TRANSPORTATION RESEARCH RECORD 861

Transportation and Land Use Impacts on Major Activity Centers

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Atherton, Terry J., Cambridge Systematics, Inc., Kendall Square Building, 238 Main Street, Cambridge, MA 02142
Baerwald, Thomas J., Department of Geography, Science Museum of Minnesota, St. Paul, MN 55101
Dunphy, Robert T., Metropolitan Washington Council of Governments, 1875 Eye Street, N.W., Washington, DC 20006
Eder, Ellyn S., Management Decisions, 101 Fourth Avenue, Waltham, MA 02154
Noguchi, Tomoko, Planning Department, City of Bellevue, P.O. Box 1768, Bellevue, WA 98009

Shaping a Suburban Activity Center Through Transit and Pedestrian Incentives: Bellevue CBD Planning Experience

TOMOKI NOGUCHI

Downtown Bellevue is a typical suburban central business district (CBD) and is emerging as one of the major activity centers in the metropolitan Seattle region. With cooperation from transit and other agencies, the City of Bellevue took several actions related to land use and transportation in recent years. In essence, the City's goal is to direct the anticipated growth to create a people-oriented urban activity center through transit, pedestrian, and other incentives. Actions taken on parking management, the pedestrian mall, the transit center, and the incentive transit service agreement will have significant impacts on the intensity of activity and the pattern of development in the Bellevue CBD. The City has adopted land use regulations necessary to transform the suburban automobile-oriented center into an urban activity center designed for people. However, land use regulations alone will not be enough to achieve this goal. If land use regulations are closely coordinated with transportation elements, such as those described here, the impacts would be much greater. The experiences gained during the Bellevue CBD planning process are valuable to others who are working in similar circumstances in other parts of the nation if planners and decision-makers hope to transform a suburban automobile-oriented CBD into a people-oriented activity center.

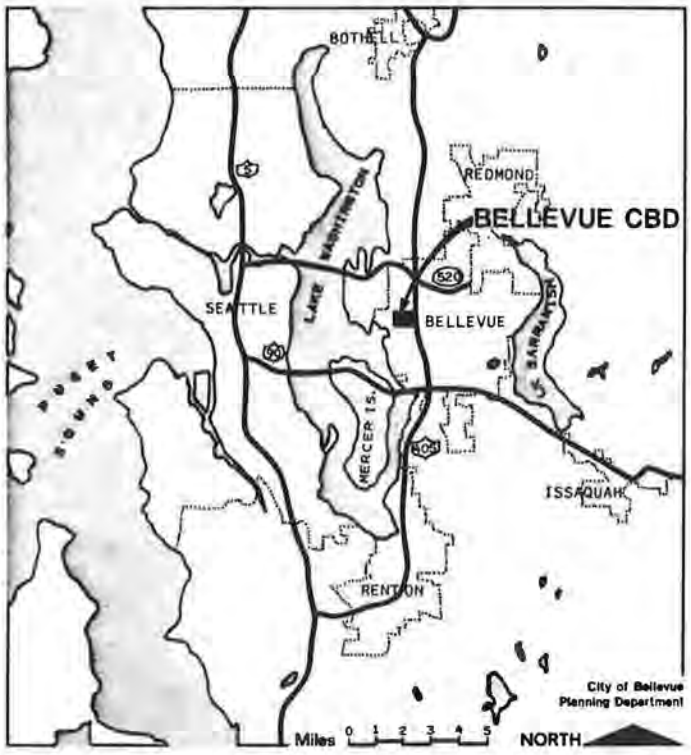
The City of Bellevue was a suburban bedroom community of 6000 residents when it was incorporated in 1953. Until the mid-1970s, employment of Bellevue residents was oriented toward downtown Seattle and other employment centers outside the City. The community had been centered around a community-scale shopping center, known as Bellevue Square, which was built in the mid-1940s. In the mid-1970s the Bellevue Square area had grown into Bellevue's central business district (CBD). Today, the City of Bellevue is the fourth largest city in the State of Washington. It has a population of 75 000 and an employed population of 42 000.

The Bellevue CBD is located in the Seattle metropolitan area (see Figure 1). It covers 430 acres and serves as the regional center for communities east of Lake Washington. As of 1981, the Bellevue CBD contained about 2.2 million ft² of office space and 1.4 million ft² of retail space; it employed about 12 000 people.

The layout of the Bellevue CBD is similar to many suburban activity centers designed around the automobile. Arterial streets are wide with large setback distances from sidewalks. Office buildings are widely dispersed. This land use and street configuration make pedestrian travel very difficult. Currently, only 1-2 percent of the people who travel to the Bellevue CBD take transit. In Seattle, more than 27 percent of the downtown-bound travelers take transit during the day (1). Some of the reasons why transit is not well used to and from the Bellevue CBD follow:

1. The CBD is basically designed to accommodate a large number of automobiles. Office buildings are fairly evenly spread throughout the CBD and are separated from each other by large parking lots.
2. Due to city parking requirements, an excess of parking exists. The average actual parking supply rate for offices was 4.4 spaces/1000 ft² in 1980. In 1980, a total of 15 000 parking spaces were provided for retail and office uses, compared with a level of employment in the CBD of about 12 000.
3. Most parking needs are satisfied by privately

Figure 1. Bellevue vicinity map.



owned off-street parking spaces. Parking charges are rarely imposed on users.

4. The regional transit agency (Municipality of Metropolitan Seattle-Metro) provides service based on a radial system oriented to downtown Seattle from outlying communities. Seattle-bound commuters are picked up at several park-and-ride lots. For a large number of people traveling to the Bellevue CBD, transit is not convenient or frequent enough to be competitive with the automobile.

5. Wide arterials and streets, the presence of a large number of automobiles, and a lack of pedestrian amenities discourage pedestrian activity in the CBD. One city study indicates that 25 percent of CBD traffic was generated by cars driving from one parking lot to another.

In the mid-1970s, Bellevue's civic leaders recognized the large growth potential of the CBD due to its central location among the communities on the east side of Lake Washington and its accessibility to other activity centers in the region. It was also realized that the increasing traffic congestion caused by cars containing only one occupant and the large amounts of parking needed to accommodate them would impede Bellevue's development potential (2).

In order to resolve some of these transportation and land use issues, the City initiated the CBD Action Plan study in 1978. This study pointed out to the City's policymakers that the parking supply requirements and level of traffic congestion in the CBD would soon become critical factors limiting future CBD development growth potential. The only perceived short-term solution to these problems was felt to be the expansion of the use of high-occupancy vehicles--transit and carpools (3).

This paper describes innovative actions that have been taken by the City in the last few years; it focuses on transportation issues such as parking, transit service, and pedestrian circulation. I believe that by using transit incentives, the Bellevue CBD can be transformed from a suburban-automobile-oriented center to a diversified urban activity center. Changes in land use elements and transportation elements could play key roles in shaping the future of the Bellevue CBD.

LAND USE ACTIONS

In 1979, the CBD Action Plan established the goals and policies applicable to the CBD. The land use concept, referred to as the CBD Land Use Diagram, was adopted. The reasons for the development of the Land Use Diagram were (a) to strengthen the existing retail core, (b) to establish an intensive office core area so that transit service could be provided more effectively and pedestrian activity could be encouraged between the Retail Focus and Office Focus areas, (c) to provide for scaled-down development intensity and building height at the periphery of the CBD, (d) to encourage urban residential development in the CBD, and (e) to preserve special areas such as "Old Bellevue."

In 1981, based on the CBD Action Plan, the City adopted amendments to the existing land use code that were specifically aimed at the CBD. The CBD Land Use Code established new dimensional requirements relating to building height, site coverage, and building setbacks. Floor area ratios were established as the method for determining development intensity. The CBD Land Use Code also established the Floor Area Ratio (FAR) Amenity Incentive System. This system provides a bonus in exchange for the inclusion of one or more of the amenities that the CBD Action Plan policies have identified as necessary to achieve the desired character of the city center. Eligible amenities include pedestrian-attracting retail frontage, plazas, pedestrian ways, street arcades, urban residential use, underground parking, internal pedestrian arcades, marquees, common community space, rooftop recreation areas, public meeting rooms, pedestrian skyways, and art or landscape features.

In order to implement the adopted Land Use Diagram, new zoning districts were established. CBD Office District 1 (CBD-O-1) is centrally located in the CBD and intended for the most intense business, financial, and specialized retail activities. Permitted FAR ranges from 5 to 8. Building height can range up to 200 ft without participating in a bonus system, and up to 300 ft if the developer takes advantage of the bonus program. The CBD Office District 2 (CBD-O-2) is basically the same as CBD-O-1, though with reduced intensity.

The CBD Multiple Use District (CBD-MU) is an area in which a wide range of retail activity, low-intensity office use, CBD support services, and residential uses is permitted. The CBD-MU zoning allows FAR ranges from 0.5 to 3 for office use and from 2 to 5 for residential use. The maximum height limitation for office is 100 ft and 200 ft for residential use.

The CBD Residential District (CBD-R) is an area in which high-density urban residential uses would be encouraged. The highest residential density allowed in the City is permitted in this district. Building height can range up to 200 ft with incentives above 150 ft allowed for participation in the amenity incentive system.

In addition to the new zoning districts, a CBD Core Design District has been established in the CBD Land Use Code. The purposes of the district are to provide specific development guidelines and to assure a high level of attractiveness, urbanity, design quality, and coordination of development within the most-intensive and visible portion of the CBD. A set of design guidelines has also been established for the following major design issues: (a) major pedestrian corridor, (b) transit center, (c) high-occupancy-vehicle routes, (d) pedestrian connections, (e) connector bicycle facilities, (f) major public open spaces, (g) minor publicly accessible spaces, and (h) view preservation corridor.

PEDESTRIAN MALL

Given Bellevue's suburban layout and its automobile-orientation, Metro and the City recognized a special need to analyze and evaluate transit alternatives specifically retrofitted to a suburban infrastructure. The transit alternatives evaluated included a CBD circulator, a transit mall, and a fixed-guideway people mover system. The Metro study concluded that the only viable downtown transit alternative would be a small scale downtown circulator system. The Bellevue CBD lacked a significant concentration of activity and had too much free parking for Metro to be able to provide effective transit service. However, the Metro consultant recommended a transit mall as a long-term alternative, which would be used as a catalyst to create a concentration of activity favorable to supporting a higher level of transit service. A plan to create a pedestrian mall in the Bellevue CBD evolved from the transit mall concept.

The CBD community leaders thought that it would be a good idea to have an automobile-free mall linking the centers of the retail and office core areas in the east-west direction. They were doubtful that the mixing of pedestrians and transit on a mall would be operable. There were basically three arguments that led to the exclusion of transit in the mall corridor:

1. Corridor width--The transit-pedestrian mall would have to have had a corridor 60-100 ft wide. Such a wide mall would consume too much expensive privately owned land. Considering the approximately 2.3 million ft² of total retail and a total employment force of about 24 000 forecast for 1990, the 60- to 100-ft-wide, 1500-ft-long mall would not fill with enough people to create an urban atmosphere. Community leaders insisted that the width of the mall should not exceed 40 ft.
2. Retail center--The expansion of the retail center called Bellevue Square Shopping Center, which was under way, was planned to add 600 000 ft² of retail by 1982 in addition to the existing 400 000 ft². It was doubtful that there would be an additional retail market large enough to fill the retail spaces that would be needed by the construction of the mall. The presence of an attractive retail facade along the transit mall was viewed as essential to its viability.
3. Focus--The Bellevue CBD needs a focal point for transit service to strengthen development of an office concentration. A transit mall might not be effective in achieving this objective. The establishment of a transit center in the vicinity of the pedestrian mall would be more desirable in a relatively small activity center like the Bellevue CBD.

After extensive discussions and some disagreement between the CBD community leaders and the City, it was decided that the individual property owners who owned land within 300 ft from the center of the pedestrian mall alignment would construct the mall when development of property along the mall took place. Under this arrangement, the pedestrian mall will be phased in over the years and appropriate activity levels would be assured in conjunction with adjacent development. Therefore, the completion date cannot be specifically set at this time, but the City is confident that the pedestrian mall will be developed because the properties along the mall are owned by only a few people, and most of them have expressed desires to redevelop their properties in the near future.

The adopted CBD Land Use Code defines the framework of the pedestrian corridor design. It also requires the property owners to submit a Pedestrian Corridor Design Plan to the City in order to assure continuity of the mall design as it is built.

TRANSIT CENTER

The plan to establish a transit center in the Bellevue CBD was formulated from basically two directions. As mentioned above, the Bellevue CBD needs a transit focal point, and such a point should be located in the center of the office core area. It was viewed that effective transit service and a coordinated transit facility such as a transit center would be a necessity in order to support the growth anticipated during the 1980s. In concert with Bellevue's planning efforts, Metro was developing its comprehensive plan for the 1980s called the Transit 1990 Plan (1).

When the 1980 plan was formulated in 1972, the year Metro was organized, its main objective was to increase transit ridership by focusing on service to downtown Seattle. This objective led to the establishment of a number of park-and-ride lots in the outlying areas. Although communities such as Bellevue had emerged as major activity centers, they had little service oriented to their centers. One of the recommendations that emerged from the Transit 1990 Plan effort was that Metro should expand transit service aggressively to capture transit demand oriented to outlying activity centers.

New transit networks with various combinations of local routes, park-and-ride lots, regional and community transit centers, freeway express stops, and regional express routes were analyzed. As a result, Metro adopted a plan that included four regional transit centers--one of which was the Bellevue Transit Center. The Transit 1990 Plan was finally adopted by the Metro Council in June 1981.

City staff felt that the proposed transit center concept could be implemented by using on-street facilities as a temporary solution, while planning for a permanent off-street facility. City and Metro staff quickly agreed on the location of this interim transit center. It was logical to place it on a street that had a relatively small traffic volume, was accessible to both the retail and office core areas, and was close to the proposed pedestrian mall corridor. It was determined that the center must be able to accommodate at least eight buses simultaneously in order to operate it in a "timed-transfer" manner, and that eight buses would come together every half-hour and exchange passengers during off-peak hours. The total cost of the on-street interim transit center was estimated at about $90 000--most of which was for a traffic signal for pedestrians crossing the busy street.

