

Market-Based Approach to Transit Facility Design

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An overview of guidelines is developed for the planning and design of transit stations, stops, and terminals. These guidelines have been prepared from a market-based point of view. Key concepts for the design of facilities are directly related to promoting the success of development activities and transit services. The underlying philosophy of these concepts provides that transit services and facilities should be designed from a market-based viewpoint. The market—the people and activities that transit serves—is the major determinant of success for transit and private, commercial activities developed jointly with transit. Quality design will create use both for transit and developments with a benefit both for public and private activities. General development policies are discussed and a summary of design guidelines is provided for various transit station types through a range of design phases.

There has been significant interest in increasing cooperation between the public and private sectors in transportation projects during the past decade. Public sector budgets have been strained. The potential for innovative private sector real estate development related to transit has been seen as a way to benefit both public transit and the private sector. In spite of this progress, little formal investigation has taken place into the role of the private sector in public transit projects, into the forms of cooperation these partnerships can take, or into guidelines for the incorporation of commercial activity into public transit projects. Much has been written about joint development as a concept, and a number of specific project case studies have been documented as successful examples of public and private partnerships in transit. However, little guidance is available on how to specifically design transit projects to generate and maximize the potential for strong market-oriented activities at transit stations.

An overview of key concepts for the planning and design of transit stations, stops, and terminals is provided. The underlying philosophy of the concepts is that transit services and facilities should be designed from a market-based viewpoint. The market—the people and activities that transit serves—is the major determinant of the success of transit and of private, commercial activities to be developed jointly with transit.

Private sector planning, particularly retail planning, is highly responsive to market forces. Projects must attract consumers in an increasingly competitive environment. Six generations

of design of the retail mall, for instance, have developed a highly responsive, functional, and attractive environment—an environment that, in fact, becomes a standard for other uses, including transit systems. However, a review of the literature on the relationship between market forces and transit facilities offers little information. An understanding of the market and how to serve it should manifest itself in station planning and design, as well as in the areas around stations. Quality design will create use both for transit and developments with a benefit to both public and private activities. Extensive work (1) has provided some detailed design guidelines.

A team with engineering, architecture, planning, and urban geography backgrounds developed this paper. Information was compiled from a large number of sources, including site visits to a variety of cities having different types of transit services and varying degrees of success at joint development. Information sources included transit-related literature, human behavioral analysis literature, planning literature—particularly that related to pedestrians and open space—architectural design, design studies from specific transit systems, and real estate information. The objective was to provide a pattern book of guidelines that could be used by transit agencies and local communities for planning and design of transit facilities that maximize market potential. A project sponsored by the University Research Program of UMTA is the foundation for the work.

Basic principles used to develop the planning and design guidelines for transit terminals are provided (Figure 1). These principles state that the market for transit and commercial activities should be the key force in determining transit facility design. In addition, the range of policies is presented that a transit agency could adopt to enhance public or private cooperation for public transportation projects. The policies range from a reactive approach, in which transit agencies have a passive role in joint development, to an active approach, in which transit agencies take an active lead in project activity. A summary of key concepts that may be used for transit station planning and design is also provided.

PRINCIPLES

Several fundamental principles can be used to guide station design from a market point of view. These principles relate to how transit supports and serves markets and activities. These activities can be used to provide more successful transit services. Design guidelines and recommendations that can

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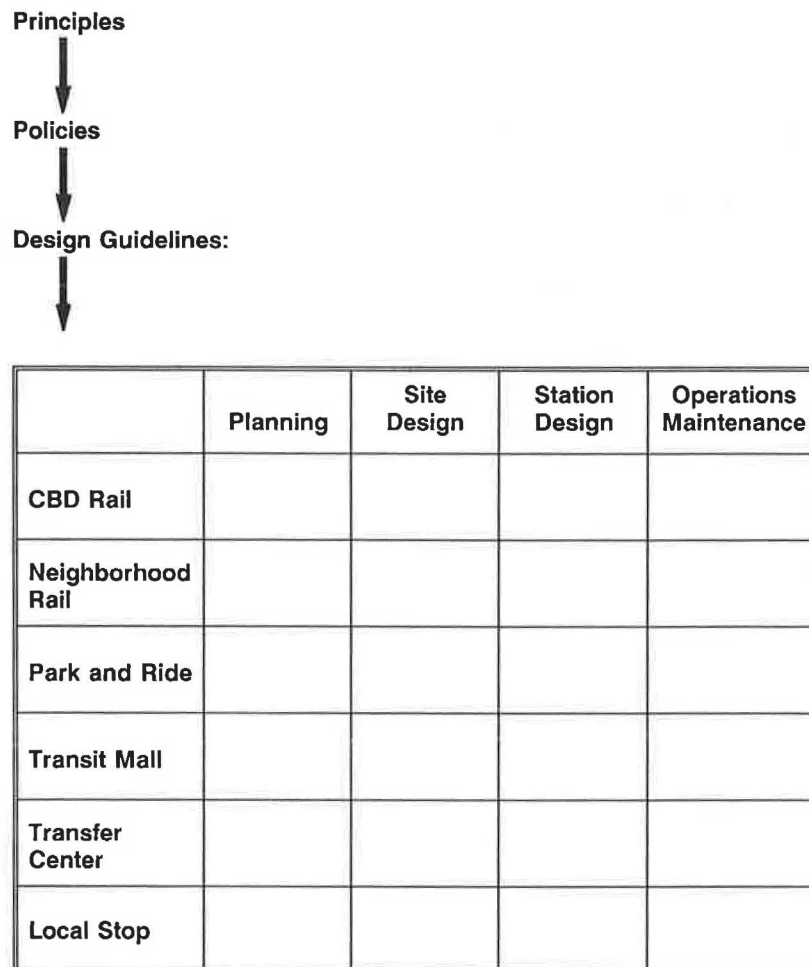


