G. Systems Planning Guidelines

Overall transit systems planning decisions need to be made to establish a transit-sensitive land use pattern. These decisions occur at a larger scale than an individual Transit Corridor District, generally at a metropolitan or regional scale. They are general guides which relate to overall locations of corridors and their basic structure. Guidelines for these decisions are given in the three categories which are essential to successful transit in the suburbs. These are Land Use, Access Systems and Transit Services. Systems planning guidelines for land use include the need to locate and designate transit corridor districts and/or transit service zones along arterials early enough so that a separation of auto- and transit-oriented land uses can occur. Access guidelines relate to the need to explicitly plan for pedestrian and bicycle access to transit and to control automobile traffic to avoid excessive congestion. Transit service guidelines deal with the types of transit modes that could be accommodated, vehicle design and operational patterns.
Predesignate a future system of transit corridors.

A transit-sensitive solution to land use in the suburbs must be part of an overall metropolitan or regional transportation plan. A transportation corridor must be linked to heavily concentrated locations, such as the central business district or existing major employment and/or activity centers.

An important element in making the concept feasible is to predesignate corridors for transit service and for the location of transit-oriented land uses. Early location and designation of the corridor is essential so that subsequent land use decisions can be made with a commitment to future transportation services. This will enable communities to separate auto-oriented land uses from transit-oriented land uses and to locate them in relation to the proper mode. Failure to do so will result in inappropriate levels of density, a separation of trip generators, and poor pedestrian access that would likely minimize the chances of successful transit services.

Transit-sensitive districts can be ideally accomplished by a physical separation of transit services from primary auto-oriented arterials. Transit services should be at least 1/4 mile away from the parallel arterial and should provide opportunities, through zoning, for development of land uses, population sizes and densities that relate to transit. The corridor could be located along an existing roadway or a proposed new roadway.

A transit corridor independent of a highway arterial would provide a full transit service area independent of the highway arterial -- walking distances to transit would then be limited to 1/4 mile and transit-oriented land uses should be within this distance to provide pedestrian access to transit services. A transit stop spacing of
TRANSIT STOPS ARE LOCATED EVERY ½ - ¾ MILE ALONG THE TRANSIT LINE FOR EASY ACCESS.
approximately 1/4 mile would provide good accessibility along the corridor itself where the most concentrated land uses would be located.

It is vital to establish the basic Transit Corridor District locations prior to most development activity. The most effective corridors will be initiated in undeveloped areas. The success of the corridor relies on the ability to integrate a pattern of land uses that are compatible with transit, as well as the internal design of each individual site. The use of transit-sensitive design guidelines from the beginning of the development process can accelerate corridor success.

Where ideal transit corridor locations contain some development, reasonable efforts should be made to incorporate existing land uses into the development of a transit corridor. This concept is especially important because finding large corridors of completely undeveloped land that could sustain dense growth may be difficult. More often there will be some older, scattered developments present. Future uses of developed parcels should also be considered as land use demands change over time.

Early establishment of TCDs reflects a commitment from the government to future developers that a full service transit line will operate in a specific area. This will help to eliminate fears and speculations about the future of the corridor. Demand for land along the corridor should stabilize once the zoning is established.

"The success of the corridor relies on the ability to integrate a pattern of land uses that are compatible with transit, as well as the internal design of each individual site."

GUIDELINES FOR TRANSIT SENSITIVE SUBURBAN LAND USE DESIGN
Transit-related development/automobile related development.

Source: Snohomish County “Guide . . .,” p. 8-7 from Portland “Public Streets for Public Use.”
Separate transit-oriented and auto-oriented land uses.

A key element in the design of transit-sensitive suburban land uses is to spatially separate activities which are highly related to the automobile from those which are related to public transit. Certain activities are distinctly auto-dependent -- it is difficult to perform them using transit. These are activities that require transporting large objects, that require multiple stops, or that take place in evenings or weekends. Examples include purchases at a lumberyard, collecting a group of children and taking them to a soccer practice, or going out for dinner and a movie. Activities conducive to the use of public transit include those that occur with some regularity and with a direct origin-destination pattern.

To maximize the potential for the use of public transit and to alleviate suburban traffic problems, we propose a separation of land uses based on their associated traffic modes. Ideally, parallel corridors would be developed, one primarily for the automobile and its associated land uses, and one for transit and its related land uses. Land uses oriented to the automobile -- car dealers, large package retail shopping, low density housing, motels, car-oriented food franchises, large plot outdoor recreation, etc. -- should be located along highway corridors. Land uses oriented to transit -- high density residential developments, office buildings, schools, facilities for the elderly and some retail -- should be located along a transit corridor. Within the corridor a mixture of building types and the proximity of building types would also encourage pedestrian access. Concentrated locations of educational facilities, office buildings, shopping and housing would reduce the amount of transportation required -- whether by auto or public transit.\(^9\)

\(^9\) See guide to auto/transit land use in Appendix A; also Snohomish County, “Guide . . . ,” p. 3-8.
Establish transit service zones along existing arterials.

Ideally there should be a physical separation of at least 1/4 mile between primary auto-oriented arterial streets and transit service corridors. This may not be possible for physical, political, or operational reasons. It may also be difficult because existing development blocks the path of a transit corridor. Many of the principles of these guidelines could still apply, however, if land use along existing arterials were more effectively managed. This could be done by designating TCDs along specific zones of arterial streets to create a linear separation of auto- and transit-oriented land uses. For example, there may be a two-mile long district with transit-related land uses and building setbacks where transit vehicles would make frequent stops followed by an area of auto-oriented land uses which transit vehicles would bypass without stopping. While this may not be as efficient as having separated roadways, it still provides advantages over current systems of suburban development.
Explore public/private opportunities for transit stop joint development.

There is a symbiotic relationship between public transit and business activity. Transit provides quick, convenient access to commercial enterprises and customers and a market demand for business activities. Business activities and private developments generate trips on transit systems and help to support viable public transportation. Every transit stop should be viewed as an opportunity for joint development -- a place to link together public and private projects. The level of activity at a stop can vary from small, with the provision of newspaper boxes, public telephones, and a cash machine, to extensive retail and service areas serving both transit, employees and shoppers, with large multiple use projects directly tied into the transit systems.

