The Net of Mixed Beads

Suburban Office Development in Six Metropolitan Regions

Gary Pivo

In the past few decades we have witnessed an explosion of suburban office development, but we are only beginning to understand the pattern of development that is emerging. In this article six longitudinal case studies are used to test the validity of four descriptive theories of office suburbanization. Urban villages, office corridors, and other popular theories prove to be too simple to capture the actual complexity in the case studies. A more complex pattern is evolving in which the majority of office space is located outside the regional CBD, with some scattered away from freeways, but most located in a large number of small and moderate-sized, low intensity clusters along freeway corridors. It will be important to evaluate the impacts of this emerging pattern on various planning issues and to better understand its underlying causes, if city planners wish to alter current trends. A new metropolis is upon us, and we need to understand what will be a critical element of the twenty-first century metropolitan region.

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During the past twenty years there has been a "radical restructuring" of metropolitan America (Berry and Cohen 1973). Explosive suburban employment growth, declining residential densities, and cross-commuting have altered the character of the modern metropolis (Cervero 1989, 1986a; Pisarski 1987; Gottdiener 1983; Richardson and Anjomani 1981; Berry 1976; Masotti 1973). Meanwhile, we have seen the economy shift its basis toward service industries and office employment (Armstrong 1979; Clark 1982). This change caused the nation's office stock to double between 1959 and 1979 and to nearly double again between 1980 and 1990 (Armstrong 1979; Schwartz 1979; Urban Land Institute 1987).

As a result of these trends, most of the nation's office space is no longer found in central business districts. By 1986, 57 percent of the nation's office space was located outside of urban downtowns (Fulton 1986).

The intrasuburban pattern of office development has become an important focus for urban planners. Our plans must take into account proposals for large and small office projects in a variety of locations that place new demands on infrastructure systems and stimulate additional urban growth. Concern about traffic congestion in particular and its relation to land use has caused some cities to limit the size of office concentrations, while it has prompted others to seek greater densities and mixed land uses in order to facilitate transit and paratransit. In general, the intrasuburban form of office development is related to a variety of physical, environmental, and social issues that are important to urban planners.

Scholars have been studying suburban office development for over 30 years (Foley 1956; Tarpley et al. 1970; Goddard 1975; Daniels 1974; Quante 1976; Nelson 1983; Kutay 1986; Pivo 1988a, 1988b). However, much of their work has focused on how many offices have located in the suburbs compared to central cities, and the reasons. There have been almost no studies of the pattern of office development within suburban areas. Some studies of individual regions are available, but so far no one has compared the evolution of suburban office development in different regions over time (Baerwald 1978; Hughes and Sternlieb 1986; Tarpley et al. 1970; Vahaly 1976). Such a comparative analysis is needed for us to gain a general understanding of suburban office development.

This article describes differences and similarities in the intrasuburban pattern of office development in six metropolitan regions. A pattern is emerging that is not reflected in most of our existing descriptive theories. The office buildings tend to be located in small, low intensity clusters. Only a few larger clusters contain a substantial share of the total office stock. Nearly all of the clusters are built along one or more freeways, with concentrations becoming larger and more intense where freeways come together. Rather than forming themselves into urban villages, scatteration, or freeway corridors, the six regions combine these familiar archetypes into a more intricate pattern of office development. Hence, actual office sub-

urbanization in the study regions is more complex than our models would lead us to believe.

Four Descriptive Theories

Before discussing the six study regions, it would be useful to review what has been said in the literature about the intrasuburban form of office development. Four descriptive theories have been developed. They will be referred to here as scatteration, clusters, corridors, and a combination of the three. Each theory describes, and to some degree explains, an alternative view of the emerging pattern of office suburbanization. The theories' validity in each of the study regions will be discussed further on.

Scatteration is low density office development that spreads randomly across the suburban fabric and is not associated with any particular focal points or activity centers (Blumenfeld 1964). It is a basic element of Fishman's "technoburb," which he describes as "a hopeless jumble of housing, industry, commerce, and even agricultural uses" (1987, 186). Scatteration would tend to be predicted by a theory of urban form that sees the metropolis as monocentric, with employment density gradients that decline with increasing distance from the central city (Mills 1969; Niedercorn 1971). It also goes along with counterurbanization and despatialization models that include falling density gradients and eroding peaks caused by communication technology, which has reduced the need for employment concentrations (Kain 1975; Berry 1981).

Suburban office clusters are a more common pattern used to characterize office development. They have been referred to by many names, including urban villages, outer cities, suburban activity centers, and suburban downtowns. They are typically described as high density concentrations of traditionally urban jobs and services amid lower density development. Various explanations for them have been offered, including the desire for accessibility and shorter journeys to work, agglomeration economies, the attraction of prestigious locations, the need for visibility, and the tendency to "follow the leader" to already successful development sites (Leinberger and Lockwood 1986; Beers 1987; Fulton 1986; Birdsall 1980; Muller 1981; Fulton 1986; Cervero 1986b; Romanos et al. 1988).

Suburban business clusters were mentioned in academic journals over 60 years ago. Burgess wrote in 1925 that businesses in outlying areas were growing in "centralized decentralized systems." In 1945 Harris and Ullman proposed a "multiple nuclei" theory of urban form (1945). By 1962 suburban nuclei were thought to be increasing in importance (Ullman 1962) and by 1970 metropolitan areas were being described as "multinucleated" (Hoover 1968; Hawley and Rock 1975; Gottdiener 1983; Erickson 1983).

The theories of scatteration and clustering are not consistent with each other. If suburban offices are locating in clusters, then the scatteration theory would need to be amended to account for employment concentrations. Erickson (1983) has begun this reconciliation with his stage theory of suburban spatial change.

A third theory points to a suburban growth or freeway corridor pattern characterized by low-density office development along freeway routes. Office corridors have been explained by their public visibility and their accessibility to labor, clients, and contacts (Berry 1959; Hoover 1968; Manners 1974; Baerwald 1978; Hughes and Sternlieb 1986; Cervero 1986b).

A combination of scatteration, clusters, and corridors has also been suggested to characterize suburban office development. This theory is based on the notion that different types of office firms or different functions within firms have their own locational preferences and that improvements in telecommunications have allowed these entities to seek their optimal location while still maintaining adequate linkages with other firms and departments (Foley 1957; Vahaly 1976; Baerwald 1978).