FIGURE 1 Framework for design.

lead to a better integration of transit and land use for the mutual benefit of both are necessary.

Principle Number 1: Transit generates business; business generates transit. A symbiotic relationship between public transit and business activity exists. Transit provides quick, convenient access to commercial enterprises and buildings and a concentrated critical mass of consumers for business activities. Business activities and private developments generate trips on transit systems and help to support viable public transportation. To understand and take advantage of the nature of this relationship and to be market oriented are necessary for a successful integration of business activity and public transit.

Principle Number 2: Transit should be an integrated part of activity centers. Transit and activity centers are complementary and should be designed jointly. Transit services often fit poorly, if at all, into major activity centers such as shopping centers, suburban office developments, medical facilities, universities, industrial parks, and even central business districts. To fit transit into existing developments is often awkward. It generally results in either long walks for transit users

or convoluted routing for transit systems. An integrated approach to the design of activity centers that actively considers transit is needed. Transit access should be designed into facilities at the initial stages of their planning and design; failing that, potential transit access should be accommodated in the plans of existing developments as projects are modified over time.

Principle Number 3: Access to activity centers should be provided for a variety of modes. Activity centers should be places where people change travel modes. Travelers should be able to arrive at activity centers by walking, automobile, bus, rail, specialized transit, taxi, or other modes. Activity centers are logical places for change of travel mode. The ease of movement from one travel mode to another should be designed into the center. Change of mode activities focuses the flow of users at an activity center and can provide a ready market for commercial activities. The flow of people between modes must be carefully analyzed and facilitated in the design process in order to provide a high-quality facility and to generate usage.

Principle Number 4: The design of transit facilities should be of the highest quality in order to compete with the automobile

and with the standards of quality commercial development. Transit is in direct competition with the automobile in attempting to attract patronage. Transit can have advantages in time, cost, convenience, comfort, safety, and security relative to the automobile. Even those users who are captive to transit have choices in the long run—to acquire an automobile, to move, to change travel patterns, or not to travel. In order to ensure long-term viability, transit facilities should be designed to provide a quality environment that is competitive to the automobile. Failure to do this may have some short term advantages, but will lead to a demise of public transit services in the long run, and an associated reduction in the quality of the urban environment.

Transit facilities must also compete with private sector environments, not only in terms of capacity, security, and convenience, but also in terms of image, amenity, and vitality.

Principle Number 5: Transit facilities undergo dynamic change over time. They need to be actively managed and designed for change. The design and construction of transit facilities is not a one-time event. Proactive facilities management is required to maintain facilities in prime condition and to frequently adapt and modify them as new situations develop. This process requires a constant effort to modify and expand retail activity, to capture gains in value, and to use excess land areas for new projects. In addition, ease of maintenance and adaptability are important factors to consider in the initial design in order to maintain a consistent high level of quality.

Principle Number 6: Transit should be user friendly. It should be clean, safe, accessible, secure, informative, and comfortable. Transit systems need to overcome traditional negative images. A strong, positive system identity is needed. Facilities design must consider passenger safety and security as well as comfort; while passenger mobility needs are accommodated in accordance with local and national policies. Positive steps are needed to present an attractive image for the services provided and information provided passengers should help them to easily find their way through the system.

ALTERNATIVE DEVELOPMENT POLICIES

A broad range of strategies exists for the enhancement of cooperation between the public and private sectors for public transportation projects. These strategies lie along a spectrum that represents different degrees of activism toward private development by public transit agencies (Figure 2). At one end of the spectrum, the transit agency takes an active role in development (e.g., as a real estate developer), whereas at the other end of the spectrum, the transit agency is relatively passive and may implement transit projects initiated and paid for by the private sector. Between these two extremes, various options with different degrees of entrepreneurial activity occur. The strategies are not mutually exclusive. A transit agency could adopt in whole, or combine parts of, each strategy as part of an overall policy. The strategies will be described and discussed beginning at the passive end of the spectrum (2).

