

Notes on a New Pattern and Process of Physical City Development: The Web Theory

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Introduction

During the past few decades, urban geographers and specialists in other fields have been referring to, using in their research, and republishing three theories (or generalizations) of city development. These theories are: 1. **concentric zone** 2. **sector** and 3. **multiple-nuclei** (4, 5). But in these decades another pattern of physical growth has evolved that needs to be identified, described, and interpreted. This new pattern and process is now conspicuous and distinctive both in the urban landscapes of large political cities, in metropolitan areas and in megalopolises where cities have coalesced or are now coalescing and also in the countryside between the cities. Tentatively, the author has labeled this new pattern and process, the *web* theory (Fig. 1). This development is oriented to the transportation-utilities-communication systems forming the circulatory arterials of urban and rural areas. The adjacent urban land use associated with primary circulation systems results in two landscapes. Within the agglomerated cities and megalopolises the transportation-utilities-communication arterials are paralleled by business-industrial land use with the spaces between the threads of the web or net occupied by less intensive land use, primarily residential. In the countryside, the arterial threads are paralleled by urban use, often primarily residential, and the interspaces or meshes are occupied by rural land uses such as cultivated land, pasture, haylands and forests. Both patterns of development produce web or net landscapes of contrasting intensive and extensive land use.

The Web within Cities

The web threads or corridors of this new pattern consist of primary free-access arterials and their associated businesses and industries. Primary arterials with their associated types of transportation, utilities and communications are the lifelines of a city. Fronting on the arterials are strips of commercial, service and industrial structures which vary in widths from half a block to several. In some places these strips or corridors (1) may be wide for several blocks and then may pinch out in the next two or three. Sometimes the corridors of intensive business-industrial use are so wide that in some places they become wider than the meshes of the web.

Parking lots in these corridors of business-industrial use are interspersed and in many places appear to occupy over fifty percent of the land surface. Sometimes these lots have frontages on the primary arterial but often they are located behind the structures.

The meshes between the threads or corridors of the web are occupied by less intensive uses of land such as single-house residential areas, schools and their playgrounds, churches and graveyards, parks and other recreational uses, and also by vacant land.

Business - industrial Web and Residential Meshes

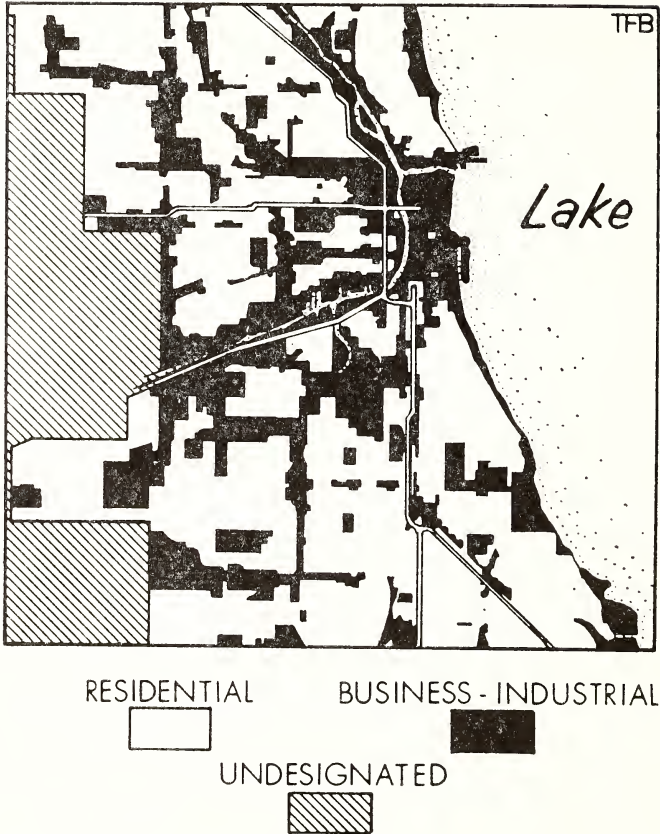


Figure 1.