Methods and Data Sources for the Study

The six metropolitan regions selected for this study were Los Angeles, San Francisco, Seattle, Houston, Denver, and Toronto. These regions were chosen because comparable data were available for them and because they vary in size, location, land use policies, and transportation systems. Older, eastern and midwestern regions were not studied because comparable data were not available. This aspect of the study should be taken into consideration when generalizing from the findings.

Toronto was included in the study because of its significant difference from U.S. regions and to see if any similarities might be found among regions from different nations. A recent study examined in depth how Canadian cities differ from U.S. cities in social structure, economic organization, political culture, urban form, access, and other factors that could affect office development patterns (Goldberg and Mercer 1986). The study showed, for example, that Canadian urban areas are more compact than those in the United States, experience a greater degree of suburbanization, and have lower status differences between the inner and outer cities, with the former retaining their traditional family-oriented households. In devising the present study it was thought that any differences or similarities in office development between Toronto and the U.S. cases could provide interesting clues to whether these basic differences influence the form of office suburbanization. The reader is warned, however, that generalizations from Toronto to U.S. cities should be made with great caution because of their fundamental differences.

The study was comparative and longitudinal. Data on the address, age, and size of individual office buildings that existed in 1960, 1970, 1980, and 1988 were collected, and trends within and among the regions were compared. Data were taken from Black's *Office Leasing Guide* for Los Angeles, San Francisco, Denver, and Houston (McGraw-Hill Information Systems 1986, 1988).

Data for Seattle and Toronto came from government and private agencies. Offices attached to industrial facilities or located in owner-occupied buildings were not included in the study.

Non-CBD office space, defined as office space outside the central city central business district, was used in this study as the measurement of suburban office space. Office space in suburban cities alone was not used because of the large variation in the size of the central cities in each region. For example, in the Los Angeles region, the central city of Los Angeles includes areas, like the San Fernando Valley, that would normally be designated as suburban cities in other regions. Therefore, figures for non-CBD office space are more comparable from region to region and better measure the decentralization of office space than figures for suburban office space. This should be taken into consideration when interpreting the results of this study.

Office Space Growth and Clustering Since 1960

Total Office Space Inside and Outside the CBD

The growth of office space in each region since 1960 is shown in Figure 1. In 1960 all of the regions for which data were available had less than 25 million square feet of space. By the late 1980s the total had increased by two- to ten-fold, depending on the region. The growth in some regions far outpaced that of others, increasing the difference among the regions.

Figure 2 shows the decline in the CBD share of office stock in each region since 1960. The percentage in 1988 ranged from 13 to 59 percent. The CBD share of the nation's office stock was 43 percent in 1986 (Fulton 1986). The Toronto CBD is notable because it retained the highest share of its region's office space and has been nearly stable since 1970. The period of most rapid decline occurred at different times in each region. For example, it occurred during the 1960s in Los Angeles, the 1970s in Denver, and the 1980s in Seattle and San Francisco.

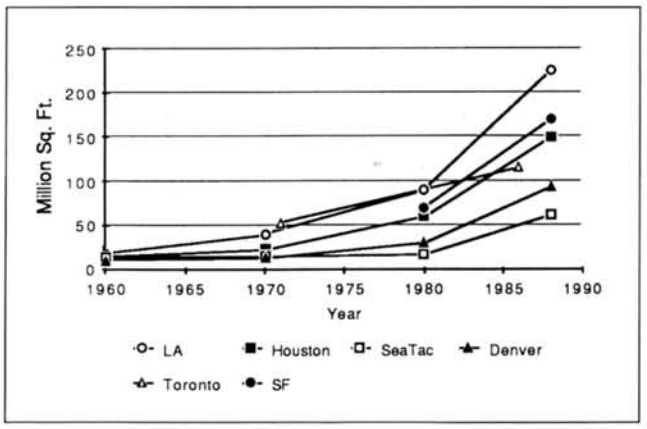

FIGURE 1: Regional office stock for the six study regions.

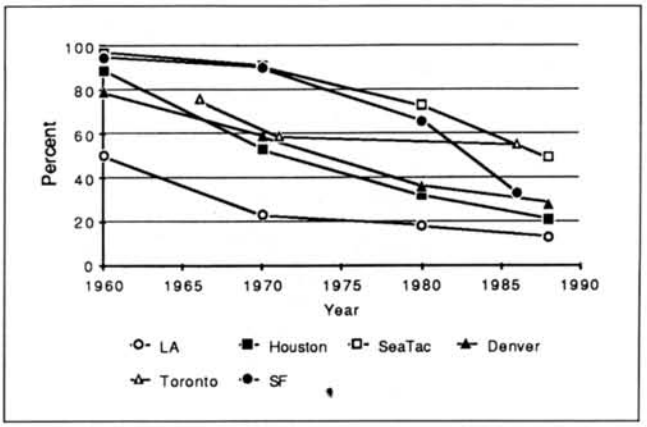

FIGURE 2: The percent of office stock in the six CBDs.

Thus, over a three-decade period the regions have converged in their levels of CBD office stock. It will be interesting to see if this convergence continues in the future. The current trend could indicate the presence of a more general restructuring process whereby, as regions grow, their CBD shifts to a lesser role in the regional office market.

The Clustering of Non-CBD Office Space

For three of the regions data were collected on the percentage of non-CBD office space located in and out of office clusters in 1988. A cluster was defined as two or more office buildings separated by one-quarter mile or less. This distance was selected because the concept of a cluster was intended to describe a pedestrian-oriented unit of analysis. Table 1 shows that in the three regions in 1988 nearly all of the non-CBD office space was located in clusters of two or more office buildings.

The Number of Non-CBD Office Clusters

Figure 3 shows that since 1960 the number of clusters in each region increased at a fairly even pace. By 1988 each of the six regions contained from 33 to 273 clusters.