The property owners in the vicinity of the interim transit center were at first reluctant to accept the interim transit center because of perceived traffic disruptions. In addition, the timed-transfer concept was new to them. It took almost six months to convince them that the transit center would bring few negative impacts and that positive impacts would largely offset the negative ones. The transit agency summarized impacts to transit service from a regional perspective if the interim transit center were not implemented as follows.

1. The transit center enables Metro to combine several relatively weak transit markets into one strong one. The center would serve riders destined to the Bellevue CBD, but it would also enable people to conveniently reach other major destinations by serving as a transit "gateway".
2. One of the lessons of the Bel-Hop experiment was that transit cannot effectively serve a specialized, select market when there is no existing ridership base. (Note that Bel-Hop was a CBD circulator initiated by Metro as a result of a citizen's task force recommendation and was discontinued in 1980 after one year of service due to lack of measurable ridership.) On an incremental basis, new Bellevue routes are started that add even more passengers to existing routes, thus strengthening the system as a whole.
3. Without this "twin-gunned" approach to reaching satisfactory ridership levels, Metro cannot justify additional transit routes serving downtown Bellevue for several years. During this time, office and retail growth in the CBD will continue to be largely supported by increased private automobile use.

The life of the interim transit center was set at four years. The interim transit center began its operation in January 1982, and the scope of work for the permanent transit center plan and the environmental impact statement are being formulated. The permanent transit center in the Bellevue CBD is scheduled to be operational in 1985.

PARKING MANAGEMENT

Parking is a particularly complex and sensitive issue in suburban communities. The amount of parking required has a definite impact on the ultimate rate

of return on investment for retail or office space. From a developer's viewpoint, parking in a suburban environment is a necessity because it offers door-to-door convenience to those persons traveling to an activity by automobile and enhances the attractiveness of the activity to its clients. From the City's viewpoint, the provision of adequate off-street parking minimizes potential impacts of automobile congestion on surrounding residential communities. Parking that is well planned and managed is an influential factor in the public's perception of the quality of development and CBD environment as a whole.

After various parking management tactics were reviewed, it became obvious that some of the tactics described by DiRenzo and others (4) were not directly applicable to the local situation. The following three concepts were adopted as the framework of the Bellevue parking management programs:

1. Excessive parking supply should be reduced through land use regulations, particularly for office use.
2. Flexibility in parking requirements should be offered to encourage the private sector to provide alternative modes of transportation, such as the use of transit, carpool, vanpool, and bicycle.
3. The private sector should be responsible for providing parking.

It had been recognized that the parking supply in the CBD was much greater than the demand that artificially depressed parking prices to near zero. Because the excessive parking supply was viewed as a major element that encouraged automobile use, it was felt that a gradual reduction of the parking supply was extremely important to establish a balanced multimodal orientation. General policies were translated into a land use code and the City Council adopted the following programs:

1. Minimum parking requirements were drastically lowered. Prior to the adoption of the new code, for example, an office building that had less than 100 000 ft^2 was required to provide 5 parking spaces/1000 ft^2. An office building that had more than 100 000 ft^2 was required to provide 3.3 spaces/1000 ft^2. These minimum requirements were reduced to 2 spaces/1000 ft^2.
2. Maximum parking requirements were established. The previous Land Use Code did not include any upper limits on parking spaces to be provided. The City Council has adopted maximum requirements slightly lower than the present level of estimated demand. For example, the maximum for office use was set at 3 spaces/1000 ft^2, whereas City staff felt that the demand was about 3.3 spaces.
3. A scheduled reduction of the maximum and minimum requirements was adopted for office development. The maximum and minimum requirements were to be reduced by 0.3 space/1000 ft^2 every two years. This policy was aimed at gradually reducing the availability of parking spaces, while accelerating programs designed to encourage the use of transit and high-occupancy vehicles.
4. A developer could propose parking construction at less than the minimum required amount, up to 50 percent of the minimum, provided he or she implemented programs to encourage the use of alternative modes such as transit and carpools.

METRO/BELLEVUE TRANSIT INCENTIVE SERVICE AGREEMENT

Prior to taking action to reduce minimum parking requirements and to impose maximum parking supply ratios, the City needed some commitment from Metro to increase local transit service. On the other hand, a citizens' task force reviewing the Metro Transit 1990 Plan concluded that any of the transit alternatives examined would not be viable, unless (a) employment density in the CBD reached a much higher level, e.g., 50 employees/acre; (b) the City's parking policy was changed to encourage transit use by the commuter; and (c) a pedestrian environment was also established, including construction of a pedestrian mall. The transit agency was, in a way, reluctant to make a strong commitment as long as the existing automobile-oriented land use practices and the environment that were not conducive to transit continued. Under these circumstances, both jurisdictions recognized the need to enter into a formal agreement to satisfy the demands of both agencies simultaneously.

The concept to form such a transit service agreement was first presented to the Bellevue City Council in December 1979. The Council adopted a resolution approving "a statement of parameters and principles for the development of an agreement between the City and the Municipality (Metro) by which a numerical relationship would be established between employment density, and parking ratios and transit service improvements over and above a baseline level of service." The resolution also authorized the City administration to negotiate an agreement with Metro.

Baseline Level of Service

The most sensitive issue discussed during the negotiation process that took place between the City and Metro during 1980 was how to define a baseline level of service. The City administration requested that Metro define the future level of baseline service before the level of incentive service was determined, because transit service programmed under the agreement would be additional service beyond the baseline level that Bellevue was entitled to receive under normal circumstances. Bellevue staff could thereby be assured that the transit service provided under the agreement would actually be allocated from a service category other than the one that provided the regular service planned for the Bellevue CBD.

The issue of baseline service was important and complex for both agencies. Both sides wanted to maintain their flexibility within the agreement. For example, Metro did not want to make a commitment to transit service beyond that that their budget allowed. The City did not want to be locked into a baseline level that was less than a regional "fair-share" level.

Originally, it was intended that an agreement be formulated that would last through this decade. But since Metro and Bellevue could not agree to a baseline level of service for the long term, i.e., more than two years, the original idea to formulate a 10-year agreement was abandoned. This deadlock situation was finally broken with the decision that the term of the agreement should be relatively short and that a baseline level of service should be defined by Metro in a two-year implementation plan. The City could expect that planned service changes in a two-year plan would be implemented regardless of the new agreement. Finally, it was agreed that the Transit Incentive Service Agreement would be a two-year agreement, with the option to continue or discontinue the agreement if it did not perform as planned after two years.

Summary of Incentive Transit Agreement

Metro decided that they could set aside 10 000 bus hours for the Metro-Bellevue Transit Incentive

Agreement. This decision was based on the adoption of Metro's Transit 1990 Plan by the Metro Council. The Transit 1990 Plan set up guidelines for providing a network of service oriented to major activity centers outside of downtown Seattle. It also contained the following policy objective: "Develop and enter into cooperative agreements where actions by local jurisdictions, such as parking restrictions and increased population/employment density, can be matched by increased levels of transit service."

The next task was to select parameters that could be easily quantified. In accordance with the "agreement to agree" and Metro's adopted policy, parking and employment densities were considered the most important parameters influencing the creation of a transit environment in the Bellevue CBD. Because it was difficult to change the existing land use pattern, emphasis was placed on influencing future development. A decision was then made to "reward" increased employment density and to limit the supply of parking associated with new or expanded development.

The next issue was whether the selected parameters should be applied uniformly throughout the CBD or only to designated areas within the CBD. The City's and Metro's goal was to establish a focal office area, referred to as the "core," within the CBD. Therefore, a decision was made to provide a larger incentive or bonus to the CBD core area than to other areas outside the core.

Metro and Bellevue agreed to allocate the 10 000 bus hours as follows:

Area	Hours
CBD (core) employment density growth	3 000
CBD (whole) employment density	2 000
CBD (core) new parking supplies	3 000
CBD (whole) new parking supplies	2 000
Two-year total	10 000

An increase in employment density or the limitation of the parking supply in the core area could be used to "claim" additional bus hours from both the core and whole CBD categories. On the other hand, if employment density growth or limitation of the parking supply occurred outside the core, it could only be used to claim hours under the whole CBD formula. Therefore, more bus hours would be earned if employment growth occurred and if new parking supply was limited in the core area rather than outside the core.

The last issue needed to reach an agreement was how to establish relations between the allocated bus hours and the selected parameters: employment density and parking. Metro and Bellevue staff agreed on the following points regarding employment density:

1. The minimum level of employment growth for which Metro should "reward" hours was to be based on the Puget Sound Council of Governments' (PSCOG) forecast. (PSCOG is the regional planning agency in the Seattle Metropolitan area.) The reason given was that the PSCOG's forecasts were much lower than Bellevue's own projections. It was on the PSCOG's forecasts that the 1990 transit comprehensive plan was developed.
2. If CBD and core employment reached the higher forecast projected by the City of Bellevue Planning Department, Metro would commit to two-thirds of the total hours allocated in each category. If employment densities increased by 25 percent above Bellevue's own forecasts, the balance of the incentive hours would become available.

Bellevue had been concerned with PSCOG's forecast because it did not assume a high level of growth in the Bellevue CBD. Thus, the City of Bellevue Planning Department produced its own more realistic forecast. Figures 2 and 3 show the relation that was accepted by Metro and Bellevue between transit service and employment density growth for the core area and the whole CBD, respectively.

The City could claim incentive service hours based on conditions at the end of each year or at the end of the two-year period. As shown in Figures 2 and 3, Bellevue could claim additional transit service if core employment density increased by more than 4 employees/acre in 1 year or 8 employees/acre in 2 years, and/or CBD employment density, including the core area, increased by 1 employee/acre in 1 year or 2 employees/acre in 2 years.

The relations between incentive transit service and parking supply were similarly established. In this case, Metro wanted to reward actions geared toward limiting future parking supplies. Instead of using absolute numbers of parking spaces, it was decided to use parking supply ratios, i.e, parking spaces per 1000 ft^2 of new development, to match with transit service.

Through the Transit Incentive Agreement, Metro wanted to reinforce the intent of the new CBD parking code. Metro and Bellevue staff together assumed that the level of the maximum parking requirement was close to existing demand. Therefore, most development proposals in the next few years probably would be designed in accordance with the maximum re-

Figure 2. Incentive hours earned relative to whole CBD employment density growth.

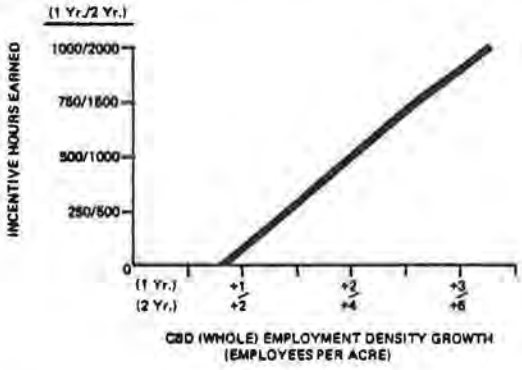


Figure 3. Incentive hours earned relative to car CBD employment density growth.

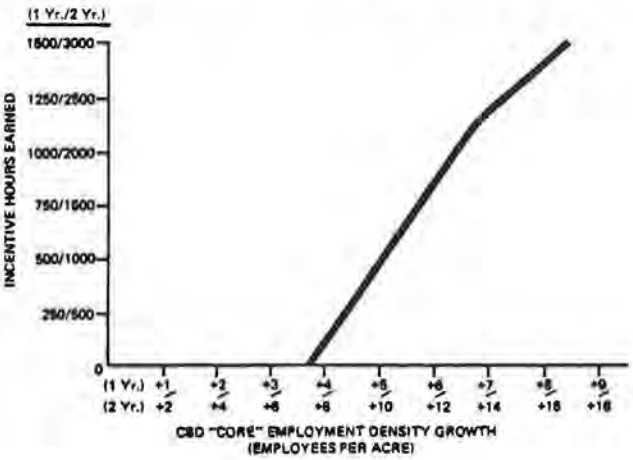


Figure 4. Incentive hours earned relative to car CBD parking changes.

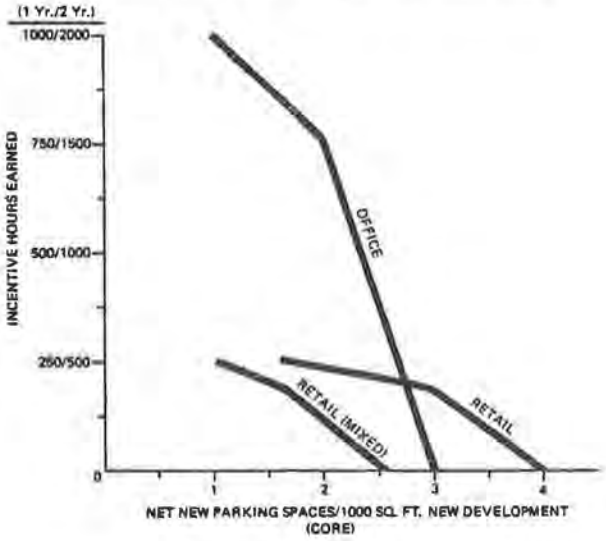
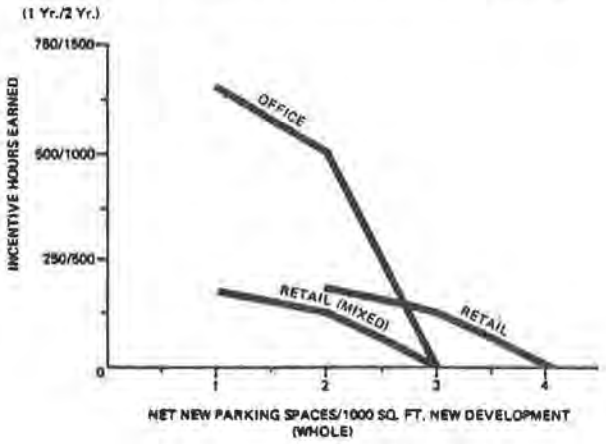


Figure 5. Incentive hours earned relative to whole CBD parking changes.



quirement, i.e., 3.0 spaces/1000 ft² of office. Both agencies agreed that Bellevue should be rewarded with additional transit service if development proposals included parking spaces at less than the maximum requirement level, i.e., the existing level of demand.