In the core of this city pattern, like the web of a spider, the arterials and their associated intensive uses form a solid nucleus. Adjacent to the core the web is more closely meshed. Branching out, there seems to be a tendency for the interspaces to become wider and wider. The writer has observed that generally as the meshes become wider the threads or corridors of business-industrial use often become narrower. Corridors are especially narrow or pinch out in recently constructed residential areas—especially in those developed since the end of the Second World War. However, the business-industrial corridors not only reappear but become wide near the urban fringes where large blocks of land are occupied by shopping and service centers and industry. Here in the peripheral areas or former peripheral ones now

engulfed by urban expansion, large blocks of land have been occupied since 1945 or are zoned for business and industrial use. However, regardless of the widths of the strips in the business-industrial corridors, the web or net they form does enclose or nearly enclose residential areas. The number of these enclosed areas increases as they are subdivided by present discontinuous corridors that join to form another mesh in the web or net.

Viewed from the air. When viewed from a low flying plane (a few thousand feet above the earth's surface) this web of intensive land use is conspicuous whether seen in the dark of night or the light of day. At night the headlights of cars and trucks, the flashing electric advertising signs, and the lights of streets, stores, offices and industries brilliantly illuminate the arterials and their parallel bands of intensive land use. The lights of major streets, freeways and expressways are quite vivid on aerial photographs taken at night. These almost treeless areas stand out in sharp contrast with the poorly illuminated and often tree covered meshes between the threads. In the daytime the threads are again distinctly visible partly due to the moving traffic and the treeless band of intensive land uses appearing as corridors through the wooded residential areas. Residential areas in arid land cities are not always as obscured by trees as residential areas in humid lands.

Viewed on aerial photographs. Aerial photographs of urban areas taken during the day or at night clearly and unrefutably substantiate the writer's observations that both the threads or bands of the intensive land use web and their less intensively used interspaces can be mapped from aerial photographs.

Viewed on urban maps. Land use maps substantiate the presence of a web pattern. On maps showing land used or zoned for residential use, one notices that the residential areas are often surrounded by other uses of land. And maps of large cities showing business and/or industrial land uses also indicate the threads or corridors. The web often becomes more distinct if an acetate map showing land zoned for commercial and industrial uses is superimposed upon one showing only that of the commercial and industrial.

Less visible elements. Some elements of the urban web development show up on maps that cannot be seen by one driving a car along the threads of the web, flying about cities or reading aerial photographs. Water, gas, sewage, storm water, telephone, electric and subway systems are often located under pavements or under the unpaved right-of-ways.

Distribution. The writer has examined land use maps for most of the cities with over a million population and the web pattern is conspicuous. Although not as extensive, the web or net pattern of urban physical growth is also distinct in cities with populations from 500,000 to one million. This pattern, in addition to being obvious in Indianapolis where the writer noticed it nearly two decades ago, also shows up distinctly in Milwaukee, Minneapolis, Denver, Atlanta and other cities of this size.

In Indiana cities with populations of over 100,000 but less than 500,000 (Fort Wayne, Gary, South Bend and Evansville) the web pattern

is present but not as extensive as in larger cities. Terre Haute, Indiana, with a population of only 72,500 in 1960, has a well-developed net pattern.

The pattern appears to develop best in cities that have comparatively level sites and are surrounded by or located on extensive plains. Pittsburgh, Pennsylvania, apparently because of its rugged terrain does not have such a pattern.

The Urban Web in the Countryside

The threads of the web which are enmeshing huge blocks of the rural land also consist of major circulation systems flanked by corridors of intensive land use. The arterials here are major and all-weather roads. Since the end of the Second World War, strips of non-farm structures fronting on highways extend for miles and miles along both trunk highways and what were once country roads serving the farm families. This growth, sometimes called ribbon or strip development, parallels one or both sides of a highway between larger cities and surrounding smaller ones and villages.

Whereas in the cities the primary uses of land fronting on the arterials are business and industrial, in the countryside, residences occupy most of the land in the corridors. In contrast with the situation in the cities where single-family residences are a less intensive use of land, in rural areas the residential use is a relative intensive one. The value of land for residential purposes is greater than if it were used for cultivation, hay, pasture and forests.

In the rural areas most of the parcels of land fronting on the arterials are occupied by non-urban and non-farm dwellers. These daily nomads sleep in the country in houses modernly designed and furnished, but they work in cities. Small businesses, services, and light industries are interspersed among the residences.