At any point in time during the study period regions with more office space contained more office clusters. This relationship is illustrated by Figure 4, which gives the least-squares regression lines for the number of non-CBD clusters in each region plotted against the total amount of non-CBD office stock in the same region at various points in time. Figure 4 shows, for example, that

TABLE 1: The percent of non-CBD office space in and out of office clusters

Region	% Clustered	% Not clustered
Los Angeles	90	10
Houston	89	11
San Francisco	86	14

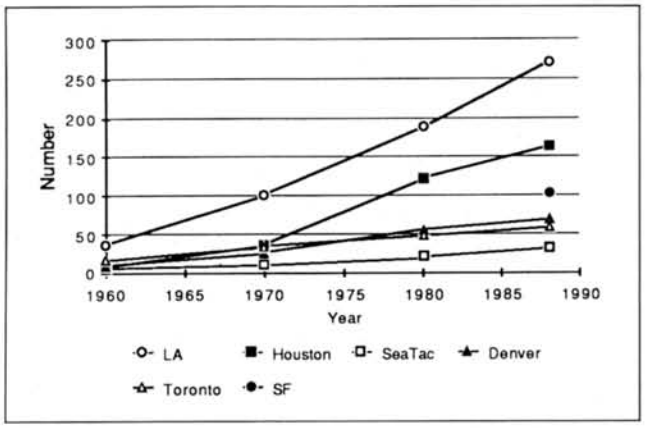

FIGURE 3: The number of non-CBD office clusters.

a region with 50 million square feet of non-CBD office space in 1988 would be expected to have 50 non-CBD clusters. Table 2 gives the regression coefficients for each year, and shows the extremely strong relationship between the two factors.

One might be tempted to use the regression line at any point in time to make predictions about the number of non-CBD clusters that will exist in a region in some future year. This would be a mistake, however, because the slopes of the regression lines have become flatter over time, making it impossible to use a regression line at one point in time to make predictions about future time periods. For example, a region with 50 million square feet of non-CBD office space in 1970 would have been expected to have 167 non-CBD clusters. However in 1988 a region with the same amount of office space would be expected to have only about 50 clusters.

Although the regression line has been shifting, the relationship between non-CBD office space and clustering has remained strong. Assuming that this relationship will continue, the projected line for the year 2000 is drawn on Figure 4 based on the linear extrapolation of the

TABLE 2: Regressions of non-CBD office stock (millions of sq. ft.) and number of non-CBD office clusters

Year	n	a	b	R square	Significance
1960	5	4.48	4.7	.969	.0023
1970	5	12.10	3.1	.984	.0009
1980	5	−4.30	2.9	.958	.0036
1988	6	−29.80	1.6	.915	.0028
2000	—	−34.00	0.5	—	—

regression coefficients from the previous years, given in Table 2. The projection indicates that regions will be adding new clusters at a slower rate relative to the addition of new office space. This means that existing clusters will grow larger, or fewer but larger new clusters will be added, or both.

Within each region a strong correlation also was found between the size of non-CBD office stock and the number of non-CBD office clusters at various points in time. Figure 5 illustrates this relationship. The curves are concave, indicating that the amount of office stock is growing faster than the number of office clusters. This is consistent with the results from Figure 4.

The Size of Non-CBD Office Clusters

The trend in the size of non-CBD office clusters is shown in Figure 6. By the late 1980s the median cluster size in the study regions ranged from 219,000 to 525,000 square feet of office space. This is much smaller than the central city downtowns, which contained between 25 million and 47 million square feet of office space.

While most clusters were small, each region had several larger clusters in 1988 that contained a large share of the non-CBD office stock. Figure 7 illustrates this with a Lorenze curve. For the five regions where data were available the cumulative percentage of office space in the non-CBD clusters was plotted against size-ranked percentiles of office clusters (i.e., the largest 10 percent,

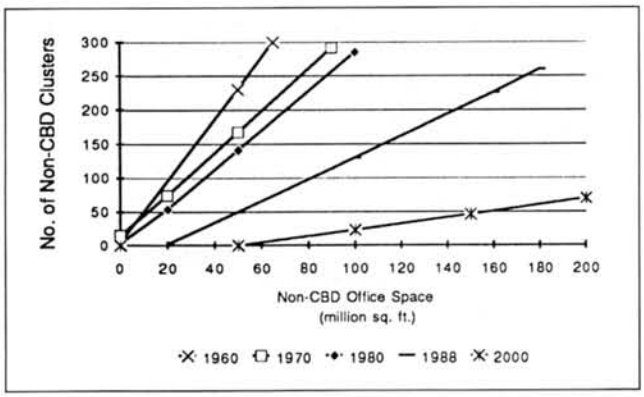

FIGURE 4: Regressions of regional non-CBD clusters and office stock in all regions.

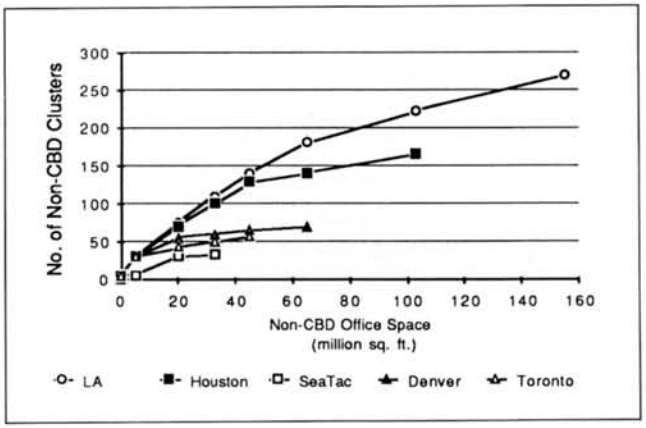

FIGURE 5: The number of clusters versus the amount of non-CBD office stock in each region.

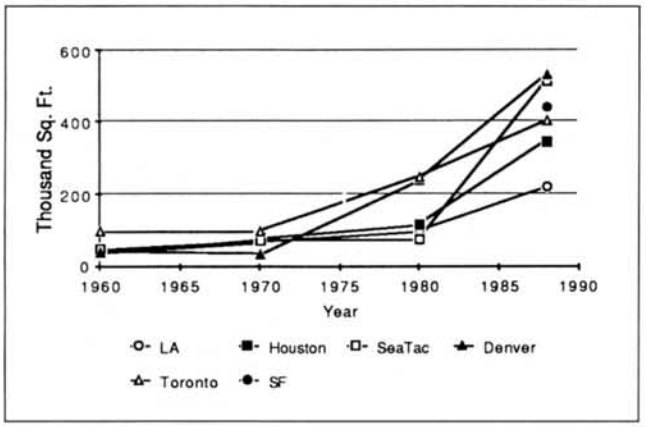

FIGURE 6: Median cluster size.