If the parking supply associated with the new office buildings, for example, averages 2.5 spaces/1000 ft² in the core area at the end of two years, the City could claim an additional 750 h of transit service as shown in Figure 4. Similarly, if new office parking supply averages 2.5 spaces/1000 ft² throughout the CBD, the City will receive an additional 500 h (see Figure 5). The total would be an additional 1250 h of transit service.

SUMMARY

Downtown Bellevue is emerging as one of the major activity centers in the metropolitan Seattle region. With cooperation from transit and other agencies, the City of Bellevue took several actions related to land use and transportation in the recent years. The City's goal is, in essence, to direct the anticipated growth to create a people-oriented urban activity center through transportation, pedestrian, and other incentives. The actions taken on parking management, the pedestrian mall, a transit center, and the incentive transit service agreement will have significant impacts on the intensity of activity and the pattern of development in the Bellevue CBD. The City has adopted land use regulations necessary to transform the suburban automobile-oriented center into an urban activity center designed for people. However, land use regulations alone will not be enough to achieve this goal. If land use regulations are closely coordinated with transportation elements such as those described here, the impacts would be much greater.

Since the City has set a framework for the development of the Bellevue CBD, the next task is to monitor changes in land use patterns and transportation-related data such as transit mode split and automobile occupancy.

REFERENCES

1. More Mobility for the Eighties. Seattle, Metro Transit, Phase IV, Tech. Rept., Aug. 1980.
2. Bellevue CBD Parking Study. City of Bellevue Planning Department; TRANSPLN Co., Bellevue, WA, April 1976.
3. Bellevue CBD Action Plan, 1980-1990. City of Bellevue Planning Department; ROMA, Barton-Aschman, Williams-Kuebelbeck, Bellevue, WA, June 1979.
4. J. DiRenzo, J.B. Cima, E. Barber, and W. Berman. Evaluation of Current Parking Management Tactics. City of Bellevue Planning Department, Bellevue, WA, Jan. 1980.

Land Use Change in Suburban Clusters and Corridors

THOMAS J. BAERWALD

Diversified land use concentrations comparable with downtown in their range of functions developed in American suburbs in the last few decades. These concentrations take two forms—clusters, which usually focus on a regional shopping center, and corridors, which develop along freeways. Examples of their development are presented in case studies of the Southdale Cluster and the I-494 Corridor south of Minneapolis. Four general factors affect cluster and corridor development: (a) variations in the locational tendencies of different land uses, which lead comparison goods stores and higher-value residences to locate in clusters, while automobile dealers, industrial plants, and warehouses are more likely to be in corridors; (b) characteristics of the transportation system, including metropolitan freeway configuration, local characteristics within a concentration, and proximity and access to other modes; (c) historical factors and the timing of development; and (d) other factors, including social and demographic patterns, local governmental impacts, and entrepreneurial prerogative. Clusters and corridors developed in response to heavy reliance on automobiles and trucks. These modes will remain preeminent in the foreseeable future.

Downtown will always be the historic core of the American metropolis--a zone of high-intensity land use, a setting for a diverse mix of activities, and a place of great convergence in the metropolitan transportation network. But downtown is no longer the only metropolitan locale with such characteristics. "Downtown Has Fled to the Suburbs" headlined Fortune magazine in 1972, and the last decade has reaffirmed Breckenfeld's assertion (1) that "instead of a single nucleus, there are several: the old downtown (which has tended to evolve into an office and finance district), and a band of satellite centers on the periphery." Muller (2) has described the evolution of multifunctional concentrations of American suburbs, noting that "these major modes now confer a greater degree of spatial order on the heretofore centerless distribution of production in the suburbs".

The list of activities found in large suburban concentrations is an inventory of traditional downtown land uses--all types of retail, service, and entertainment establishments; office buildings; hotels and meeting places; governmental and institutional activities; medical facilities; industrial and warehousing operations; and higher-density residences. The only downtown activities not likely to be in suburban concentrations are low-rent transient housing and the highest-level financial exchanges. Although functionally similar to the historic downtowns, the forms of these new suburban aggregations differ radically. Nonetheless, they have become major foci of activity patterns and transportation networks for large parts of the metropolis.

Like the original central business district, the new suburban "downtowns" have evolved in response to changes in the metropolitan circulation system. A number of scholars have examined facets of the development of these suburban concentrations and their relation to transportation. Geographers and other social scientists have described the changing locations of different types of land use; these studies are summarized in recent texts by Muller and Hartshorn (2,3). Attention has also focused on land uses along different types of roads. These have included analyses of land use changes along all Interstate segments in Rhode Island; studies of offices and manufacturing plants along radial freeways; and a recently completed assessment of the land use and development impacts along circumferential beltways (4-7). All of these inquiries involved comparative analysis of a set of case studies, research that logically followed a diverse set of analyses of land use-transportation relations in specific locales. Finally, Schneider examined the characteristics of large suburban concentrations with special emphasis on prospects for transit development (8).

Although these studies have shed considerable light on these suburban activity concentrations, some basic questions remain unanswered. What are the basic forms and land use patterns of these new suburban downtowns? How have they developed? What factors have influenced their development? How has transportation affected their growth, and what is its role likely to be in the future? This paper will address these questions. General conclusions will be based on experiences in metropolises throughout North America, and special insights will be drawn from examination of the two largest concentrations in the Minneapolis-St. Paul metropolitan area.

CLUSTERS AND CORRIDORS

The new suburban "downtowns" take two forms--clusters and corridors. The cluster is an areal form, focusing on one or more nuclei. Large regional shopping centers are the foci of most clusters, but other activities, including airports, medical centers, and convention centers, may also attract a large number of other activities. Growth in the cluster generally proceeds outward in all directions until barriers are encountered, producing a somewhat circular form. On the other hand, corridors are linear. Activities string out along an axial freeway with most growth in the two directions along that artery, although minor spurs may also form. The corridor, therefore, takes an elongated, rectangular shape.

Distinctions between clusters and corridors are not always clear. Because many activities in clusters desire easy access from a large part of the metropolis, clusters frequently are found near freeways. Therefore, the cluster may coalesce with the corridor, producing a hybrid form that looks like a snake that has swallowed a large egg. Whether an aggregation of diverse activities in a suburban concentration is a cluster or corridor is best defined by relative location--cluster activities will refer to their location in terms of the cluster nucleus (e.g., near the XYZ Mall), while places in corridors are located relative to the freeway (e.g., along I-800).

Transportation characteristics of clusters and corridors differ substantially. Traffic in the cluster is on the existing grid of surface streets or on special routes like shopping center ring roads. There is little through traffic; most trips begin or end in the cluster. Freeways are accessed by major arterials, and street intersections in the cluster are at grade and are controlled by traffic signs or signals. In contrast, the freeways that are the backbone of the corridor carry large volumes of both local and through traffic. Grade-separated interchanges hasten flows along the freeway, but feeder streets with signal-controlled intersections often are unable to handle peak loads. The presence or absence of frontage roads has a profound impact on the accessibility of sites fronting on the freeway, and although the freeway whisks traffic along its length, it is a barrier to movement across it.

CASE STUDIES

The processes of development in suburban clusters and corridors are identifiable in two case studies, both from the Minneapolis-St. Paul metropolitan area (Figure 1). Southdale shopping center, eight miles southwest of downtown Minneapolis in Edina, is at the core of the oldest, largest, and most diversified suburban cluster in the Twin Cities area. The largest and most diverse of the Twin Cities suburban freeway corridors is along a seven-mile stretch of I-494 in the suburbs of Bloomington, Richfield, and Edina.

Evolution of Southdale Center

The Southdale Cluster evolved in three stages (Figure 2). The first stage consisted of the construction of the core shopping center in the mid-1950s. Dayton's, the Twin Cities' largest department store chain, hired Victor Gruen in 1952 to develop plans for a shopping center and associated activities on 500 acres in Edina. The site was at the edge of the rapidly advancing wave of residential expansion. One freeway was present in the area (MN-100, 1 mile to the west), and two more were planned (County Highway 62, 0.25 mile to the north, and another segment of MN-100, later completed as I-494, 1.5 miles to the south). The proposed center was to be built between these freeways, at the intersection of two major arterials (66th Street and France Avenue).

Figure 1. Location of case studies.

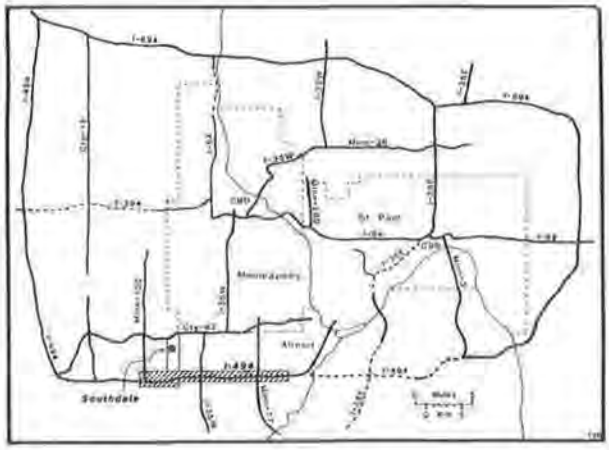
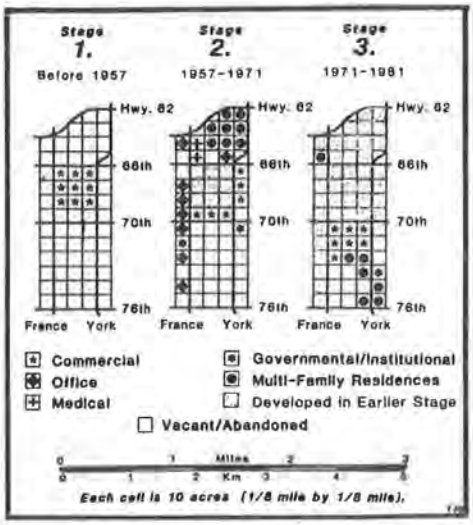


Figure 2. Southdale Cluster: generalized land use change.



Gruen's design included three major changes from previous shopping center arrangements. First, the design included two stories of shops that fronted on a central mall, all of which were enclosed and climate-controlled. Second, the center was anchored by two large department stores, Dayton's and its principal competitor, Donaldson's, rather than by just one store, as had been the norm. Third, the land surrounding the center was to be sequentially developed with a set of complementary land uses. Construction of the center began in 1955, and Southdale opened in October 1956 as the nation's first enclosed shopping mall. It contained 82 stores on 760 000 ft² of retail space. A month after it opened, Frank Lloyd Wright visited Southdale and prophetically commented that the center was "just like downtown" (9).

The second stage of the Southdale Cluster evolution, roughly from 1957 to 1971, saw the center ringed with a mix of uses that quickly gave it an identity as a major diversified center. Commercial expansion to the south and east followed the guidelines of the original plan and led to construction of many free-standing establishments. Commercial diversification continued in the latter part of the stage with construction of the first secondary shopping center, with a half-dozen shops, and culminated in a major additon to Southdale in 1972. J.C. Penney anchored the new wing, which brought the total number of establishments in the center to 135 on 1.1 million ft². Medical, office, and apartment buildings also clustered around the center in the second stage. Original plans for a medical office building northwest of the center were realized in 1957, and a hospital was constructed just north of that facility in 1965. Zoning prohibited commercial activities near the hospital, so office and apartment buildings were built nearby. Throughout the 1960s, office buildings also were constructed west and southwest of the center.

The third stage of the Southdale Cluster evolution occurred in the 1970s. Major expansion to the east, north, and west was limited by single-family residences, although a mix of establishments filled in on smaller tracts in these directions. South was the only direction for significant growth, where 300 acres remained undeveloped. Seventieth Street was breached in 1973. By 1981, a flood of commercial and residential uses inundated about 50 percent of the available land. Two new shopping arcades with about 15 smaller stores were built, and one was expanded. Some new structures housed activities that had outgrown the shopping center. Residential expansion south of Southdale in the 1970s included townhouses, walk-up apartments, and high rises. Two complexes were constructed especially for elderly residents, who were attracted by the same diversity in nearby services that traditionally were available only downtown. Apartment buildings continued to be built west of the offices along France Avenue, and expansion of that string of offices led to the first contact between the Southdale Cluster and the I-494 Corridor.

Evolution of I-494 Corridor

Development of the I-494 corridor has proceeded through four stages (Figure 3) (10). First-stage development in the mid-1950s was keyed to the

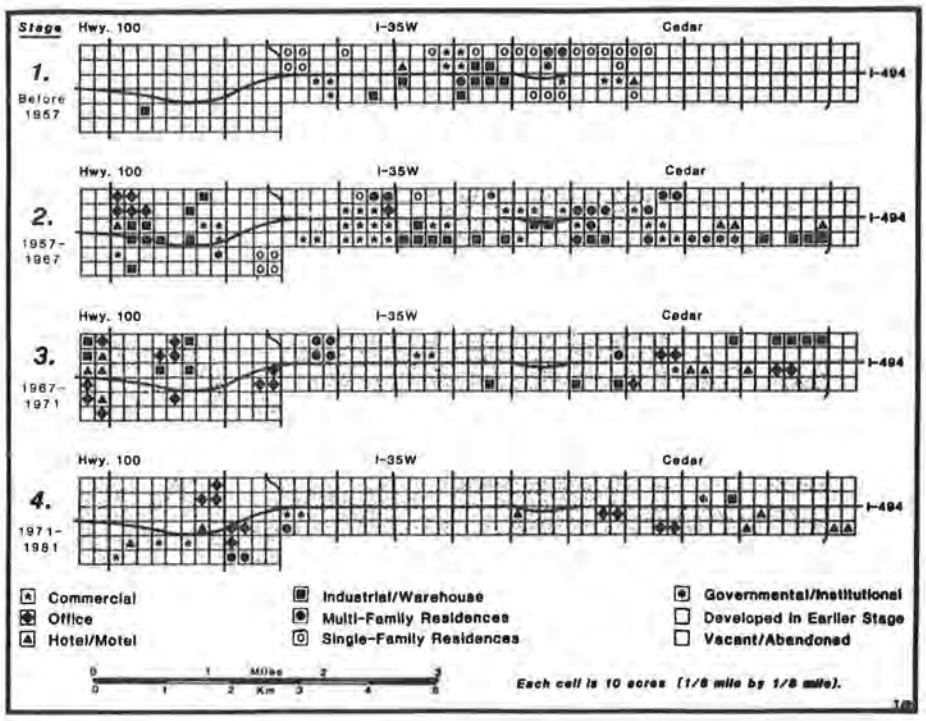


Figure 3. I-494 Corridor: generalized land use change.

rapidly expanding residential market of the southern Minneapolis suburbs. The axis of the corridor was MN-5, a two-lane rural bypass. Plans for upgrading the route to include it as part of the MN-100 beltline around the entire metropolis already had been formed, however, and the wave of residential expansion jumped over a three-block swath, leaving vacant land along most of the highway. Passage of the Federal-Aid Highway Act of 1956 changed the funding mix for the proposed freeway, but it did not affect the alignment or completion schedule for the freeway, which opened in 1960 as the Twin Cities' first Interstate segment. Nonresidential development in the initial stage was directly related to the neighboring residential boom. Building materials and equipment dealers grouped around the point where a branch rail line crossed the highway, and small neighborhood shopping centers sprouted next to central corridor interchanges.

