Land Use Trends and Transit Operations

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This paper brings together two related topics: land use development trends and how these trends can be addressed by the transit operator. The first section deals with development trends in general as well as in specific areas such as housing, retail, office, and industrial users. External forces such as financing and adequate infrastructure, which can fundamentally alter trends in these areas, are also explored. The ways in which the financial markets allocate money toward certain uses, for example, may be altering future housing patterns significantly, resulting in a more costly residential unit. At the same time, office development with its greater financial resources are made available.

The decentralization trend in many metropolitan areas is well advanced, but new trends favoring clustering of office, some retail, and residential uses appear to be emerging. If this continues, the result will be multicentered metropolitan areas that can be advantageously served by transit operators. The second portion of the paper deals with how transit operators can respond to the multicentered trend through new operational forms. Portland, Edmonton, Houston, Seattle, and New Jersey are used as examples of where the identified trends are being addressed through new operations and closer links between service levels and land use types and density to serve new travel demands in cost-effective ways.

LAND USE AND DEVELOPMENT TRENDS THAT WILL AFFECT PUBLIC TRANSIT

There is one overriding issue regarding land use as it affects the future of public transit: Will the pattern of land development established immediately following World War II continue over the long term, or will economic and other forces that began to come into play in the mid-1970s cause significant and permanent changes in land use arrangements and trends? Answers to these questions will affect the overall importance of public transit, the types of transit services that can and must be provided, and even the allocation of responsibilities for providing those services.

A summary of land use information and forecasts pertinent to these questions follows. The information is organized according to physical land use categories. Forces that affect land use such as demographic and economic change are discussed in the context of each category. Given the deep uncertainty about the future that flows from present economic conditions and the lack of hard data about land use, all conclusions and forecasts must be labeled short-term (at most five years), tentative, and, for the most part, speculative. It can be argued, however, that the uncertainty and speculation are mainly matters of the timing of change (when and at what rate forecast changes will occur) rather than of the direction of change. The fundamental economic changes that the nation is now experiencing are in the view of most experts deep and long-lasting. Land use will reflect these changes in due time.

Public Infrastructure

Land use and development decisions are strongly affected by the decisionmaker's perception of existing and prospective public infrastructure conditions. There can be no doubt that decisionmakers are faced with different infrastructure conditions and prospects than was the case a decade ago.

- Investment in public works by all levels of government has dropped by more than 25 percent since 1972 ("One-half of all American communities cannot expand because their water-treatment systems are at or near capacity.") (1). This continues a trend begun in 1968. The result is a seriously deteriorated infrastructure system.
- Funding for repair, replacement, and infrastructure expansion is currently restricted and will likely be restricted in the future by high interest rates on public borrowing, federal spending limitations, and continuing pressure to devote public resources to other purposes. This condition will effectively limit all types of land development, revitalization, and redevelopment (1). A slowing of infrastructure expansion and replacement will limit growth in the supply of developable land (i.e., land serviced by water, sewer, roads, and properly zoned), thus causing significant increases in the cost of land. This increase in turn will act as a deterrent to development.
- Public infrastructure funding limitations are causing public agencies to attempt to shift funding for new facilities to the private sector. This tends to increase the cost of new development, in some cases, to slow development or to direct it to areas where facilities with excess capacity are already available or to areas where public facility demands are not made. The net results of these pressures are not yet clear; however, it is probable that development will slow, costs will be passed on to consumers, and areas of excess capacity will be quickly absorbed if market conditions are not adverse. Movement to unregulated, unserviced areas (mainly in non-metro areas) will occur but will probably not account for a large percentage of total development because of environmental standards and because service and facility demands will escalate with population increases.
- In older urban areas the cost of infrastructure improvement will contribute to inordinate tax burdens on old and new land users. This will slow revitalization and cause con-

tinued displacement of lower-rent-paying commercial uses to suburban and non-metro areas.

- A beneficial aspect of present and prospective funding problems is that it is leading both public and private interests to be more cooperative in solving development problems. Consequent negotiations and regulatory reform movements are helping overcome barriers to land use arrangements that are compatible with more efficient delivery of public services including transit.
- Funding limitations will also lead to innovative financing arrangements and privatization of public facilities and services. For example, sewerage collection and treatment systems may be built and operated by private parties. Private non-profit organizations, such as The Denver Partnership Inc., may assume management and maintenance responsibilities for specific urban districts.
- Despite adjustments to infrastructure funding limits through negotiation and innovative financing, the net effect of the limits will be to limit the availability of developable land, thus increasing land costs and slowing development. This effect will be slow to be realized except in a few high-growth rate areas where there is little or no excess public facility capacity. Nevertheless, the effect will occur over time in most urban or urbanizing areas.

Housing

The American dream of ownership of a single-family home is threatened with alterations. The fundamental problem is financial although other factors are contributing to changes in not only housing tenure and unit characteristics, but also in housing density and location.