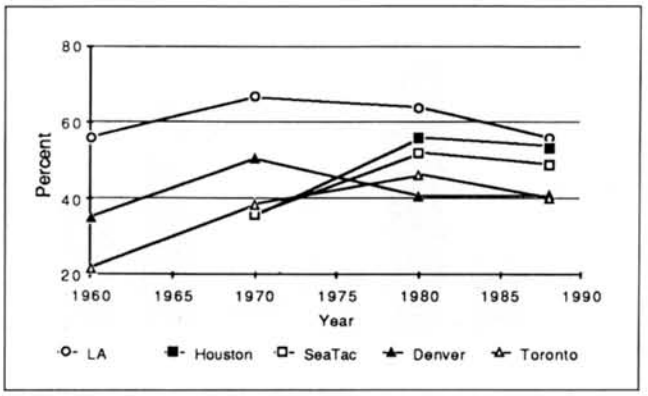

FIGURE 8: The percent of cluster stock in the largest 10 percent of the clusters.

25 percent, 50 percent, and 75 percent of the clusters). The curved lines show the actual distribution in the regions and the diagonal line shows what the distribution would be if all clusters were the same size. There was a generally consistent size distribution pattern among the regions. The largest 10 percent of the clusters contained about half the office space, the largest 25 percent of the clusters contained about two-thirds of the space, and the largest 50 percent of the clusters contained about 90 percent of the space.

During earlier study periods the largest clusters increased their share of the non-CBD office stock, but during the 1970s or 1980s the trend was reversed, depending on the region. This reversal is illustrated in Figure 8. The very largest clusters are no longer increasing their share of the new office space, even though they are still growing. The smaller clusters are gaining on the larger ones, creating a more even distribution of office space among the clusters in any given region. This would be represented by a falling curve in Figure 7.

The largest clusters in each region were still modest in size compared to typical regional CBDs, even though they contained a large share of the non-CBD office space. The average size of the largest 10 percent of the clusters in each region in 1988 ranged from 3.5 to 6.5 million square feet. This was one-fifth to one-tenth the size of the region's CBD.

Each region had a single largest "primate" cluster in 1988 that contained a substantial portion of the suburban office stock. These clusters were anywhere from two to four times as large as the next smallest cluster and contained from 10 to 36 percent of the non-CBD office stock. They ranged in size from 9 million square feet (downtown Bellevue in the Seattle region) to 23 million (Silicon Valley in the San Francisco Bay Area) and approached the size, but usually not the intensity, of central city CBDs.

Since 1960 the primate cluster in every region except Seattle has contained a decreasing share of the suburban office stock. This is illustrated by Figure 9. In 1960 the largest cluster in every region contained between 20 and 35 percent of the non-CBD office stock. By 1988 this proportion had declined to between 10 and 20 percent.

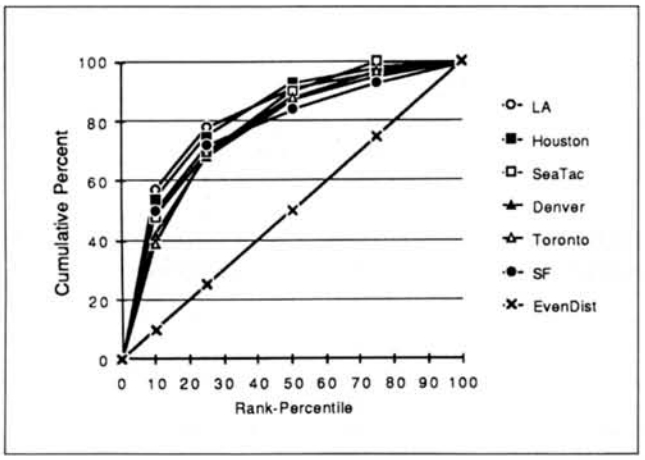

FIGURE 7: Cluster size: cumulative percent versus ranked percentile.

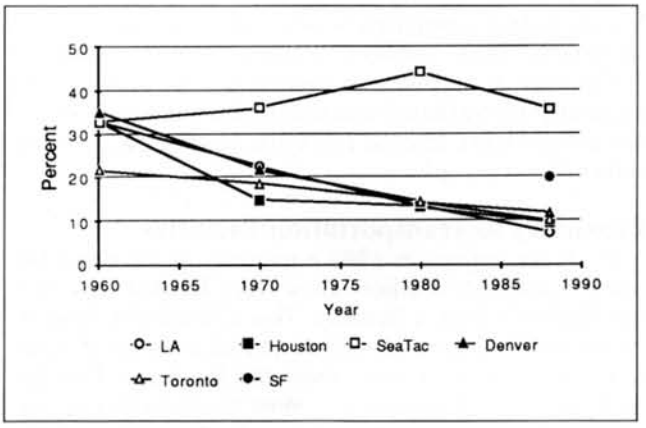

FIGURE 9: The percent of non-CBD office stock in a region's largest cluster.

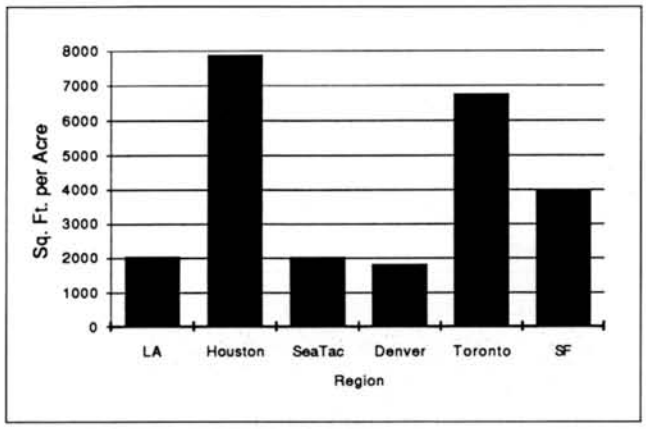

FIGURE 10: Median suburban cluster intensity.

The Seattle region was an exception because of the growth of downtown Bellevue, which grew into a major urban downtown and captured a growing share of the market until 1980. However, since then it too has experienced a relative decline.

The Intensity of Suburban Office Clusters

The gross intensity of each non-CBD office cluster was calculated by dividing the total gross floor area of the buildings in the cluster by the acreage of land within a polygon defined by the cluster's outermost buildings. Other types of existing buildings (e.g., retail) that would increase the development intensity of each cluster are not reflected in the measure.

These clusters are much less intense than central city CBDs. The median intensity for each region in 1988 is given in Figure 10. It ranges from as low as 1,900 square feet per acre in Denver to as high as 7,900 square feet per acre in Houston. The intensity of central city CBDs ranges upward from 25,000 square feet per acre.