The second stage from the 1950s into the mid-1960s saw an enormous increase in the volume of construction along the I-494 corridor. Completion of the freeway increased speeds and volumes of traffic and improved accessibility to corridor sites. One large shopping center and five smaller groups of stores were built, and six automobile dealers migrated to highly visible locations within 0.5 mile of the I-494/I-35W interchange. Industrial plants and warehouses also entered the corridor in large numbers during this stage because of improved accessibility and the availability of large tracts of land, especially at the ends of the corridor.

The third stage of development in the I-494 Corridor dated from the mid-1960s into the early 1970s, when the Twin Cities' economy, like that of the nation, grew considerably. Industrial, wholesale, and commercial expansion continued as it had during the second stage. Meanwhile, tax laws prompted wealthy individuals to invest in corridor real estate development, which virtually guaranteed rapid returns. Office buildings, hotels, and apartment buildings were the most attractive investments. Offices joined industrial facilities on vacant plots at the ends of the corridor. Hotels also gravitated to the ends, especially toward the airport and stadium to the east. Apartments filled in smaller tracts in the central part of the corridor on vacant parcels.

The last decade was a period of continued infill coupled with redevelopment of some sites in the I-494 corridor. Most remaining tracts at the ends of the corridor were developed for activities comparable with those established in earlier stages. By 1981, the only large area that remained vacant was north of the freeway between Xerxes and France Avenues, where the Southdale Cluster and I-494 Corridor ultimately will coalesce. The fourth stage also saw increased redevelopment as the supply of vacant land diminished and some activities ceased to be viable at their original locations. Especially notable was the abandonment of some of the original sites by construction-related industries because most residential construction in the area had ceased.

FACTORS THAT AFFECT CLUSTER AND CORRIDOR DEVELOPMENT

Although case studies of concentrations like the Southdale Cluster and the I-494 Corridor are illustrative, they do not explain why clusters and corridors develop as they do. Many factors affect land use patterns in these concentrations, including locational tendencies of specific land uses, characteristics of the transportation system, historical factors and the timing of development, and other factors.

Locational Tendencies of Different Land Uses

The overall pattern of land uses in a cluster or a corridor is the cumulative product of decisions made at particular sites. The types of locales preferred by different activities vary considerably.

Commercial establishments as a group have great geographical tolerance, and they are found in a wide range of locations. Stores that carry goods that customers will travel longer distances to purchase, often after comparing the offerings of a number of merchants, are the mainstay of cluster shopping cen-

ters. Shopping centers became a fixture in the metropolitan commercial fabric after World War II for three reasons. First, greater use of the automobile vastly increased the distances a customer would or could travel for shopping and increased the volume of purchases one could make. Second, the growing size of the metropolis meant that stores providing high-ordered goods and services, previously restricted to downtowns, could feasibly locate in the metropolis' outer margins. Third, merchants discovered that by clustering collectively, they could offer a wider range of goods and services; by creating a larger pie, each store's share was greater than if it stood by itself.

The mixture of multiple department stores and specialty shops pioneered at Southdale has become the norm for shopping centers throughout the nation. The largest centers now have three levels, eight major stores, and 200 smaller shops. Additional commercial alternatives are available in nearby secondary centers. The attraction of shopping centers transcends their basic function as retail spaces. Large malls have become community centers for the suburbs, and center managers have booked a plethora of activities into their courtyards; they range from craft and automobile shows to symphony concerts. Child-care services, exercise programs, entertainment facilities, and cultural events attract more customers, which, in turn, attract more stores.

Not all commercial activities want or can afford cluster locations, however. Automobile dealers like to be near one another, but their space requirements force them to highly visible sites on cheaper land in corridors. Merchants offering convenience goods for local customers now occupy smaller corridor centers, as do stores offering second-hand merchandise. Such low-overhead retailers like the low rents of older corridor centers, which are still easily accessed from throughout the metropolis.

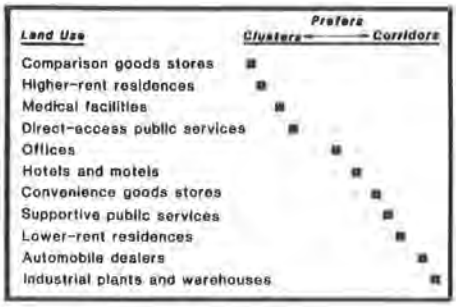
Office activities no longer must congregate downtown because frequent face-to-face contacts and direct transfers of paper have been obviated considerably by advanced communications. Easily accessed corridor locations with ample space for parking now are favored by many office users, although others prefer proximity to stores and restaurants and the prestige often associated with a cluster location. As a result, office buildings are an integral part of both clusters and corridors.

The locational criteria of hotels and motels also lead them to locate in both types of concentrations. The large, modern hostelries that now dominate the suburban lodging industry increasingly provide their own meeting facilities, but spill-over trade is common, which makes close proximity desirable. High visibility and easy access for passing motorists are important, too, so lodgings tend to string themselves out in corridors. The traffic generated by the metropolitan airport affects locational decisions. Therefore, the greatest suburban hotel-motel concentrations usually are along freeways that lead to airports.

Governmental and institutional uses vary considerably in terms of their locational preferences. Cluster locations are favored by activities that deal directly with the public; hence, libraries, licensing bureaus, and even courtrooms are found in or near shopping centers. Support services that require more widely accessible locations, such as public works and public safety facilities, prefer sites in corridors. Corridor locations also accommodate activities that generate large traffic loads, especially sports stadiums and arenas.

Suburban medical offices and hospitals more often are found in clusters than in corridors, but they may also stand independently. When present in a cluster, medical facilities represent the desire of the developer to diversify the range of activities in the area, to attract more people to the cluster, and to increase its visibility in the metropolis.

Figure 4. Locational preferences of land uses.



Like most other land uses, industrial and wholesaling operations have adapted their locations to changes in transportation. Earlier reliance on waterways and railroads for moving freight has been replaced by orientation to highways and freeways because trucks have become the primary mode for hauling most commodities. The desire for easy access to freeways leads many industrial plants and warehouses to locate in corridors, as does the need for large tracts of less expensive land on which to construct efficient, one-story facilities with ample space for freight transfer and employee parking. Although most suburban industrial facilities are relatively clean, they still are considered undesirable neighbors and often are zoned into a part of the corridor unwanted by other activities.

The explosive growth in demand for suburban multifamily housing since the 1960s has led to construction of many units in both clusters and corridors. More expensive apartments and condominiums are attracted to prestige locations in clusters because of the status and the proximity of stores, restaurants, and other attractions. Multifamily residential complexes often are buffers between the more frenetic activities in the cluster's core and surrounding single-family residential areas. Corridor locations are sought for lower-rent housing because units are easily accessed and are highly visible, which keeps occupancy rates higher. Buffering is important here, too, so that heavier traffic associated with apartment complexes does not pass through lower-density residential areas. Unfortunately, such buffering ensures that the maximum number of people are exposed to air pollution and noise from the freeway.

No absolutes govern the geographic behavior of specific land uses, but their locational tendencies may be arrayed on a continuum based on their preferences for locations in clusters or corridors (Figure 4). Comparison goods stores and higher-rent residences are the activities most likely to be found in clusters. In order of decreasing attraction to cluster locations are medical facilities, direct-access public services, offices, hotels and motels, convenience goods stores, supportive public services, and lower-rent residences. Automobile dealers and industrial plants and warehouses are those activities most likely to be in corridors.

These locational tendencies allow formulation of composite models of cluster and corridor structure. The cluster's focus is a large regional shopping mall, surrounded by smaller shopping arcades, individual stores, office buildings, and direct-access governmental and institutional facilities. Also

medical facilities and one or two large hotels may be nearby. Higher-density housing is a buffer between the cluster and surrounding single-family residences. The corridor, on the other hand, has no focus; it is formed by the coalescence of activities around its interchanges. Commercial activities group around interchanges with roads that serve residential areas, but hotels and motels are attracted toward airports and interchanges with other freeways. Industrial and wholesale operations are the mainstay of the corridor and occupy large tracts not desired by other land uses. Office buildings and apartments also are found throughout the corridor; these frequently fill in gaps between interchanges that are not commercially desirable.

Characteristics of Transportation System

The characteristics of the transportation system affect the forms and developments of clusters and corridors. Especially important are the configuration of the metropolitan freeway network and local characteristics within a concentration. Proximity and access to other modes may also be important.

Freeway configuration has a significant impact on the number and desirability of sites for cluster and corridor development. Because circumferential freeways offer greater access to larger parts of the metropolis than do radial freeways, clusters and corridors usually are more intensively developed along beltways. Metropolitan areas with complete freeway networks therefore tend to have a well-defined set of suburban concentrations, as do metropolises that have their freeway networks truncated by a lake or ocean or restricted by a large river. In contrast, metropolises that have incomplete freeway networks because of topographic restrictions or conscious decisions not to construct freeways offer few links or nodes for large cluster or corridor development. Development that would have taken place in these freeway-oriented concentrations instead is arrayed on major streets.

Transportation system characteristics within a cluster or corridor affect its form and development. Where frontage roads are present and have easy access to and from the freeway, as is true in most Texas metropolises, all sites fronting on the freeway are desirable--especially for commercial activities and hotels and motels. If frontage roads are absent or have restricted access, development is concentrated around interchanges. Interchange spacing is important; when interchanges are close together, such as the 0.5- to 1- mile intervals in the I-494 Corridor, corridor development is encouraged. With wider spacing, interchange-oriented clusters rarely reach the size that permits coalescence into linear corridors. Also influential is the importance of intersecting roads. Clustering will occur around more heavily traveled interchanges when there are wide variations in traffic volumes on intersecting roads. If traffic volumes are roughly equal, however, a corridor probably will result.

Although automobiles and trucks are the primary forms of suburban conveyance, people and goods also move by air, rail, and ship. Some activities rely on more than one mode of transportation, and they are prone to locate where both modes are accessible. Industrial operations, offices, and lodgings that rely on air transportation gravitate toward airports, so many freeway corridors are anchored by an airport. Industrial and wholesale operations dealing in large, bulky, or heavy commodities will also string out along freeways when rail or harbor facilities are available.

Historical Factors and Development Timing

To a great extent, the form and structure of a suburban cluster or corridor are products of the history of the metropolis and development timing. Although freeways have become the dominant thoroughfares in most North American metropolises, older routes are more important in some areas that have markedly different structural forms. In Vancouver, for example, the absence of freeways except in two remote areas has allowed old streetcar routes to remain the highest-volume highways. Commercial strips along these streets are still an integral part of the city's retail landscape, and few significant clusters have emerged.

The timing of freeway construction relative to the development of adjacent land is also important. If adjacent land is developed before the freeway is built, little land is left for any freeway-oriented development, and only small clusters will form at major interchanges. If the freeway is built long before the adjacent land is improved, clustering at interchanges again will predominate, with development along the freeway between interchanges only as spillover from the clusters. Ideal for corridor development are circumstances like those along I-494 south of Minneapolis, where concurrent development of the freeway and of nearby land left a narrow band of available sites, which were rapidly improved.

Present land use patterns also reflect the norms of the period when development took place. Clusters and corridors that emerged in the two decades after World War II were aggregations of many smaller, independent activities and evolved with little comprehensive planning. More recently, larger projects planned by single developers with active local governmental involvement have produced more cohesive mixtures--especially notable in showcase clusters like Newport Center, which is southeast of Los Angeles.

Other Factors

A final set of factors that influence cluster and corridor development includes social and demographic patterns in the metropolis, actions of local governments, and enterpreneurial prerogative. Social and demographic patterns are manifest in metropolitan patterns of prestige and disposable income. In most metropolises, the oldest and largest cluster is in the highest-income suburban sector. Given a certain number of customers who will visit shopping centers in a cluster, merchants would prefer them to be wealthy; more cash in pocketbooks usually translates into more cash in the till. Shopping centers that cater to wealthier persons also attract less prosperous customers; the converse is not true.

Local governments have a variable impact on the timing and rate of development. As noted by Schneider (8), Canadian cities generally have more extensive development controls than municipalities in the United States. As a result, high-intensity activity is more concentrated within Canadian central cities, and suburban clusters and corridors are less developed. Within the United States, opportunities for public control have been more limited. The similarity of suburban development forms in metropolises like Houston, which is famed for the absence of zoning, and the Twin Cities, which has an active and powerful metropolitan government, indicates that what controls are exercised have relatively little impact on cluster and corridor development.

A final explanation for cluster and corridor development might be called enterpreneurial prerogative. Land use patterns ultimately result from the decisions of many individuals, and some people will not do what is expected. For example, based on the relative preferences for various locations by different land uses, an office building should not face

the highly visible but inaccessible interchange of I-494 and I-35W south of Minneapolis. This building is the headquarters of the Twin Cities' largest outdoor advertising company, however. It is more than an office building; it is a billboard attesting to the company's success.

TRANSPORTATION AND SUBURBAN DOWNTOWNS

Any examination of suburban clusters and corridors invariably emphasizes the importance of transportation. These concentrations evolved in a period when the automobile was the primary mode of intraurban passenger travel and the truck was the most common way to move freight. Their land use patterns, scales, shapes, and identities resulted from heavy reliance on these modes. No other forms of transportation serve as well for most trips in these concentrations, and none will do so in the foreseeable future. Experience in the last decade, when Americans turned to more fuel-efficient vehicles and adjusted their tripmaking behavior to conserve fuel, showed that a transportation system dependent on automobiles and trucks is extremely flexible. Continued increases in gasoline prices likely will reinforce the locational advantages of suburban clusters and corridors because these concentrations offer the greatest range of destinations, thereby facilitating multipurpose tripmaking.