- Housing's share of capital markets will probably be permanently reduced. Residential mortgage credit has accounted for an average of 26 percent of all funds raised in the economy in the last 30 years (2). Changes in financial institution regulations and strong pressures on capital markets from other sectors ensure that this percentage will be reduced and that capital funds for housing will be more expensive than in the past three decades, even after the current recession is ended. This increase in finance costs combined with the tendency of public agencies to shift costs from public borrowing to the private sector (either through taxes, fees, or other requirements on new development) could permanently increase housing costs and limit markets that can be served.
- A major reduction in housing prices could (and should) offset interest rate increases, but the difficulties of increasing the housing supply and consumer resistance to equity losses may keep prices disproportionately higher. There is as yet no evidence that incomes will increase at a rate to compensate for recent and prospective housing cost increases. Technical measures (e.g., new mortgage instruments) designed to overcome this problem may help, but there is no evidence that they will fully compensate for high rates and uncertainty.
- Demographic change is also affecting housing. The baby boom generation has reached the home-buying age. During the 1980s the age group 30-44 will increase 34 percent (3). Given past trends and normal conditions, this group would be expected to contribute a large number of small households to the housing market. Average household size in fact has been forecast to continue to decline. Baby-boom households, along with a larger number of elderly persons, should theoretically provide a market base for 20-23 million new housing units in the 1980s, or at least 1.7 million/year (4). However, market conditions indicate great elasticity in household formation and demand. One estimate indicates that 30 percent of potential demand in 1982 will be absorbed through doubling up (5). Vacancy reductions are also being experienced. Annual production this year (1982) is expected to be less than 1.1 million units. The point is that demographic projections can no longer be easily translated into housing demand statistics. The probable continuation of difficult economic circumstances indicates major changes in housing occupancy and demand. For example, home ownership is already falling and the demand for rental units is increasing.
- Between 1970 and 1980 the suburban population grew 18 percent and nonmetropolitan areas grew 15 percent. Central cities experienced minor gains and very large central cities had large population losses. The number of SMSAs increased from 243 in 1970 to 318 today. Clearly population decentralization and movement to smaller urban areas continued through the decade. Employment decentralization was even more marked with the proportion of employment in non-metro areas growing from 29.4 percent in 1970 to 31.2 percent in 1977. Throughout all this movement, however, the proportion of the population living in "urbanized" areas did not change significantly between 1970 and 1980. An urban environment remains attractive, but smaller, less dense urban areas are preferred.
- Decennial statistics can be a misleading guide to future trends given the fact that forces that might alter housing location patterns did not occur until mid-census. Nevertheless, it is reasonable to forecast that the momentum of population growth will continue toward suburban and non-metro areas. This does not mean that older areas will not experience growth also. Housing provided through revitalization, infill, and redevelopment will be attractive to many households, especially small, childless households (more than 50 percent of all households) employed in service industries in central areas. The desire of many households to reduce or control travel expenditures appears to have been a factor in the expanded market for close-to-employment housing. This phenomenon is expected to be important.
- New housing provided on infill sites, for example, has proved popular in recent years. As with other types of built-up area development, however, there are limitations to infill. HUD-sponsored studies indicate that only 50-60 percent of infill sites in urban and exurban areas will actually be available for development in the next 5 years. Public policy actions will be necessary to expand this opportunity as in the case of revitalization and redevelopment. The difficulty of land assembly and acquisition for development is a very serious impediment to further density increases in built-up suburban and central city areas.

- During the last 4 years the escalation of housing prices at rates in excess of inflation has severely limited the number of households who can enter the housing market. Price increases have been due to a variety of factors including materials and land cost increases. One of the major adjustments in the housing business to cost increases is to reduce housing sizes. Housing size increased until 1979, but has been declining ever since. A major size reduction is predicted as necessary to offset cost escalation.
- Another reaction to cost increases has been the shift to attached housing, a shift that is forecast to continue. Attached units are more economical to produce than detached units and are more energy-conserving. Nationwide, the proportion of the existing housing stock that is attached increased only from 3 percent to 4 percent from 1970 to 1979 (6). However, this understates the rate of change that occurred in the late 1970s, especially in high growth rate areas. In some of these areas anecdotal information indicates the attached units have constituted up to 50 percent of total production.
- Rental housing has long been in disfavor with investors because of lags in rent levels, threat of rent controls, and other factors. The costs of ownership and a flattening of housing value increases are leading a large number of households to consider the rental market. Multiunit rental production is forecast to increase substantially in the next few years (4).
- Modest housing density increases have been and will continue to be associated with the increase in infill activity, the shift to attached single-family housing, and an increase in multifamily housing. An even more important force leading to increased densities is the infrastructure problem referred to earlier. Public agencies will make every effort to use existing public facilities efficiently and resist incurring expansion costs. Working against these trends will be the capacity constraints of existing facilities, the costs of enlargement, and the cost of replacing deteriorating or obsolete facilities. Another very important constraint to density increases will be continuing resistance from citizens acting through the political process. At the present time this resistance means that development cost reductions are achieved through clustering of housing units rather than overall density increases. On balance, however, housing densities should increase modestly. Even clustering can help make it possible to deliver public services like transit more efficiently if development is planned with that objective in mind. Furthermore, zoning subdivision and site plan review regulations must give recognition to the public-service efficiency requirements.

Retail

Retail development is undergoing major changes in the 1980s. The dominance of super-regional malls has been established, and diversification and specialization are now becoming more important.