The median intensity varied by more than 400 percent among the regions. That is about twice the variation that was found for the median cluster size.

In all of the regions except Seattle there was a moderately strong correlation between the size and intensity of clusters. Table 3 shows the correlation coefficients.

The size of a cluster explained between 12 and 55 percent of the variation in intensity. Larger clusters were not always more intense and quite often grew outward rather than upward.

Proximity to Transportation Facilities

In all six regions in 1988 a majority of the non-CBD office clusters and office stock were located less than one-half mile from a freeway. This is shown in Table 4. At the same time, however, substantial amounts of office space were located away from the freeways. This detachment from freeways was most common in Los Angeles, where, as shown in Table 4, 39 percent of the clusters and 34 percent of the clustered office space was located more than half a mile from a freeway. Thus, while the "office corridor" concept does characterize the location of most suburban office space, it does not incorporate the location of as much as one-third of it.

The non-CBD office clusters within one-half mile of a freeway were generally larger and more intense than other office clusters in every region except Seattle. This is shown in Table 5. Depending on the region, the median size and intensity of clusters near a freeway ranged from 1.0 to 2.9 times the size and 0.6 to 1.75 the intensity of the other clusters.

The clusters within 1 mile of a freeway interchange also were larger and more intense than other clusters, although Seattle was once again an exception. This is shown in Table 6. The median size and intensity of clusters near an interchange ranged from 1.0 to 2.9 times the size and 0.6 to 1.7 times the intensity of other clusters.

Most of the non-CBD office clusters were not located near a freeway interchange. Table 7 shows that in each region between 61 and 86 percent of the clusters were located more than one mile from a freeway interchange. However, because of their greater size and intensity, the clusters near an interchange contained between 27 and 69 percent of the non-CBD office stock.

The two regions with rail transit systems were examined to determine whether rail transit stations are associated with non-CBD office clusters and whether the clusters near transit stations were larger and more intense than other clusters. The findings are presented in Tables 8 and 9. In both the San Francisco Bay Area and Toronto regions a relatively small percentage of the clusters were located within walking distance (one-quarter mile) of a transit station. Clusters near a transit station in metropolitan Toronto were nearly eight times as large and twice as intense as other clusters and contained 25 percent of the non-CBD office stock. Clusters near a transit station in the San Francisco Bay Area were 1.4 times as large and equally intense as other clusters and contained 10 percent of the non-CBD office stock.

In both regions transit stations did not attract most of the non-CBD office development. However, they were associated with larger and, in Toronto, more intense clusters. There are several possible explanations for the differences between Toronto and the Bay Area. One might be the different zoning policies that have supported concentrations near transit in Toronto and have discouraged them in the Bay Area. Another explanation

TABLE 3: The correlation between size and intensity of suburban office clusters

Region	N	R	P
Los Angeles	262	.52	.00
Houston	138	.34	.00
Seattle	18	.33	.20
Denver	68	.74	.00
Toronto	58	.52	.00
San Francisco	29	.43	.02

TABLE 4: The proximity of clusters and clustered office space to freeway corridors

	Clusters				Space (million sq. ft.)			
	<1/2 mile		>1/2 mile		<1/2 mile		>1/2 mile	
Region	No.	%	No.	%	No.	%	No.	%
Los Angeles	159	61	103	39	112.2	66	57.6	34
Houston	80	57	58	43	82.0	70	34.1	30
Seattle	29	88	4	12	29.6	93	2.2	7
Denver	42	62	26	38	49.5	73	17.9	27
Toronto	34	58	25	42	35.2	79	9.5	21
San Francisco	90	87	13	13	91.6	93	7.1	7

might be that Toronto has a less developed freeway system than the Bay Area.

Clusters and Shopping Centers

Qualitative observations were made of the relationship between the location of clusters and shopping centers. Many shopping centers did have clusters nearby. However, most clusters were not located near shopping centers. Although many people believe that most suburban office nodes grow around retail centers, this was not true for most of the non-CBD clusters examined in this study.

The Pattern of Clusters and Cluster Groups

The overall location pattern of clusters in 1988 is illustrated in the maps in Figures 11 through 16, which show four general patterns: sectoral dispersion, general dispersion, single corridor, and multi-corridor. In Houston (Figure 11) the clusters are dispersed in a single sector reminiscent of Hoyt's sector theory of urban development. In San Francisco, Toronto, and Seattle (Figures 12-14) the clusters are more generally dispersed. In Denver (Figure 15) most of the clusters are located along a single corridor, and in Los Angeles (Figure 16) they tend to gather along several freeway corridors.

The maps also show how clusters frequently are organized into groups. This feature is important to consider because, even though the definition of a cluster used in this study was based on a reasonable walking distance between buildings, the definition is somewhat arbitrary from a regional standpoint. Obviously, if the separation criteria were changed, the number, size, and intensity of clusters would be altered. This should be remembered when interpreting the results.

A Summary of the Six Regions

The conclusions from this small sample of regions should be modestly stated and readers should be careful not to generalize from them too broadly. Nevertheless, several valid observations can be made about this group of regions. It will be interesting to see if these findings can be generalized to other regions by future studies.

Since 1960 the total stock of office space in the six regions grew in an exponential manner while the percentage of stock in the central city CBDs declined. The most rapid decline occurred during different decades in each region. The regions that experienced the earliest decline in their CBD share of the office stock now appear to be reaching greater equilibrium, although the decline is still occurring.

Over 85 percent of the non-CBD office stock in each region is located in clusters of two or more buildings separated by less than one-quarter mile. The number of clusters has been increasing since 1960. By 1988 each region contained 33 to 273 non-CBD office clusters.