Limits are being reached in the local transportation systems of clusters and corridors, however. Traffic volumes are very high. In the Southdale and I-494 areas, for example, major surface streets now carry more than 20 000 vehicles daily, and freeways carry from 60 000 to 90 000 vehicles (11). The three highways that serve mammoth Woodfield Mall northwest of Chicago collectively carry more than 156 000 vehicles/day (12). Congestion is common during morning and evening rush hours in large clusters and corridors, and it also occurs at midday because many workers must drive to restaurants for lunch. Traffic control improvements have been implemented to make cluster and corridor traffic flows more efficient. Little more can be done to improve movement in most established concentrations. If congestion continues to impede traffic, activities will redistribute themselves in smaller clusters or at accessible points on the freeway network, thereby adding to the forces of corridor development.

Ridesharing programs in suburban clusters and corridors have not been as successful as planners had hoped, largely because dispersed locations and divergent working hours have made trip scheduling difficult. With up to 100 000 employees in the largest concentrations, however, the potential for ridesharing remains great--especially as flexible work scheduling is more widely accepted by employers. The increasing use of shuttle vans and other forms of paratransit in clusters and corridors will continue for elderly residents who do not have automobiles.

Regular-route transit's future in suburban clusters and corridors is problematical. The dispersal of activities in these concentrations makes effective bus or fixed-guideway service difficult. In addition to uncertainty about what system designs, if any, might efficiently serve clusters and corridors, grave doubts exist regarding funding for construction and operation of new transit systems. Shopping centers in major clusters now are being used as transfer points for larger numbers of bus lines, making them more accessible by transit from a larger part of the metropolis. Nevertheless, the only example of transit used for internal circulation likely will be peoplemovers at major airports, monorails at Disneyland and Disney World, and the showcase shuttle at Fairlane Center near Ford Motor Company headquarters in suburban Detroit.

A final mode that deserves mention is walking. Previously encouraged only in the interiors of shopping centers, pedestrian movement is now more viable elsewhere in clusters--thanks to the addition of walkways and improved signals. The scale and arrangement of activities make walking highly unadvisable in suburban freeway corridors, however. They still remain exclusively vehicular turf.

ACKNOWLEDGMENT

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REFERENCES

1. G. Breckenfeld. Downtown Has Fled to the Suburbs. Fortune, Vol. 86, No. 4, Oct. 1972, p. 82.
2. P. Muller. Contemporary Suburban America. Prentice Hall, Englewood Cliffs, NJ, 1981, p. 120.
3. T. Hartshorn. Interpreting the City: An Urban Geography. John Wiley & Sons, New York, 1980.
4. D. Hammerschlag and others. The Interstate Highway System and Urban Structure: A Force for Change in Rhode Island. Office of Program and Policy Planning, Federal Highway Administration, U.S. Department of Transportation, 1976.
5. A. Ludwig and others. Radial Freeways and the Growth of Office Space in Central Cities. Office of Program and Policy Planning, Federal Highway Administration, U.S. Department of Transportation, 1977.
6. Hammer, Siler, George Associates. The Influence of Central City Radial Freeways on Manufacturing Location Decisions. Office of Program and Policy Planning, Federal Highway Administration, U.S. Department of Transportation, Volumes 1 and 2, 1973.
7. M. Dyett and others. The Land Use and Urban Development Impacts of Beltways. U.S. Department of Housing and Urban Development; U.S. Department of Transportation, Volumes 1-4, 1980.
8. J. Schneider. Transit's Role in the Creation of the Polycentric City. Urban Transportation Program, Department of Civil Engineering and Urban Planning, Univ. of Washington, Seattle, 1978.
9. F. Murray. For Him, Wright Is Kind to City. Minneapolis Star, Nov. 27, 1956, p. 13A.
10. T.J. Baerwald. The Emergence of a New "Downtown." Geographical Review, Vol. 68, 1978, pp. 308-318.
11. 1980 Traffic Volumes, Street Series, St. Paul-Minneapolis Seven County Area. Bureau of Policy and Planning, Minnesota Department of Transportation, St. Paul, map 4D, 1980.
12. 1979 Average Daily Total Traffic. Office of Planning and Programming, Illinois Department of Transportation, Springfield, map, 1979.

Defining Regional Employment Centers in an Urban Area

ROBERT T. DUNPHY

Suburbanization of employment in urban areas has reduced the significance of the traditional downtown not only for shopping but also for commuting. However, there are no standard definitions of suburban employment centers comparable with those of central business districts. This paper describes a study of regional employment centers within the Washington, D.C., area. Guidelines are given for applying the technique to other regions. An empirical definition of employment centers was developed based on a detailed investigation of employment concentrations throughout the region. Criteria were developed based on size of the center, area, and specialization of employers. The study made use of a 1974 census of employment, aerial photography, and U.S. census maps.

Analysis of population clusters has been an important focus of urban geography from its beginnings to the present. However, the study of employment clusters has been limited to research on urban-type settlements within a rural environment, until recently. Advanced techniques for geoprocessing of work locations and improved availability of work place data now make it possible to replicate some of the population cluster research for employment centers. In contrast to patterns of population distribution, which are relatively continuous, employment tends to cluster in a relatively limited number of well-defined business districts, including the central business district (CBD). Neidercorn and Hearle (1) found that commercial and industrial land on which most jobs are located accounted for only 12 percent of the total regional land area. Therefore, it is necessary that studies of employment centers develop new geographic units rather than being limited by the same census tract boundaries frequently used in studies of population concentrations. Some of the principal reasons for identifying and analyzing employment centers in urban regions are as follows:

1. It has been suggested that such centers could serve as a major focus for transit service in the suburbs (2).
2. Improved knowledge of the location and function of current employment centers will make it possible to develop better forecasts of growth in existing centers and identify the location of future centers.
3. They can be used to target special transportation policies, such as ridesharing and carpooling.
4. Prior knowledge of the locations of major employment clusters in a region will focus data-collection efforts for special surveys.

CONCEPT

The concept of a regional employment center is one in which there are concentrations of employment in a limited geographic area, similar to the retail clusters defined as major retail centers in the U.S. Census of Business. In addition, there should be a diversity of different employers rather than one or two principal ones that dominate the center. It is generally easy to reach agreement on the location of the CBD according to certain criteria of density and business type. However, there can be great controversy over not only the limits of a noncentral employment area but also its very existence. A number of high-rise offices clustered around a suburban crossroads would probably qualify in most planners' minds. However, what about a suburban office park, an industrial park, or a shopping center?

Central-place theories developed in urban geography could be useful, except that they tend to focus on the hierarchies of towns within a rural region. One of the most comprehensive studies to date was that undertaken by Berry in southwestern Iowa, which analyzed the distribution of towns in a farming area (3). One of the reasons for this lack of urban research has to do with data limitations. It was not until the 1970s that small-area employment data began to become available within several metropolitan regions, typically based on state employment security files. Moreover, it was found that converting these data into the types of establishment-based information required by planners required considerable additional processing (4). For this reason, the study described here represents some initial steps to define regional employment centers based on empirical data. It is expected that further research will make it possible to improve the theoretical basis for the classification.

IDENTIFYING EMPLOYMENT CLUSTERS

Before questions of size or composition can be addressed, it is necessary to develop a candidate list of employment centers for further screening. The small geographic scale involved requires an employment data base coded to very detailed geography, preferably block. This study was able to use an inventory created by the Metropolitan Washington Council of Governments (COG), which was a census of employment throughout the region for 1974. This regional employment census was tabulated by block in order to pick up the "hot spots" that serve as the core of a regional employment center. The block served as a more convenient geographic summary unit than building premise addresses, which are a cumbersome identifier to work with in a large file. In major employment districts, block-level summaries may include all employment located in buildings on the main street as well as the back street or side streets. In less-dense areas, one facility may occupy an entire block. All blocks with more than 1000 employees were identified. Such blocks accounted for almost 50 percent of regional employment in only 4 percent of all blocks. Those areas with several blocks of high employment were then considered for inclusion as employment clusters. In addition, density maps of employment grouped to grid squares were analyzed to pick out cases of possible medium-density employment centers with less than 100 employees/block, but that extended over a large continuous area. Aerial photographs were then used to delineate areas of nonresidential land use for each potential center. Employment tabulations were then made for each of these centers, and the land area was calculated. The distribution of these trial centers by land area and employment size is shown in Table 1.

IDENTIFYING A MINIMUM SIZE OF CENTER

An analysis of Table 1 indicated that there were many employment centers with less than 5000 employees compared with fewer large centers. Out of 99 centers, 56 had less than 5000 employees. However, they only accounted for 15 percent of the jobs in all of these centers. The types of centers included in this category were industrial parks and sites, 14; hospitals, 13; shopping centers, 10;

Table 1. Distribution of trial centers: land area and employment size.

No. of Acres	No. of Employees			
	Less Than 5000	5000-9999	10 000-20 000	More Than 20 000
0-99	22	2	-	-
100-199	14	8	2	2
200-299	9	5	-	2
300-399	-	2	-	3
400-499	5	2	3	-
500-599	3	-	3	1
600 or more	3	6	1	1
Total	56	25	9	9

military and government sites, 7; universities, 3; and town centers and other, 9.

A conclusion of this phase of the analysis was that regional shopping centers not accompanied by office development were too small (median size, 2000 employees) to be considered regional employment centers. The same was true of hospitals (median employment, 1500) and most industrial areas (median employment, approximately 2000).

DEFINITION OF AREA SIZE

Many of the centers summarized in Table 1 encompassed rather extensive land areas, in some cases more than 600 acres, which is almost 1 mile^2. The problem was typically a result of using blocks as the basic unit of geography. In suburban areas, where there is little residential development and, consequently, no regular grid system of streets; some of these blocks are quite extensive. It was, therefore, necessary to split blocks and only include the area of the block devoted to intense commercial uses. In some cases, this modification reduced the total employment in the center below 5000, and the center was eliminated. A further refinement was made to the boundaries of some centers with extensive campus-type sites, but with most of the jobs clustered in one area. In this case, the final land area considered was only that to be used probably for employment purposes. The only two industrial centers remaining after this phase were a large, high-density one in Fairfax County, Virginia, and an industrial corridor near the railroad in the District of Columbia. Although no centers were eliminated on the basis of a maximum area threshold, there were only two centers found with sites covering about 700 acres; all of the others were much more compact.

Once the basic employment centers had been identified, a final check was made on the boundaries. This involved cutting back areas near the perimeter with very low employment densities. Although the density of each block was not calculated, it was possible to relate the employment totals to those of other blocks and visually compare the areas.

CORE EMPLOYMENT CENTERS

The same method of analysis was conducted in the central area as in the suburbs. This produced a definition of suburban regional employment centers consistent with that used for the core area, the traditional downtown. Washington is unique, however, in that a building-height limitation has resulted in a downtown area in which employment has spread out rather than up. For descriptive purposes, the Washington central employment area was subdivided into seven districts. One of these, Georgetown, which serves as a fashionable shopping area on the edge of the downtown employment area, was eliminated because it employed less than 5000 people. The remaining area was divided into six different districts for descriptive purposes based on the mix of employment and traditional distinctions between these areas. In addition, the regional employment core also includes three somewhat more distinct employment districts in the adjacent portion of Arlington, Virginia, which is actually an extension of the District of Columbia core.

SPECIAL EMPLOYMENT GENERATORS

An analysis of the revised list of centers that have more than 5000 employees showed that there were nine centers in the range of 5000-10 000 employees that were quite specialized in nature. As indicated above, one of the criteria for defining regional employment centers was a diversity of different employers. The justification for this is that a single business or government agency can employ vast numbers of employees at a single location, but numbers alone do not provide a truly regional economic base. For one thing, once such a massive installation is established, it is not likely to generate the type of agglomeration growth that would be expected when several similar types of business are located together. On the other hand, a single decision by that establishment or a parent group could result in substantial employment declines during economic slowdowns in that industry. In addition, such specialized employers as universities, military bases, hospitals, and even government installations do not serve a truly regional labor market in the sense that their jobs are generally restricted to a small portion of the labor force at any given time (e.g., active military, academic, or medical personnel with credentials to practice at particular institutions). Such specialized centers in this size range were therefore eliminated from the regional employment center definition. This excluded one university with an affiliated hospital, seven military installations, and the Federal Center in Suitland, which serves as the headquarters of the U.S. Census Bureau. In addition, a slightly larger center, National Airport, was excluded for similar reasons.

Other special employment generators that have more than 10 000 employees were not excluded from the final definition. It was felt that the scale of these facilities was so large that they should be included. Four facilities fell into this category: Pentagon (military offices), 30 000 employees; NIH-Bethesda Naval Hospital (medical), 19 000 employees; Langley (security agency), 16 000 employees; and Andrews Air Force Base (military base), 13 000 employees. Collectively, they account for 78 000 jobs, equivalent to the CBD of a large city.

FINAL REGIONAL EMPLOYMENT CENTERS

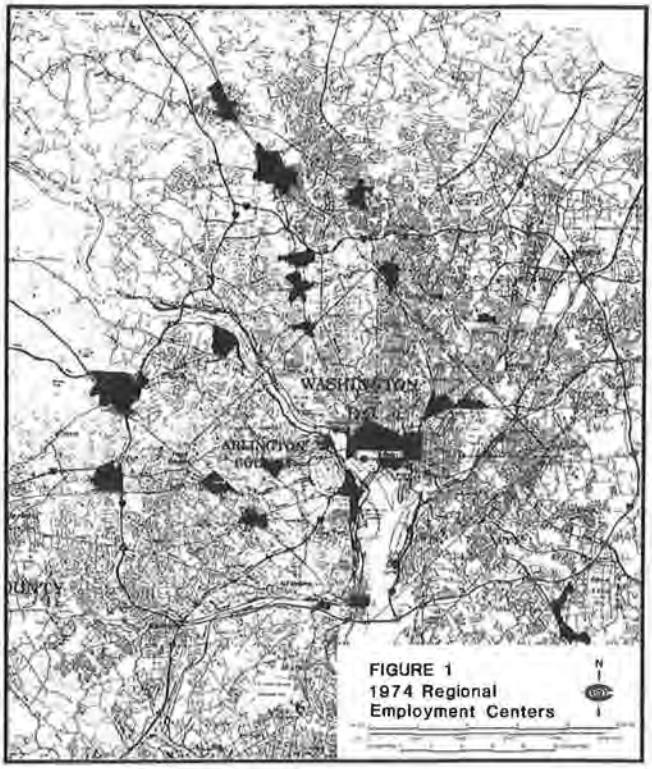
The final definition of regional employment centers yielded 27 centers. Nine of these were different core employment districts either in Washington, D.C., or in adjacent areas of Arlington County. The individual centers are listed in Table 2. Their location is shown in Figure 1.