The convenience of retail, service and office uses at a stop enhances the attraction of using public transit and the transit in turn strengthens these commercial activities. Convenience uses such as cleaners, flower shops, shoe repair, VCR rental and automated money machines, as in many other transit locations, will be successful as neighborhood enterprises. These will be relying on the neighborhood customers with a strong contribution due to the station location. Other uses will also have a strong competitive advantage -- this includes shopping for staples on the trip home, including grocery, drug and liquor stores.\(^{10}\)

Local government agencies and transit systems should work cooperatively with developers and private investors to seek out locations with good transit access for new development projects.

\(^{10}\)Rabinowitz, Beimborn, Lindquist and Opper, "Market Based Transit Facility Design."
Provide adequate population size and density to support transit use.

The density of trip ends at a transit stop is a critical element in determining if public transit has sufficient demand to justify its service. Both land use densities and the total population in the service area of a stop are important. Average residential densities of at least seven dwelling units per acre within the service area of a route are considered as the minimum level to justify the use of local bus routes with 30 minute headways, while densities of 15 dwelling units per acre are needed for 10 minute headways. These values, however, can vary significantly based upon assumptions that are made concerning capture rates of transit, service frequency, average fares, subsidy rates, hours of operation, speeds, and average hourly costs. These terms can be derived from settling daily revenues on a transit route to be equal to daily costs for break-even operation. The following equation results:

\[
\text{Transit trip density} = \frac{(\text{Cost recovery ratio} \times \text{Service ratio})}{160}
\]

Transit trip density is the number of daily transit trips per acre in the service area (within 1/4 mile) of a route. For a residential area this is the product of the residential density in dwelling units per acre times the trip rate in trips per dwelling unit and the capture rate (i.e. the percentage of trips that use transit). The cost recovery ratio is the average hourly cost of operation times a farebox recovery rate and divided by the average fare per passenger. As such it represents the number of trips per hour needed to generate enough revenue to operate a subsidized transit service. The cost of recovery ratio is the result of government policy as it relates to...

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11 Seattle, Encouraging Public Transportation Through Effective Land Use Actions, p. 30, as developed from Pushkarev and Zupan, Public Transit and Land Use, p. 140.
subsidy levels and fares. For example, if a policy is set to have the users pay a major portion of the costs with a high farebox recovery rate, this will require a high transit trip density. If transit fares are raised, then the required trip density would be lower.

The service ratio is the product of the frequency of transit service on the route (vehicles per hour) and the daily hours of operation divided by the average speed of the transit service, including stops. The units of the service ratio are daily vehicle hours of service per route mile. It represents how often transit service is provided. If vehicles operate frequently or for long periods of time during the day it will result in a high service ratio and the need for a higher transit trip density. The final term in the equation, the constant 160, is a conversion of square miles to acres. It is 640 divided by 4 (divided by two because there is two way service and divided by two again because the service area is 1/2 mile wide).

An example can help to understand these tradeoffs. Suppose transit service is to be provided 16 hours per day at 30 minute headways (2 vehicles/hour) and it can be operated at an average speed of 20 mph including stops. The average cost of operation is $50 per hour with an average fare of $.75 and a farebox recovery rate of 60%. What is the required trip density?

From these data the cost recovery ratio can be found as follows:

\[
CRR = \frac{50 \times 0.60}{0.75} = 40 \text{ passengers/hour}
\]

The service ratio:

\[
SR = \frac{16 \times 2}{20} = 1.6 \text{ vehicle hours/mile}
\]
The required average transit trip density in a route's service area:

\[
TTD = CRR \times SR / 160 = 40 \times 1.6 / 160 = 0.4 \text{ trips/acre}
\]

The required transit trip density can be converted to residential or employment densities given assumptions on the portion of trips that use transit and trip rates per household. There is an important tradeoff between these factors. In the above example, a trip density of 20 trips per acre is required if there is a 2% capture rate by transit, but only 4 trips per acre if the capture rate is 10%. The density requirements drop off rapidly if transit successfully captures market share. On the other hand, a high capture rate is likely the result if there are low fares and high levels of service. These in turn increase the need for higher trip density. Thus there are many combinations of factors that need to be considered in determination of required density levels for transit.

The figures to the left indicate how four of these factors, transit capture rate, average fare, service frequency and farebox recovery rate, affect the necessary trip density. The required trip density varies inversely with capture rate and average fare. An increase in these factors leads to a lower density needed to support transit service. Trip density varies directly with service frequency and farebox recovery rates. If high levels of service are provided, there will be a need for higher densities. These graphs were developed using the data from the example and holding everything constant except the variable on the x axis of the graph. A five percent transit use was used in the base case as well. These indicate that the required residential and employment densities for transit are strongly dependant upon policy (i.e. subsidy rate fares), as well as operational factors.
Development is Phased Over Several Years' Time
Design for a phased implementation of transit corridors.

The development of a redesigned suburban environment based on high accessibility to transit services is a long term project. There must be an assurance of quality transit service in order for private developers to commit to projects that rely on transit for a portion of their access. Similarly, there must be a concentration of demand and trip density in order to provide quality transit. Failure to do one leads to the failure of the other. Implementation should be done in phases in order to accommodate intermediate stages of land use and transit services. It is important that the system works well at all points in time so that a viable transit service can be provided to encourage further land use activity. Flexibility is also required since the sequence of projects is largely determined by private developers and market forces beyond the control of local government agencies. The design and associated zoning regulations and approved procedures should provide a framework for implementation which permits flexibility rather than a detailed blueprint. Predesignating transit corridors is an important step in this process. Also there should be a series of intermediate plans which examine viability at earlier stages.

The transit corridor is not meant to be an automobile-free zone; rather it should be a place where transit dominates and the automobile is accommodated rather than the reverse, which is typical in existing suburban areas.
Periodic breaks are made in the transit path to prevent through auto traffic.
“... it is important to control through automobile traffic to prevent excessive congestion along transit corridors.”

Control of through automobile traffic.