Throughout the 1960-to-1988 period there has been

TABLE 5: The median size and intensity of office clusters less than and greater than 1/2 mile from a freeway

	Size (000 sq. ft.)		Intensity (sq. ft./acre)	
Region	<1/2 mile	>1/2 mile	<1/2 mile	>1/2 mile
Los Angeles	230	193	2,313	1,857
Houston	506	222	9,506	5,466
Seattle	513	526	1,848	3,221
Denver	571	250	2,012	1,150
Toronto	432	261	7,644	5,804
San Francisco	442	154	4,000	3,950

TABLE 6: The median size and intensity of office clusters less than and greater than 1 mile from a freeway interchange

	Size (000 sq. ft.)		Intensity (sq. ft./acre)	
Region	<1 mile	>1 mile	<1 mile	>1 mile
Los Angeles	629	193	3,150	1,801
Houston	420	370	8,302	7,750
Seattle	968	312	2,136	1,140
Denver	588	528	2,613	1,555
Toronto	334	408	8,286	6,549
San Francisco	687	322	4,100	3,467

TABLE 7: The proximity of clusters and clustered office space to a freeway interchange

	Clusters				Space (million sq. ft.)			
	<1 mile		>1 mile		<1 mile		>1 mile	
Region	No.	%	No.	%	No.	%	No.	%
Los Angeles	37	14	222	86	48.3	30	115.2	70
Houston	35	25	106	75	33.4	29	83.5	71
Seattle	13	39	20	61	22.1	69	9.7	31
Denver	14	21	54	79	24.5	36	42.9	64
Toronto	13	22	46	78	12.2	27	32.3	73
San Francisco	27	26	63	61	51.8	52	46.9	48

a very strong positive relationship between the number of non-CBD office clusters and the amount of non-CBD office stock in a region. However, the line describing this relationship has been shifting downward. With the passage of time fewer additional clusters have been associated with the same incremental growth in office stock.

There has also been, over time, a positive association within each region between the total non-CBD office stock and the number of office clusters. The growth in office stock within each region has been associated with an increase in the number of clusters, but at a declining rate.

Although clusters have been growing at an increasing rate, they are still much smaller than central city CBDs. The median cluster size in each region in 1988 ranged from 219,000 to 525,000 square feet compared to between 25 and 47 million square feet for the CBDs.

The size distribution of clusters is similar in all of the regions at the present time. About half of the clustered office space is located in the largest 10 percent of the clusters, two-thirds of the office space in the largest 25 percent of the clusters, and 90 percent of the office space in the largest 50 percent of the clusters. Although the largest clusters contain much of the non-CBD office space, their average size was still an order of magnitude smaller than the central city CBDs.

The largest clusters increased their share of the non-CBD office stock until the 1970s or 1980s (depending on the region), when they began to lose their market share. Now a more even distribution of office space among the clusters is emerging.

There tends to be a single largest "primate" cluster in each of the six regions that is two to four times larger than the next largest cluster and contains from 10 to 30 percent of the non-CBD office stock. These primates can be as large as a central city CBD, but typically are not as intense. In general these largest clusters have been losing their market share of the office stock since 1960.

The median intensity of non-CBD office clusters varies widely among the regions—from 1,900 to 7,900 square feet per acre. This is an order of magnitude lower than the intensity of central city CBDs. Larger clusters are not necessarily more intense.

Most of the office development is locating along freeway corridors although, depending on the region, up to a third of the office space can be found in other locations. In all but one region, the office clusters near a freeway were larger and more intense than other clusters. One-quarter to two-thirds of the non-CBD office stock is located within one mile of a freeway interchange in clusters that are larger and more intense than other office clusters.

In the two regions with rail transit, the majority of clusters are not located within walking distance of a transit station. Twenty-five percent of the clustered office space was within walking distance of a station in Toronto and ten percent in San Francisco. The clusters near transit stations in San Francisco were only slightly larger and no more intense than other clusters. In Toronto, however, they were eight times larger and two times more intense than other clusters.

The distribution pattern of office clusters appears to vary among the regions. In one region the clusters are

TABLE 8: The proximity of clusters and clustered office space to rail transit stations

	Clusters				Space (million sq. ft.)			
	<1/4 mile		>1/4 mile		<1/4 mile		>1/4 mile	
Region	No.	%	No.	%	No.	%	No.	%
San Francisco	13	13	90	87	9.9	10	88.9	90
Toronto	5	10	54	92	11.2	25	33.4	75

TABLE 9: The median size and intensity of office clusters less than and greater than 1/4 mile from a rail transit station

	Size (000 sq. ft.)		Intensity (sq. ft./acre)	
Region	<1/4 mile	>1/4 mile	<1/4 mile	>1/4 mile
San Francisco	567	416	3,850	4,000
Toronto	2,500	333	12,946	6,035

concentrated in a single sector, in some they are grouped along one or more freeway corridors, and in some they are more evenly distributed along most of the freeway lines. In addition, groups of clusters have formed, creating larger auto-oriented concentrations of office development.

An Emerging Pattern

Individually, the scatteration, cluster, and corridor models do not capture the complex pattern of office development in the study areas. A more intricate arrangement has emerged that contains elements of all three models. Some scatteration can be observed in the small clusters and single office buildings located away from freeway corridors. Clusters are a more common feature, though, and come in a variety of sizes and intensities. Much of the office space is located along freeway corridors, but not exclusively and not in continuous bands of development. Thus, the intrasuburban form of office development in these six regions is better described as a melange of scatteration, clusters, and corridors.

The fact that the pattern has changed over time adds another layer of complexity. Central city CBDs and larger non-CBD clusters contain lower shares of the total office stock as time progresses. A large number of new clusters are emerging and the median size of clusters is growing bigger.

It is indeed challenging to try and perceive a pattern amid what may appear to be chaos. However, when the evidence is pieced together, what comes into view is an archetypical region where the majority of office space is located outside the regional CBD, some scattered away from freeways, but most arranged in a "net-of-mixed-beads" pattern. The net consists of a large number of office clusters (e.g., 125), composed of one or two very big clusters (i.e., 10 to 20 million square feet); an in-

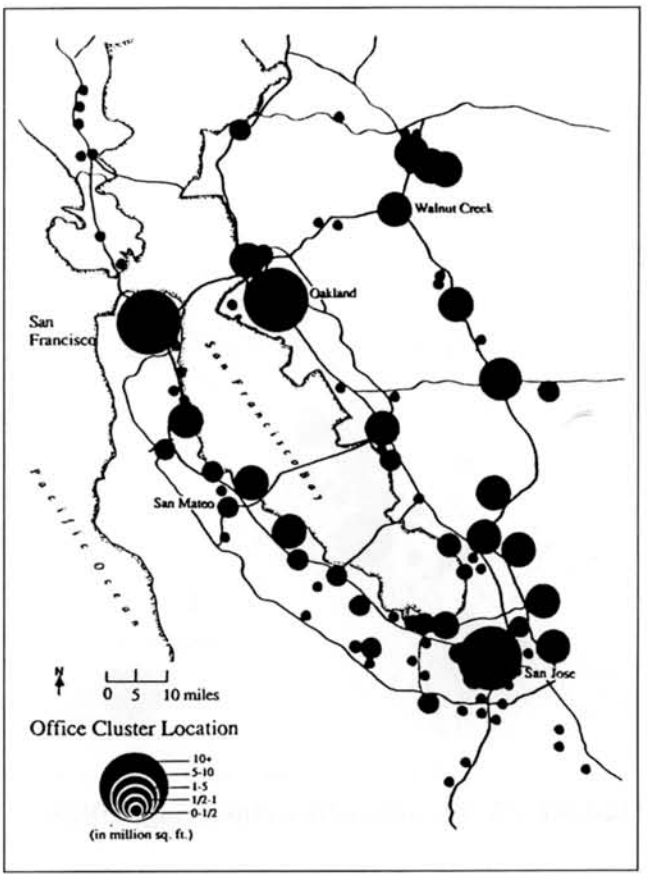

FIGURE 12: San Francisco Bay Area office clustering, 1988.

