RECONSTRUCTING THE NORTH AMERICAN URBAN LANDSCAPE: FIRE INSURANCE MAPS - AN INDISPENSABLE SOURCE

With 5 figures and 1 table

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Zusammenfassung: Feuerversicherungskarten: Unverzichtbares Hilfsmittel zur historisch-geographischen Rekonstruktion der nordamerikanischen Stadt

Historisch-geographische Stadtforschung ist auf zuverlässige Überlieferungen (= Quellen) angewiesen. Historische Karten und Atlanten bilden dabei eine wichtige Quellengruppe, deren Auswertung weit verbreitet ist. Besondere Bedeutung kommt ihnen bei der morphogenetischen Stadtanalyse zu, für die M. R. G. CONZEN mit seinen Arbeiten über Alnwick, Newcastle und Ludlow wichtige methodische Grundlagen geschaffen hat. Systematisch vergleichende Untersuchungen sind aber in der Regel mangels einheitlicher, großmaßstäbiger und über einen längeren Zeitraum kontinuierlich fortgeschriebener Kartenserien nur mit großen Schwierigkeiten durchzuführen.

Die vorliegende Studie stellt in ihrem ersten Teil einen Kartentypus (Feuerversicherungskarten) vor, der in besonderem Maß als Quelle für die morphogenetische Stadtanalyse geeignet ist, und veranschaulicht im zweiten Teil am Beispiel der Entwicklung des Stadtzentrums von Knoxville, Tennessee, während des Zeitraumes von 1880 bis 1920 einige Interpretationsmöglichkeiten, die diese Karten bieten.

Entwickelt in England Anfang des 18. Jahrhunderts und von dort parallel mit der Expansion britischer Versicherungsunternehmen in der ganzen Welt verbreitet, erlebte dieses Kartensystem seine Blütephase auf dem nordamerikanischen Kontinent in der Zeitspanne zwischen dem Ende des Bürgerkrieges und der Mitte des 20. Jahrhunderts. Mehr als 13 000 Orte in den Vereinigten Staaten und immerhin 1300 in Kanada wurden während dieses Zeitraumes kartographisch erfaßt; ein großer Teil davon regelmäßig in Abständen von 5 bis 10 Jahren. Feuerversicherungskarten stellen somit eine der umfassendsten und detailliertesten Dokumentationen der baulichen und funktionalen Entwicklung nordamerikanischer Städte dar.

Die Auswertung von vier Kartenserien für Knoxville, Tennessee, ergab eine im Vergleich mit den großen Städten des Nordens um etwa zwei Jahrzehnte verzögerte Transformation des frühindustriellen innerstädtischen Kerns zum „modernen" CBD. Die vergleichende, detaillierte Untersuchung der baulichen und funktionalen Entwicklung von zwei Straßenblöcken der Innenstadt veranschaulicht die verschiedenen morphogenetischen Prozeßabläufe, die der Veränderung zu Grunde liegen.

Historical maps and atlases constitute an indispensable source for urban historical geography. They are of particular importance for morphogenetic analysis. Due to the lack of uniform, large-scale map series, systematic-comparative studies on the changes of the urban landscape can only be performed with great difficulty. It is thus a fortunate coincidence that in North America, where the principle of laissez-faire in the economic life has resulted in the most radical changes of the urban landscape, city development has been documented in detail in fire insurance maps since the Civil War. The possibilities offered by these documents have been neglected, not least because of the little interest American geographers paid to urban morphological research. In the last two decades, however, growing public awareness of urban preservation and restoration of historic city quarters has encouraged the revival of interest in the urban landscape. As a result, fire insurance maps have gained new importance as one of the most crucial source groups. The study at hand presents these maps and demonstrates some aspects of their usage focusing on the functional and morphological change of the commercial core of an intermediate city in the North American South during the transition from the traditional city center to the "modern" CBD.

The second half of the nineteenth century stands out as a period of spectacular urban growth and tremendous change in the internal organization of cities in North America. Urbanization processes and inner-city transformation were, inter alia, influenced by such major factors as industrialization, migration (foreign immigration as well as rural-urban migration) and innovations in technology and management. But the factors which shaped the North American urban landscape were not uniform in their impact. American cities also developed a significant variety and an individual identity. Systematic research on these regional variations is still very limited and most generalizations about the development of the urban landscape are based on a few studies of mostly larger cities in the East. Comparative analysis of appropriate historical urban maps allows the identification of the formative processes during the different morphogenetic periods which created the North American city (CONZEN 1980, 1990).

1 Fire insurance maps

Fire insurance maps are an important but still underused source for research on urbanization and industrialization during the 19th and early 20th century, particularly for North America and the British Isles. Originally created as a reference tool for fire insurance underwriters, these large-scale, special purpose urban maps were used by individual companies to determine insurance risks and to record the issuance of policies (GETTY 1910–11).

For an accurate dating of the origin of fire insurance cartography more research has still to be done. Presumably the first maps developed during the early 18th century in England (RELTON 1893). These early surveys consisted of manuscript plans of individual buildings (mainly factories, mills etc.) and were for the exclusive use of the ordering insurance company (COCKERELL 1976, HYDE 1970–73). Along with the overseas expansion of the insurance business during the last two decades of the 18th century plans of factories, docks, or whole towns were created wherever English underwriters accepted a risk or expected a future market, reaching from Russia to the New World (RAYNES 1964, 254ff, TREBILCOCK 1985, 162ff).

Richard Horwoods' Map of London (1792–99) opened up a new dimension in insurance cartography (HOWGEGO 1978). It was probably the first attempt to offer for sale a uniform map as a working basis for *all* potential customers (COCKERELL 1976). Although not yet a commercial success Horwood's idea was to be applied with great success particularly in North America only five decades later. The period of the rapid urbanization and development of the distinct city system in North America after the Civil War (cf. CONZEN 1977, GLAAB 1967, MCKELVEY 1963) coincided with the hey-day of fire insurance cartography. The rapidly expanding market forced insurance companies to rationalize their working procedures, and the maps gradually became an indispensable component of the daily work (ZARTMAN 1909).

Two groups of maps may be distinguished: firstly there are series of large scale maps of individual cities or city regions, which, depending on their size and making, were either introduced in the form of loose sheet maps or as bound atlases (cf. Fig. 1). Plans of individual industrial properties (single houses or building complexes) establish the second group of insurance maps. They consist of surveys of industrial plants, warehouses and similar objects of high investment value. These plans were generally supplied with detailed descriptions of the surveyed facilities and sometimes included isometric drawings of the main buildings[1]. Since insurance companies needed up-to-date information for their calculations and risk assessments, the plans were revised far more frequently than other comparable urban maps.