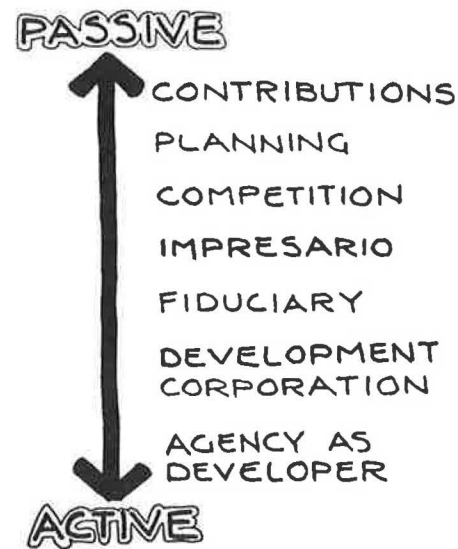


FIGURE 2 Developmental policy continuum.

Contributions

At the most passive end of the continuum, a transit agency could accept contributions from the private sector in the forms of land, services, and monetary contributions to create links to a development project. Generally, the private sector approaches the agency with needs that must be met, such as a transit and real estate project connection required for a private development project to be successful. This approach to the transit agency may be made indirectly through the local municipality in which the project is located, or directly to the agency. The transit agency imposes some criteria over the private project and may modify its plans for a better chance of mutual success. At this point, the project can move ahead if the developer is ready to contribute at a high enough level.

The contribution approach has several advantages. It is legal under existing legislation in nearly all states; it provides a way for the transit agency to receive compensation for project components that are clearly related to private development; it provides developers with a means to get the infrastructure improvements they need if they are ready, willing, and able to pay for them; it is simple and can be done relatively quickly; it can provide high leverage; and it is responsive to comprehensive needs. The disadvantages of this approach are that to relate the benefits of a project to a single development is difficult, and that the developers may not be willing to provide any contributions. Negotiations may lead to different results at different locations, and to use a contribution for some projects and not for others may be awkward.

An example of the contributions strategy follows:

- A substantial suburban shopping center contributes land and the costs of a structure for a bus transfer center. The transit system locates a transfer center at the shopping center, thus generating additional business for the shopping center and convenience for passengers.

Planning

Under a planning strategy, the transit agency expands its planning function, trying to influence local land use and zoning decisions in order to ensure a better environment, a higher quality transportation system, and a sharing of project benefits. Tools that might be used by the transit agency, in cooperation with local government, are expanded access control, zoning, and planning requirements. The transit agency, or local government, may require that a land use plan be developed for an area within a specified distance of a transportation improvement, and that any zoning changes be made before project construction. This policy would ensure that the value of transportation investment is not diluted by inadequate local control of land use, traffic flow, function, or aesthetics. This strategy may or may not have a direct economic benefit like other strategies, but would result in a higher quality transportation system by protecting both transportation investment and the environment. It would also ensure that trip generators are integrated with transit facilities.

The approach could be applied consistently across a community. A critical issue of the proposed policy is the effect on local autonomy. What is the role of the transit agency in relation to local government?

Examples of the land use planning strategy include the following:

- A suburban park-and-ride facility is located in an area that is expected to see rapid growth both in suburban retail and office facilities. The transit system is a major participant in developing a comprehensive plan for the area. Commercial developers are required to locate buildings so they relate to local transit routes and provide loading areas for transit near their buildings.
- A subsidized elderly housing project is proposed for part of the city. The transit housing agencies succeed in changing the project location so that it can be directly served by transit. Project design includes a protected bus waiting area immediately adjacent to the front entrance of the building.

Competition

This strategy is based on the urban development action grant (UDAG) selection process that was used by the federal government to encourage private-sector monetary involvement in urban development projects. The UDAG program was established to help alleviate physical and economic deterioration both in distressed cities and urban counties by fostering public and private partnerships to revitalize cities. Monies were granted on the basis of distress, the project's impact, and the amount of private-sector monies involved. The program used a scoring and ranking system for project selection purposes.

This strategy, as applied to public transportation decisions, would allocate points to transportation projects on the basis of the ratio of private and local dollars to state or federal funds. These points would then be considered along with other factors such as community distress and benefit-cost ratio to select and prioritize projects for the funding agency. The funding agency would reduce costs on the project because of the

larger nongovernment share, and also would be able to leverage existing monies to fund additional projects.

The funds would be applied for jointly by the private sector and local government. Competition between projects and localities would lead to a maximum ratio of local dollars to public dollars. The nongovernmental share could be private- or public-sector contributions.

This approach would encourage local communities and the private sector to put together joint public-private development plans that maximize development potential of a transportation project. In addition, the approach would provide incentives, through a competitive process, for localities to increase their share of project costs while providing a greater return on public investment. A potential disadvantage of this approach is that other criteria such as mobility and congestion might be ignored in the decision process if too much emphasis were placed on the financial aspects. A proper balance between criteria would be necessary. The process should also consider the effects of project size as decisions are made.

