Transit Station Principles as Applied to Belmont

The transportation network associated with a rail station must be carefully balanced to create a safe and inviting environment for non-motorized modes and buses. Walkable environments include not just sidewalks, but elements like seating, signage, and trees that make the area inviting.

A)Pedestrian Accommodation

Pedestrian access maintains the urban vitality needed to support the dense mixed use character and transportation objectives of having a train station within a core suburb. Successful pedestrian networks offer high levels of pedestrian service in four key measures:

- Safety,
- Convenience,
- Comfort, and
- Attractiveness.

Safety involves keeping vehicle speeds, pedestrian exposure to traffic, and vehicle volumes down to levels that reduce conflicts between cars and people. Convenience entails delineating clear paths to the train station through design gestures and helpful wayfinding, while comfort means providing adequate walking paths and sidewalks. Attractive environments draw people in by providing use, beauty, and company.

A successful rail station starts at the focus of activity, which is the rail station site. The station must be permeable to pedestrians, bicycles, buses, and cars in order to integrate it effectively into the surrounding neighborhood and promote successful transit-oriented development (TOD), safe spaces, and positive reinforcement of the existing built environment. Many train stations have been built in existing neighborhoods that are completely out of character with their surroundings. A successful station includes compatible architectural elements, similar scales to surrounding buildings, pedestrian-friendly and transparent facades on all sides, and welcoming entries near all possible points of approach by all modes of transportation.

Clear and accommodating pedestrian access to the station area is critical to the success of good stations. In order to create a welcoming active environment to support safe residential areas and local supporting retail activity, pedestrians must find walking to and from the station an easy, pleasurable, and un-complicated experience. Several pedestrian accommodation principles should be maintained around a station:

Circulation and Connectivity

The roadway system should provide overall connectivity. For pedestrians, this means a continuous sidewalk or side-path network with frequent street-crossing opportunities that do not require pedestrians to travel out of their way to reach destinations. Once a pedestrian has reached a crosswalk, a clear series of design characteristics should be followed:

- Clarity: The crosswalk should make it obvious to motorists that pedestrians can be expected to cross, and pedestrians should be guided to the designated crosswalk;
- Predictability: Crosswalk placement should be predictable, and should increase in proximity to the station, where more pedestrians can be expected to cross;
- Visibility: In the rail station area, crosswalks should be clearly marked, signed, and illuminated so that motorists and pedestrians are visible to each other;
- Limited Exposure: There should be limited conflicts with traffic, and crossing distances should be reasonably short or made shorter through the incorporation of curb extensions or pedestrian refuges;
- Clear Crossing: The crosswalk should be free of all obstacles or hazards and is accessible to all users.

Safety

To maximize safety, optimal vehicle speeds should be 20 miles per hour, with a posted speed limit of no greater than 25 MPH. Among the features that can encourage adherence to posted speed limits are:

- Rigorous enforcement of existing speed limits;
- Utilization of portable or permanent radar devices which show the posted speed limit and the motorist's actual speed;
- Traffic calming features to narrow the roadway, including curb extensions, center medians and on-street parking;
- Striping or other visual treatments to visually reduce travel lane widths, including bicycle lanes, curb lines, and other innovative treatments;

Ensuring adequate lighting is another crucial element in providing adequate pedestrian safety. Lighting should be placed at regular intervals along a roadway to provide a uniform level of light, and should be present at all crosswalks to maximize pedestrian visibility. In rail station districts, pedestrian-scale lighting should also be considered to increase security and create a sense of "place".

Design elements such as shorter blocks, narrower rights of way, curb extensions at intersections, less frequent curb-cuts, and driveways that give visual emphasis to the continuation of the sidewalk are a few basic design elements that can minimize pedestrian risk exposure. Turning options should be minimized for vehicles along key pedestrian routes.