Until the turn of the century numerous publishers were occupied with the production of fire insurance maps. Companies like Sanborn (RISTOW 1970), Goad (HAYWARD 1974, ROWLEY 1984), Hexamer (MOAK 1976, THOMAS 1921), Perris and Browne (MULLINS 1921, RISTOW 1970), Dakin (HOEHN 1976) or Fischer[2] and a few insurance companies operated in numerous cities. There was also a fair number of small firms, run by local merchants, which limited their activities to their immediate surroundings[3]. Despite this variety of producers, the products were nevertheless uniform in content and format (MULLINS 1921, THOMAS 1921), because of the early adaptation of standard map symbols (Fig. 2). In the 20th century, after a period of harsh competition and subsequent business mergers, two enterprises eventually dominated the market: the Sanborn Map Company in the USA and the Charles E. Goad Company in Canada (HAYWARD 1974).

The Sanborn Map Company, founded in 1866 in New York as "D. A. Sanborn National Diagram Bureau", developed from poor beginnings into one of the largest map producers in the US, and virtually monopolized the market for insurance maps after

[1] Several publishers were engaged in the production of these plans: The Sanborn Map Company, for example, published a series of plans of "Whiskey Distilleries and Warehouses" as well as plans for "Sugar Warehouses at Principal Ports" of Cuba. The "California Warehouse Book", presented by the Dakin Publishing Company, covered 349 factories and warehouses in California. And similar plans were produced by Hexamar ("Hexamar General Survey"), Barlow, and Goad. An early English predecessor of these plans represents "Loveday's London Waterside Surveys, For the Use of Fire Insurance Companies, Merchants, Brokers, Agents, Wharfingers, Granary-Keepers etc." published in 1857 by J. T. Loveday ("Surveyor of Risks, Phoenix Fire Office") in London. For a description of the Barlow and Hexamer plans and their potential use for Industrial Archeology see: H. WRIGHT (1983).

[2] Walter I. Fisher's General Inspection Bureau published insurance maps for more than 640 towns in the Midwest, and is one of the few businesses, which survived as independent producers the harsh concentration process after the turn of the century (cf. RISTOW 1981).

[3] Among these smaller enterprises were Alphons Whipple (St. Louis), G. H. Jones (Philadelphia), the Rasher Map Publishing Company (Chicago), Scarlett and Scarlett (New Jersey), the Bennet Map Company (Iowa) etc.

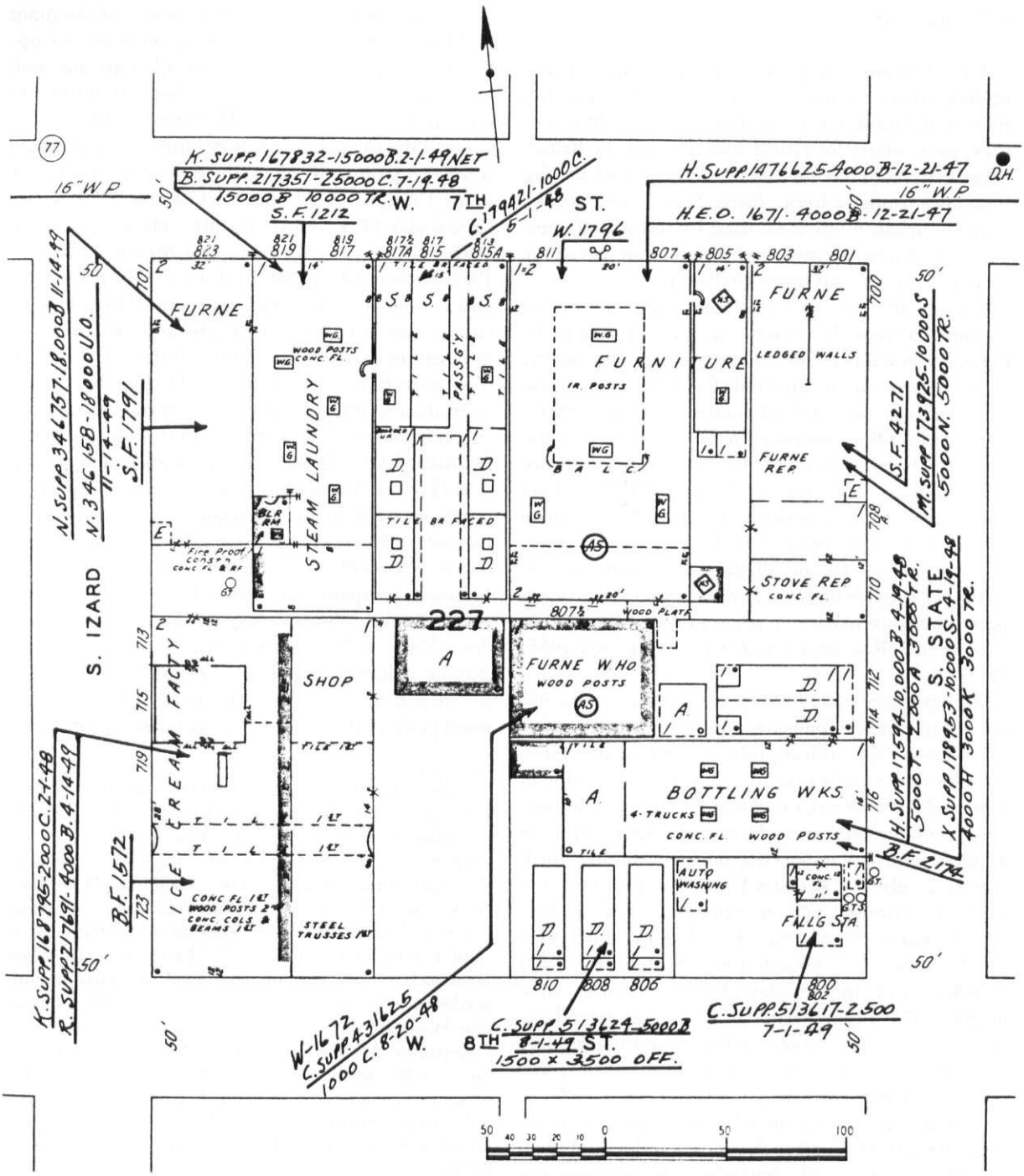


Fig. 1: Sanborn sample map illustrating the typical method of recording liabilities on the map