Example scenarios for this selection process include the following:

- A bus complex is proposed in a major city. Interstate, intrastate, airport buses, and local buses will all use this facility. The city will fund a parking garage for 300 cars (\$3,000,000); a developer will build a hotel of 150 rooms (\$7,000,000); and some retail (\$500,000) can be made part of the \$2,000,000 terminal. The land (\$1,000,000) is being bought and donated by a local development corporation. The match comes to \$11,500,000 for a \$2,000,000 state project—a 5.75 to 1 match (or leverage) factor.
- A transit system is considering the expansion of its service in several areas. Local business associations and developers are willing to support several new projects along one of the proposed lines. This line gets priority over alternative locations because of the higher ratio of local to private support for the project.

The Impresario Role

As the transit agency takes a more active role in the development process, the next strategy is the role of the impresario—that is, the agency serving as a broker or middleman to promote, generate, market, coordinate, and seek financing for public-private projects. The agency devises mechanisms to assist development in the form of tax incremental financing (TIF) districts, loans, tax abatements, grants, infrastructure improvements, etc. The benefits of this program are a better environment, higher tax returns, and potential direct contributions. The transit agency, in cooperation with local government, would assist private developers in organizing project packages using a variety of funding and assistance mechanisms. Funding by the federal or state government, if necessary, would eventually be paid back through loans, tax revenues, direct payments, services, and land contributions as in the fiduciary strategy.

The advantage of this strategy is that it allows the transit agency more direct involvement in the development process. With its expanded participation, the transit agency would have a greater degree of control over results. However, the agency

may not have the development and investment expertise to design deals that are good for the agency. Some projects may not occur if they become caught up in public debate. In addition, the transit agency may be in competition with local governments that perform a similar role. This system, if adopted, would have to have a strong transit agency and local partnership to be effective.

The impresario approach can be widely used in joint development. Project financing is found from a number of sources (e.g., foundations, UMTA, Economic Development Administration (EDA), private-sector financing, and investment equity) and a mix of uses—retail, public, office, cultural, housing, and transportation—are proposed to generate integrated and viable projects.

Example scenarios of the impresario strategy include the following:

- The transit agency serves as a major force in integrating the local business community, elected officials, and local government in initiating a station modernization program for a neighborhood rail transit station. The project includes a rehabilitated office building and a new parking structure to be built on the site of a vacant building adjacent to the station. The transit agency helps to negotiate an agreement between a local business association and city government for the project. A tax incremental financing district provides funds for station modernization and the construction of new pedestrian links to the office project.

- A transit system works to attract several large trucking firms and a private charter bus operator to locate their maintenance facilities on excess land adjacent to the bus system's central maintenance depot. Private parts suppliers and fuel vendors are encouraged to locate in the area. Discount prices can be offered because of the activity volume in this location.

Fiduciary

The next strategy along the spectrum is the transit agency acting as fiduciary. The transit agency views itself as a guardian of public trust in the administration of an investment program. Transit agency holdings could be managed to maximize the long-term benefits to the taxpayers with the greatest return on agency investment. The rationale behind this approach is that the transit agency can maximize the long-term return while promoting economic development for its transportation investment. The transit agency adopts strategies to recover value gains through holding land and capturing property value increases. For instance, the transit agency could purchase and hold land in a land bank to capture value for future development, see access rights, and provide loans for qualifying private development.

The sale of access rights involves a charge for access to the transit system for developments larger than a given threshold size. Traffic impact fees paid by developers would cover additional costs created by the traffic impact of those projects and the need for additional transit services. Payment may be in the form of cash, land, service, or developer-constructed local improvements. The fees could be set in proportion to the trip generation, square footage, or other factor of a development. TIF used to pay for transportation improvements could be

viewed as a type of fee system. An advantage of this fee system is that the fees are not related to the timing of a transportation project because they are collected when the development occurs rather than when the transportation project occurs.

The transit agency would maximize revenue and provide a means to recover value generated by its projects. Policies can be uniform throughout the area so one community would not have an advantage over another. Fees can directly place the cost of transportation improvements on uses that generate the need for the improvements. Direct access to a transit system has a real value and this approach can provide a mechanism to capture the value. However, the agency can wind up holding too much land through speculation and be criticized for unfair competition with the private sector. For these reasons, involvement in land purchases and sales would have to be carefully controlled. Fee systems have a disadvantage because they impose a fee, where in the past fees did not exist, and may be viewed as unfair to new projects. In addition, they may cause jurisdictional problems with local government, especially for projects that have a major impact, but are not located directly in the affected community.

The following is an example scenario for a fiduciary strategy:

- During the initial construction period of a light rail line, the transit system acquires vacant property in the vicinity of several stations located near the edge of the central business district. The property is land that was taken for the project and contains parcels with vacant buildings. The property is leased for parking and eventually sold to a private developer for an apartment complex. Residents of the apartment complex are heavy users of the light rail line for commuting into the central business district, outlying shopping centers, and employment areas.

Development Corporation

Another active strategy is the establishment of public transportation development corporations. These independent government-authorized but autonomous agencies could encourage and assist development related to public transportation projects. Projects would be identified by the development corporation. Negotiations would be made by the corporation on the basis of market factors, and the benefits would operate a better environment with a higher return on investment.