Traffic Engineering Elements

Traffic elements such as traffic and crosswalk signals, crosswalk and curb ramp treatments, and signal timings should be designed with pedestrians in mind and should maximize convenience, comfort, and safety levels. In terms of crossing times, cycle lengths should be minimized so that pedestrians do not have to wait an unreasonably long time to cross. Related to this, crossing times should be adequate to allow pedestrians to cross in a reasonable amount of time (assuming the average pedestrian walks at 4 feet per second). The use of concurrent and protected pedestrian crossing phases where feasible is preferred over push-button actuated pedestrian phases that can cause significant delays to pedestrians. Any concurrent phase should also have a leading pedestrian interval (LPI). Where concurrent or protected phases are not

feasible, exclusive pedestrian phases should be accommodated on recall without the use of actuation buttons.

Landscaping and Aesthetics

Aesthetics play an important role in supporting station access. Sidewalks and plazas should be visually appealing and physically inviting. Appealing streetscape design can be an effective means of announcing the uniqueness of the rail station environment, and encourage initial visits to the area. When combined with quality land uses, such aesthetics can play an important role in drawing and maintaining the vitality that marks successful stations.

Convenience

Pedestrian walkways leading to the station should be well maintained, safe, and well-lit. They should be sufficiently broad to comfortably handle the expected pedestrian traffic peaks. Signage should be adequate to lead individuals, especially those unfamiliar with the area, to the station. Pedestrian levels of service along connecting routes between major origins and destinations should be emphasized. Nearby uses along walking paths should provide commuters and the local community with daily needs, minimizing additional vehicle trips.

Application to Belmont

While Belmont is blessed with two commuter rail stations located directly in walkable commercial districts, both are visually and physically isolated – often entirely unseen by visitors. Waverly Station is in an ideal below-grade location, but vertical access is foreboding and poorly signed, with no escalators or elevators. Belmont Center station is in a historic station building, but it is separated from the center by the rail bed, with only one poorly marked tunnel to the platform. Neither station is ADA accessible and both lack basic signing, adequate lighting, and any compelling features to attract pedestrians.

Pedestrian access to Belmont Center station

B)Bicycle Access

Integrating bicycles is beneficial for rail stations as bicycles extend travel options in a low-cost and low-impact manner. There are three fundamental components to bicycles and rail stations:

- Connecting the station to the cycling network;
- Including safe and secure bicycle parking at stations; and
- Ensuring that bicycles can be brought on board transit so that they may be used at both ends of a journey.

Rail station stations should be woven into the bicycle network, which may include on and off-street routes, and people need to have a secure place to lock up their bike at the station. The following principles should guide bicycle accommodation in a rail station.

Connecting Transit to Bikes

Dedicated bicycle facilities should connect to the station area but not conflict with pedestrian movements. Signage near the station should direct cyclists to bike parking, local points of interest and distant destinations, in much the same way that wayfinding is provided for pedestrians and drivers.

Maps and information kiosks are useful at disseminating information. The transit map should contain information about bicycle facilities; the local bicycle map should show where the transit stops and lines are. The goal is one map per journey, not one map per mode.

Chicago, IL Bike Map

Note: the map identifies preferred bike routes, transit services and transit stations that offer secure bike parking.

Bike Parking

The lack of a secure parking space keeps many people from using their bikes for basic transportation. Leaving a bicycle unattended, even momentarily, is not an option for most urban bicyclists. Finding a bike rack that doesn't work or isn't conveniently located can discourage future bike use. The design and placement of appropriate bicycle parking should be incorporated into rail station planning throughout the surrounding area, as well as at the rail station. This can include special zoning requirements for the provision of bike storage for new developments, including locker shower facilities at larger employers. Bike racks should be as close as possible to the rail station or the front door of businesses for security and convenience.

Station area bike parking, Washington DC

Shared Use Lanes

Shared use lanes are an effective method for designating bicycle routes to and from the rail station. The signing and chevron pavement markings are an easy retrofit that provide great value to bicyclists and motorists, especially where full bike lanes cannot be accommodated in the available right-of-way.