- Financing for retail development has gone through a major change as lenders have sought equity positions to share in the benefits of escalating property values. Adjustment of financial arrangements fortunately have occurred much more quickly and easily than in the residential field. Until very recently retail development, particularly shopping centers, has been attractive to a wide variety of financing sources. The recession and high rates have brought retail development to a halt, but a longer-term concern is beginning to gain attention. Will consumers continue to shift a portion of their income from retail buying to savings, as they have been doing recently? Until consumer spending habits are clarified after this recession, there will be great caution in investing, especially in major retail facilities.
- Super-regional mall construction is tapering off and will continue to represent a smaller, but still dominant, proportion of actual construction over the balance of the decade (7). Current markets are saturated. Slowing population growth (expected to be 10 percent for the 1980s) and reduced population mobility (because of economic problems and housing costs) will inhibit center growth except in the South and West, which will enjoy larger percentage increases in population. The emphasis in most areas will be on center upgrading, expansion, and maintenance.
- As part of the upgrading and expansion program many regional centers will diversify into mixed-use projects and become major employment/service centers/core areas for suburban areas. A mixed-use project is defined as a relatively large real estate project [usually more than 500 000 ft^2 with floor area ratio (FAR) of 3.0], including 3 or more significant revenue-producing uses (e.g., retail, office, and hotel) that are functionally and physically integrated. Uninterrupted pedestrian circulation is an important feature of mixed-use projects. Some new centers will be originally planned as mixed-use projects. Other single-use centers will become surrounded with other types of developments (office, industrial, and public facilities) and become part of de facto community employment/service centers.
- Centers moving toward mixed use or community center status are experiencing the need for better public transit access. Some have resorted to privately financed transit arrangements to facilitate local circulation.
- The balance of the 1980s will see substantial increases in development of suburban strip centers, specialty centers, freestanding stores, off-price malls, so-called middle-market centers, and center-city malls. In part, these trends are a response to the high costs of super-regional mall operations for retailers. In part they are also efforts to take advantage of market gaps and a diversity of consumer preferences. In the case of the center-city malls, the effect will be to help revitalize areas typically served by transit (e.g., The Gallery in Philadelphia). In the case of other types of retail development, however, the effect will be to further decentralize shopping trip destinations.

Office

The last 25 years have been a boom time for office development. Central-city office development has been especially strong in major regional cities in the past decade. The demand for face-to-face communication has persevered in the face of adverse

circumstances and high costs, but suburban office development has been equally strong. The basic force behind office expansion is the massive shift of the economy away from a manufacturing-dominated base to a more diverse base emphasizing service outputs.

- Financing of office development, as in the case of retail and residential development, is undergoing major changes. Creative financing arrangements of all sorts are in vogue with lenders taking prominent ownership positions. While the present recession and overbuilding have slowed office development, there appear to be no major financial barriers to office development in the future. It remains a preferred investment.
- Center-city office development will continue, but growth in major regional centers (e.g., Denver, Houston, Seattle, Atlanta, etc.) will depend heavily on the availability of transit services to help overcome congestion barriers, according to Tom Black of the Urban Land Institute (unpublished paper). Growth in smaller-city CBDs will continue, but will be somewhat limited by the fact that new space costs are well above typical local lease rates. A great number of office facilities in all types of CBDs will be part of mixed-use projects.
- More than 50 percent of office development will occur outside CBDs with a large portion occurring in suburban employment cores that will include many mixed-use projects. An example, cited by the Rice Institute, is the number of mixed-use centers developing in the Houston metropolitan area. As in the case of shopping centers, these office-oriented, mixed-use projects become the core of major community employment/service centers.
- Suburban office development will accelerate as CBD land costs soar and lower-level functions and firms unable to pay CBD rents are dispersed (8). Technological improvements in communication and data handling will facilitate this trend. Large numbers of office operations will seek suburban employment center locations with public transit access options, but the extent to which they locate in these areas will be dependent on land costs and public policy. Suburban residence resistance to density increases in employment nodes may in the end be the determining factor. In any case, various forms of public transit will play a key role in suburban center development.

Industrial

Industrial/warehouse development proceeds on a more steady course than other types of development because the market can be more accurately gauged and the development process is less complicated.

- Financing is more difficult, aside from recession problems, in part because of space user resistance to rent increases. Financing problems will slow industrial development. In a letter to clients of the Mid-America Appraisal and Research Corporation, it was stated that those projects that are well-located, designed, and pre-leased will be favored.
- An increasing number of industrial and office parks are in rural areas. In 1981 about one-quarter was in rural areas compared with almost none two decades ago (9). The extent to which this trend will continue is questionable. Park developers have become very sensitive to employee access problems and are beginning to provide accessory services such as day care to accommodate convenience demands. It is likely that the growth of remote rural industrial business parks will slow.
- Much more important and compatible with employee interest in convenience is a trend toward development of multiuse or mixed-use parks with industrial space, shopping, housing, and other uses (9).
- Distinction between office and industrial space is blurring as many back office functions move into industrial space for cost reasons. This will accelerate business-industrial park development and increase the need for public transit access to the parks.

Conclusions Regarding Land Use Trends

Limitations placed on development by changing economic circumstances will have a dominant effect on urban form changes during the next 5-10 years. The high cost of money, the elimination of favored treatment for housing in the capital markets, and high energy costs will lead to all kinds of efforts to reduce costs and make more efficient use of investments, new and old.

Public officials will be conservative in making infrastructure decisions. Infrastructure expansions will be limited, thus encouraging greater urban compactness. Housing will be smaller and clustered, and sometimes more dense. Retail centers in suburban areas will diversify and become "community employment/service centers". Suburban office developments will tend to cluster and include a mix of uses attractive to office workers. Many suburban-office-dominated mixed-use projects as in the case of retail-dominated mixed-use projects will become major community employment/service areas. CBD office development will continue to thrive. Industrial developers and users will also become more attracted to concentrations that offer a variety of services including transit. The term mixed use will become a familiar term to the public as the development community and public officials learn to master that difficult form of development.