Two types of development corporations are possible: (a) a corridor development corporation could be established that would invest in a particular public transportation corridor, and (b) an area-wide development corporation would seek private sector development to be related to public transportation projects throughout the community.

The advantage of a development corporation strategy is that it is a single-purpose agency that would concentrate all of its efforts on facilitating joint development. The agency would be able to put together projects and serve as a bridge between the public and private sectors. This approach may be applicable only to a limited number of projects and may require considerable lead time to become effective. It could be viewed as a competitor to private development, but with a properly defined charter, it could be a positive influence.

Example scenarios of the use of transit development corporations include

- A light rail system is being built in a city. A corridor development corporation is formed. It has acquired an abandoned 200,000-ft² food manufacturing plant and 50 acres on the northwest side of the city, which is adjacent to the right-of-way and a state highway. A kiss-and-ride lot, park-and-ride lot, and a bus transfer center will be developed. The corporation is marketing the building either as offices or a specialty shopping center and will connect the station to the building with a glass-enclosed walkway. EDA, industrial revenue bonds (IRB), and the corporation's own bonds will be used.

- The air rights over the major downtown station will be developed as a parking (500-car), office (200,000-ft²), and retail and bus transfer station (20,000-ft²). The rights are provided free to the developer in return for station connections to the street, station areas within the new buildings, as well as other planning considerations.

Agency as Developer

In the last strategy, the transit agency assumes an entrepreneurial role to become a developer in its own right. The transit agency would purchase land, plan, finance, execute, and manage projects for profit. Market considerations determine the investment and the benefits are measured by return on investment. The transit agency would be limited to projects that were in the overall public interest.

The advantage of this approach is that the transit agency both assumes risk as well as receives benefits from its projects. The transit agency would be able to exercise control in order to meet overall goals. The disadvantages are that this type of control may provide unfair competition with the private sector, and that there may not be expertise available to carry it out on a wide scale. Competition between areas could lead to politically acceptable but economically unsound projects. In addition, the extra level of bureaucracy and the requirements for an open process may inhibit projects more than it helps them.

Example scenarios of the agency as developer strategy include the following:

- A transit agency needs new office facilities and purchases a tract of land near one of its stations. A new building that will be occupied by the transit system (40 percent of the space) and by private firms will be constructed at the site. The building will include retail shops on the first two floors. The transit agency finances the building through bonding and capital grants. The bonds are paid back through rental income at the property.

- A new garage and central maintenance facility are needed by the transit system. A large site is available and a new facility is built. The new garage is also used for maintenance by the city sanitation department, a private school bus operation, and several handicapped vehicle operators. Space is leased out to the users. A system is developed to enable the transit system to perform maintenance activities for the other users and the other users to do other work for the transit system. A centralized parts depot is used by all agencies that occupy the building.

KEY CONCEPTS

A major output was the extensive development of guidelines for transit stops and stations. These guidelines range from basic questions of systems planning, such as location, joint development opportunities, and intermodal connectivity, to issues of site planning, stations building design, and operating and maintenance. Issues and guidelines also apply to a variety of locations and modes—central area rail terminals, neighborhood rail stations, transit malls, park-and-ride locations, transfer centers, and local bus stops. Each facility has a market that can generate an environmental response. Even a local bus stop can contain a newspaper box and shelter. Because of space limitations, it is impossible to include all of these ideas. Nonetheless, it is possible to summarize certain key concepts that emerged from the study.

Take the Customer Viewpoint

Transit services exist to serve the needs of their users. Transit facility planners and designers need to think like users and understand what barriers and difficulties users encounter and seek ways to overcome them.

Seek Out and Use Expertise in Development and Property Management

To maximize potential for joint development and shared facilities, working with people who fully understand the development process and how to make projects successful is helpful. One cannot expect real estate people to be knowledgeable in the nuances of public transit, or expect transportation planners to design successful retail or commercial projects without some help.

Use Site Selection To Create Value

Location of stations can follow two approaches. First, stations can be located to serve well-established neighborhoods. Developers should find station sites in neighborhoods that have a mix of high residential densities and commercial development within the market area around the proposed station.

An alternative approach is to locate stations in underdeveloped areas to stimulate new growth and development. New development may follow in the form of high-density residential, shopping centers, and office space (see Figure 3). Transit service could be integrated with other land uses at the site to maximize access to residences and activity centers within the market area. This access in turn could stimulate further development in the surrounding neighborhood. In such a situation, the transit system should be actively involved in seeking development projects. Land banking at station sites may be a way to help influence future development projects.