The AASHTO guide describes signed shared roadways (bike routes) as "those that have been identified by signing as preferred bike routes" and goes on to describe the reasons why routes might be so designated:

- Continuity between bicycle lanes, trails or other bicycle facilities

- Marking a common route for bicyclists through a high demand corridor
- Directing cyclists to low volume roads or those with a paved shoulder
- Directing cyclists to particular destinations (e.g. park, school or commercial district)

The AASHTO guide recommends considering a number of factors before signing a route:

- The route provides through and direct travel
- The route connects discontinuous segments of shared use paths or bike lanes
- Bicyclists are given greater priority on the signed route than on the alternate route
- Street parking has been removed or limited to provide more width
- A smooth surface has been provided
- Regular street sweeping and maintenance is assured
- Wider curb lanes are provided compare to parallel roads
- Shoulders are at least four feet wide

In all cases, shared use roadway signing should include information on distance, direction and destination, and should not end at a barrier such as a major intersection or narrow bridge.

Bike Lanes

In several key locations within Belmont, bike lanes are a preferable method for safely defining bicycle routes, especially close to rail stations. The designation also has the advantage of reducing through vehicle speeds by better-defining the vehicle travel lane. Bike lanes are defined as "a portion of the roadway which has been designated by striping, signing and pavement marking for the preferential or exclusive use by bicyclists". Bicycle lanes make the movements of both motorists and bicyclists more predictable and as with other bicycle facilities there are advantages to all road users in striping them on the roadway. In general, bicycle lanes should always be:

- One-way, carrying bicyclists in the same direction as the adjacent travel lane
- On the right side of the roadway
- Located between the parking lane (if there is one) and the travel lane

Application to Belmont

Both of Belmont's rail stations entirely lack any form of bicycle accommodation: bicycle parking or connected bicycle facilities.

C)Transit Interface

Beyond the commuter rail connection central to the rail station district, connectivity to feeder transit services is also important. These services encourage development of the rail station as a hub, and provide a focal point where services can locate and take advantage of high daily

pedestrian volumes. The following practices are recommended to maximize the advantages of feeder services on the development of the rail station community.

Interservice connectivity

Effective feeder service must connect the rail station to other areas where people want to go. Feeder service should be focused on remote locations that do not provide the same retail and commercial services as near the rail station itself, so that travelers come to utilize not only the commuter rail service, but the businesses that aren't available to them at the remote location.

Transfers between different transit modes or routes frequently require travelers to change grade (i.e., from the depressed/raised train platforms to an at-grade bus line). Each change of grade adds a disincentive to travelers, as it increases travel time and effort, and increases the potential to miss connecting service. Connections points should be developed to minimize the number of grade changes. Where grade change is necessary, escalators and elevators should be installed along the most direct alignment to bus stops.

In addition, transit connections should always provide a safe and active environment (both actual and perceived). Placing commercial developments along the connections provides travelers with services and offers an opportunity for businesses to serve high trafficked areas, while allowing security personnel to maximize their focus.

Interservice coordination

Scheduled transfers between modes should include sufficient time for travelers to connect without having to run. Peak period service should be frequent enough so missing a connection does not require a long wait. Off-peak service should include timed transfers between multiple operators to allow rail station developments to function as hubs.

Interservice information exchange

A critical part of modal connectivity is providing information that draws on all transit services, so riders do not need to know in advance or even care which service will take them where they want to go. Comprehensive information should be provided at the commuter rail platforms and at station-area bus stops so that riders perceive all transit as one linked system. This information should include schedules, maps, service bulletins and real-time information about all routes accessed from the station-area, as well as information about all routes that can be accessed. In this way, travelers can plan their trip at their origin, instead of making forced decisions mid-trip.

Assessment of Belmont Transit Connections

Both of Belmont's rail stations exhibit no planning and accommodation for feeder transit connections. While Belmont Center has periodic bus service, it is oriented inbound of the commuter rail station and does not directly connect to it. This does not benefit potential commuter rail riders. Similarly at Waverly, the trackless trolley routes to Harvard Square act as their own transit spine, originating at the Waverly Station as opposed to serving it. There is little attraction to riding the bus outbound to board an inbound train, and there is no bus service to the west of the station.

D)Transit-Oriented Development

Rail station planning should begin by recognizing the fact that mixed-use transit-oriented development (TOD) generates less parking demand than separate freestanding developments and a park and ride lot[1]. Furthermore, through its denser, transit-supportive, and pedestrian-focused urban design, the rail station environment offers potential for decreased vehicle use and ownership. These factors justify seeking strategies for aggressively minimizing the use of development opportunity area for vehicle storage.

