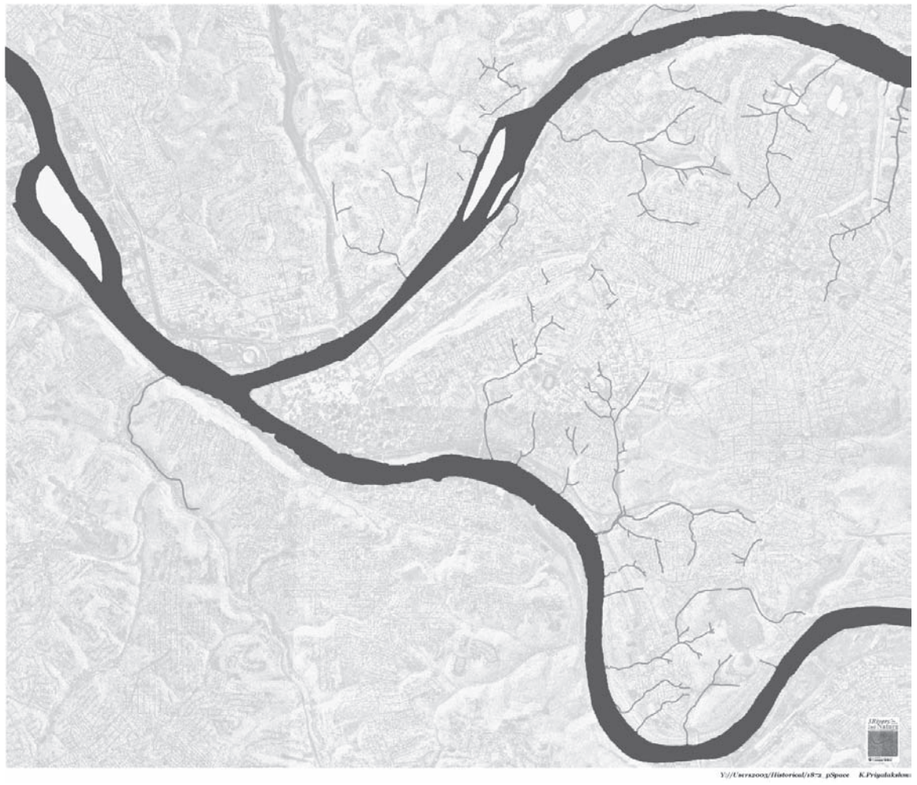


Figure 37b: Streams in Pittsburgh 1872

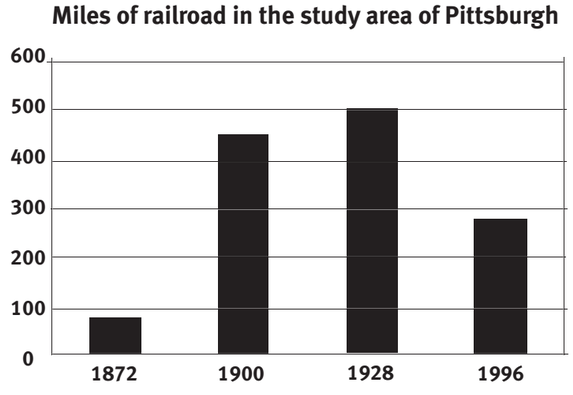


Figure 38: Total mileage of Pittsburgh Railroads

Figure 39: Shifting pattern of Railroad location

Footnotes

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[2] Kevin Lynch, *A Theory of Good City Form* (Cambridge MA: MIT press, 1981), 47
[3] Ibid, 327
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[6] Lynch, *A Theory of Good City Form* 330
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[23] The Census Bureau calculates the center of population each decade. The center is determined as the place where an imaginary, flat, weightless and rigid map of the United States would balance perfectly if all residents were of identical weight.
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Source: Author

Figure 2: Publicly accessible space & Street Network
Source: Author

Figure 3: Nolli's Map of Rome
Source: Cliff Moughton et al., Urban Design Methods and Techniques (Oxford: Architectural Press, 1999) Page 51

Figure 4: Orientation of Building on Street
Source: Author

Figure 5: Coal Mines in Pittsburgh 1815
Source: Killikelly, Sarah H The History of Pittsburgh Its Rise and Progress pg.164b

Figure 6 : Pig Iron and Rolled Iron production in the United states of America 1856-1872
Data Source: Warren Table 20 Page 67
Map Source: Author