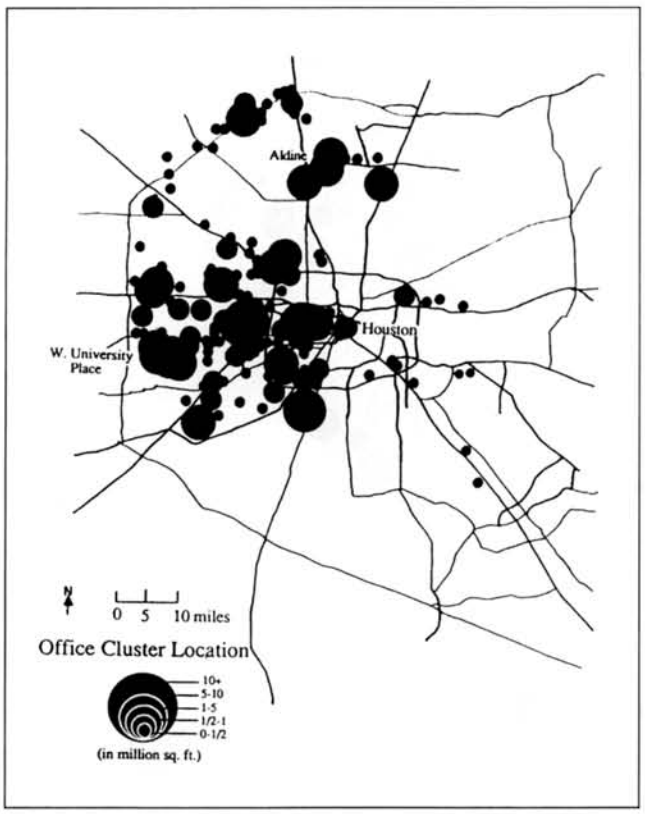

FIGURE 11: Houston office clustering, 1988.

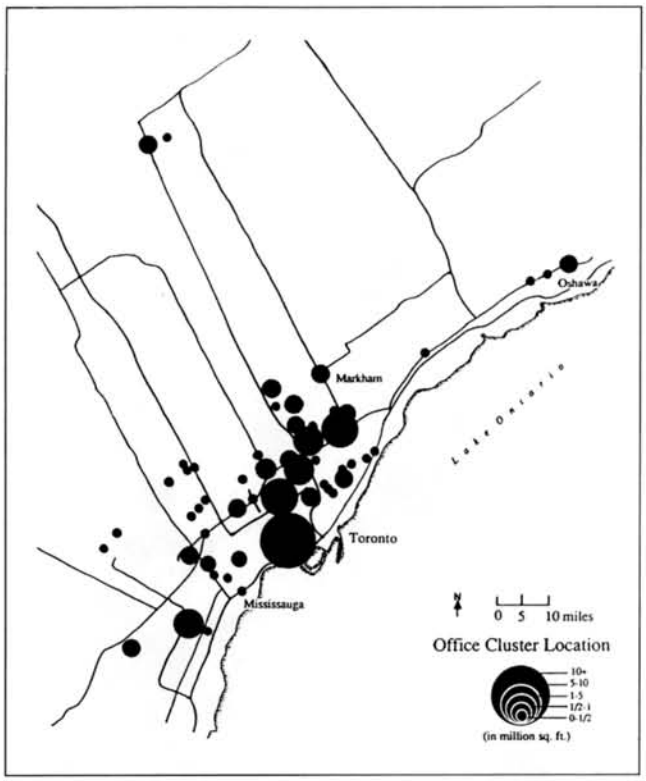

FIGURE 13: Toronto office clustering, 1988.

creasing share of medium clusters (i.e., 1 to 3 million square feet); and a large number of smaller, but growing, clusters (i.e., ½ million square feet), all but a few of which are low-intensity (i.e., 5,000 square feet per acre) and intermittently distributed along freeway corridors, with the largest and most intense clusters located where the freeways come together.

It will be interesting to see if these observations hold true in other regions or if variations emerge because of the age, transportation network, governmental structure, or other attributes of different regions. Any features of a region that could alter the development pattern should be considered before assuming that the observations from these six cases are applicable in other areas.

Planners must also evaluate the pros and cons of alternative patterns. The location, size, intensity, land use mix, and other features of suburban office developments may be systematically linked to a variety of planning issues, such as traffic congestion, affordable housing, air pollution, and infrastructure constraints. Whether these issues are linked to forms of office development will help determine if planners should try and shape the future development pattern or simply accommodate the projected trends.

To the extent that planners wish to shape future suburban office development, it will be important to understand its underlying causes. That will require the careful study of location and development processes.

A closer examination of different types of office developments may provide the necessary clues to explain the development pattern. Studies of developments that vary in location, size, intensity, and land use mix could uncover the basic forces that shape them. A number of scholars emphasize the importance of market demand and suggest that variations in space and location requirements among firms and functions of firms best explain the complex pattern of development observed in this study (Foley 1957; Vahaly 1976; Baerwald 1978). If the demand side of the market is most important, then certain forms of development should be associated with certain types of office firms or functions, preferences of key managers, or other occupant traits.