Sanborn Beispielkarte zur Demonstration der typischen Dokumentationsweise von Versicherungsabschlüssen auf den Kartenblättern

World War I. Between 1880 and 1930 Sanborn surveyors mapped almost every town with more than 1,000 inhabitants at a scale of 1:600 or 1:1,200 (Sanborn 1926). Their products were so sophisticated that even one of Sanborns' sharpest critics had to admit: "The maps, as made today, are perfect of their kind,

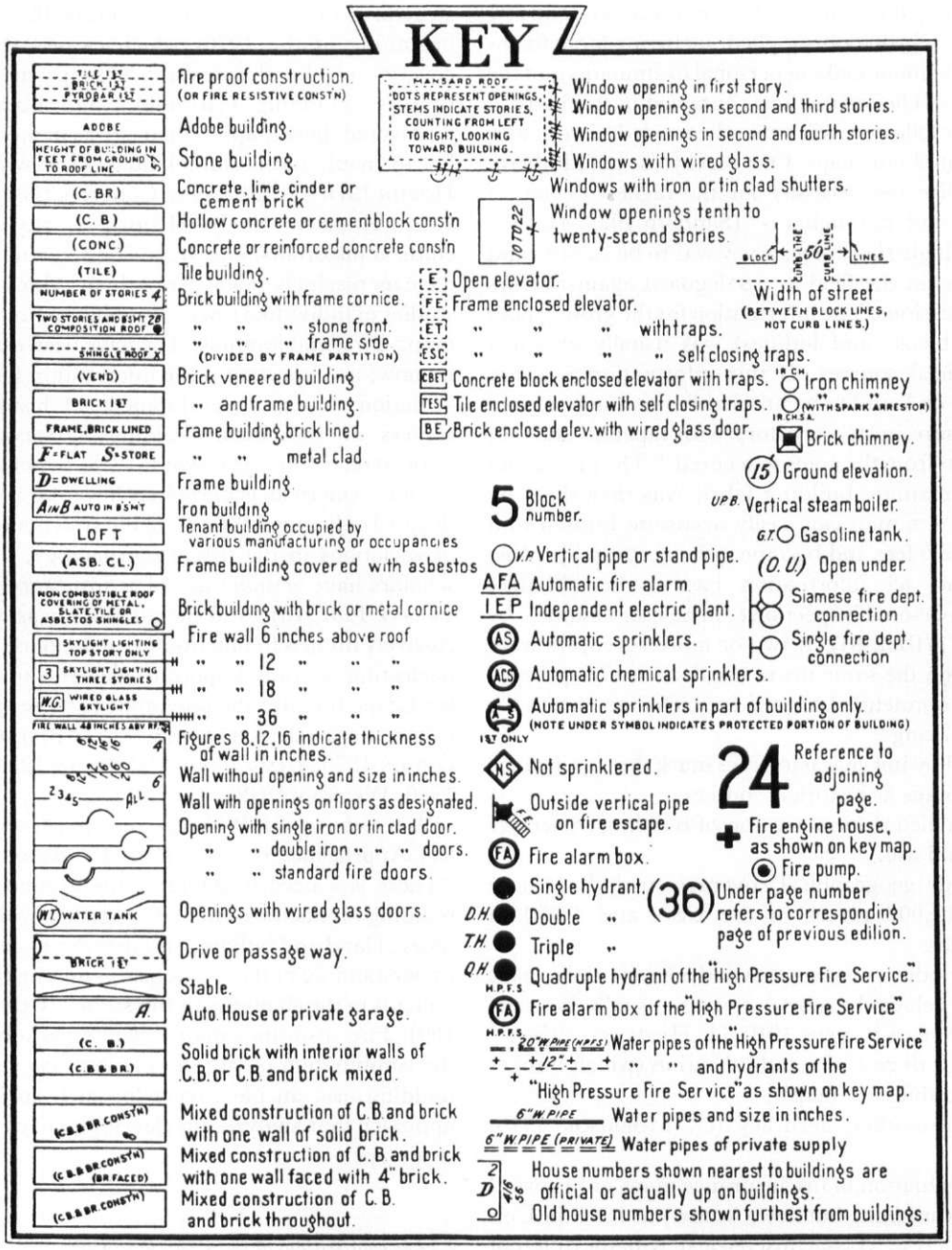


Fig. 2: Sanborn map legend (1936)
Sanborn Kartenlegende (1936)

being splendid examples of the printers' and bookbinders' art. Their accuracy is unquestioned, and any improvement, while retaining this type, would have to be confined to details of arrangement, etc." (MORRISON 1916).

In order to guarantee that every employee in the field would work in accordance with these strict requirements, the Sanborn Map Company developed a comprehensive list of instructions and regulations. The introduction to the *Surveyors' Manual for the exclusive use and guidance of employes of the Sanborn Map Company* emphasized: "Our maps are made for the purpose of showing at a glance the character of the fire insurance risk of all buildings. Our customers

depend upon the accuracy of our publications, and rely upon the information supplied, incurring large financial risks without making personal examinations of the properties. The instructions contained in this book, if uniformly followed, will attain the much desired standardization of our maps. Our surveyors should, therefore, realize the necessity for the highest degree of accuracy and thoroughness" (Sanborn 1923, 4).

Each single sheet of a survey was to be colored and completed in the field as a safeguard against errors and ommissions. The information for the ground plan (street-, block- and lotlines) was usually obtained from official sources. If this information was not available or found to be unreliable, the surveyor had "to measure up the territory with tapeline and [to] plot sheets from the notes so secured." The measuring of the remaining building fabric was then done by pacing ("- a man can easily accustom himself to a stride of 2½ feet and become quite accurate"). Most important: all information had to be obtained through personal inspection ("in no case assume - be positive") (Ibid. 9f). If two or more surveyors were working on the same town, the Sanborn Map Company recommended that they exchange sheets for cross-checking.

The following characteristics mark the significance of these maps as historical sources:

- the detailed documentation of building structures and land use;
- the wide geographical coverage (including more than 13,000 places in the USA and 1,300 in Canada);
- the periodic issuance of revised editions of the maps within relatively short intervals: usually between 5 to 10 years (Getty 1910–11, Hayward 1974);
- the high degree of standardization (which implies comparability of maps);
- the outstanding accuracy (cf. Morrison 1916, 125).

The evaluation of fire insurance maps as historical sources is anything but new. As early as 1895 the Colonial Society of Massachusetts dealt with the different map systems and discussed at length the significance of a continuous collection of the maps. The original aim was to acquire fire insurance maps to enable the State's libraries to build up an extensive documentation of urban development (Colonial Society of Massachusetts 1895–97). However, the high prices of the maps made them a highly specialized item among experts and they remained largely unnoticed as a document of contemporary urban history.