Paralleling the all-weather highways are telephone and electric power lines and more recently gas, water and sewer mains.

The threads of the web development occupy a very small percentage of land in the countryside. But already the non-farm dwellers living in these urban corridors outnumber the farmers living in most of the counties east of the Mississippi River and north of the Ohio. In fact, there are few, if any, states in the United States in which full-time farmers and their families make-up over half of the population (2).

Interpretation of City Web Pattern

The web pattern of intensive land use in cities is related to economic factors, the flow of people and goods, and the metabolism of a city.

1. Economic factors. Land fronting on good transportation arterials will have higher values and will in turn support more intensive uses of land. Most strip-located businesses and industries rely primarily on truck transportation and are often associated with adjacent or nearby supporting activities in the strips which have their own or use public trucking lines.
2. Flow of people and goods. Prior to the industrial revolution people who daily went to work in the countryside returned to the city at night

for protection bringing with them food, animals, fuel, raw materials from forest and mines and sometimes water. Government and cultural structures and uses occupied the center of the cities. Markets and cottage industries were scattered throughout the residential areas.

During the industrial revolution in most countries, factories and businesses located in cities adjacent to the central market place; or in the United States these were found around the village green and later around the courthouse.

But all-weather roads, the gasoline motor age and electronics have freed man from a center-focused city with its central core and traffic congestion. During the last half of this twentieth century, the spread of the city not only involves suburban subdivision spread and sprawl but the migration of business-industrial use of land to circulation systems with numerous transportation, utilities and communication facilities resulting in business-industrial corridors. Residential areas fronting on these "zones of flow" were and still are often quickly rezoned for more intensive land use. Today many city dwellers seldom fight the traffic which focuses on a core of the city; rather, they drive to work or shop in the peripheries of cities or in the non-core business-industrial corridors. Many if not most of the intracity and intercity trucks never enter the central core of large cities.

Technological improvements, such as central heating and air conditioning, odor, smoke, noise, and waste control, and landscaping, all help make ribbon development of business and light industry less objectionable to low and middle income residential owners. The enclosure of residential islands by ribbons of business-industrial development is no longer as obnoxious as formerly. Today many city, county and metropolitan planning commissions are deliberating zoning land for business and industrial use along primary arterials which enclose residential areas. Consequently, in the future, the process of residential island development will quicken in tempo.

3. **Metabolism.** The flow of water, gas, electricity, food and raw materials into the city and that of manufactured products, wastes, and rubbish out of it is sometimes called the city's "metabolism" or its "input" and "output." This flow, whether in trucks or pipes, is obviously the greatest along primary routes. As these materials move into the residential areas from all sides the size of the distribution systems, whether water pipes or streets, logically become smaller and smaller when servicing single-family houses in a residential area. The collecting systems of wastes such as sewage and storm sewers become larger and larger as the wastes from individual houses and then from entire blocks are collected and conducted to the primary pipe along the arterials.

Interpretation of Web Pattern in the Country

The urban land use webs, which continue out from the city into the countryside engulfing extensive areas of the rural land near cities, appear to thrive in a habitat based upon and encouraged by increment in land values; access to "city" services; accessibility of electric power and machines; relatively low-priced land; and attitudes of people.

1. Increment in land values. The state and federal government builds all-weather hardsurfaced highways without taking title to the adjacent land which fronts these roads. Consequently, the fortunate owners with land abutting these publicly-financed highways have the value of their property increased far above its original cost without their investing in the improvement. Moreover, since the primary roads are built with state and/or federal taxes, the local landowners are not taxed. In reality the road becomes a street for ribbon or strip urban development.

2. Access to the city and its services. Flow on these arterials is in both directions. These all-weather highways are helpful in emergencies enabling city ambulances and city firemen and police to help non-farm and non-urban people who are in distress whether they support the services with inadequate taxes or any at all. Also these all-weather roads permit trucking services to daily deliver food products, newspapers, gasoline and other necessities from the political city to these ribbons of development. Along these rural "streets," workers and school buses drive into the cities in the morning and out in the evening. Regardless of the weather, whether it is clear or raining, the gasoline-powered vehicle carries the traffic and only a rare blizzard or ice storm creates an emergency. The highway has brought many of the assets of living in the city to the countryside.