The provision of a convenient transit service requires a speed and level of service competitive with automobile travel. If transit vehicles operate along a congested street, travel times by transit would be increased and the street would be dominated by auto traffic. TCDs are areas of concentrated development which will generate significant numbers of trips and it is important to control through automobile traffic to prevent excessive congestion along transit corridors. This could be done by providing periodic sections in the transit right-of-way where only transit vehicles would be permitted. This would prevent other vehicles from using the transit path for through movement. These breaks should occur approximately at every mile and would likely be located at high activity stops. The remainder of the corridor could operate with mixed traffic with the roadway serving as a local or collector street. Auto access to the properties in the corridor would be from parallel or intersecting arterials rather than from the transit corridor. Only limited parking would be permitted along the transit roadway. Careful planning will insure a proper mix of circulation without excessive traffic on the transit corridor.
Cross-section of Transit Corridor in an 80’ ROW
Use corridor for primary pedestrian, bicycle and transit movement.

The corridor should be designed to accommodate pedestrian and bicycle movement as well as transit vehicles. Separate pathways should be provided parallel to the transit routes. These pathways should be on both sides of the roadway and accommodate two-way movement. A typical section of the minimum configuration for the corridor is shown in the figure. The corridor should consist of a roadway with a minimum width of 34 feet and shoulder/tree lawn an adjacent pathway areas of a minimum of 23 feet on each side for an overall minimum width of 80 feet. The pathways area would consist of a seven foot wide bike path, a five foot walkway and eleven feet for tree lawn and landscaping. The bike path would be specified as a class I bike path and be wide enough to permit two way movement (AASHTO). There should be a minimum of five feet from the transit roadway to pedestrian path and five feet between pedestrian and bicycle paths. The 34 foot roadway provides the minimum width necessary for transit vehicle stop areas and a bypass lane for through vehicles. A wider right-of-way of 100 to 200 feet is preferred which would provide area for a median along the roadway, and additional roadway areas and green space between the pedestrian and bicycle paths as well as a better buffer between transit service and adjacent uses.

Avoid need for shuttle services.

One option that is considered in the design of major development projects is the provision of a shuttle service which connects the project to a primary transit route. This type of service should be avoided. Shuttle services require additional time for users to wait for the shuttle vehicle and to transfer between vehicles. This is highly inconvenient for users in that it involves out-of-vehicle time and transfer penalties. Travel demand studies have demonstrated that out-of-vehicle time to be perceived at two to five times as important as time spent in the vehicle in travel choice decisions. Hence a shuttle service could significantly reduce the potential demand for transit use. A second reason to avoid shuttle services is their costs. To be effective shuttle buses should operate throughout the day and evenings and at low headways. Annual operating costs can run several hundred thousand dollars per vehicle. The result is that service may be cut back to reduce costs. A reduced level of service makes it less attractive to users which in turn will reduce demand.
AUTO-ORIENTED LAND USES ARE KEPT NEAR ARTERIAL TO MAINTAIN PEDESTRIAN MOVEMENT AT THE TRANSIT CORRIDOR.
Highway/transit relationship.

Corridors for transit service should be a minimum of 1/4 mile away from, but parallel to, major highway arterials. A parallel highway arterial serves two important functions. (1) Mobility: transit cannot provide service for all people to all destinations, especially traffic passing through the area; automobiles will be required for some travel. (2) Land access: while the transit line will be able to serve most development, there are certain land uses that are incompatible with transit and which need auto access. There are also developments, like major shopping centers, that are best served by both transit and auto access.

A minimum distance of one quarter mile should be maintained between the arterial highway and the transit line. A large proportion of the public will utilize transit if located within a quarter mile walking distance of their residence or workplace. Access to the highway arterial is also convenient at this distance for those uses that need access to both modes of transportation.
Provide high quality transit service.

Transit service should be of high quality to attract users from the automobile. The concept of a Transit Corridor District provides a concentration of land uses, connected by a high quality pathway system to the transit system. The transit service itself should have high operating standards to assure its continued use.

Transit can be successful in attracting ridership if a user-oriented service is provided. A high quality user-oriented transit service requires that direct service is provided between a user's origin and destination, without the need to transfer, at a schedule which matches the user's needs, at a reasonable cost compared to the automobile, and in a clean, comfortable, reliable, safe and secure vehicle. If transfers or waiting are necessary there should be a safe, secure and interesting place to wait and change vehicles. Information on how to use the system, its routing, when, and how much it costs should be readily available and easily understood. If these conditions are met, people will use transit. More transit use will reinforce the land use plan which can in turn generate a higher level of transit service and more usage.
Transit vehicles should be quiet and have low air pollution levels.

Transit vehicles, especially buses, have a very poor image in suburban areas. Local residents will often protest the location of bus routes in their neighborhoods because of the noise and air pollution produced by the vehicles. Noise levels of buses (in the range of 80-85 dBa while pulling out from a stop) are excessive and would need to be significantly reduced in order to prevent negative reactions to transit services. Similarly, vehicle emissions of pollutants and visible exhaust need to be reduced. Transit service in the corridor district must be of a high quality to both attract patrons and not be a nuisance in the community. Efforts to design cleaner, quieter, and higher quality vehicles are critical for the development of the overall concept.

14 American City and County Magazine, January, 1991, p. 28.
Identity: Signage and compatibility of stops.\textsuperscript{15}

Transit stops along the corridor are entry points to the transit system. At a minimum these would be equipped with a shelter and associated information and signage. The transit stop is the first image many passengers have of the system as well as being an important piece of "street furniture" at the neighborhood scale. Therefore it is important to make it positive and recognizable.

- Provide colors, logos and forms which produce a sense of identity for the system itself.
- Use materials and images that are compatible with the surrounding community.
- Locate shelters so they can be seen and identified from a distance.

Signs identifying the stop and route should be designed to provide clear understanding for all users including those unfamiliar with the English language in appropriate neighborhoods.

- Maintain consistency throughout the system -- logos, color, lettering.
- Place information in direct lines of sight.
- Construct signage of low-maintenance materials.

The local stop is located along a transit corridor which may also serve as a collector street. The stop is surrounded by residences and occasionally a small shopping area.