It was the growing public interest in the preservation and restoration of the still remaining historical structures in the cities at the end of the 1960s and beginning of the 1970s which caused the "rediscovery" of the fire insurance maps as historical sources. Planning institutions and libraries also discovered these maps in their stocks in the 1970s and began methodical compilations (Hayward 1977, Hoehn 1976–77, Library of Congress 1981, Rowley 1984, Karrow 1990). Historians, city planners, cultural historians, city archeologists, and architects have increasingly made use of them. Many historical studies of individual towns also refer to fire insurance maps. First and foremost they have been established, by now, as important basic information for the conservation and/or redevelopment of historical city centers or individual buildings (Aspinall 1980, Bloomfield 1982, Hayward 1973, Stacey 1983).

Since American geographers have, for a long time, devoted only minor interest to the systematic research of variations in the urban morphology, only a few scholars have actually used fire insurance maps (cf. Frantz 1987, 18). And the attention was almost exclusively limited to function[4] (i. e. land use), thereby neglecting not only important elements of the urban landscape but also the potentials of these specialized urban maps (cf. Applebaum 1952, Bohnert 1964, Gibson 1975, Lamb 1961, Mattingly 1964, Sauder 1980, Wrigley 1949).

A decade ago M. P. Conzen in a paper on "Analytical Approaches to the Urban Landscape" stated: "There is a need to integrate the ground plan and building character of the city together with the patterns of land and building use in order to gain a fuller understanding of the relationships among these components in the changing urban scene" (Conzen 1978, 139). Fire insurance maps offer, especially through the combination of city morphology *and* generalized building use, an ideal basis for such an integrated approach that analyzes the development of the urban landscape.

2 The composition of the urban landscape

The urban landscape is composed of three formal components in space: (I) ground plan, (II) building fabric, (III) land use pattern. Each of these three systematic form complexes is again made up of several form elements (Conzen 1975, 1988). To what extent can these formal components be identified from the maps?

[4] For the few exceptions see: Bowden (1971), Conzen (1990), Ross (1971).

2.1 Ground plan

The ground plan is composed of a street system, plot pattern, and building pattern. Street system and building pattern are shown in the maps whereas property-lines are often not depicted[5]. Even though street numbers are usually assigned to the individual buildings or properties, this information cannot in all cases be considered reliable (cf. Sanborn 1923, 36ff). Nevertheless it seems justifiable – especially in comparing consecutive editions of the maps – to draw some conservative conclusions about the change of the plot pattern.

2.2 Building fabric

The maps provide a wealth of information about the physical characteristics of individual buildings through the use of color coding, symbols, and abbreviations. The color coding is used to identify a building's construction material, while a variety of symbols is used for other features such as: roof composition, fire escapes, fire walls, partitions, interior openings, windows, chimneys, elevators, skylights. Moreover, the building height, the number of floors, and even attached decorative facades are also shown. Other architectonic details, however, are missing. As a result, "cosmetic" alterations or modernizations of building facades for example cannot be identified from the maps.

2.3 Land use pattern

Abbreviations record the generalized building-use (for example: "S" = store, "Whol." = Wholesale, "D" = dwelling, "F" = flat, "Rest" = restaurant). The names of apartment buildings, hotels, office blocks, factories, or bigger trade companies and public institutions are also listed. Sanborn surveyors in addition had to note on the maps boarding houses as well as all "specially hazardous occupancies, such as blacksmith, printing, painting, oils, carpenters, cabinet shops, binderies, upholstering, broom factory, candy factory, chemical works ..." (Ibid. 21). In summary, the fire insurance maps contain information about most of the formal components that are necessary for a systematic analysis of the city landscape.

Nevertheless one more significant limitation has to be mentioned: the maps, particularly those dating from before the turn of the century, do not record the entire area of a city, or even the whole built-up area. Rather they cover the commercial center (CBD) and any large commercial or industrial complexes (also railroad yards) at the urban fringe[6]. The maps are therefore especially suited for an analysis of the city centers and commercial and industrial areas.

"A static inventory of landscape elements, however, is neither a worthy end in itself nor sufficient to comprehend the formative influences. A dynamic perspective on the urban landscape recognizes the changing needs of the occupying society over time and the translation of those needs into different periods of townscape development that mirror the functional periods of changing socio-economic organization" (Conzen 1978, 145f). Historical-geographic city plan analysis, therefore, has to emphasize the systematic-comparative evaluation and interpretation of maps from different time periods. Despite the limitations mentioned above fire insurance maps probably constitute the best data base for this research especially for the crucial period of the late nineteenth and early twentieth century.

3 The transformation of the commercial core

Some of the possibilities which an interpretation of fire insurance maps offer for historical-geographical city analysis, taking into account both formal and functional criteria, are illustrated in the following example.

Knoxville, TN was very much a part of the so-called New South movement. At the outset of the Civil War it was a modest town on the railroad lines that linked the South to the more dynamic regions in the North and West (McDonald 1983, 10ff). Only after the Civil War did rapid growth begin in response to incoming capital from the North. The exploitation of the natural resources in the region, such as coal, iron ore, timber, and marble as well as wholesale trade, led the way. In the 1890's it was said that Knoxville was the third or fourth largest distribution center in the South and that its fifty wholesale houses did an annual business of around fifty million dollars. The

[5] Real estate descriptions were not required for maps produced by Sanborns' Eastern and Pacific Departments (cf. Sanborn 1923).

[6] Only in the early 20th century did the Sanborn Surveyors, in particular, attach importance to cover the built up areas as completely as possible (cf. Sanborn 1923, 7).

processing trades also expanded enormously in the 1880's and 1890's, attracted by the availability of cheap and unorganized labor. More than ninety new factories were established between 1880 and 1887, and by 1900 industry was the largest sectoral employer in the city (30.6% of the labor force). Stimulated by the rapid expansion in business activity thirteen new banks were organized in the final two decades of the century (WHITE 1976). The population rose from 8,682 (1870) to 32,637 (1900) and to 77,818 (1920) (MCDONALD 1983). The growth rate was thus highest in the 1880's with 132% and lowest in the 1870's with 11.7% This growth can be attributed to an extensive incorporation policy, and rapid rural-urban migration (MACARTHUR 1976). Most of the in-migrants were poor whites from the surrounding hinterland, who left their Appalachian homes to seek employment in the booming city. Like foreign immigrants in the eastern cities they constituted a large potential labor pool for low-wage employment.