All these trends leading toward more efficient urban arrangements will continue to be opposed and counterbalanced to some extent by other forces favoring continuing dispersion, a lowering of densities, and separation of land uses. Public preferences for low densities is still a major force. This is especially the case when the political system favors those persons who are already comfortably established and who are not threatened with cost increases or service losses if densities are not allowed to increase or land uses to diversify. It is important to note, however, that this factor, which has already declined in the last few years, will continue to decline as fewer and fewer jurisdictions are immune to fiscal problems or housing cost problems. Also increasing public/consumer interest in more convenient access to employment, shopping, and community services has and will reduce opposition to change.

Another powerful factor constraining density increases is land cost inflation due either to supply restrictions or speculation or both. The tendency of infrastructure and other economic constraints to

restrict the expansion of the supply of developable land will increase land costs substantially in the future, given a reasonable level of demand. Some of these costs will be absorbed by land users, but there will be resistance that will either result in a diversion of investment to other areas of the economy or leapfrogging to urban areas with expansion capacity with lower costs.

The outcome of this push and haul of forces, which has heightened in recent years, is becoming quite clear and is well illustrated by land use arrangements in the Houston area where the market operates without zoning constraints (while Houston lacks zoning, land covenants are commonly used to restrict uses so the market does not operate entirely without constraints). Houston has a strong and growing CBD, but it also has strong and growing subcenters where developers and facility users have sought to take advantage of greater convenience (less congestion) and lower land costs. A balance is being struck between centralizing influences and decentralizing influences, and the result is a multinucleated urban area. There is evidence in many urban areas of a similar trend. It is a trend that should set the pattern for urban form development for many years to come. This is an encouraging trend because the nucleated form can be served more efficiently by a variety of public services than can a dispersed, sprawl pattern.

Central-city CBD areas will continue to be strengthened through office and mixed-use development (except in older industrial centers with no headquarters functions). In many areas the CBD will remain the dominant employment center with certain specialty functions. Other employment centers, however, will begin to rival the CBD in size. The extent of CBD development will be very dependent on the availability of public transit. Residential areas tributary to CBDs will become very diverse with some neighborhoods changing to middle- and upper-income status but declining population density. Other neighborhoods will experience a decline in both incomes and density. Suburban core areas will develop around mostly existing retail or office centers. Tributary residential areas will "thicken" somewhat with increased multifamily and attached housing contruction.

Although the private development industry is increasingly interested in building mixed-use projects, it should be emphasized that the focus of private concern is on projects, usually single-owner projects. One mixed-use project or even a collection of them does not necessarily constitute an efficient employment/service concentration (efficient in functional or public-service delivery terms). Individual private owners may or may not coordinate their development schemes. In the long term the evolution of efficient multinucleated urban areas will be dependent to some degree on public policy guidance. While this guidance will continue to be difficult to provide, it is extremely important to realize that market forces are moving in a different direction than they were 10 years ago (toward more sprawl) and that a modest level of guidance has a chance of making big improvements in the efficiency of the development pattern.

EMERGING TRANSIT OPPORTUNITIES WITH THE NEW DEVELOPMENT PATTERN

The challenge facing transit operators in the near future, apart from daily survival struggles, will be focused on market-type issues and how best to maintain and increase ridership in the face of fare increases and reduced public subsidies. The fiscal situation should prove enough of an impetus for many transit authorities to begin a thorough re-examination of some basic operating assumptions and how these may or may not be still relevant in light of the resulting change in land use patterns and shifts in the real estate market identified in the first part of this paper.

Clearly, most of the public transit industry has not adapted itself to these shifting markets nor really understood the forces behind the postwar development pattern that has been viewed as a threat rather than as new opportunities for service to be exploited. Yet, in a few examples where transit has or is in the process of adapting to the emerging clustered or multicentered urban pattern, they each can prove increased and sustained ridership growth. The Toronto and Edmonton systems, for example, each serve a multicentered destination pattern, can point toward 5-8 percent rider annual growth rates over the past 10 years, and, despite fare increases, continues to increase ridership. In Portland, Oregon, where Tri-Met recently instituted some suburban bus route restructuring, a 38 percent ridership increase has been reported. The examples to be discussed will show it is possible for transit to adapt and grow with the changing development patterns. Each of these examples will be touched on in the following portion of this paper to gain further understanding of the complex forces that can work to improve transit operations.

Structuring Operations to Serve Cluster Development

For the most part, current transit operations, either bus or rail, are radial and structured to serve one principal hub, the CBD, exclusively. There is an occasional foray to a suburban shopping center, usually with infrequent service as an extension of an existing radial route or, similarly, peak-hour-only service to an office or industrial park. With the proliferation of shopping centers, office parks, and low-density housing, the transit industry tendency is to view this bewildering sprawl pattern as forbidden transit territory, which is understandable. One thing the suburban development is noted for is the "from-many-to-many" trip pattern to which transit service seems ill-suited. Since transit cannot possibly serve all trip origins and destinations in suburbia, the general transit view appears then to serve it minimally at best and stick to serving the CBDs.

However, based on the first portion of this paper, the tendency to cluster suburban or indeed any new development is a growing phenomenon. The clustering of development can provide centers on which to build a new transit network of routes and services not commonly found in American urban areas but that could work to achieve the expanded ridership and revenue goals that most transit operators now want to seek more aggressively.