Understand Market Areas

Studies have shown that the average driving access distances for express bus ridership generally range from 3 to 6 mi,

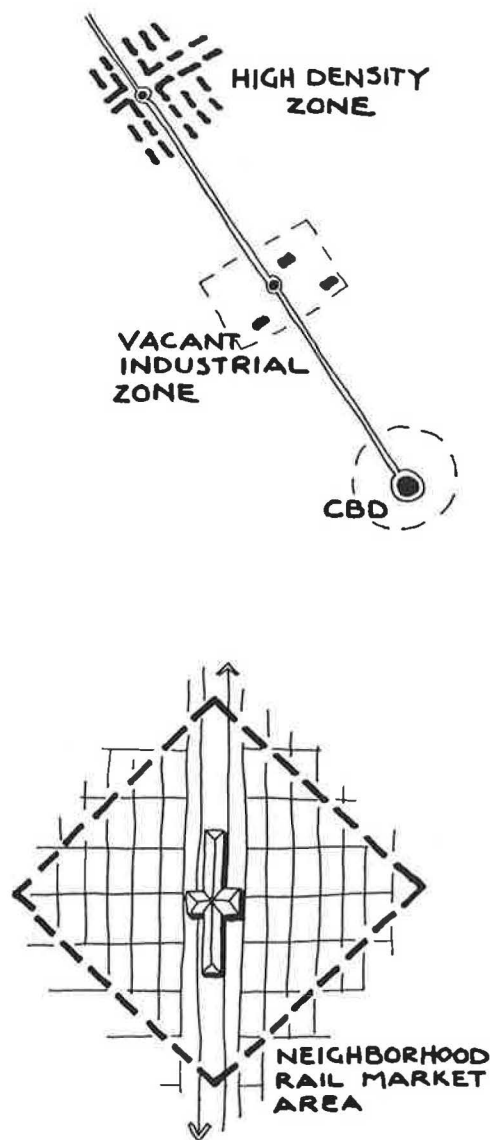


FIGURE 3 Key concepts: use of vacant areas and market areas.

depending on distance from the central business district (CBD). Auto-based access for rapid transit has been shown to vary with the distance of the station from the CBD. Median access distances range from 2.5 mi at 10 mi from the CBD to 5.0 mi at a distance of 40 mi from the CBD.

Average driving distances will be greater for park-and-ride facilities at the route terminus than at those located along the route. At intermediate stations, the market area for park-and-ride facilities is larger in the direction away from the CBD (or other terminal node) because passengers are reluctant to backtrack to the facility.

Pedestrian access distances generally are not greater than $\frac{1}{2}$ mi (see Figure 3). The distribution of passengers choosing to walk to the station decreases rapidly with distance. Activity centers should be placed well within the $\frac{1}{2}$ -mi limit.

The boundaries of the walk-based market area will reflect the street network due to limited path choices for pedestrians. In grid systems, the market area will be diamond-shaped.

However, the shape and extent of the market area can be altered by the following modifications:

- Introduce mid-block crosswalks and grade-separated walkways over busy streets;
- Alter signalization at intersections to increase pedestrian times traveling in the direction of the station; and
- Provide exits at each end of the platform (3,4).

Increase Consideration of Transit in Commercial Development Decisions

Although transit access is often a low-priority factor in the site selection by most developers, it will become increasingly important as traffic congestion increases and conditions to mitigate traffic are levied on new developments, or if energy costs increase substantially.

When a new development is located within an existing activity center, the cost of providing public facilities and service to the development will be lower than if it is located in an undeveloped area. Transit systems should encourage commercial and industrial development to locate in existing urban activity centers, where public facilities and services are already in place or needed improvements can be provided cost-effectively.

Clustering activities also results in a concentration of trip ends. For example, when a recreation complex, health unit, public library, and senior citizens' center are all situated adjacent to a shopping mall, the transit routes that serve the shopping mall also allow people to travel to the other activity centers without transferring (5).

Actively Seek To Have Transit Needs Considered in the Land Use Design Process

The incorporation of transit route planning early in the land use design process will, in most cases, ensure that walking distances to transit are kept to acceptable levels. Community planning and road system design should also provide for the incremental extension of transit routes without the need to restructure or substantially revise existing service.

The following guidelines may be useful in planning a street network which can be efficiently served by public transit:

- To connect clusters, design arterials, and transit service in advance of development;
- Encourage neighborhood and service area designs that minimize street lengths and the percentage of area devoted to streets;
- Apply suitable roadway geometries to accommodate bus turning maneuvers;
- Ensure that streets identified for possible transit usage be structurally capable of supporting the weight of transit vehicles;
- Sidewalks should be provided on at least one side of the street carrying transit. Sidewalks and an attractive pedestrian environment are particularly necessary on collector and arterial roads;
- Bicycle access to transit centers, park-and-ride lots, freeway flyer stops, and other major bus stops should be encouraged by local jurisdictions. Wide curb lanes (13 ft, minimum)

or striped bike lanes should be considered for major streets leading to transit facilities (5).