One can therefore assume that the transformation of Knoxville's traditional city center into a "modern" CBD took place during the time between the late 1870's and the early 1920's. Hence an analysis of this process using fire insurance maps will have to concentrate on this time period. Sanborn surveyors mapped Knoxville's city center four times between 1880 and 1920: in 1884, 1890, 1903, and 1917[7]. The following interpretation is based on these four sets of maps and, in addition, the corresponding city directories[8].

Downtown Knoxville is physiographically clearly separated from the rest of the city (cf. Fig. 3). In the south the steep bank of the Tennessee river marks the boundary. The First and Second Creek establish the eastern and western boundaries respectively. And in the north the downtown borders on the tracks and yards of the Southern Railroad. The main business-area is located along Gay Street (the actual "Main Street" of the city) and Market Street, including Market Square (with the Market Hall).

Compared with WARD's (1971, 85 ff) model of the emergence of the CBD the transformation of Knoxville's city center was delayed by almost twenty years. At the beginning of the 1880's the commercial core still contained a diverse mixture of commercial and industrial activities. In accordance with the shift of the main transport function from the Tennessee river to the railway, the center of gravity moved northward a few hundred meters along Gay Street during the early 19th century. However, only after the Civil War did the two – originally independent – nuclei of commerce on Gay Street and Market Square grow together as one zone of commercial use.

The rapidly growing wholesale trade (mainly finished products) concentrated on the north-east side of Gay Street, where the plots were up to 25% larger than those on the west side. Together with this northward expansion of the commercial core a first functional and also structurally fairly homogenous section developed within the city center. The typical multi-story wholesale building had a representative facade with display-windows facing Gay Street, whereas the shipment of goods was executed from the back lane. Almost every building possessed elevators for the internal movement of goods. Sales rooms and storage extended over several floors, whereas the offices were usually located in the rear part of the first floor. Most wholesale enterprises on Gay Street combined retailing and wholesaling under one roof. Consumer access is one substantial reason for locating within the city center. But such a location also reflects the economic importance of these enterprises at that time. The wholesale merchants constituted – at least until the turn of the century – the economic and political elite of the city. Wholesale trade (with finished products) therefore formed a functional part of the commercial core until the end of the 19th century. After the turn of the century, as a result of the separation of retailing and wholesaling and together with major changes in transportation and communication, a new location pattern developed. More and more wholesale businesses gave up the expensive location in the city center and moved towards the railroad-warehouse district. The small size of the city prevented the development of more than one specialized section at this time.

In 1917, however, a distinct spatial differentiation of retail functions can be recognized. The growing spatial demand of the new emerging businesses was satisfied by both internal growth and outward expansion. Particularly after the turn of the century, the business district expanded westwards in the direction of the better residential areas (and the L & N railyards). But Gay Street kept its dominant position.

[7] Sanborn Fire Insurance Map of Knoxville, Tennessee 1884, 1890, 1903, 1917 published in New York in 1885, 1890, 1903 and 1917. A similar map has been used for cross-checking: Fire Insurance Map of Knoxville, Tenn., published by Fire Underwriter's Map Association (Cincinnati, OH 1885).

[8] There are generally considerable variations in the accuracy and consistency of different city directories, since they were often compiled in a very cursory manner. For Knoxville in all critical cases the maps proved to be far more reliable than the corresponding city directories.

Fig. 3: Central Knoxville, 1917 (Sanborn index map of the congested district)
Stadtzentrum von Knoxville, 1917 (Sanborn Indexkarte des "congested district")