Extensive work in identifying such possible centers and transit operation improvements that could transform them into transit hubs has been undertaken by Jerry Schneider of the University of Washington. His most recent work, Transit and the Polycentric City (10), attempts to relate subcenter or minicenter development to transit and to survey a number of cities where conscious planning decisions have been made to implement the development of centers. As he states, the downtown area has only become one of several, perhaps many, centers in any given metropolitan region.

The clustering of development will involve fairly sophisticated planning approaches to land use, between the specific uses themselves and all forms of transportation services. The three major land uses that seem to occur most frequently in such clusters

are residential, office, and retail--the shorthand for this being a "mixed-use development". These uses, when repeated in a series of nodes, either highway interchanges (Houston) or transit stations (Toronto) since they are integrated uses, seem to offer a certain pedestrian-oriented scale within their borders and, when in close proximity, in a series after the possibility of interaction between them. This interaction can be enhanced in transit settings that use them as the hub of operations.

Since it is virtually impossible to serve all trips via transit, new route structures need to be developed that will use these new development centers as hubs for local services, express services to link major and minor centers together, and regional services linking many centers together. As the development pattern begins to concentrate in small centers, these new approaches can more readily be implemented and adjusted.

Edmonton, Portland, and Houston: Case Studies on Center-Based New Transit Routings

Three notable recent attempts to tie transit operations with the diverse metropolitan trip pattern around transit centers are Edmonton, Alberta; Portland, Oregon; and Houston, Texas.

Edmonton

In the Edmonton case, the transit operation of Edmonton Transit (ETS) was completely restructured around 11 transit centers in addition to the downtown. All bus routes in Edmonton converge simultaneously on each of these 11 centers on a minimum policy-established 30-min headway. The centers are located at major, nondowntown (i.e., outer-city activity centers such as shopping centers, hospitals, and educational institutions), which were selected on the basis of both scale of activity and operational compatibility, such as appropriate spacing distance necessary with this type of transit routing. Usually, 4-8 routes serve each center with arrivals and departures timed to within 2 min so that any necessary transfers between buses can be accomplished conveniently. By having a considerable number of non-CBD-oriented bus routes as well as CBD-oriented routes, all 11 centers are linked either directly or can be reached through transfers. Therefore, new trip destinations can be served that were not previously possible or at great inconvenience. As new centers in Edmonton develop, the bus routing structure can be easily adjusted to serve growth areas. Heavily traveled corridors have limited-stop express services at all hours with the major stops being the timed-transfer centers. In one high-growth corridor, ETS replaced its line-haul buses with light rail transit; the new stations function as timed-transfer centers with the bus routes reorganized to serve them.

Portland (Tri-Met)

Portland offers a second excellent example of a timed-transfer system, one that is now emerging from an existing radial system. The Tri-County Metropolitan Transportation District (Tri-Met) established a policy in 1977 of setting up multidestinational systems and has established two centers in suburban growth areas on its west side with a series of local buses "timed" at the center with "trunk" routes to downtown Portland. A comprehensive evaluation of all routes as well as all major land use generators in this area was undertaken. These suburban centers were identified for their ridership generation and compatibility with this method of operation.

Tri-Met implemented the Westside transfer centers and route reorganization in 1979 after an extensive community participation effort. The centers were specifically designed for the arrival and departure of all assigned local and trunk route buses on a minimum policy headway of 20 min.

The results of Tri-Met's timed-transfer experience are impressive. In one year, ridership in the Westside area rose 40 percent on a daily basis (19 286 in 1980 versus 13 808 in 1979), a growth twice the level expected. Off-peak ridership also grew by 40 percent in the area (11). Operational costs on a per-rider basis, while greater with the new system ($1.20 old versus $1.30 new timed-transfer), were less ($1.49) than had been projected. (This modest cost increase may be attributable to other factors given the large increase in the number of riders during the same period.)

Since 1980, Tri-Met has gone to establish two more timed-transfer centers in other portions of the Portland area. The principal motivating influences toward adopting the timed-transfer mode of operations appear to be a desire to top the new growth markets in a way that is cost effective and create new trip opportunities for existing riders.

Houston

Houston has the potential to be the next major transit operator to switch to timed-transfer. As indicated earlier in this paper, the shape of development in Houston embodies the strong tendency without zoning and now evident elsewhere to cluster. Another recent TRB annual conference paper analyzes the future of bus operations in this environment. The paper, Transit and Shopping Centers, by Houston MTA staff, demonstrates the potential viability of serving major shopping centers through working with mall operators (12). Indeed, among the most successful routes on the MTA system are those that serve both the Houston CBD and one of the major regional centers. A 5-year MTA plan of route reorganization is designed to focus on the regional centers, recognizing the reality of the land use pattern, a pattern essentially developed in an unregulated free-market way.

The purpose of introducing the timed-transfer examples in this portion of the paper is to demonstrate that what may seem to the tradition-bound transit operator to be adverse land use conditions for transit can, in fact, be served to advantage. But the application of timed-transfer must be done carefully, through the careful analysis of the local activity centers, an intensive community relations program, and development of a thorough understanding of an operator's own existing system with a view toward what elements can be adopted for timed-transfer. The accompanying chart shows how this can be accomplished (Figure 1).

Living with and Influencing the Metropolitan Land Use Pattern

Having touched on ways in which transit operations can be adjusted in the new land use pattern, this section will explore ways in which the emerging pattern can be directly influenced through greater involvement by transit operators in the development process. In the United States very little direct development involvement has been noted other than those transit systems with fixed-guideway operations and sufficient adjacent real estate holdings. In this case, joint development opportunities with pri-

Figure 1. Timed-transfer operational requirements.