The transit stop must fit into and enhance the neighborhood.

- The shelter must be compatible with the area that the station serves. Consider elements such as roof slopes, height, materials and details.
- Provide an image that is understandable and acceptable to the local community.
- Landscaping is an important design feature at the local community level.
- The facility should be identifiable as part of the transit system overall design.
- Climatic conditions should be considered, orient the stop if possible to take best advantage of sun exposure and wind conditions.
H. District Level Guidelines

Guidelines for design and planning within a Transit Corridor District are provided in this section. These include guidelines related to land use, access systems and transit services. Land use guidelines include consideration of the mix and arrangements of activities, phasing of development and flexibility in implementation. Access guidelines provide specific details for pedestrian and bicycle pathways and the provision of feeder services. Finally, transit service guidelines relate to details of service design, transit stop features, safety, security and maintenance.
Designate type and location of transit stops.

The designation and location of transit stops is a key decision in the planning process for a Transit Corridor District. This should be one of the first decisions to be made so that land use patterns and access systems can be designed to maximize potential transit use. Pedestrian use of transit falls off rapidly when offices or residences are located more than 1/4 mile from a stop. In order to provide quality pedestrian access, stops should be spaced no more than 1/4 mile apart, which provides a maximum walking distance of 1/8 mile for trips beginning or ending on the corridor itself and a band width 1/2 mile wide for concentrated land use related to transit. The overall pattern is a series of overlapping concentric circles that define the zone of transit-oriented land uses. These areas (stadtwurst -- sausage city) may be separated by areas of open space where stops are omitted. In areas of concentrated demand stops could be located closer together, as close as 1/8 mile to improve accessibility.

Transit stops should be placed away from auto oriented arterials and closer to trip generators. A general pattern where arterials are located at one mile spacings would be to locate the stops at 1/8, 3/8, 5/8 and 7/8ths of a mile from the first arterial. This would provide four locations for more intense land use with the outer two served by both transit and auto and the inner two more transit oriented. Where arterials are at a 1/2 mile spacing, stops would be at the 1/8 and 3/8ths points -- the segment between these two stops (or between the interior stops with 1 mile arterials spacing) would likely be a logical location for a transit-only segment on the corridor.

A local residential stop may serve 200 riders each day and contain a newspaper/candy kiosk open at peak hours only.
DISTRICT PLANNING/LAND USE DESIGN

- A local residential/local office/shopping stop may generate 600 riders per day.

- An office/retail center may generate 6,000 passengers/day and have a full complement of specialty, retail, and convenience stores as well as places to eat.
Figure showing one mile spacing between arterials
Figure showing one-half mile spacing between arterials
Provide mixed land uses, including housing, office, retail, industrial, and recreational uses.

Traditional suburban zoning can be characterized by a separation of land uses such as residential, commercial, educational and recreational land uses, requiring the use of the car and many separate trips. By locating different land uses in close proximity to each other, two benefits can be achieved. First, the total number and length of trips by people within the area can be reduced. It will not be necessary to travel to numerous locations when running errands because most destinations would be within a few minutes walking distance of each other.

The second advantage of mixed use activities and land use is the improved feasibility of transit service. Transit operates best when there are simple origins and destinations. A major reason suburban residents do not use transit is because of the need to make trips to multiple locations during the day. If these activities and destinations can be consolidated and located along a corridor, the auto's advantage over transit will be greatly reduced.¹⁵

Land uses should be arranged to maximize the potential for walking and bicycle trips as well as by transit. A mixture of activities including housing, employment, shopping, public facilities and schools is desirable around each transit stop. Densities would be highest near the stop and then remain fairly high within the 1/4 mile walking distance of transit. Beyond this area densities would be lower and there would be little effort to serve these areas with pedestrian access to

¹⁵Calthorpe, Transit Oriented Development Design Guidelines, p. 23; Snohomish County, p. 5-2.
transit. Land uses less compatible with transit (lumberyards, auto dealerships, etc.) should be located further from transit.\(^{16}\)

\(^{16}\)Delcan Corp., p. A-22.
Relate design to the market.

For a development to be successful it must attract tenants and purchasers who are
drawn by the features, character and cost of the project. In the United States
private sector real estate developers construct over 90% of new building; this
project must be able to compete against other private sector developments.

The public's attitudes towards housing choices are changing. The provision of a
life style is now important to the public in addition to a home. The character of
the development is also critical. While a functional, for instance, a split-level
house was a typical purchase in the past, a distinctive style is now desired. The
quality of 'neighborhood' is also an important criterion for many potential
homeowners.

The attributes resulting from many of the guidelines contribute to the ambience
desired by much of the public. The density and walkability of the district imparts
a neighborhood feeling as does the variety of scope of services in proximity to the
housing. Recreational and civic services are also provided. The mix of housing
types also provides a heterogeneous character and the ability to market to a
broader segment of the population.

The area should be given an identity based on the character and location of the
site. For example, Greendale, the Cascades, Laguna West, Sandy Springs, all
developments documented in the first report of this project, provide an identity
and cachet for their projects. Identity should be continued at the neighborhood
scale. In the prototype development designed as part of this study, each tract was
provided a unique name, such as the 'Woods' and the 'Estates' area. Each tract
has a different character, and often there are distinctions even within each tract
based on the natural features and topography of the area.
**DISTRICT PLANNING/LAND USE DESIGN**

**Provide variety within the district.**

While a common themes should be created for the entire district, there is a need to avoid too much uniformity in the area. It is important to develop variety within the project in order to create unique places and interest with which residents can identify.

To develop this variety, a number of criteria and design methods can be employed. Each tract within the TCD, for instance, has a required mix of housing units to attract a variety of users. Retail and commercial uses are also present throughout the district. Small parks can be required in each tract and these can provide a focus and unique attributes to areas within a tract. Natural features of each area within a district should also be respected.

In addition, a variety of developers, planners and designers should be used throughout the district. Using the guidelines presented in this report, they will create very different schemes. The firm of Duany-Plater-Zyberk uses this method for many of their larger projects. The prototype that we have proposed in the final section of this report was designed by five faculty and students from the Department of Architecture, based on the guidelines.
DENSITY GRADIENTS

Employment / Retail Center

Residential Stop

Residential Between Stop
Land use density gradient.