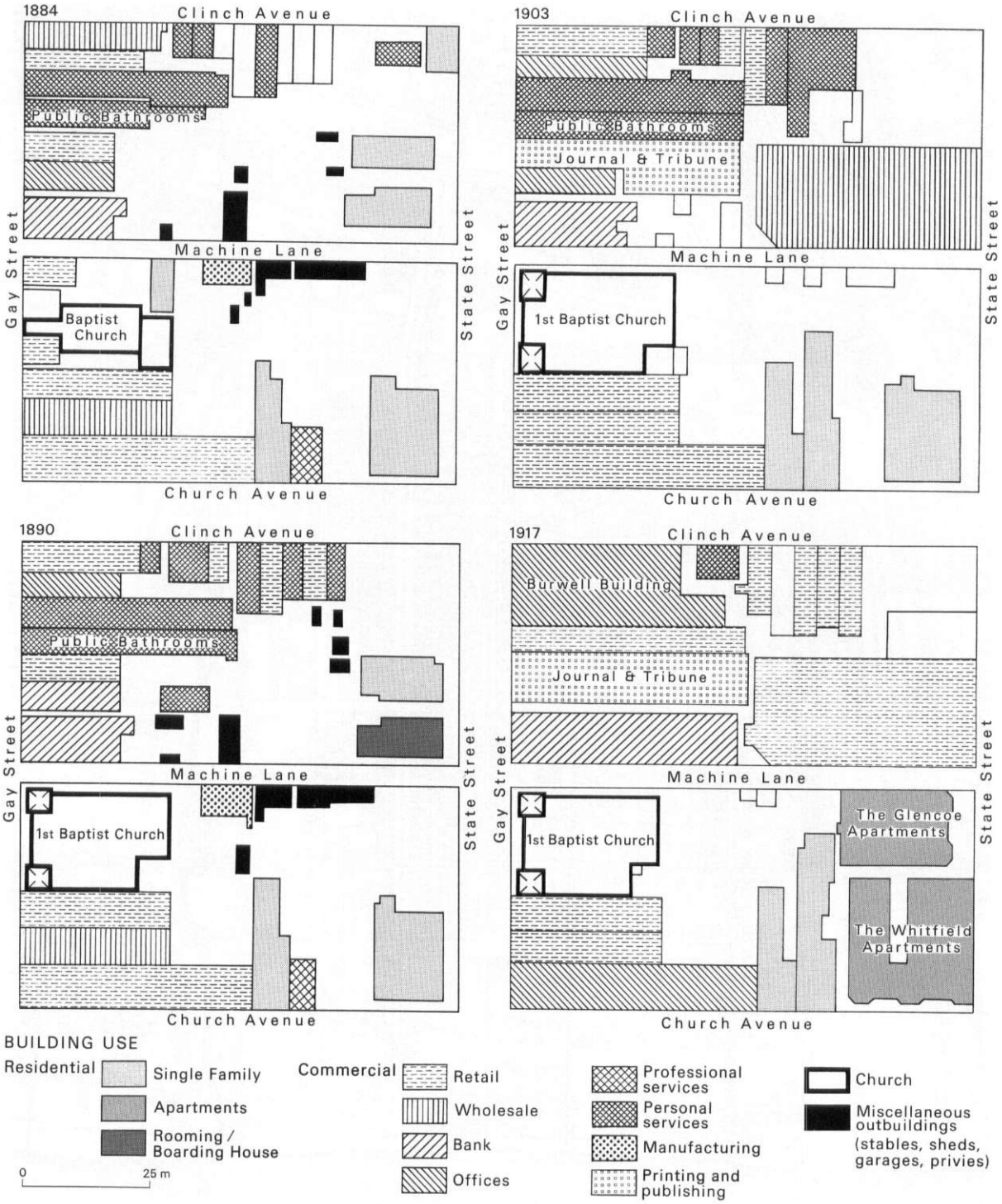


Fig. 4: Evolution of a street block in central Knoxville, 1884–1917
Entwicklung eines Straßenblocks im Stadtzentrum von Knoxville, 1884–1917

Table 1: Morphological and functional change of a row of houses on Gay Street, central Knoxville, 1884–1917
Morphologischer und funktionaler Wandel einer Häuserzeile im Stadtzentrum von Knoxville (Gay Street), 1884–1917

Gay Street	1884			1890			1903			1917		
Building N°[1)]	Use	Height[2)]	Material	Use	Height	Material	Use	Height	Material	Use	Height	Material
1	Wholesale/ Warehouse	2	Brick	Retail	2	Brick	Retail	2	Brick	Offices	10	Steel Frame-Brick Curtain Walls
2	Retail	2/1	Brick/ Frame	Offices	2/1	Brick/ Frame	Offices	2/1	Brick/ Frame			
3	Service	2	Brick	Service	3/2	Brick	Service	3/2	Brick	Offices/ Service 2nd	3/2	Brick
4	Service (Barber/ Baths)	1	Brick/ Frame	Service (Barber/ Baths)	3/1	Brick	Service (Barber/ Baths)	3/1	Brick	Retail	3/1	Brick
5	Retail	2	Brick	Retail	2	Brick	Publishing and Printing	2	Brick	Publishing and Printing	2/1	Brick
6	Offices	2	Brick	Bank/ Offices 2nd	2	Brick	Offices	2	Brick			
7	Bank/ Offices 2nd	2	Brick	Bank/ Offices 2nd	2	Brick	Bank/ Offices 2nd	2	Brick	Bank/ Offices 2nd + 3rd	3	Reinforced Concrete
8	Retail	1	Frame	Church	1-3	Brick	Church	1-3	Brick	Church	1-3	Brick
9	Vacant	2	Brick									
10	Church	2	Brick									
11	Retail	2	Brick									
12	Retail	3	Brick	Retail	3	Brick	Retail	3	Brick	Retail	3	Brick
13	Wholesale	3	Brick	Wholesale	3	Brick	Retail	3	Brick	Retail/ Printing 2nd Service 3rd	3	Brick
14	Retail/ Wholesale 2nd + 3rd	3	Brick	Retail/ Wholesale 2nd + 3rd	3	Brick	Retail	3	Brick	Offices	3	Brick

In 1917 the intersection of Gay Street and Clinch Avenue, framed by the city's three highest buildings, and also an important junction of the municipal street car system, formed the center of gravity of the CBD.

Some significant elements of this transformation process which changed the physical and functional structure of the city center will be exemplified in a microlevel-analysis. The development of a street block in the commercial core will be contrastet with a street block in a peripheral downtown area.

3.1 Commercial core

The transformations in this block reflect the general trend of development within the city center: both the intensity of use and the degree of specialization increase steadily (Fig. 4). The multiplication of offices for brokers, lawyers, insurance agents, bank and company headquarters underlines the affiliation of Gay Street to the commercial core of the city and is, at the same time, the impetus for structural change. By 1917, as a result of new building and change of use, offices became predominant in this part of Gay Street. The floor space occupied by offices in the ten-storied Burwell Building alone exceeds by 2.5 times the total space that is claimed by the retail trade in this block. The different phases of congestion (the built-up density of the block increased from 43% to 70% between 1884 and 1917) and that of the vertical extension (the average building height increased from 1.9 to 3.8 floors) can easily be noticed. At first the vacant courtyards are filled up by accessory buildings, mostly low-cost wood constructions. The existing buildings are enlarged with annexes causing a gradual repletion of

the plots. Where these expansions do not satisfy the continuing demand for space, the old buildings are demolished and replaced by bigger and higher ones. This replacement is often accompanied by the amalgamation of adjacent plots thereby making investments more profitable. And the larger properties are almost completely built up (Burwell Building, Journal & Tribune). Only the three buildings on the southwestern corner of the block (Table 1, Nos. 12–14) remain without any structural changes. In 1884 they are the highest and – with regard to floor space – the largest buildings in the block, and apparently still satisfy the different demands in 1917.

In 1884 the block still shows visible characteristics of the early industrial city. Trade and industry are mixed along Gay Street. Wholesale and retail, warehouses and insurance companies, banks and manufacturers, the Baptist Church, and "The only Bathrooms in the City" exist side by side. The Baptist Church serves as an example of the originally multifunctional use of many buildings in the city center (Table 1, Nos. 9–11). The entrance to the church rooms located in the rear of the building is through a small passage between two shops. One of the shops is occupied by a retailer, the other one is vacant. The connection of such different functions as church and trade in one building is – according to RIFKIND (1977, 63) – a typical feature of many American cities in the preindustrial era. In 1887 this building and two others were replaced by the imposing new building of the First Baptist Church, which was now exclusively reserved for religious purposes (MACARTHUR 1976, 43).

The wholesale business of Oates, White & Co. (Table 1, Nos. 13–14) in the southern part of the block also shows the multi-functional character of the original trade structure with its combination of production (partly carried out in annexes and sheds in the backyard), storage, wholesale, and retail uses. Fifty workers were occupied with the manufacturing of saddles, harnesses, collars, and whips. This large number of laborers is not at all exceptional. On the contrary, other wholesale houses in Gay Street employed up to a hundred workers, underlining the importance of such warehouse-workshop units into the 1880's and even 1890's (Knoxville Chamber of Commerce 1882). The increasing concentration of high order office functions in this area as well as the structural change in trade and production led to the relocation of wholesale functions until the turn of the century.