Establishment of a true transit network - all routes interact directly at centers - i.e., metro area recognizes reality of diverse land use and emerging centers and seeks a multi-destinational solution.

Establish minimum policy headway such as 15-minute, 20-minute, 30-minute, etc. for which all transit in the entire network operates.

Based on careful land-use analysis, space timed-transfer centers at bus travel times that are within the policy headway. For example: Policy headway: 30 minutes - transfer centers - 26 minutes apart in bus travel time, are usually about 2.5 to 3 miles apart.

Allow two minutes at either end of the bus time between centers to permit transfers to take place.

Establish a hierarchy of local, trunk, express bus routes, sort out operational issues and have services converge at the centers within the two-minute transfer time.

Have as many routes as possible end at centers rather than in isolated locations.

Establish a flat-fare to serve the entire network. Transfers should be free to encourage acceptance of transferring.

All transfer stations should provide enough physical space to line up all buses that will converge at the two-minute transfer interval.

An intense community relations program should be established both to obtain public input and educate the public in the benefits of the new system.

Educate all drivers and checkers prior to implementation.

Two-way radio system mandatory.

vate-sector developers can be exploited, a subject to be dealt with shortly in this paper.

For those operators without significant real estate holdings or in those portions of a fixed-guideway transit operator's system that are bus-only, other approaches will need to be used. In these situations more active involvement with local and community planning and zoning boards is critical. The nature of local transit operation is not usually fully understood by these local boards yet their decisions on land use, subdivision design, and zoning have far-reaching impact on transit operations. Although most local master plans often recognize better transit as an important potential element in urban and some suburban development, it is mainly in the ordinance implementation and execution that there is a failure to guide the specific development proposals toward compatible uses permitted in certain zones, densities, and designs that are transit serviceable and operationally efficient.

Seattle Metro/Bellevue, Washington, Agreement

Several examples do exist of both the transit real estate development model and the "transit operator as institutional reformer" model. In the latter category, there is the recent example of Bellevue, Washington, where the operator, Seattle Metro, working with the municipality, formulated a zoning ordinance for downtown Bellevue that ties the level of transit service to the density of development (13).

Essentially, Bellevue, a city in the Seattle region, sought to have its downtown become a major office and retail center, which, while it contained a significant amount of existing office and retail space, was basically automobile-oriented. As is typical of most suburban settings everywhere, the CBD zoning ordinance required from 5 to 3.3 spaces/1000 ft^2 of office space with an actual supply of 4.4 spaces/1000 ft^2. There were 15 000 parking spaces in 1980 compared with actual CBD employment of 12 000 persons. Under these circumstances, only 1 to 2 percent of all persons entering the Bellevue CBD took transit (Metro). Dispersed office buildings among large parking lots were the rule.

Despite this high degree of automobile-orientation, the City wanted the CBD to grow as an office/retail center as well as including higher-density residential uses without adding to automobile congestion. Increased Seattle Metro service was regarded as the main solution. The City proceeded to pass new CBD zoning that split the center into a tight dense office-retail core with FARs of 5 to 8 surrounded by zones of mixed-use commercial/residential. The City recognized the need to reduce its minimum parking requirements to 2.0/1000 ft^2 and also set a maximum ratio of 3/1000 ft^2 and a reduction in these numbers were to be reduced by 0.3/1000 ft^2 every 2 years.

At the same time, Seattle Metro was revising its route system and service approach to develop four regional timed-transfer centers similar to the Portland operation described above. Bellevue was one of the transit transfer centers to be established in the new system.

Understandably, prior to the adoption of these new regulations, Seattle Metro had been reluctant to increase levels of transit service in such an automobile-oriented environment. However, through a "Transit Incentive Agreement," a formula was developed "rewarding" Bellevue for future increases in employment density and reduction in the parking ratio through allocating additional hours of transit service. Up to 10 000 extra hours of service will be available through the incentive agreement over 2 years based on greater employment per acre in the core of the CBD and reducing the parking ratios over time below the maximum under the new ordinance.

The Bellevue/Seattle Metro experience demonstrates how land development through zoning can be tied directly to levels of transit service where both the municipality and the operator are conscious of the direct connection between the two. This case shows what can be done in transit systems without significant transit-owned real estate holdings to try to improve ridership. The next portion of this discussion on land use and public transit examines possible approaches for those operators with significant property holdings as part of fixed-guideways. In these cases, the operator can directly impact the development pattern through not only all of the above methods but also through some entrepreneurial risk-tasking on its own property in partner-

ship with the private sector through joint development.

Directly Influencing the Development Pattern: New Jersey's Statewide Joint Development Program

There has been much literature on the subject of joint development in recent years. However, much of the discussion has focused on the new rail transit systems built since 1970 as attractive development opportunities and as a way of returning some of the high investment in them to the operator. Less attention has been focused on the older systems, those with little previous joint development and little in the way of real estate-generated revenue other than from commercial concessions. The older systems also are plagued with a deteriorated physical plant that generally presents a negative image for both users and possible development interest.

New Jersey Joint Development Program

In New Jersey, a unique, statewide program was formed in 1980 within the New Jersey State Department of Transportation (NJDOT), which sought to attract and develop private/public partnerships for real estate development at key transit stations. The Office of Joint Development was created to work with the state's major public transit operators to develop their transit stations and terminals as focal points for economic growth.