Existing suburban development patterns result in low density developments which cannot support transit operations and mixed use development. Increased densities and a variety of building types are a necessity for the feasibility of a Transit Corridor District. Density levels near traffic arterials would be similar to existing suburban densities -- for instance, a floor area ratio (F.A.R.) of .3 for commercial uses and .1 for housing. However, commercial uses and housing in proximity to transit stops may have minimum FARs in the range of 1 to 3. Different parts of the district, depending on the concentration of activities, will vary in their FAR profile.
DISTRICT PLANNING/LAND USE DESIGN

Utilize appropriate land use adjacencies.

A prime consideration for planning development on proximate parcels should be the compatibility of land uses. Thoughtful location of land uses can create the same benefits as mixed-use developments. Neighboring projects should be compatible in the sense that there will be a high pedestrian movements between the sites. This can reduce the need for auto trips.
Provide recreational opportunities and amenities.

A Transit Corridor District should be an attractive place to live with high quality amenities and recreational opportunities. The pathway system which links transit to buildings should be located to take advantage of natural features and to be usable for neighborhood circulation and exercise. Amenities should be distributed throughout the corridor but with a gradient away from the transit route. Those nearest the transit route should be relatively small and would be places where people can gather and interact. Those amenities located furthest from the route would be larger, open spaces for outdoor sports and/or natural areas.

A TCD should provide a range of civic and private amenities at all levels of the project. District-wide amenities could include an outdoor recreation facility, perhaps tied to a school, a library, ice skating rink, farmers' market area, a civic plaza, athletic fields, playgrounds, tennis courts, youth centers and parks.

The quality of the landscape is an important symbol and visual feature of the suburbs. The projects reviewed in the first report of this project all contained a strong landscape element. Landscaping at all scales, from the transitway, to the scale of the block and small park, is a critical part of the success of this development.

Private sector amenities are also required. Opportunities for socialization such as coffee shops, restaurants and bars should be a part of the planning as well as retail opportunities for teens and children. Events are significant to create a spirit of neighborhood and district, and parades, festivals, arts and crafts shows, and so on should be planned. The position of recreation/social coordinator should be created to implement events and activities for the residents.
Accommodate multiple developers and development patterns.

The integration of a variety of developments and land use patterns is critical to effective completion of a transit corridor. Developers often specialize by building type, therefore regulations must accommodate various building uses; changing market forces also require local development regulations to be flexible. Although the underlying highway arterials and transit line must be firmly established; road patterns within the district can vary.

The use of guidelines for density, land use, and parking gradients provides a basis of regulation for development patterns while at the same time allowing flexible development. Developers use the desired land use characteristics of each sub-area of the TCD, though each developer should be allowed to reach the final objectives in different ways. This provides the diversity and real estate feasibility that is necessary for the long term survival of a transit-sensitive community.

The final part of this report contains a prototype design in which each major section was planned separately. However, each designer used these guidelines as criteria. The result is a diversity of character and experiences for each tract notwithstanding adherence to a common set of criteria.
Relate the design and connections of adjacent developments across `seams'.

The incremental planning and development of suburban subdivisions and parcels results in an unrelated functional and visual environment between these tracts. These mismatched `seams' can be avoided in a master planned district. Each land development parcel should be required to include access points to neighboring tracts in their site planning. The coordination of these seams and connections should be strictly regulated by the district. The visual character of these adjacent parcels, which also serve as major entries to the district, should also be coordinated by the design of landscaping, building setbacks and massing, the placement of landmarks, etc.

17 Snohomish County, "Guide . . .," p. 7-4.
District Planning/Land Use Design

Parking density gradient.

The need for great amounts of parking for many suburban functions results in sites and designs that are dominated by parking lots. While access by automobiles and parking will still be required for many uses, the need for parking near uses served by transit will be limited. A Parking Density Gradient, based on building use and the anticipated mix of transit/automobile use will be used to develop the amount of parking within a district. Those uses near transit stops will have limited parking, while a traditional amount of parking should be provided near the auto arterial. The exception to this would be when auto spaces are dedicated to the transit service such as in the case of park and ride lots.

Zoning regulations in a TCD will address the issue of parking lot size at various distances from the transit service.\(^{18}\) Development nearest a transit line should necessitate fewer auto parking spaces than are presently required by most suburban zoning codes. In fact, the presence of large parking lots with free parking can discourage use of the transit system. Less parking area will also permit a higher density of development and a better network of pedestrian pathways.

Property near an auto arterial will require the size of parking areas to be similar to present suburban zoning requirements. Development in this area will be of a lower density and more auto dependent. The types of land uses found along a highway would be those rated with a 1 or 2 (low rating) on the transit compatibility chart (Appendix A).

\(^{18}\)Snohomish County, "Guide . . .," p. 5-6.
Develop a program to encourage shared parking facilities.

Whenever possible, adjacent land uses should be planned to allow the use of a single parking facility for more than one activity. Land uses that require parking facilities during different parts of the day can share a common lot. This will reduce the amount of parking area needed to serve the same land uses. For example, one parking lot could be used as a transit park and ride lot during the day, as theater parking during evenings and for church parking on Sundays. Shared parking facilities reduce the need for surface parking, thus allowing higher density development to take place.
TRANSLIT SERVICEABLE DEVELOPMENT\textsuperscript{19}

\textbf{EFFECT OF SITE LOCATION ON TRANSIT PERFORMANCE}

\textit{from: Levalin Inc., for CMHC, 1979}

\begin{itemize}
  \item \textbf{CURRENT PRACTICE}
  \item \textbf{REDUCED SETBACK}
  \item \textbf{BUS STOP AT BUILDING}
\end{itemize}

Minimize the distance between building entrances and transit stops; provide logical connections between buildings and transit.

Nearly all trips begin in a building and end in a building. To maximize the potential for transit, building entrances and transit stops should be located in close proximity to each other. Moreover, there should be a clear, direct path between the building and transit stop locations. While this may seem obvious, it is seldom done in conventional suburban development. Transit stops are located on arterials and it is necessary to walk considerable distances through parking lots and across grassy areas to get to a building. Pedestrian walking distances should be measured along the actual paths, not just straight line distances.