CONCLUSIONS AND TRANSFERABILITY

This study has backed into a definition of regional employment centers because of the lack of accepted criteria. It appears from this empirical analysis

Table 2. Regional employment centers, 1974.

Employment Center	1974 Employment (000s)	Land Area (acres)
Core		
Downtown retail area	59	344
Connecticut Avenue	102	303
Federal Triangle	26	253
Foggy Bottom	40	320
Southwest	59	264
Capitol Hill	47	561
Rosslyn	13	136
Crystal City	21	184
Pentagon	30	127
Total	397	2492
Suburban		
Silver Spring	19	427
NIH-Medical Center	19	405
Langley	16	532
Bethesda	14	401
Andrews AFB	13	424
Tyson's Corner	12	714
Friendship Heights	11	190
Ballston	9	216
Twinbrook	9	157
Merrifield	8	708
Prince George's Plaza	8	114
Wheaton	7	345
Rockville	6	583
New York Avenue, N.E.	6	500
Seven Corners	6	334
Cameron Run Valley	6	248
Alexandria	5	194
Bailey's Crossroads	5	295
Total	179	6787



that a regional employment center will have the following characteristics:

1. A minimum of 5000 jobs,
2. A maximum developed area of 700 acres, and
3. A diversity of region-serving employers rather than a few special institutions.

In the Washington area, which has a very high percentage of jobs in the regional core, the 18 suburban regional employment centers employed almost half as many people as worked downtown in 1974. It is likely that in more dispersed regions, the cumulative employment in such centers could exceed that of the downtown. The ability to isolate such a high percentage of regional jobs within a relatively small number of well-defined centers should make it possible for researchers and planners to focus more sharply on the growth and distribution of employment within an urban region and how well it relates to population patterns.

The research described here has been a case study of the application of a regional employment center definition to the Washington, D.C., metropolitan area. This region has a few major differences with most other urban areas: (a) the dominance of government employment (about 4 out of every 10 jobs, including state and local employment) and (b) the concentration of regional employment in the central area.

It is believed, however, that the pattern of suburban employment centers in other regions will be similar. In fact, because of the much higher relative importance of the central employment core in Washington, D.C., it is likely that other regions will contain more and larger suburban employment centers. It is expected that such centers will also satisfy the criteria of a large number of employees and a diversity of businesses clustered on relatively compact sites. The maximum area definition may need to be expanded. Assuming that the basic approach applies, it will be possible to identify a substantial share of the regional employment base on a limited number of job sites. Special policies for improving transportation efficiency can then be focused on a reasonable number of potential sites.

ACKNOWLEDGMENT

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REFERENCES

1. J.H. Neidercorn and E.F.R. Hearle. Recent Land Use Trends in 49 Large American Cities. Land Economics, Vol. 40, 1964, pp. 105-110.
2. J. Schneider and S. Smith. Redesigning Urban Transit Systems: A Transit-Center-Based Approach. TRB, Transportation Research Record 798, 1981, pp. 56-65.
3. M. Yeates and B. Garner. The North American City. 2nd ed. New York, Harper and Row, 1976.
4. R.T. Dunphy. The Illusion of the Secondary Source. Proc., Urban and Regional Information Systems Assn., Atlantic City, NJ, 1973.

Impacts of CBD Fare-Free Transit on Retail Sales

TERRY J. ATHERTON AND ELLYN S. EDER

Results of an analysis of changes in central business district (CBD) retail sales associated with the implementation of fare-free transit service in downtown Albany, New York, are presented. The analysis reported here was performed in conjunction with a broader evaluation effort under the Urban Mass Transportation Administration's Service and Methods Demonstration Program. In addition to examining changes in aggregate CBD retail sales, changes in sales by type of retail establishment and location relative to major bus lines were also considered. Results are based on a time-series analysis of retail sales tax receipts provided by the New York State Department of Taxation and Finance for a panel of 115 CBD retail establishments. In addition, total retail sales tax receipts for Albany County were used as a control for the CBD panel. The analysis results suggest that CBD fare-free service has had a positive impact on sales among downtown merchants, primarily during first quarters (December 1 through February 28), which correspond to holiday shopping seasons, and among miscellaneous sales establishments (i.e., specialty and gift shops). Also, retail establishments located in close proximity to major bus routes appear to have benefited most from the implementation of fare-free service.

Over the past decade a number of urban area transit operators have instituted programs involving some form of fare reduction on an experimental or, in some instances, permanent basis. One of the more popular variations of such programs has been the elimination of fares within the central business district (CBD), usually only during off-peak hours. Although this particular form of fare reduction has been implemented to serve a wide range of objectives, the focus of many such projects has been revitalization of the downtown area. For example, as a result of improved accessibility within the CBD brought about by the elimination of fares, downtown employees may find it more convenient to accomplish many of their shopping needs by patronizing downtown merchants. Similarly, for people already shopping in the CBD, the improved accessibility between various downtown retail opportunities could make it more convenient to do even more of their shopping within the CBD. This potential increase in retail activity could spark the revitalization of an otherwise declining retail core.

This paper presents results of an analysis of changes in retail sales associated with the implementation of a CBD fare-free zone in Albany, New York. The analysis, which is based on sales tax receipt data provided by the New York State Department of Taxation and Finance, addresses the following specific questions related to changes in retail sales:

1. Aggregate retail sales--To what extent does fare-free service lead to increased retail sales within the CBD?
2. Type of retail establishment--Are increases in sales uniform across all types of establishments within the CBD, or are increases greater for some retail activities than for others (e.g., restaurants versus clothing stores)?
3. Proximity to bus service--For a given type of retail activity, are increases in sales realized by all establishments within the fare-free zone, or are increases at those establishments located near major bus routes accompanied by decreases (or smaller increases) at more distantly located establishments?

BACKGROUND

In November 1978, the Capital District Transportation Authority (CDTA), in cooperation with the Urban Mass Transportation Administration (UMTA), established a fare-free zone in downtown Albany, New York, as part of UMTA's Service and Methods Demonstration (SMD) Program. This project eliminated fares for trips within the 0.67-mile^2 fare-free zone during off-peak hours (9:00 a.m.-3:00 p.m.) during the week and from 9:00 a.m. to 5:00 p.m. on Saturdays.

The fare-free zone contains most of the downtown's retail activity, the Empire State Plaza (the state capital office complex), several large private office complexes, and residential neighborhoods. About 35 000 employees work in the fare-free zone, of whom approximately 21 000 are government employees. Population within the zone is about 8000, with an additional 4500 people residing within one block of the fare-free zone boundaries.

Retail activity within the Albany CBD had declined steadily during the decade prior to the implementation of fare-free service. In 1967, for example, there were a total of 284 retail establishments located in downtown Albany. In 1972, this number had decreased to 198; in 1977, only 133 retail establishments remained in the CBD. As shown in Figure 1, total retail sales in the CBD dropped by a factor of 3 between 1967 and 1977 in terms of constant 1967 dollars, while over the same period total standard metropolitan statistical area (SMSA) sales increased by 20 percent. As a percentage of total SMSA sales, CBD sales declined from 4.2 to 1.1 percent between 1967 and 1977.

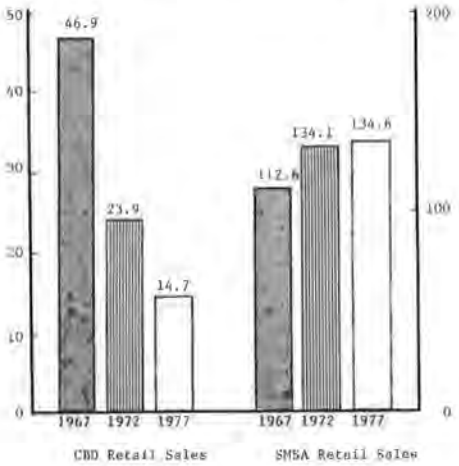
In addition to changes in the number of establishments, changes in the character of retail activity within the CBD have also occurred. In 1967, for example, two major department stores, four home furnishing stores, and eight appliance stores were located in downtown Albany. In 1977, both department stores, all four home furnishing stores, and all but two appliance stores had left the CBD. In contrast, although the number of eating places decreased in absolute terms from 69 to 45, the proportion of all retail establishments categorized as eating places increased by nearly 40 percent (i.e., from 24.3 to 33.8 percent) between 1967 and 1977. These shifts in the types of establishments forming the downtown retail core are evidence of a transformation of the CBD from a regional shopping area to one more oriented toward serving the increasing employee population located in the downtown area.

POTENTIAL CHANGES IN PURCHASE PATTERNS

There is little question that the elimination of fares in downtown Albany has increased accessibility within the CBD. After fare-free service was implemented, transit ridership within the downtown area tripled. Although this increase was attributable primarily to shifts in mode, average trip lengths were greater after fares were eliminated, indicating that changes in destination choice had occurred as well. However, while accessibility within the downtown area has been increased, the relation between this increased accessibility and increased retail activity is not totally understood.

In developing an understanding of this relation, it is probably best first to explore what changes in individual purchase patterns are likely to occur as a result of CBD fare-free service that would lead to increases in retail sales. In general, any increase

Figure 1. Albany CBD versus SMSA retail sales.



in sales among CBD retail establishments would be the result of either an increase in the total amount of purchases made by those individuals able to take advantage of fare-free service, or a diversion of purchases formerly made at retail establishments located outside the downtown area.

With respect to the former, substantial increases in total purchases would occur only if accompanied by corresponding increases in purchasing power. Since the increase in purchasing power of individuals in the downtown area as a result of the elimination of fares within the CBD, for all practical purposes, is negligible, an increase in total purchases, particularly for large-purchase items, would not be expected to be the primary mechanism by which CBD retail sales are increased. However, to the extent that the improved accessibility resulting from fare-free service exposes a greater number of people to more retail opportunities, one might expect an increase in impulse buying of small purchase items. In addition, the elimination of fares (or the need to pay for parking in those instances where an automobile was formerly used) could be considered as a reduction in purchase price, which in turn could lead to an increase in total purchase expenditures for small-purchase items and dining out for lunch.

However, while some increase in both sales of small purchase items and restaurant receipts may be the result of an increase in total purchases, any increase in the sales or more-costly items (e.g., clothing, appliances, etc.) would almost certainly be the result of the diversion of purchases from areas outside the CBD. The incidence of this redistribution of purchases would to some degree depend on the extent to which the increased accessibility within the CBD makes it more convenient to shop in the downtown area relative to other retail areas. For example, CBD employees may find it much easier to accomplish their shopping needs during their lunch hour rather than stopping off on their way home from work or making an additional trip either in the evening or during the weekend. Since much of their shopping was probably already done in the CBD prior to fare-free service, little diversion of purchases for downtown residents would be expected.

ANALYSIS APPROACH

The impact of fare-free service on retail sales in the Albany CBD was examined primarily by using retail sales tax receipts provided by the New York State Department of Taxation and Finance (NYSDTF). The basic approach involved a time-series analysis of quarterly sales tax receipts over a 15-quarter period (from December 1976 through August 1980) for a panel of CBD retail establishments that were in business throughout the 15-quarter period. Quarterly sales tax receipts for all retail establishments in Albany County during the same period were also used in the analysis in an attempt to provide a control for exogenous economic factors in the region that could also influence retail sales.

The Albany CBD panel consisted of 115 retail establishments organized into the following seven groups based on type of sales:

1. Full-service restaurants,
2. Other restaurants,
3. Apparel,
4. Furniture and appliances,
5. Food stores,
6. Services (e.g., travel agencies, cleaners, tailors, etc.), and
7. Miscellaneous sales (e.g., sporting goods, books, hardware, gifts, liquor, etc.).

For three of these groups (i.e., other restaurants, apparel, and miscellaneous sales), establishments were further categorized by their proximity to bus service. Two categories were used: (a) near--defined as being located within one block of the Washington Avenue-State Street bus routes; and (b) far-defined as being located beyond one block of these bus routes. The number of establishments included in each category is shown in Table 1.

In establishing whether fare-free service has had an impact on CBD retail sales, the preferred analysis approach would involve some formal, statistical trend-analysis technique. For this study, however, the number of observations available (i.e., aggregate retail sales tax receipts for 15 quarters) was not sufficient to estimate a regression equation. Instead, reliance was placed on informal judgment about whether patterns in the data suggested that a change in retail sales had occurred as a result of fare-free service. Although this approach lacks the rigor of a formal statistical estimation procedure, it can provide valuable insights into the relation between the improved accessibility brought about by CBD fare-free service and increased retail activity.

The analysis approach, then, is essentially based on comparisons of trends in retail sales of the panel of CBD retail establishments with those observed countywide. Two points should be noted with respect to the use of this approach for assessing the impacts of CBD fare-free service on total CBD retail sales.

First, by restricting the analysis to a panel of retail establishments remaining in business over the 15-quarter period for which retail sales tax data were available, the opening or closing of other retail establishments within the CBD is not accounted for. This has two implications. First, results of the analysis will not necessarily represent the overall impact on total CBD sales resulting from fare-free service. For example, if results indicate that sales among establishments comprising the CBD panel remain unchanged as a result of fare-free service, total CBD sales still could have increased as the result of an increase in the number of retail establishments located in the CBD.

In addition, trends in retail sales observed for the CBD panel could be influenced by changes in the total number of establishments located in the CBD. For example, while a decrease in sales for a given retail category in the CBD panel could indicate an overall drop in retail activity within the CBD for

Table 1. Composition of CBD panel.