The difference in rank between trade and industry in the main street and in a side street (Clinch Avenue) already becomes apparant in a comparison of the building sizes. The uses of most buildings along Clinch Avenue could not be identified from the 1884 Sanborn map. In 1890 low status services, such as tailors, cobblers, Chinese laundries, or "Bleaching and Pressing", are dominant.

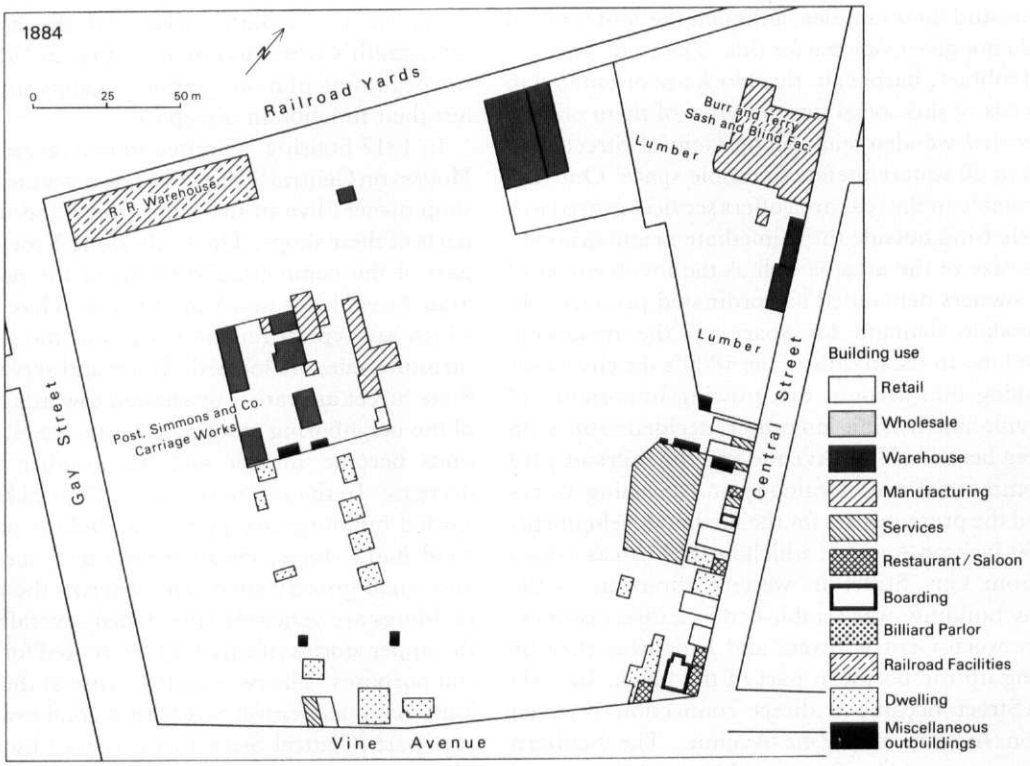
Housing, in the form of detached family houses, was predominant in the eastern half of the block in 1884. This portion was gradually reduced and, in 1917, limited to the southeastern quarter of the block. But the residential floor space increased considerably as a result of the intensification of use, in the form of two three-story apartment buildings with eighteen flats.

Only after the turn of the century did innovations in building techniques and material reach Knoxville, gradually changing the physical character of the city. Until this time the wholesale houses, which had been erected in the traditional fashion (i. e.: brick) during the 1880's and 1890's were the largest buildings in the downtown area with regard to floor space, and the highest with six storys at most. Burwell Building, built in 1907, was the second "high-rise" building in downtown, constructed with the "modern" steel-skeleton structure. The new construction techniques, however, were not limited to high-rise buildings. The building of the Mechanics Bank & Trust Co. (Table 1, No. 7), also built in 1907, was put up as a Fire Proof Construction ("Reinforced Concrete Floors and Roofs, and Brick Curtain Walls") to meet insurance requirements.

3.2 Periphery

Until far into the 1880's the area between city (Vine Avenue) and railroads was little developed and its marshlands were even regarded as dangerous to the public health (GRAY 1976). Fig. 5 a shows the situation in 1884. The building density of 12 % is very low. Two processing companies take up the largest portion. Twenty-five workers were occupied with the production of coaches and wagons at Post, Simmons & Co., whereas the planing mill and factory of Burr and Terry employed forty workers. Both companies were attracted by the large vacant lots (at low costs), favorably located at the fringe of the commercial core and next to the railway. This is also true for the warehouses in the northern part of the area, all of which have direct access to the railroads.

It seems reasonable to regard the houses (one-storied wood constructions) adjacent to Post, Simmons and Co. as the accomodation for the company's



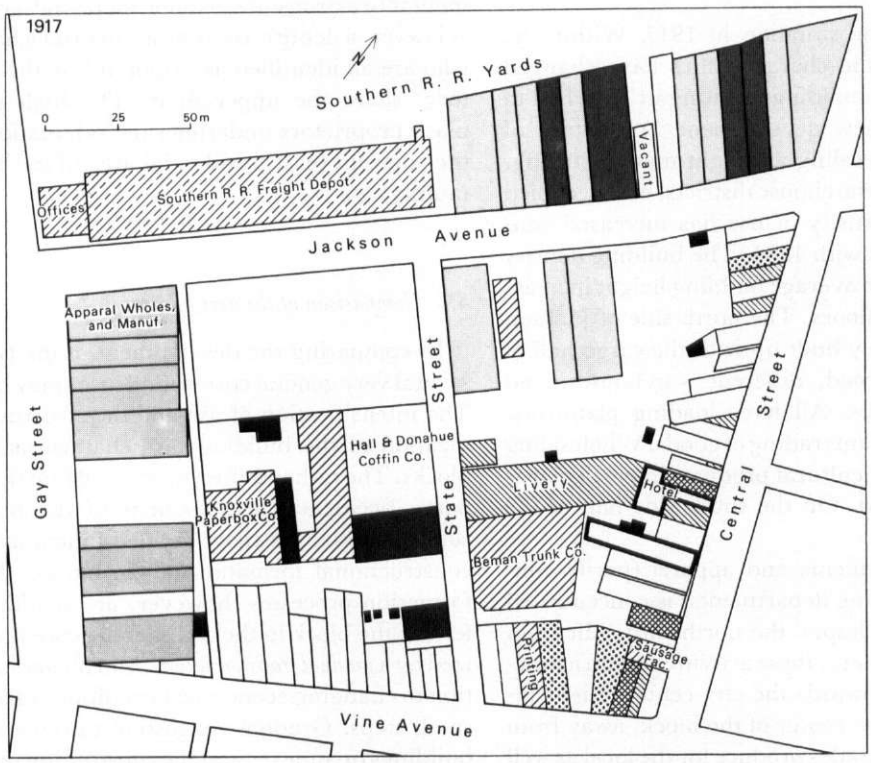


Fig. 5a–b: Evolution of a street block at the periphery of central Knoxville, 1884–1917
Entwicklung eines Straßenblocks am Rande des Stadtzentrums von Knoxville, 1884–1917

workers and their families, although the sources used here do not give evidence for this. The trade and services (cobbler, barber) in this block are orientated to the needs of this social group. Most of them occupy one-storied wooden stalls along Central Street with less than 20 square meters of usable space. Only the livery stable in the rear area offers services geared to a clientele from outside the immediate neighborhood.