There are various ways to provide good access to buildings, especially in the site design phase of development. Ideally, buildings and their entrances can be directly located next to transit stops. This may mean locating parking or open space behind or beside a building rather than in front of it. Buildings themselves could be set perpendicular to the transit corridor rather than parallel to it. This allows for direct transit access to a building as well as access to other buildings. It is also beneficial to cluster buildings together rather than designing in a "strip mall" fashion. This permits shorter and safer travel for pedestrians between buildings.  

Finally, pathways should be provided from all transit stops to surrounding buildings for safe and reasonable access. People cannot be expected to walk across open land without pathways, especially during inclement weather.

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20PACE, p. VI-8; Delcan Corp., p. A-6; Snohomish County, p. 5-11, p. 8-5.
Municipalities can ensure compliance with these principles by modifying the zoning ordinance. New developments should be required to provide site plans with walking contours shown. The contour lines should be representative of the actual walking distance along pathways to the transit stops. This will help to reveal deficiencies in pedestrian accessibility at a time when they can still be easily changed.\textsuperscript{21}

\textsuperscript{21}Delcan Corp., p. A-11.
Building location and design should be sensitive to transit-generated noise and views.

The buildings located along a transit corridor can be subjected to the view and high levels of noise if present bus technology is used as a primary transit vehicle. Until quiet vehicles can be designed, building setbacks and design must be planned to accommodate the current noise levels. A 150 foot setback from the transit vehicle lanes between stations for residential land uses is recommended. This distance provides some perceptual ‘room,’ especially if landscaping is used to shield the transitway. Building orientation and territoriality should be taken into account in design. Commercial uses such as offices and retail can be much closer to transit lanes.

The section through the transit corridor should be a linear park-like setting with residential structures set back some distance from the actual transit right-of-way. Retail and commercial uses tied to transit can be located adjacent to transit stops. Extensive landscaping can screen transit vehicles from incompatible uses.
VARIATIONS ON CURRENT DESIGN PRACTICE TO PROMOTE DIRECT ACCESS TO TRANSIT

Source: British Columbia, "Guidelines . . .", p. 28.
Pedestrian/bicycle pathway system.

The design of a transit-sensitive community assumes that the majority of users of the transit service will access to the system by walking or by bicycles. Once transit stop locations are identified and basic land use patterns set, it is important that a strong network of pathways for bicycles and pedestrians be developed. Pathways should be included in the transit corridor parallel to the transit route and radiating from each stop to serve adjacent uses. Pathways should be separated from the roadway and it may be desirable to separate bicycle and pedestrian pathways. Pathways should be a minimum of five feet wide for pedestrians and six feet for bikeways.

Pathways should be direct but can be combined with open space and access to recreational areas. Open space would ideally be located further from the transitway.\(^{22}\)

\(^{22}\)Calthorpe, "TOD Guidelines," p. 61.
Figure: Paths facilitate pedestrian and bicycle movement through development to transit stops.

Source: Pace Development Guidelines, p. VI-4 (modified).
DISTRICT PLANNING/ACCESS SYSTEMS

Provide for safe, convenient pedestrian circulation.

Because of the number of patrons who will walk to neighborhood transit stops, pedestrian circulation and access is a prime design consideration. It is also important to combine the transit stops with market-based consumer services.

- Pedestrian circulation should be afforded maximum protection by traffic control devices. Streets should be narrowest at pedestrian crossing points to minimize pedestrian/vehicle conflict.

- Pedestrian access points should be close to the expected approach paths and on-street stops.

- Once in the area of a stop the pedestrian paths should be as direct as possible with a minimum of obstructions and conflicts with any vehicular traffic.\(^{23}\)

- Convenience retail services (newspaper boxes, vending machines, banking machines, etc.) should be located at transit stops.

\(^{23}\)Appleyard, p. 275; Petersen, pp. 407, 417; Canadian Transit Handbook, p. 27; IRT Guidelines and Principles, pp. 8, 14; TRB #760, p. 40.
## Pedestrian and Bike Transit Access Distance

<table>
<thead>
<tr>
<th>Average Trip Distance</th>
<th>Average Speed</th>
<th>Average Service Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking: 0.33 miles</td>
<td>2 mph</td>
<td>0.34 sq. mi.</td>
</tr>
<tr>
<td>Biking: 2 miles</td>
<td>8 mph</td>
<td>12.6 sq. mi.</td>
</tr>
<tr>
<td>Biking vs. Walking:</td>
<td>6 times distance</td>
<td>4 times speed</td>
</tr>
</tbody>
</table>
**DISTRICT PLANNING/ACCESS SYSTEMS**

Promote bicycle access to transit through high quality pathways and secure storage systems.

Bicycles can be an important element in the success of transit-sensitive land use design. They can substantially expand the market area of a transit station or stop because of higher average distances and speeds of bicycles as compared to pedestrians. A comparison of these differences is shown in the attached figure. As indicated, the average walk distance people walk to a transit station is a third of a mile at an average speed of 2 mph. Bicycle trips are an average of two miles in length at an average speed of 8 mph. This translates into a substantially larger area which can be served by a transit stop. The catchment area of walk access is about one-third of a square mile, while that of a bicycle is 12.6 sq. mile or 37 times that of a pedestrian catchment area.\(^{24}\) A well developed bicycle pathway system adds another significant market element to a transit service. Such pathways should be designed with a high degree of safety and security and or year-round operation.

A second element of high quality bicycle access is to provide secure storage for bicycles at transit stops. People who use bicycles should be confident that their bicycles are safe from theft or vandalism in order to use them on a regular basis. This could be done several ways -- through placement of bike racks or lockers at stops or by having bicycle check-in corrals at stops that have associated retail or commercial activity.

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\(^{24}\)“Trip Reduction and Affordable Housing,” Maryland National Capital Park and Planning Commission, March 15, 1990, Silver Spring, Maryland.
DISTRICT PLANNING/ACCESS SYSTEMS

Provide for feeder bus and auto access points.