Other scholars have argued that land use patterns also are caused by forces on the supply side of development

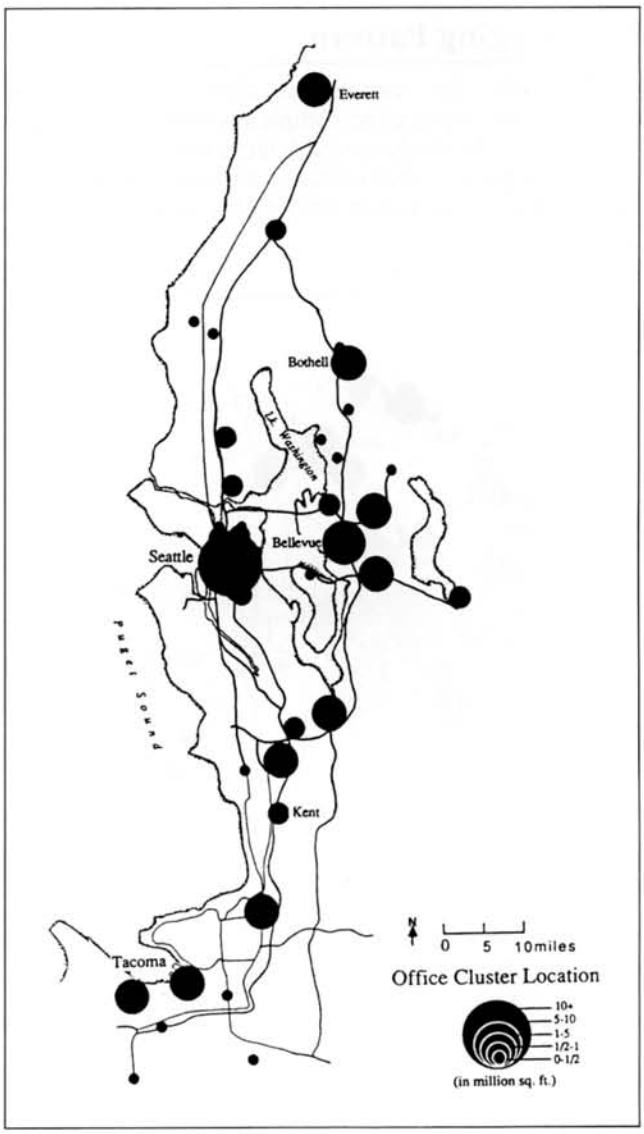

FIGURE 14: Seattle office clustering, 1988.

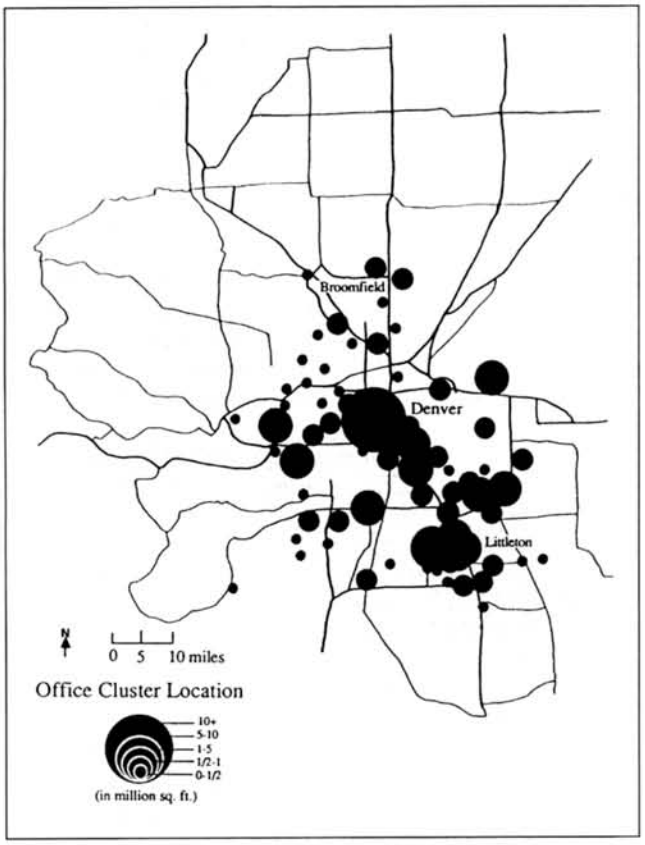

FIGURE 15: Denver office clustering, 1988.

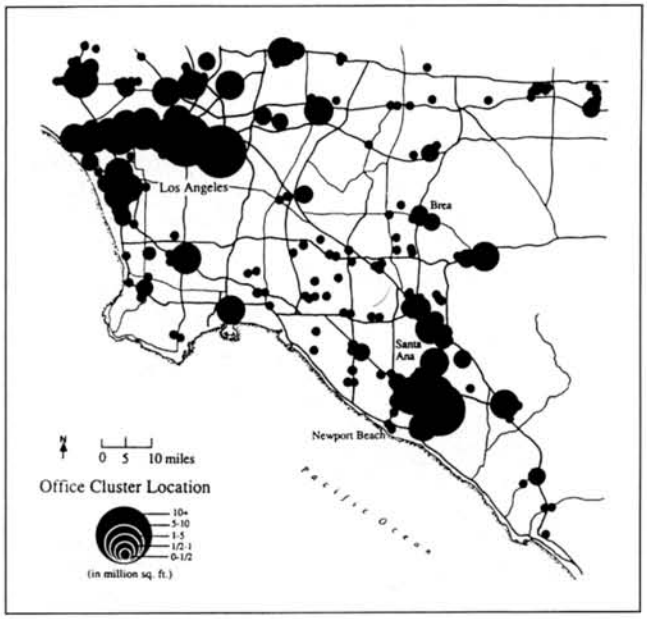

FIGURE 16: Los Angeles office clustering, 1988.

(Walker 1981; Harvey 1973). If the supply side of the market is most important then development patterns should be associated with factors such as developer preferences, capital markets, or land supplies. It is also possible that nonmarket factors, such as zoning policies and community growth politics, are important. If this is true, then there should be a correlation between the form of development and local policies or politics. Whether one or several factors best explains the pattern, planners will need to understand the causal levers that are available to them if they wish to alter the future form of office suburbanization.

A Step toward Understanding

A new metropolis is upon us and a key ingredient is office suburbanization. This article has reported on the pattern of non-CBD office development in six metropolitan regions. Existing descriptive theories appear to be too simple to capture the combination of clusters, corridors, and scatteration that is evolving. Another archetype, yielded by this study, suggests a pattern resembling a net of mixed beads. This metaphor describes suburban office development in six metropolitan study regions. Yet clearly we are only beginning to understand what will certainly be a critical element of the twenty-first-century metropolis.

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