Type of Retail Establishment	Proximity to Bus Line		Total Establishments
	Near	Far	
Full-service restaurant	-	-	15
Other restaurant	12	8	20
Apparel	5	14	19
Furniture and appliances	-	-	7
Food store	-	-	12
Service	-	-	15
Miscellaneous sales	10	17	27
Total	27	39	115

that category, it could also reflect increased competition arising from a greater number of establishments in that category located within the CBD. For example, in such a situation it is conceivable that although reduced sales at individual retail establishments are observed, aggregate sales would actually increase because of the greater number of establishments.

Another concern is related to the suitability of countywide sales as a control in view of differences in the mix of aggregate retail sales between Albany County and the CBD panel. For example, the CBD panel had a much higher proportion of sales associated with apparel and eating and drinking establishments, while Albany County as a whole had a much higher proportion of automobile and food sales.

If the distributions of retail sales by type for the CBD panel and Albany County were similar, one could argue that sales in each group would be similarly affected by exogenous economic factors. Under these somewhat ideal conditions, the use of countywide sales tax receipts as a control for those observed for the CBD panel would be quite reasonable. Because these distributions of retail sales by type are different, consideration should be given to the differential impacts that changes in economic conditions would have on Albany County versus CBD panel sales. For example, the greater proportion of food sales (i.e., grocery stores, etc.) in Albany County would suggest that countywide sales would be somewhat less sensitive to any changes in economic conditions. Further, the lower proportion of sales by eating and drinking establishments would also suggest that countywide sales would be less sensitive, since these expenditures are likely to be much more discretionary in nature than those for groceries. On the other hand, the higher proportion of automobile sales would tend to make total countywide sales more vulnerable to downturns in the economy because people would tend to retain older cars rather than buy new ones during periods of recession.

Overall, then, it is not clear how the response of total countywide sales would differ from those of the CBD panel. However, to the extent that the responses hypothesized above would tend to cancel each other, the use of aggregate Albany County sales tax receipts as a control for those of the CBD panel is not unreasonable.

RESULTS

Trends in Retail Sales: CBD Panel Versus Albany County

Average quarterly sales tax receipts by year for Albany County and the CBD panel are presented in Table 2. As shown, retail sales in Albany County increased by 2.9 percent in 1978 relative to 1977 and an additional 0.9 percent in 1979. In 1980, sales fell off markedly to 3.6 percent below their 1977 level. For the CBD panel, too, sales increased in 1978. In this case, the magnitude of this increase in percentage terms (11.5 percent) was nearly three times that observed for Albany County. Sales then increased in 1979 by an additional 0.4 percent and dropped off slightly in 1980. For the CBD panel, 1980 sales were still 9.7 percent greater than in 1977. These results indicate that relative to countywide sales, CBD sales were much more stable in 1980.

Retail Sales by Quarter: CBD Panel Versus Albany County

The relation between Albany County and CBD panel sales on a seasonal basis is presented in Figure 2. As shown, with the exception of first-quarter sales, trends in CBD panel sales are quite similar to those of countywide sales, particularly during the third quarter of each year. However, the trend in first-quarter sales of the CBD panel is quite different from that of Albany County. As shown in Figure 2, first-quarter sales for the CBD panel were declining prior to the implementation of fare-free service and reached their lowest point in the quarter ending February 28, 1978. Once CBD fare-free service was in effect, first-quarter sales increased sharply and reached a level in 1980 that was 25 percent greater than in 1978. Countywide first-quarter sales, on the other hand, increased slightly from 1978 to 1979, and then dropped off in 1980. During the two-year period over which CBD panel first-quarter sales increased by 25 percent (i.e., February 1978 to February 1980), countywide first-quarter sales declined by 5.6 percent.

It should be noted, however, that in the first quarter of 1978 sales had dropped to an extremely low level for certain types of establishments in the CBD panel (i.e., "far" miscellaneous sales establishments and "near" other restaurants). To a certain extent, then, the increase in first-quarter sales observed between 1978 and 1979 for the CBD panel can be attributed to the return to normal sales volumes in subsequent quarters of 1978. Furthermore, first-quarter sales countywide increased slightly between 1978 and 1979. To the extent that Albany County sales serve as an appropriate control, a similar increase would have been expected for the CBD panel.

The increase in CBD panel first-quarter sales between 1979 and 1980 cannot be explained by either a resurgence of CBD sales or a general upturn in retail activity in the Albany region. For both Albany County and the CBD panel, fourth-quarter sales between 1978 and 1979 and second- and third-quarter sales between 1979 and 1980 declined--most likely reflecting a change in economic conditions that had a similar effect on both CBD and countywide retail activity. This effect is also reflected in the decrease in first-quarter sales between 1979 and 1980 for Albany County. For the CBD panel, first-quarter sales increased between 1979 and 1980.

In view of the similarities of the decreases in second-, third-, and fourth-quarter sales tax receipts between the CBD panel and Albany County, a decline in CBD panel first-quarter sales between 1979 and 1980 similar to that observed for countywide sales also would have been expected. For example, first-quarter sales tax receipts in Albany County dropped by 6.2 percent between 1979 and 1980. Had CBD panel sales experienced the same percentage decrease, 1980 first-quarter sales tax receipts (in 1967 dollars) would have been $203 100. Actual 1980 first-quarter sales tax receipts were $230 200, which represent a 13.4 percent increase

over what would be expected if CBD sales had followed the same trend as countywide sales. With Albany County's 7 percent sales tax, this $27 100 difference in sales tax receipts would translate into a $387 100 difference in gross sales in 1967 dollars. In terms of 1980 dollars, this difference would be $875 300.

The fact that CBD sales increased during this period suggest that there was some factor unique to the CBD that had a positive impact on first-quarter sales, the time period that includes most of the holiday shopping season (i.e., December). One possible explanation is that these increased sales were the result of an intense promotional effort on the part of downtown merchants during the holiday shopping season. However, discussions with the head of the downtown merchants' association indicated that this was not the case.

Another possible explanation, although certainly not the only one, is that the impact of CBD fare-free service is most pronounced during the holiday shopping season. During this period, people typically purchase a large number of items (i.e., gifts) in a relatively short period of time. As a result,

Table 2. Average quarterly sales tax receipts by year: Albany County versus CBD panel.

Year	CBD Panel			Albany County		
	Quarterly Sales Tax Receipts[a] ($)	Change from Previous Year (%)	Change from 1977 (%)	Quarterly Sales Tax Receipts[a] ($)	Change from Previous Year (%)	Change from 1977 (%)
1977	190 553	-	-	4 744 913	-	-
1978	212 386	+11.5	+11.5	4 882 453	+2.9	+2.9
1979	213 124	+0.4	+11.8	4 925 962	+0.9	+3.8
1980	209 091	-1.9	+9.7	4 574 780	-7.1	-3.6

[a]Sales tax receipts expressed in constant 1967 dollars.

Figure 2. CBD panel versus Albany County sales tax receipts by quarter.

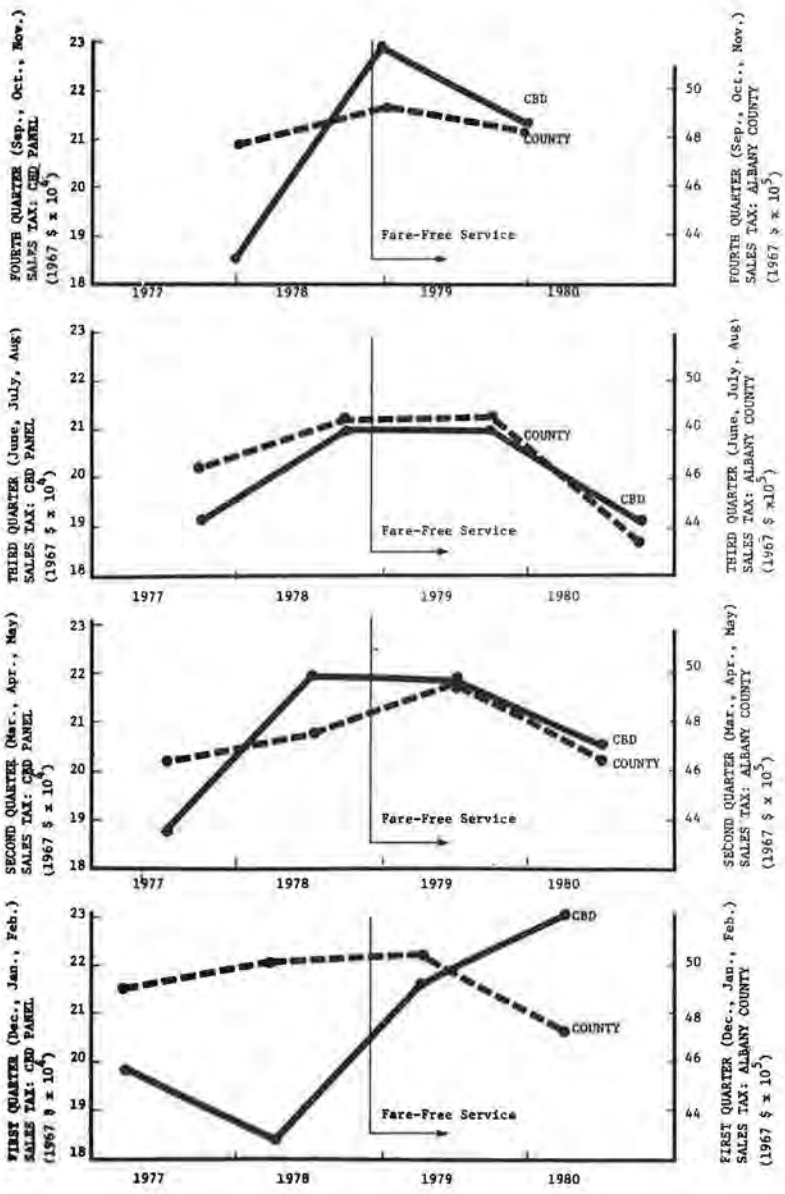
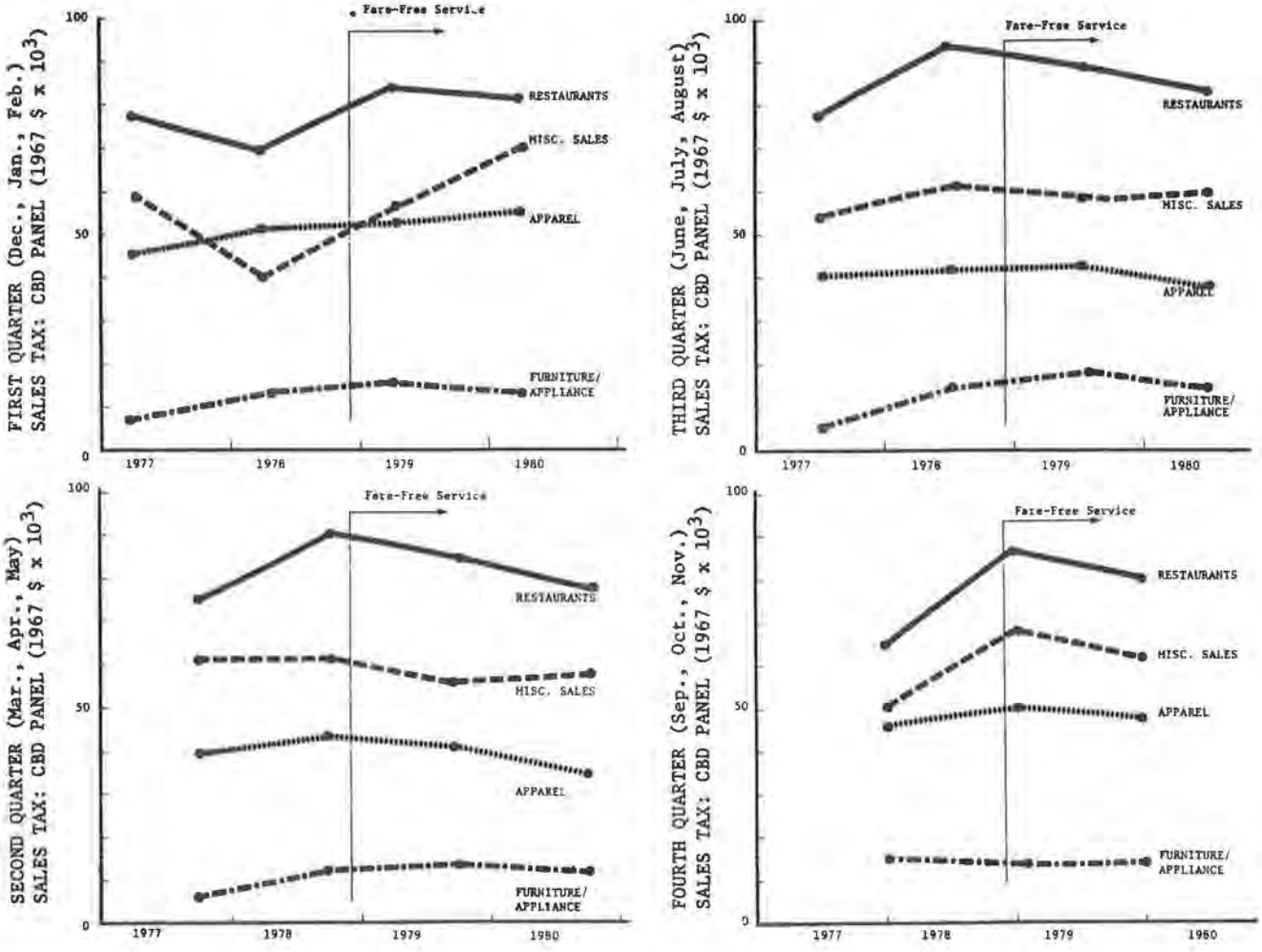


Figure 3. CBD panel sales tax receipts: restaurants, miscellaneous sales, apparel, furniture and appliance.



anything that makes shopping more convenient could have a fairly strong influence on where and when these purchases are made. In this case, for example, the elimination of fares in the CBD may have made downtown employees more inclined to accomplish their holiday shopping needs by patronizing downtown merchants during their lunch hour rather than by contending with crowds at suburban shopping locations during the evenings or on weekends.