Figure 7: Pig Iron and Rolled Iron Production in Pennsylvania 1856
Data Source: Warren Table 4 Page 29
Map Source: Author

Figure 8: Locations of rolling mills 1800-1860
Data Source: Warren Page 34
Map Source: Author

Figure 9: Railroad expansion in the United States 1850-1860
Image Source: Allan Pred , The spatial dynamics of US urban industrial Growth 1800-1914; interpretive and theoretical essays(Cambridge ,MA: MIT press 1966)
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Figure 10: Production of rails in Pennsylvania and the United States 1856-1872
Data Source: Warren Table 28 Page 93
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Figure 11: United States Center of Population
Data Source: US Census Bureau
Map Source: Author

Figure 12: Location of Connellsville and Juniata Coal Supply Areas in relation to Major Cities
Map Source: Author

Figure 13: Production of iron ore in the United States 1880- 1920
Data Source: Warren Table 36 Page 116
Map Source: Author

Figure 14: Production of Steel in Thousand Tons 1901
Data Source: Warren Table 45 Page 148
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Figure 15:Transportation Costs 1908
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Figure 16: National Production and Consumption of hot steel rolled steel products
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Figure 17: Growth of Pittsburgh
Map Source: Author

Figure 18: Warrantee Map of Pittsburgh
Map Source: Digital Research Library, University of Pittsburgh

Figure 19: Land Ownership in Pittsburgh 1872
Map Source: Author

Figure 20: Directions and Locations of Major Railroads 1872
Map Source: Author

Figure 21: Round House
Detail from Panoramic Map of McKee's Rocks by T.M.Fowler
Map Source: Library of Congress

Figure 22 : Pittsburgh 1872
Detail from Panoramic Map of Pittsburgh by Otto Krebs
Map Source: Library of Congress

Figure 23: Subdivision of land
Map Source: Author

Figure 24: Subdivision of land in McKee's Rocks
Map Source: Author

Figure 25: 25a: McCullough's Island1872
25b: McCullough's Island 1900
Detail from GM Hopkins Maps of Pittsburgh 1872 and 1900
Map Source: Digital Research Library

Figure 26:26a: Webbed Rail Road Line
Map Source: Author
26b: Railroads 1900
Map Source: Author

Figure 27: Independent Packet Line Landing
Map Source: Citizens Committee on City Plan of Pittsburgh Waterways of the Pittsburgh district: a part of the Pittsburgh Plan. (Pittsburgh: Citizens Committee on City Plan of Pittsburgh, 1924.)
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Figure 28:Steel and Iron industry locations Pittsburgh 1900
Map Source: Warren Page 135

Figure 29:Land Subdivision in Hazelwood
Map Source: Author

Figure 30: River Packet Terminal
Map Source: Citizens Committee on City Plan of Pittsburgh Waterways of the Pittsburgh district: a part of the Pittsburgh Plan. (Pittsburgh: Citizens Committee on City Plan of Pittsburgh, 1924.)
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Figure 31:Proposed Barge Terminal at the Duquesne Freight Depot
Map Source: Citizens Committee on City Plan of Pittsburgh Waterways of the Pittsburgh district: a part of the Pittsburgh Plan. (Pittsburgh: Citizens Committee on City Plan of Pittsburgh, 1924.)
Page 37

Figure 32: Existing Barge Terminal at Anderson Street Freight Depot
Map Source: Citizens Committee on City Plan of Pittsburgh Railroads s of the Pittsburgh district: a part of the Pittsburgh Plan. (Pittsburgh: Citizens Committee on City Plan of Pittsburgh, 1924.)
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Figure 33: Methods for consolidating the bank
Map Source: Citizens Committee on City Plan of Pittsburgh Waterways of the Pittsburgh district: a part of the Pittsburgh Plan. (Pittsburgh: Citizens Committee on City Plan of Pittsburgh, 1924.)
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Figure 34: Number of Streets accessing River by neighborhood
Source: Author

Figure 35: Total number of Streets
Source: Author

Figure 36: Land Ownership and subdivision
Source: Author

Figure 37: 38 a: Streams in Pittsburgh1815 ,
Map Source: Source: Killikelly, Sarah H The History of Pittsburgh Its Rise and Progress pg.164b
38: b 1872 Pittsburgh streams.
Source: Author

Figure 38: Total mileage of Pittsburgh Railroads
Source: Author

Figure 39: Shifting pattern of Railroad location.
Source: Author