City services have also been or are being brought to these nets of "rural-urban" growth. Both privately-owned and city-owned service systems parallel the highways and occupy the right-of-ways. First came rural telephone systems. Next, in the 1930's the federal government encouraged the construction of electric systems to service people living along the highways. Now in the 1960's the federal and state governments are subsidizing rural water and sewage systems. The cities often own and operate the water and sewage treatment plants and provide these services to the rural systems. The rural systems are primarily used and owned by the non-farm urban people living in the urban ribbons or threads of this web pattern superimposed on a rural landscape. These people and their structures form a "city" but its shape is a net or web, not a compact area as the conventional city that developed during the past several thousand years.

As the primary lines of telephone, electricity, water, gas and sewerage are extended out from the city parallel to the all-weather highways, the potential number of their users skyrockets.

3. Electric machines and machinery. In this electronic age, industries can and are moving out of the cities and occupying sites in the ribbons or strips along the primary arterials. Apparently, in the future, settlements may well be an infinite variety of retail, service, industrial and communication centers appearing as nodal areas on a web of countryside urban land use. In a truly capitalistic society distances and relative costs of distribution and collection systems might have deterred this development, but today government subsidies at federal, state, and sometimes county and city levels only accelerate the process.

4. Low priced land. Although the construction of the trunk highway has added "unearned" value to the adjacent farm land, its value for

urban purposes is much lower than that of the building sites in the city. An acre-size residential lot in the city fronting on a paved street paralleled by water, sewage, gas, electric and telephone lines may be listed on the market at \$10,000 or more. In the country the same size lot with the same services might only cost one-half or one-third as much.

5. Attitude of people. The white "flight to the suburbs" has been going on for several decades and has been the object of numerous research papers. Many of these articles, bulletins and books stressed the economic and social reasons for this abandonment of older residential areas adjacent to or surrounding the old business-industrial core. It was not until 1966 that the Gallup Poll indicated that 40 percent of the Americans interviewed "look wistfully on the small town and farm as the ideal place to live" (3). The poll indicated that although only about a third of the people in the United States live in rural areas or in small settlements of 10,000 or less, 49 percent of those surveyed said "they would like to live in a small town or on a farm if they could live anywhere they wished" (3). Only 28 percent expressed a desire to live in suburbs, 22 percent in large cities (more than 10,000) and 31 percent in small towns. It is obvious that 49 percent of the Americans cannot and should not live on farms or in small towns. However, more and more people are substituting "acreages" fronting on major highways for their ideal—"living on a farm." These acreages often have accessibility to city living on one side and a farm view on the opposite. There is always the danger, of course, that the land to the rear of one's property may be sold to an urban developer. The acreage owner sometimes attempts to protect himself against this possibility by buying an area large enough so that he can subdivide his holding into smaller parcels or sell it to a developer. Some potential owners prefer to spend \$6,000 for ten acres of land with a 660 foot frontage on a highway rather than \$6,000 for a lot in a city with a hundred foot frontage, especially if the city lot is serviced by a macadam road with no curbs or sidewalks.

Conclusion

This article is written primarily to call attention to and identify a new theory or generalization concerning the physical pattern of city growth. To show how the urban web pattern with its business-utilities-industrial threads or corridors encloses and as growth continues subdivides residential areas and produces residential "islands" of various sizes. The partially-enclosed residential areas both within and on the periphery of the web pattern indicate that additional residential subdivision will occur.

Even in its initial step of formation, this theory may aid city planning by: 1. helping to justify the planning and constructing of both city and private services in the new primary arteries on fringes of the geographic city before the construction of stores, offices and factories begin; 2. supplying a defense for the zoning of land along the primary arterials for business and industry; and 3. zoning the location of business-industrial corridors to regulate the size of residential islands or communities so that these may be more economical and viable.

In fact, the development of multiple distribution systems—of streets and transit lines; water, storm water and gas mains; below-surface telephone and electric wires and other forms of transportation, utilities and communication both public and private—may provide the means of controlling patterns of urban development.

Or should this web growth be malignant, techniques need to be made and implemented to arrest, stop and, if possible, destroy and even remove part of the present web pattern. However, the writer feels that the present web growth and pattern are so extensive and well entrenched in numerous large cities in the United States, that they will remain as challenges for decades.

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