To the extent that fare-free service has had an effect on CBD retail sales, these results suggest that the most significant impact occurs in December during the holiday shopping season. This would account for the increase in CBD panel first-quarter sales between 1979 and 1980, and, probably to a lesser extent, the increase in first-quarter sales between 1978 and 1979. Because total expenditures for holiday-related purchases appear to have decreased over this period, as evidenced by the decline in countywide first-quarter sales, these results would further suggest that the increase in CBD retail sales is primarily the result of a diversion of purchases from other shopping locations. In addition, to the extent that CBD residents did much of their shopping in the downtown area prior to the implementation of fare-free service, these increases are most likely attributable to CBD employees and other non-CBD residents in the downtown area during the day.

Type of Retail Establishment

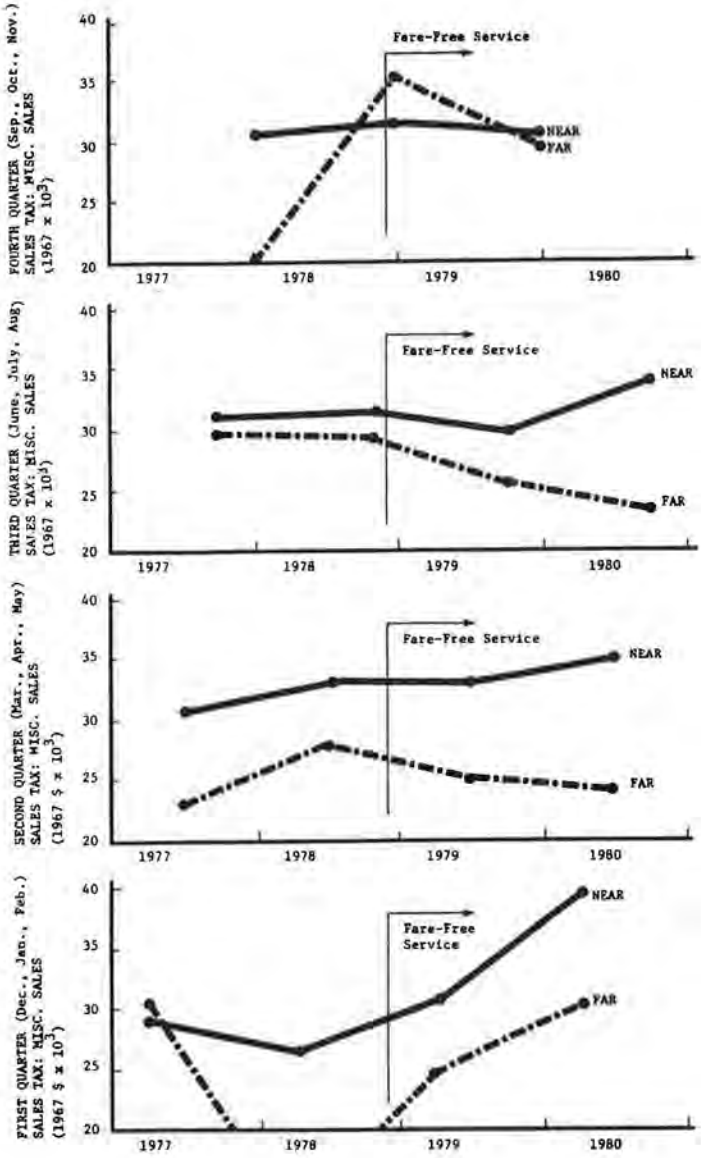
A second issue in the analysis of changes in retail sales is the extent to which these changes vary by type of establishment. This section discusses the distribution of aggregate quarterly sales tax receipts for the CBD panel among miscellaneous sales, apparel, restaurants, and furniture-appliance establishments.

Miscellaneous Sales

Quarterly sales tax receipts from miscellaneous sales establishments are presented in Figure 3. As shown, first-quarter miscellaneous sales have increased dramatically since the implementation of fare-free service. From a low of $41 000 in 1978, sales tax receipts for these establishments increased to $70 000 in 1980--a 71 percent increase over this two-year period. This increase accounts for 64 percent of the total increase in first-quarter sales tax receipts observed for the entire CBD panel during this same period. Second- and third-quarter sales tax receipts for miscellaneous sales have remained relatively stable, while fourth-quarter sales increased from 1977 to 1978, and then declined somewhat in 1979.

Overall, then, to the extent that fare-free service has had an effect on retail sales, it would ap-

Figure 4. Retail sales tax receipts versus proximity to bus lines: miscellaneous sales.



pear that miscellaneous sales have benefited most. Further, increased sales are observed only during the first-quarter periods, indicating that this increase is primarily the result of more purchases during the holiday shopping season. Since "miscellaneous sales" represents a wide range of specialty and gift shops, one would expect that the increase in holiday sales for the CBD panel noted earlier would occur to a great extent among establishments in this category.

Apparel

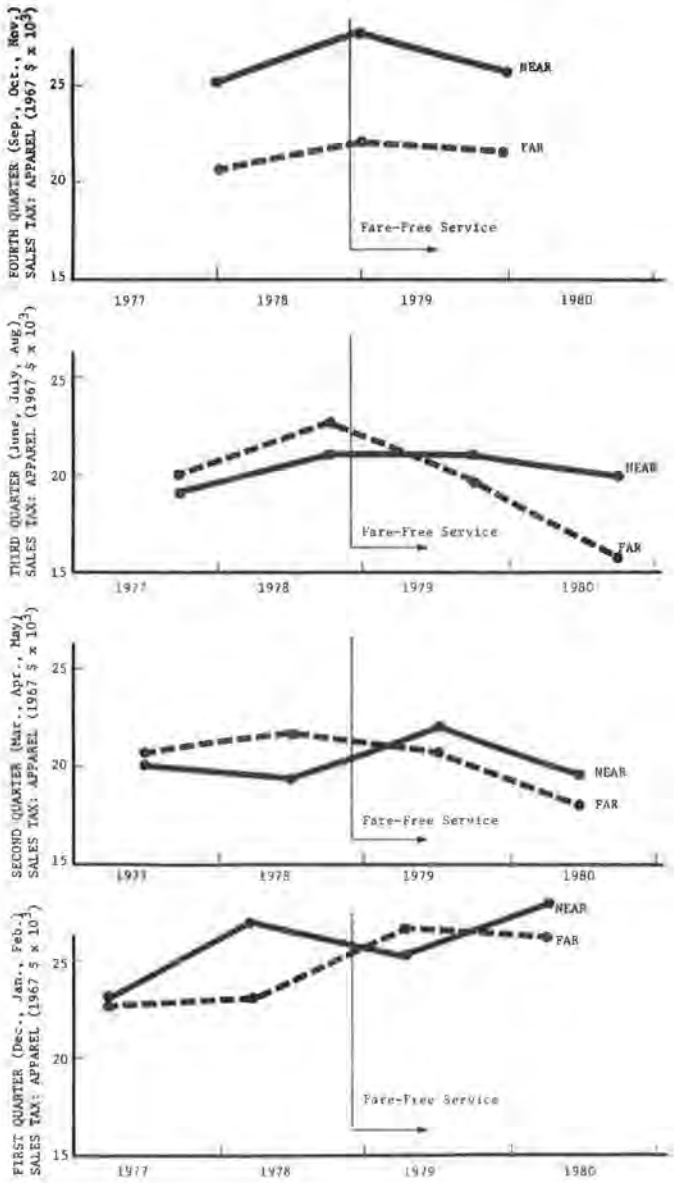
First-quarter tax receipts from apparel sales have increased steadily over the entire 15-quarter analysis period. As shown in Figure 3, first-quarter sales tax receipts increased from about $46 000 in 1977 to $54 000 in 1980--an increase of 17 percent. Since this increase occurs both prior to and after implementation of CBD fare-free service, it is not clear to what extent it can be attributed to the demonstration project. Apparel sales in second, third, and fourth quarters appear to have been relatively stable, showing slight decreases in second and third quarters and a slight increase in fourth quarters.

Restaurants

Between 1978 and 1980, first-quarter sales tax receipts from restaurants increased from $70 000 to $81 000--an increase of 16 percent. This increase represents 23.9 percent of the total increase in first-quarter retail sales tax receipts observed for the entire CBD panel during this two-year period. It is quite likely that there exists a strong relation between this increase in first-quarter restaurant sales and the similar increase noted earlier for miscellaneous sales. For example, if people have already decided to make a trip within the downtown area for shopping, they may be more inclined to eat lunch out as well.

In looking at the trends in tax receipts in other quarters, it appears that sales for restaurants included in the CBD panel reached a peak in late 1978 and have declined steadily since then. This general decline could indicate a decrease in expenditures for eating and drinking, which tend to be more discretionary, in response to a general downturn of the economy evidenced by the decrease in countywide sales over this period. On the other hand, if the total number of restaurants in the CBD increased during this period, the decline in sales for restau-

Figure 5. Retail sales tax receipts versus proximity to bus lines: apparel.



rants in the CBD panel could reflect increased competition.

Furniture and Appliances

Retail sales tax receipts from furniture and appliance establishments doubled between 1977 and 1978, and have remained relatively stable since. Sales appear to be highest during second quarters, and lowest during third quarters. Given the relative stability of sales from early in 1978 through 1980, it would not appear that fare-free service has had a significant impact on furniture and appliance sales within the CBD.

Proximity to Bus Lines

In addition to comparisons between retail sales tax receipts of Albany County and the CBD panel, further insight into the relation between retail sales and the improved accessibility brought about by CBD fare-free service can be gained by comparing sales among those establishments in the CBD panel located very near bus lines that have frequent service with those etablishments located at a greater distance from these bus lines.

Miscellaneous Sales

The impact of proximity to bus service on miscellaneous sales is presented in Figure 4. In general, these results indicate that retail sales of those establishments located near major bus lines have increased since the implementation of CBD fare-free service, while sales at more-distant establishments have either decreased or increased at a slower rate. For example, as shown in Figure 4, third-quarter retail sales tax receipts from "near" miscellaneous sales establishments were $1970 greater than those from "far" establishments in 1978, just prior to fare-free service. One year later, this difference had increased to $4200. In 1980, this difference had further increased to $10 600. A similar trend is observed for second-quarter sales. Prior to fare-free service in 1978, second-quarter retail sales tax receipts from "near" establishments were $5100 greater than those from "far" establishments. After fare-free service was implemented, this difference increased to $8000 in 1979 and to

$11 000 in 1980. For first-quarter sales, although retail sales tax receipts from "far" establishments increased sharply between 1978 and 1979, the rate of increase between 1979 and 1980 was less than that observed for "near" establishments. As shown in Figure 4, 1979 first-quarter retail sales tax receipts from "near" establishments were $5700 greater than those from "far" etablishments. In 1980, this difference had increased to $9100.

These trends strongly suggest that establishments located along major bus routes have benefited from fare-free service to a greater extent than other CBD retail establishments. Further, these trends are not restricted to any particular quarter, but appear consistently throughout the year. This would indicate that in addition to the possible diversion of sales from establishments located outside the CBD as a result of fare-free service, there appears to be a redistribution of sales within the CBD as well. These results also provide further evidence of the linkage between fare-free service and increased retail sales.

Apparel

The relation between proximity to major bus lines and retail sales for apparel establishments is presented in Figure 5. As shown, this relation is similar to that observed for miscellaneous sales. For example, third-quarter retail sales tax receipts for "near" establishments were $1600 less than those from "far" establishments in 1978 prior to fare-free service. One year later, receipts from "near" establishments were $1000 more than from "far" establishments, with this difference increasing to $3000 in 1980. Similarly, second-quarter retail sales tax receipts from "near" establishments were $2400 less than those from "far" establishments in 1978. One year later, "near" establishment tax receipts were $1200 greater. In 1980, this difference had increased to $1500.

First-quarter results are somewhat mixed. In 1978, prior to fare-free service, receipts from "near" establishments were $3900 greater than those from "far" establishments. One year later, "near" establishment tax receipts were less by $1000. In 1980, this pattern reversed again, with "near" establishment receipts greater by only $1900. Overall, these results tend to support those noted earlier for miscellaneous sales.

SUMMARY AND CONCLUSIONS

This paper analyzes changes in retail sales resulting from the implementation of CBD fare-free transit service in Albany, New York. The analysis, which is essentially based on comparisons of trends in retail sales of a panel of 115 CBD merchants with those observed for all retail establishments in Albany County, addresses the following specific issues related to changes in retail sales: (a) aggregate changes in retail sales resulting from CBD fare-free services, (b) changes in sales by type of retail establishment, and (c) the effect of proximity to bus service on retail sales.

The results of this analysis suggest that CBD fare-free service has had a positive impact on sales among downtown merchants. Average quarterly sales tax receipts for the CBD panel over the seven-quarter period following the implementation of fare-free service were 4.9 percent greater than those during the eight-quarter period immediately prior to the elimination of fares. Average quarterly sales tax receipts for all retail establishments in Albany County decreased by 0.8 percent.

This increase in sales among the CBD panel occurred primarily in first-quarter sales (December 1 through February 28), corresponding to the holiday shopping season, and among miscellaneous sales establishments (i.e., specialty and gift shops). Between 1978 and 1980, first-quarter sales tax receipts from the CBD panel increased by 25 percent, while countywide sales tax receipts decreased by 5.6 percent during the same period. Sales tax receipts from miscellaneous sales establishments accounted for 71 percent of this increase.

Although part of this increase in first-quarter sales among the CBD panel (i.e., that between 1978 and 1979) could be attributed to a general resurgence of sales occurring independently of the implementation of fare-free service and an overall increase in regionwide retail activity, these factors would not account for the increase in first-quarter sales occuring between 1979 and 1980. Nor can this increase be attributed to any sort of intense promotional effort on the part of downtown merchants during the holiday shopping season. This would suggest, then, that fare-free service was at least partially responsible for the increase in first-quarter sales of the CBD panel between 1979 and 1980 and, to a lesser extent, for the increase in first-quarter sales between 1978 and 1979 as well.

Further evidence of the linkage between CBD fare-free service and increased retail sales is provided by trends in retail sales for establishments located in close proximity to major bus routes relative to those for more distantly located establishments. Among the 27 "near" establishments in the CBD panel, average quarterly sales tax receipts for the seven quarters after the implementation of CBD fare-free service were 6.3 percent greater than for the eight quarters preceding the elimination of fares. Among the 39 "far" establishments, average quarterly sales tax receipts after fare-free service were 3.4 percent lower than before.

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