The size of the area as well as the involvement of many owners demanded a coordinated procedure to accomodate demand for space on the remaining vacant lots. In the middle of the 1880's the city council, taking into account the growing importance of Knoxville as a distribution center, decided to open up the area between Vine Avenue and the railroad yard for commercial use. Drainage and levelling works created the prerequisites for the further development: in 1890 Jackson Avenue, which in 1884 ran as a dead end from Gay Street in western direction to the railway building, was established as a direct connection between Central Street and Broadway thereby opening up the northern part of the block. In 1903 State Street became a direct connection between Jackson Avenue and Vine Avenue. The Sanborn maps now record Gay Street and Central Street, and also Jackson Avenue and Vine Avenue, as "brick-paved".

Fig. 5b shows the situation in 1917. Within the trapeziform block the characteristics have changed radically. All of the buildings existing in 1884 had to give way for the new development. A mixture of warehousing, wholesaling and light manufacturing, typical for railroad-warehouse districts, now occupied the block. The intensity of use has increased considerably compared with 1884. The building density is over 62%, and the average building height increased from 1.4 to 2.6 floors. The north side of Jackson Avenue is completely built up with the cargo hall of the Southern Railroad, different warehouses, and wholesale companies. All have loading platforms, which allow an efficient trading of goods. Wholesaling of groceries and agricultural products in particular is strongly represented. On the south side half of the plots remain vacant.

Wholesale of garments and apparel (partly connected with processing departments) is concentrated along Gay Street. Despite the northward shift from the core to the periphery, these activities retain a functional orientation towards the city center. Light industry is based in the center of the block, away from the main roads. All trades produce for the local as well as for the regional market, and most of them have additonal offices and shops in the city center. The big livery stable on State Street and the neighboring blacksmith's workshop indicate that in 1917, despite the beginning of motorization, wagons still have not lost their function in transport.

In 1917 housing is limited to two larger Boarding Houses on Central Street. In a few cases the respective shop owners live in the upper story and/or the rear parts of their shops. The trade along Vine Avenue is part of the commercial core up to the point where State Street leads into Vine Avenue. Here the trades which are typical for the margin of the CBD, e. g. furniture sale, are located. Trade and services east of State Street are rather orientated towards the supply of the neighboring working class quarters. The shop units become smaller and the number of storeys decrease. In the northern part of Central Street one-storied buildings are prevalent. Billard parlors, second hand stores, cheap restaurants, hairdressers, and small grocery shops characterize the area. The buildings are generally subdivided several times and the upper stories (if existing) are rented for commercial purposes. The two-storied house at the corner of Vine Avenue/Central Street ist a good example: the rear part (Central Street) ist occupied by a sausage factory with an adjoining meat sale. The front part (Vine Avenue) is subdivided three times in the basement into a drugstore, a tailor shop, and a restaurant. A lawyer, a dentist, two physicians and a hairdresser, who are all identified as "colored" by the city directory, share the upper floor. The high portion of black proprietors underlines the orientation towards the adjacent (east) residential area of the black community.

3.3 Comparison of the development

In comparing the development of the two blocks, several very general correspondences may be noticed. The intensification of use and the structural modernization of the buildings are characteristic of both blocks. The rather diffuse mixture of functions and, in parts, accidental arrangement of the buildings is superceded by a strictly defined functional and also constructional formation of the blocks. The transformation processes, however, are significantly different: the block in the commercial core is characterized by a *gradual transformation.* Morphological adaptation to changing economical conditions takes place in small steps. Gradual congestion through additional buildings or annexes and the substitution of old forms for new ones form parts in a sequence. In general, only individual buildings or small groups of buildings

are involved in this transformation, which depends on the momentum of economical pressure (market forces). As a result, old and new forms exist side by side, at least for some time. The morphological adaptation is often preceded by the functional transformation in the form of change of use.

The transformation of the block at the periphery, however, takes place as a *singular and comprehensive transformation.* The important aspect of this transformational process is the clearing of large areas and their subsequent complete re-arrangement. This process is costly and usually requires administrative regulations (public intervention). The radical break in the development is connected with the dislocation of the original use and a totally new arrangement of the plot pattern. During the time period considered in this study this form of transformation appears only twice: once in the development of the trade area between Vine Avenue and the railroad (as described above), and again in the establishment of the L & N railroad yards after the turn of the century. This second case implies an even more drastic change. It was connected with filling up the Second Creek for several hundred meters, extensive levelling work and the dislocation of roads. Along with some trades, more than forty residential buildings had to give way to the redevelopment. In the 1930's this form of city transformation became important for the building of breakthrough roads, and reached its climax after World War II in the drastic "renovation" of the city's slum areas through the construction of a beltway – the "downtown loop".

4 Conclusion

The applicability of fire insurance maps to historic geographical urban research exceeds by far the example presented here. For numerous cities the map series were continually updated until the 1960's and 1970's. Therefore the maps can become a fundamental tool in a morphogenetic city analysis, explaining the evolution of recent city structure, and offering an important contribution to townscape conservation and city planning. The uniformity and thus comparability of the maps, even by different publishers, opens up the possibility of studying regional differences in the internal development of the cities and the distribution of technical (structural) innovations on the continent, creating a basis for research on the formation of regional subtypes of the North American city. Using the detailed information documented in fire insurance maps together with a wide range of possible supplementary sources (census manuscripts, street and business directories, and photographs) permits a better and deeper understanding of the processes, rates, and agents of change which form the urban landscape.

The discovery of further map series, the publication of new, more complete map inventories, and the growing availability of some of the map series on micro film[9] will stimulate more frequent use of the material in the future. No comprehensive history of fire insurance cartography, covering the origin, distribution and function of the maps, yet exists. Nevertheless fire insurance maps represent a substantial tool for historical-geographic urban research in North America.

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[9] For a review of some of the available material see: Karrow (1985).

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