New Jersey, a highly urbanized state, noted in postwar years primarily for its extensive suburban sprawl pattern, contains the highest number of automobiles in relation to lane-miles of any state in the United States. This saturation, particularly in northern New Jersey, was the result of both high automobile ownership and also a virtually unchecked reliance on local municipal zoning powers with little regional or state framework to guide the development pattern. In recent years extensive office and retail development has taken place along the state and Interstate highway system, very little of it transit serviceable. Indeed, approximately 45 million ft^2 of office and retail space was constructed in the five northern New Jersey counties in the 1970s. What transit opportunity there may have been in this area has largely been lost due to the sprawl pattern.

Given these circumstances and the fact that at the same time the state continued to maintain a large, but declining, system of commuter rail and local and regional bus services, the state has recognized the transit operation as one in which future development opportunities need not be lost. Through direct activity by the transit operators the state could begin to draw more development toward their extensive facilities to increase direct revenues from the development, increase ridership, and enhance the station environments.

Also, the creation of NJ TRANSIT as the publicly owned, statewide transit agency began to reverse the decline and improve operations. With 170 commuter stations on 200 miles of rights-of-way, NJ TRANSIT is a major state property owner. Some of these stations handle 10 000-50 000 passengers daily. With this property potential and working with NJ TRANSIT, the newly created Office of Joint Development began a process of attracting private-sector interest in the redevelopment of its stations.

In addition to working with NJ TRANSIT, the Office of Joint Development has also recently begun working with the Delaware River Port Authority (DRPA) on its Lindenwold-Philadelphia high-speed line (PATCO) to develop the nine stations in New Jersey. The PATCO line, already projecting a highly positive image, has been successful with its semi-automated operation and minimal operating deficits--$1-2 million annually, carrying 40 000 riders daily. The Office of Joint Development with DRPA will be exploring shortly those stations with maximum revenue-generating potential. It may even be possible with several successful joint development projects to erase the operating deficit.

Joint Development Process

The NJDOT Office of Joint Development, usually at the request of the local government, begins a process that includes formulation of a development program at a given station or terminal. This process includes ongoing community involvement, transit operator, and local government participation. The product of the process is a development program that reflects the operators' and community's goals and objectives for the station area and is expressed in terms compatible with the goals of private-sector developers; that is, the ability to make a profit through development of the site.

The Office of Joint Development approaches the project area as a private-sector developer, providing up-front funding and guidance on market potential for all types of uses including office, retail, and residential. Grounded in the realities of the marketplace, the potential uses and their magnitudes are arranged around or on the station, constrained by transit operations, physical barriers, and community goals. The financial feasibility of this arrangement is tested and must demonstrate an adequate return to both the transit operator and the private-sector developer. Once all major public-sector participants agree on a development program and any public costs are assigned, the final step in program process begins. This is the developer solicitation and selection process. Where possible, competitive proposals are solicited from reputable developers who have worked in public-sector partnership arrangements. Proposals are selected based on compatibility with the development program and financial return to the transit operator. The accompanying simplified diagram outlines this process (Figure 2).

This process has been completed or is under way at a number of NJ TRANSIT stations. At Sumit Station, a developer has been selected for negotiations for a 200 000-ft^2 office-retail complex by a committee composed of the Office of Joint Development, NJ TRANSIT, and city representatives. The developer selection process is under way for NJ TRANSIT properties at Princeton (200 000-ft^2 office and 130 housing units) and Princeton Junction (500 000-700 000 ft^2 office and 300-400 housing units). A development program has been formulated for Hoboken Terminal (1 000 000-ft^2 office, 400-room hotel, and 700 housing units), a major hub of operations with 40 000 passengers daily, as part of an overall waterfront development program. Trenton Station has also been programmed for major office development. Development programs are under way at Elizabeth and Newark-Broad Street Stations, and several others including Metropark and New Brunswick are proposed for major efforts.

The development scales at each of these projects is large enough to influence the local marketplace and development pattern in each of the surrounding areas. These concentrations of development as proposed through the process are well received by developers who prefer the clustered types of development suggested earlier in this paper.

Insofar as increased ridership is concerned, it is NJ TRANSIT's goal not only to increase revenues but also to have as many tenant employees and resi-

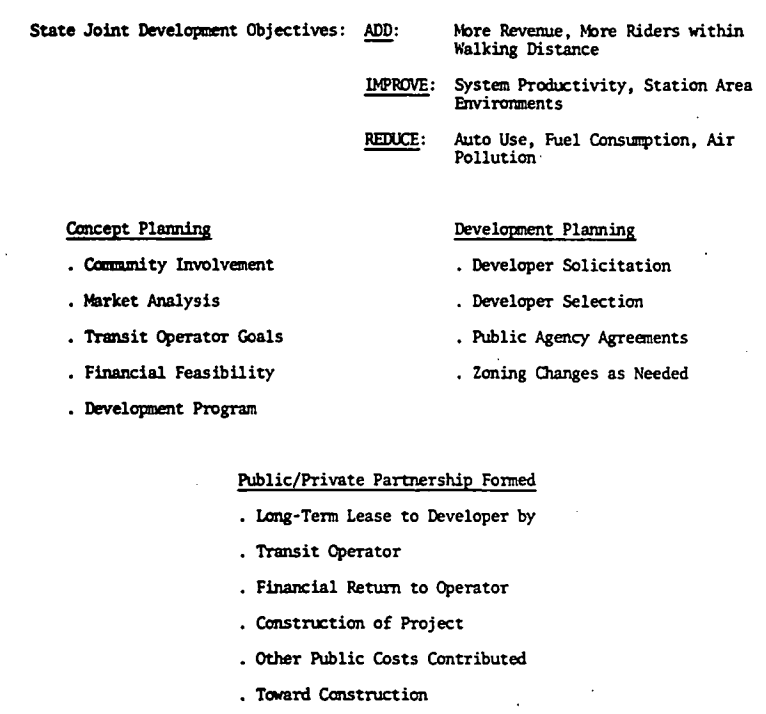

Figure 2. NJDOT/NJ TRANSIT joint development process.

dences within walking distance in very tight clusters at these stations. Walking distance is, of course, a critical variable in drawing ridership to the system, a factor that Toronto, in particular, has, of course, been able to use advantageously (14).