Although the primary market area for transit will be users in the transit corridor district, the features of the transit services will attract other riders. Park and ride lots as well as feeder transit services will enhance the feasibility of the overall transit system.

- Connections should be direct, short and simple.
- Access can be enhanced by using priority traffic management techniques, making it easier to enter and exit from the station area.
- Sufficient space on some sites must be furnished for any feeder buses (turning radii, parking, etc.) and drop-off areas.\(^ {25} \)
- Providing market-based services (cleaners, newspapers, shoe repair, auto repair) will enhance ridership.

\(^ {25} \)Hoel, p. 2; Misek, p. 152; DOT, "Encouraging Public...", p. 35; DOT, "Transit Center Based Transit Systems...", pp. 35-39; DOT, "Decision Procedures in Transit Station Design," p. 6; TRB #817, p. 37.
IMPLEMENTATION OF THE GUIDELINES

I. Implementation of Guidelines

These guidelines contain many concepts and rules that should be integrated into municipal zoning codes. Some guidelines involve general concepts that require a broad review of the zoning ordinance for improvement, while others necessitate the insertion of a specific regulation. Determining exactly how each of the guidelines can be applied may be time consuming for a municipal staff with many responsibilities. In addition, the number of different guidelines presented may be cumbersome for those trying to add transit to an existing zoning ordinance. The following summary was developed to assist local planners with the implementation of these guidelines in their communities.

Because every local code differs, it is not possible to provide details about where guidelines could fit in a municipality code. However, this summary should assist with the difficult first step towards implementing this report. Key guidelines are included below and suggestions are made for how they can be made legislation.

**Zoning should encourage transit-sensitive land use design through the designation of Transit Corridor Districts (TCDs).**

This zoning code should accommodate the concept of a Transit Corridor District (TCD). The TCD requires the creation of a new zoning district. The TCD would be similar to a Planned Unit Development (PUD) because it incorporates many aspects found in other zoning districts. The TCD should have transit service as a main objective. Mixed use development should be encouraged and projects in the TCD should have to meet all district level guidelines. The idea of a TCD focuses transit service and develops a separation of land uses that relate well to transit from those that relate to the automobile.
IMPLEMENTATION OF THE GUIDELINES

Provide for transit-sensitive review of site plans and development proposals.

It is important that the needs of transit be considered in the planning review process, since most land development projects are developed with little or no transit input. A transit-based review should be added as a requirement to the development review process in the same manner that landscaping, aesthetics, and utilities are reviewed by many municipalities. This review should cover all developments, even those outside TCDs. If the municipality has a staff person with training in the transit service field, the review can be done in-house. If present staff does not have background in this area, then the local transit agency should consult in site plan reviews. Transit-related concerns must be given serious consideration for all developments.

Provide a transit checklist for potential developers.

A checklist of transit-based requirements could be used not only as an aid for developers, but the local government could actually adopt it as an official part of the review process. Once a comprehensive, final checklist has been completed in conjunction with the transit agency, a statement such as the following can be added to the zoning code: "All development proposals will be reviewed using the official transit checklist and any other applicable regulations." This statement would be added with the previous guideline. The checklist can be more informally used as a means by which developers are informed of the issues a municipality will consider when reviewing a proposal. The checklist should be reviewed and updated on a regular basis.
IMPLEMENTATION OF THE GUIDELINES

Parking requirements in TCDs should reflect availability of transit services.

Implementation of the parking guidelines requires a general review of the zoning ordinance. Specific parking requirements in a TCD should be covered by provisions for a parking gradient or the provision of different levels of parking based on proximity to transit. Parking requirements in the current zoning ordinance should be reviewed. Most likely, the ordinance has minimum levels of parking that must be provided and changes should be made to lower the minimum number of spaces required in areas where transit is present. There could be two sets of minimums for land outside of TCDs. Minimum levels of parking for land uses that are not compatible with, or near, transit services should be set to accommodate all patrons as auto travelers.

Establish a Transit Management Association to oversee transportation services and land use development along the transit corridor.

Most TMAs are organized and operated by non-government organizations in the region. However, the local municipality can attempt to get a TMA initiated. Local landowners and early developers should be contacted regarding the organization of a TMA. A municipality may provide initial funding for a TMA.

Predesignate a future system of transit corridors.

TCDs and other future main transit routes should be located before development occurs. It is important to take a long range view and to map out where future
IMPLEMENTATION OF THE GUIDELINES

corridors of transit service will be. TCDs should be zoned as entire districts. It could be feasible to add to a TCD district if future growth patterns warrant, but the initial rezoning should include all land necessary for the successful development of a corridor.

Separate transit-oriented and auto-oriented land uses.

The separation of transit-oriented and auto-oriented land uses can be accomplished by excluding specific types of land uses from TCDs and areas near transit service. The exclusions should be based on the ability of a land use to be served by transit. For example, a lumber yard should not be a permitted use in zones that can be served by transit. The uses summarized in Appendix A can be a starting point for identifying such exclusions.

Establish transit service zones along existing arterials.

TCDs can be designated along existing, developing corridors. Flexibility must be incorporated into the TCD if existing developments are present. If a TCD zone has been established in a partially undeveloped area, it may be necessary to create two districts, TCD-1 and TCD-2, with one zone more permissive of older developments.

Explore public/private opportunities for transit stop joint development.

A most opportune location for joint development by the private and public sectors is at transit stops. Local governments should consider a proactive approach to

“Local governments should consider a proactive approach to development surrounding stops.”
IMPLEMENTATION OF THE GUIDELINES

development surrounding stops. Large stops can become part of the surrounding buildings. Developers may pay to construct sheltered stop areas that tie directly to their buildings and revert the actual right-of-way to the municipality. The main benefit for the developer is the increased patronage that will flow from the transit stop directly into the building. For the municipality, capital costs are reduced.

At smaller stops, simple retail services can become part of joint development efforts. The presence of retail services at transit stops can be contracted out to businesses for different services. This also allows small businesses to become established in each neighborhood. Another alternative is to seek joint development opportunities with private companies. In return for providing some of the needed funds to develop the transit stop, a private firm is allowed to use the adjacent land for retail service provision.