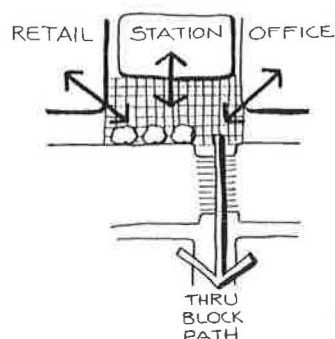
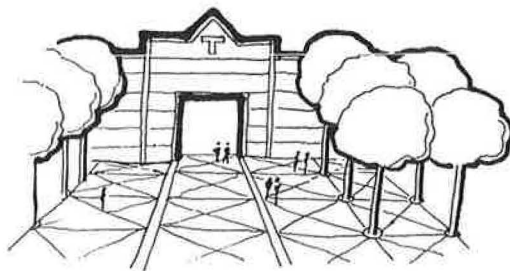
Maximize Joint Development Opportunities

Transit terminals can present significant opportunities for major joint development activities. The large volume of people using a station provides a market for retail activities, office complexes, and hotels. In a number of cities, major development projects have been implemented in coordination with transit terminals (Figure 4). The results can be mutually beneficial with successful private development supported by transit activity and increased transit system usage related to more intensive land use activity. Cost sharing by the private sector or payment for access rights can be a major source of funding to the transit system.

If possible, station locations should be coordinated with strong retail centers and the development of proposed centers. Connections to these centers can be retail oriented. In more severe climates, these links, both underground and above-ground, may stretch for a number of blocks and even connect separate station locations.

Facilitate Pedestrian Access to Stations

The maximum walking access distance has generally been observed to be less than $\frac{1}{2}$ mi. Passenger demand will be significantly influenced by the level of office and retail space available within a half-mile walk of the station. Since the distribution of passenger demand over distance follows a distance decay function, passenger demand will be strongly influenced by the level of activity within the immediate vicinity of the station. For activity centers located further from the station, pedestrian linkage to transit can be facilitated by extending the pedestrian range.



- Introduce open spaces and walkways within blocks to reduce network distances to the station—particularly in the direction of demand generators such as high-density office and retail developments;
- Introduce midblock crosswalks and grade-separated walkways over or under busy streets;
- Construct enclosed skyways or underground walkways in cities with cold winter climates;
- Alter signalization at intersections to increase pedestrian times traveling in the direction of the station (4,6).

Maximize Connections to Other Modes of Travel

Transit facilities can serve as the focal point of large transit systems for a variety of modes. The station can serve as the primary connection between commuter rail service from the suburbs and local rail service in the form of either heavy- or light-rail service. This extends mobility for incoming travelers within the city. Connections should also extend to local and express bus service. Specifically, the station should consider the following:

- Provide off-street auto access for parking and for dropping off passengers. Where possible, include parking structures with access to the station, surrounding office buildings, and shopping centers.
- Provide platforms both for commuter and heavy-rail lines, light rail, and bus stops in the station or station vicinity with clearly defined pathways between them.
- Align local bus routes within the immediate area to serve the station. Where possible, construct bus bays and passenger loading areas within the station development.
- Provide intermodal transfer passes to increase passenger mobility throughout the system.
- Provide areas for taxicab and specialized handicapped vehicle pickup around the station.

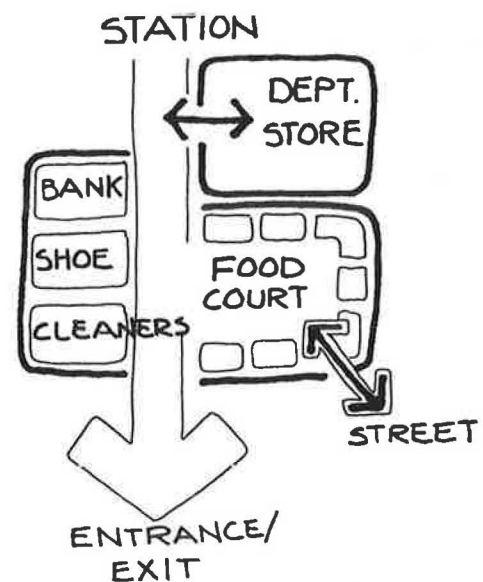


FIGURE 4 Key concepts, integrated development, and pedestrian access.

- Provide additional space for other modes involving unscheduled service, such as charter buses and limousine service, to maintain easy access to the station.

Design in Context of Surrounding Areas

Design of the site should be linked with the district in which it is located. A local identity for the system must be provided. An image that is easily recognizable and comfortable, as well as convenient to access from the surrounding community, is a prime consideration.

- Consider the means of access, traffic characteristics, site flow, layout, and location of access streets.
- Design in accordance with topography, demography, surrounding land uses, street axes, existing focal points, land buffering, visual relationships, facades, historic references, and landscaping.
- The potential for expansion must be considered in the initial planning decisions.
- In areas of high density there is often minimal open space. If possible, provide high-density open space as part of terminals in these areas.
- Provide for less formal vending activities at entry plazas of stations. This includes itinerant sellers, kiosks, and seasonal pushcarts (7,8).

Separate Pedestrian/Vehicle Domains

Primary consideration should always be given to pedestrians in station areas—safety and convenience. Because of the large number of riders in CBD areas, provision must be made for distinct, conflict-free pedestrian circulation in the site planning.