Recent research on the Toronto and Edmonton rail systems indicates that walking distance related to land use and development density around transit stations is important in determining transit mode split. Walking distances of 4000 ft or less achieved high transit mode splits, particularly for rapid transit. The types of land uses were also important in determining mode split and when placed within walking distance (or the "impact zone") of a transit station, achieved transit modal splits ranging from 60 percent for multifamily residential; 50 percent for single-family residential; and 30 percent for office development. These differences may be related to automobile access and the provision of parking at suburban office sites (14).

This type of data clearly shows the necessity of understanding transit travel behavior in order to increase ridership. At NJDOT/NJ TRANSIT the need to design concentrated and financially viable projects that will serve the transit system and increase patronage is being met through the joint development program.

CONCLUSION

This paper has attempted to demonstrate that there is a tendency in recent and projected development toward greater clustering of employment office-retail and industrial facilities. Many of these clusters are developing into major employment/service centers serving large community areas. These centers are beginning to define a multinucleated urban form in many metropolitan areas. CBDs are part of this pattern and many will remain the dominant center in these respective areas if CBD office development continues to expand. Residential areas tributary to each nucleus or center will increase only modestly in density but in many cases will be clustered, which will allow more efficient service.

The evolving clustered form of development can have beneficial effects for transit if operational and entrepreneurial skills are employed by the transit operator. The key is the transit operator taking initiative in both areas, adjusting service toward timed-transfer to serve the new concentrations in a cost-effective way (Edmonton and Portland) and to maximize its non-fare box revenue through direct real estate development where possible (NJ TRANSIT) or where not possible, tying levels of service directly with zoning changes that support transit (Seattle Metro). Without these types of initiatives, little will be done by other entities involved in land use to aid the operator in the current financial situation. These examples, not widely known, show the extent to which the operator can adjust to the new financial realities while maintaining and improving service. They go a long way to improving local support for the service, which can be translated into greater local financial support.

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Changes in the Economic Base of Urban Areas: Implications for Urban Public Transportation

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Although the economic base may not have been a major concern of urban public transportation planners or policymakers in the past, it will undoubtedly become increasingly important in the future. And as concern for the economic base becomes more commonplace, the way we think about the city, its economy, and the role that urban public transportation could play in its development will change considerably. The challenge for urban public transportation is to redefine its role in the development and redesign of the city and of the region for which the city serves as a center.

With the advent of one-world markets and the emergence of an increasingly international or global economy, a fundamental restructuring is occurring in both the national economy and in the economic base of cities. The nature of these changes suggests that cities will continue to play a very critical role in the nation's development and, furthermore, that the type of development that will be occurring could be located in the central cities if the cities are redesigned and rebuilt to accommodate them. This will be very difficult because activities in growing sectors differ significantly from activities in declining sectors.

Given the type of changes occurring in the environment in which cities are developing and given the nature of structural changes that will be taking place in the economy and spatial forms of cities, it appears that urban public transportation could become a principal tool for their redesign and rebuilding. This is one of the most important lessons that have been learned from the global laboratory of cities (1). Moreover, the timing is right. There is a growing awareness that this is a critical time for cities (2). Many are in transition (3). Some are beginning to think about their future (4), and a few are preparing for the 21st century. Urban public transportation will play a major role in future city development once its value as a tool for redesigning and rebuilding cities is appreciated.

Given this perspective, it would be worthwhile to consider, at the outset, a fundamental policy shift in regard to urban transportation planning. Urban public transportation, which currently plays a passive role, needs to become an active part of the process in the building of cities. This policy shift is needed so that instead of simply responding to existing or anticipated transit demand--and reacting to problems, usually under crisis conditions--management can begin to create and structure this demand. Urban transportation systems need to become more balanced so that they become more economically feasible and more broadly accepted as socially desirable. All modes of transportation serving intra- and inter-city travel need to be coordinated and integrated into the overall design or plan of the city. This will enhance greatly the city as a place to live, work, and play. Well-designed, well-managed, and efficient urban public transportation systems will enable cities to remain viable even in an increasingly competitive global economy.

It is highly unlikely, however, that urban transportation systems, particularly public systems, can realize their potential unless transportation planning is widely understood as a necessary part of a comprehensive long-range plan for a city and for its region. Among planners, themselves, transportation has always been recognized as a critical component of comprehensive long-range urban planning because it is viewed as the primary mechanism for integrating, organizing, and maintaining society (5). But there is a major obstacle that will have to be overcome--cities in the United States have not been engaged in long-range planning, at least not since the City Beautiful movement around the turn of the century. Even during the decades of unprecedented growth that followed World War II, there was virtually no comprehensive long-range planning.

ORIGINS OF THE ACCIDENTAL CITY

There are many reasons why comprehensive long-range