Design for a phased implementation of transit corridors.

The designation and official zoning of a Transit Corridor District (TCD) is the first step toward implementing transit service. The municipality should develop standards by which the corridors' growth will be measured. After growth in population and building has occurred, additional service should be added. The additional service should include the improvement and expansion of transit stop facilities. The municipality should develop a schedule, based on the amount of development, showing when upgrades will be made to services and stops.
IMPLEMENTATION OF THE GUIDELINES

Control of through automobile traffic.

Successful TCDs could generate large amounts of automobile traffic and will interfere with the ability to provide high quality transit service. It would be very difficult to close an existing roadway after substantial development has occurred. Early location of no-auto zones along the transit route before development is critical and will limit automobile interference. These can be protected through official mapping and/or the zoning map.

Use corridor for primary pedestrian, bicycle and transit movement.

The zoning code and site review process should be modified to assure that there is a provision for separate, high quality, pathways for pedestrians and bicycles. All cul-de-sacs should include pathways at their ends to connect to surrounding streets. Logical pathways should be provided to provide direct connections for between different parts of developments. Sufficient rights-of-way should be reserved (through official mapping) to permit separate, parallel bike and pedestrian paths along transit corridors and arterials within transit service zones.

Transit vehicles should be quiet and have low air pollution levels.

Develop standards for the purchase of quality transit vehicles. Improvements in the development of quieter vehicles, cleaner burning engines, and comfortable vehicles are necessary to attract ridership.
IMPLEMENTATION OF THE GUIDELINES

Identity: Signage and compatibility of stops.

Local governments should establish a set of standards for transit stops. The standards must fit with the character and needs of the individual community. They should be officially adopted and used in the design of each stop.

Provide mixed land use including housing, office, retail, light industrial and recreational uses.

This guideline would be implemented by developing special zoning categories at transit stops. Larger projects would be encouraged that contained a ratio of uses (for example, a ratio of office space to residential units, with flexibility. Single parcel, mixed use developments provide better interaction between different land uses than separate, adjacent parcels with different land uses. Another option would be to zone on a small parcel level to ensure a variety of compatible uses adjacent to one another.

Land use density gradient.

Radiating from the transit stop, different density zones should be established. Development within the zone closest to the transit stop should have minimum density levels that are fairly high for both commercial and retail uses. The first zone should extend approximately 1/8 mile from the transit stop. The subsequent zones should step down in density levels. Beyond 1/4 mile from transit service, densities should be lowest. Even with high density minimums in some areas,
maximum density levels also should be adopted to prevent development that does not fit the character of the area. These density zones should be adopted as part of the TCD zoning.

Relate the design and connections of adjacent developments across `seams'.

The ability to tie together individual development projects is critical to the success of a Transit Corridor District. Developers should be allowed considerable flexibility in their planning within a project; however, project review and stipulations must assure that adjacent developments fit together. Conditions that should be met include maintenance of the continuity of transit roadways, circulation between adjacent properties, provision of easements on rights-of-way for pathways and appropriate adjacencies of land use.

Parking density gradient.

A parking gradient should be regulated which is similar to the density gradient. Development closest to transit stops should have little or no parking. Development located further from transit should have more parking spaces present. The zoning should utilize the same 1/8 mile zones as the density gradient. Again, each zone should have both a minimum and maximum parking space requirement. Current parking requirements in suburban codes would most likely apply only outside TCDs and away from transit service.
IMPLEMENTATION OF THE GUIDELINES

Develop a program to encourage shared parking facilities.

To encourage the use of shared parking lots, the municipality should require each proposed project to identify all parking facilities on adjacent parcels and explore the feasibility of their use as shared lots. Local government also could approve development proposals on the condition that the land owner sign an agreement stating that they will arrange for joint use of parking facilities whenever deemed feasible by the municipality.

Minimize the distance between building entrances and transit stops, provide logical connections between buildings and transit.

A basic tenet that should be implemented in the zoning/building code is that pathways should be provided between transit stops and building entrances. This is seldom done in suburban areas; often it is necessary for a user to walk across lawns or through parking lots to reach a building. This regulation also would specify a maximum walking distance from transit stops to building entrances.

Building location and design should be sensitive to transit-generated noise and views.

This guideline can be easily adapted to a zoning code. Either the municipality can maintain a very large right-of-way along the transit path, or building setback requirements can be regulated to keep residents removed from the sight and noise. Setbacks should be greater near transit stops for residential buildings where vehicle acceleration and braking noise is loudest. Commercial buildings can be permitted
IMPLEMENTATION OF THE GUIDELINES

to be closer to the transit line than residential uses. In addition to the increased setback distances, trees and berms can be used to block the view of the transitway. Local government should have a policy of maintaining tree plantings along the transit rights-of-way.

Technological and infrastructure flexibility.

Local governments should retain a right-of-way width along the transit line that can handle changes to the system that may need more space. Also, space for any transit corridor crossing paths should be reserved. The transit service should be periodically evaluated to determine if ridership is high enough to warrant an upgrade in the type of transit service. The transit agency should set up review standards and a proposed time schedule for this review. Transit service should be able to be converted to improved vehicles if they become available.

Pedestrian/bicycle pathway system.

As part of the TCD, a pathway system of public rights-of-way should be developed within its boundaries. This system should be mapped out and be designed with area-wide connectivity. Private developments also should become part of this system. The municipality would require each developer to submit a pedestrian/bicycle pathway plan. The plan should show how pedestrians and bicycles will be able to cross the property and how the pathways will connect into the overall pathway system. All cul-de-sacs should have pathways that lead from their ends to adjacent streets. The municipality should maintain an updated pathway system map.
Provide for feeder bus and auto access points.

This guideline requires some type of transit station or parking area to be used by the transit service. Feeder bus service should be at a major stop along the transit corridor. On the other hand, the park and ride facilities should be located away from the larger, dense stops. If feasible, park and ride lots may utilize some type of shared parking facility. Developments with large parking areas should be required to include sufficient space for bus movements in case future park and ride or feeder service becomes practical on the site.