- Pedestrian paths and circulation should be separated from vehicle circulation and rights-of-way as much as possible and designed for direct access to and between modes.
- Any crossings should be adequately marked with acceptable forms of barriers, including fences, walls, and elevation differences.
- Priority in design is always focused on pedestrian flow as opposed to vehicle movement (9,10).

Create Space for Special Events

A transit facility can be an urban gathering place for special events and temporary uses. These could include festivals and street fairs (e.g., noon time concerts, art fairs, ethnic food festivals, flea markets, and open air displays of civic information) as well as seasonal or part time operations (e.g., food pushcarts, flower vending, and street musicians). Active use of the area near transit facilities generates community spirit as well as usage of the transit system. Activity can be sought by local businesses or civic associations, or coordinated through a downtown management district.

Provide a Functional Facility

The functional design of a station is the most critical of all its attributes. The large number of people using stations at peak

hours provides a demand that will stress the station. The feasibility of designing to the highest levels of service to meet these loads is prohibitive. A lower standard with high passenger loads requires that functional station planning must be carefully done.

- Platforms and waiting areas should be designed to a high level of service in circulation, waiting, and queuing;
- Provide access for handicapped persons to all areas;
- Provide bathrooms and trash receptacles;
- Provide a safe, secure feeling for users through open design and good visibility;
- Provide materials that are highly durable;
- Plan for phased replacement of materials and systems over the building's life cycle through the use of a replacement reserve fund;
- Use high quality materials and design;
- Provide sufficient areas of landscaping;
- Provide skylights or visual access to outdoors wherever possible.

Provide Orientation and Systems Information

A transit station can have a level of complexity, in terms of the number of routes and connections, that requires a high degree of explanation. The number of users in such a center is high and some will be unfamiliar with the system.

- Provide overall system routing, fares, and local area information at a central location in the building;
- Provide individual route information—a schedule and route map—at individual bus queuing areas;
- Provide an active sign board identifying departure time of buses;
- Provide information services such as a dedicated telephone line or electronic information board in low volume centers, or a manned booth in heavily used facilities (11,12).

Provide a High Degree of Passenger Safety

A transit station is a busy environment at peak hours, especially with a timed transfer system in which many vehicles arrive at the same time. The number of elderly passengers also dictates safety requirements.

- Provide easily visible and tactile safety strips at edge of platforms;
- Provide guard rails and guide rails to control circulation at points of crowding;
- Stop signs, crosswalks, and control signals should be appropriately used where pedestrian traffic crosses automobile and bus traffic;
- Consider the needs of special user groups, such as handicapped, children, elderly, etc. With passenger volumes high at stations, the conditions of crowding and crowd flow may cause problems for these groups (13).

Provide a High Degree of Passenger Security

A high proportion of transit riders are elderly persons and women. These groups are often the victims of criminal activ-

ity. Increased ridership will result with the perception that the transit system is a safe system.

- Provide a design that facilitates surveillance of station facilities. This includes an open design, avoidance of hidden areas, and high levels of lighting.
- Minimize usable areas and entrances to station at times of minimal travel demand.
- Provide transit personnel at station whenever possible. Provide electronic surveillance at times station is unmanned.
- Retail uses, amenities, and other activities will increase security by concentrating and increasing the number of users of the facility (14).

Design for Flexibility of Use

The configuration of a transit station and supporting uses should be adaptable to new conditions and usages. Most regional shopping areas are remodeled as often as every 5 to 7 years and the same could apply to transit facilities. Flexibility should be designed into a station so that the transit agency and vendors can quickly change their configuration to respond to a changing market (15).

- Provide an open plan in the building and concourse area that allows for future modifications;
- Provide for a generous use of space to accommodate future contingencies;
- Provide utilities that have the capacity to supply additional growth and change;
- Ceiling heights should be used that will allow for future changes;
- Reserve areas with knockout panels for future expansion and development.

Provide Adequate Maintenance

General maintenance of transit facilities, stops, and shelters should be done on a regular basis. Bus shelters deteriorate to a poor condition that detracts from the neighborhood and gives a poor image of the transit system. Glass or plastic panels in shelters should be replaced if they become scratched or discolored and schedule and route information should be updated regularly. Graffiti and broken glass should be cleaned or replaced immediately to prevent further damage. Graffiti-resistant materials should be used as necessary.

Vending machines, newspaper boxes, and public telephones all can be placed in conjunction with local stops. The transit system should require a minimum level of maintenance for them and should be able to order their removal if they are poorly maintained.

Advertising may be placed at local stops, shelters, or benches if in accordance with transit system policy. To maintain a good transit system image, performance standards and aesthetic standards may be necessary in the advertising contract.

CONCLUSIONS

The concept of market-based design of transit facilities has been summarized. Basic principles for facility design and alternative policies for public and private development were

presented along with key concepts for facility design. The fundamental viewpoint is that the market—the customers of public transit—should be the driving force in decisions made regarding planning, location, design, operations, and maintenance of public transit facilities. A symbiotic relationship can be developed between public transit and private activity for the mutual benefit of each.

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