TOD is commonly defined as mixed-use development, designed to maximize access to, and promote use of, public transportation, with an emphasis on pedestrian circulation and accessibility. Typical elements of this design strategy include:

- **Elevated densities** – Increased population and employment densities place more potential riders within walking distance of transit stations/stops;
- **Mixed-uses** – Retail, office, residential, and public spaces promote concentrations of public activity around rail station/stops, increasing the physical and cultural prominence of transit in the community, as well as facilitating trip chaining linked to transit (i.e., stopping at a dry cleaners or day care facility on the way to the train during a morning commute, instead of making separate trips); and
- **Pedestrian orientation** – Placing daily goods and services, as well as recreational destinations, within walking distance of residents reduces incentives for car ownership and use, supporting transit use for commuting and other regional travel.

TOD has been promoted for decades in the United States as a means of promoting smart growth, expanding lifestyle options, boosting transit's share of trips (especially commuter trips), and revitalizing neighborhoods. It is promoted as a means of redressing a number of the ill effects attributed to urban and suburban sprawl, including traffic congestion, air pollution, open space consumption, and a diminishing sense of civic connection in modern residential communities.

TOD's clustered mixture of land uses and elevated density levels, all in close proximity to transit options, offer a stark alternative to the traditional forms of development associated with sprawl. Its unique combination of dense, walkable surroundings and mobility options beyond private automobile use has proven appealing to a number of growing demographic segments in the United States, especially singles, childless couples, "empty-nesters," and the soon-to-be-retiring "baby-boom" generation.

More recently, steady increases in both fuel costs and commute times across the country have increased interest in mobility options among all demographic groups. Several recent Federal initiatives have explicitly sought to promote TOD:

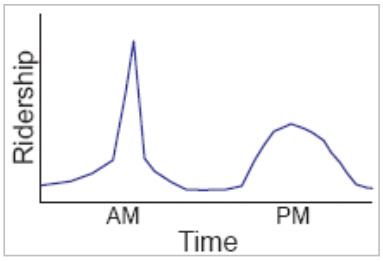
- New transit joint development policies, including a more permissive interpretation of Federal common-grant rules;
- Criteria for the Federal Highway Administration's "New Starts" program that explicitly favor coordinated transit and land use in evaluating proposals for major capital investments in transit; and
- The Location Efficient Mortgage (LEM) program, underwritten by Fannie Mae, that makes it easier to qualify for a loan to purchase a home situated near transit.

[1] Urban Land Institute, "Shared Parking", 1983.

E) Station Parking

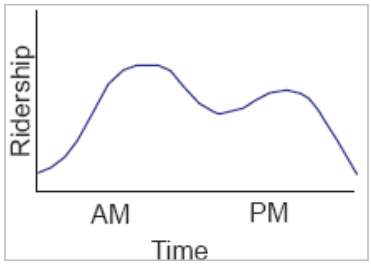
Transit agencies have realized two significant benefits from TOD. First, agencies have seen great revenue potential from leasing underutilized properties to TODs. Secondly, TODs create significantly higher ridership. Most noticeably, progressive transit agencies have recognized that the unique ridership profile of TOD produces much higher daily ridership than park & ride lots, without the peak hour capacity crunch created by commuters (see Figure below). This revelation has been significant for the planning and siting of park & ride facilities.

Ridership trends "Before" TOD



- Overloads station infrastructure (stairs, platforms) morning peak
- Under capacity midday
- Rush to find free parking spots morning peak

Ridership trends "After" TOD



- Marginal cost per rider decreases
- Spreads out peak ridership
- Efficient midday utilization
- Parking pricing evens out morning rush

Traditional commuter rail parking policy has been to maximize parking at every stop in order to maximize ridership. With the results of TOD assessments clearly demonstrating the higher ridership of walkable station areas, agencies have begun re-evaluating that policy and altering their replacement parking programs – especially since most transit agencies don't actually want to also be in the parking business. This has resulted in distinct station pro formas on new and revitalized commuter rail lines that define several levels of station design:

- **Park & Ride Stations.** Generally located in under-developed areas with good highway access, these stations are oriented to large park and ride lots or garages and see almost all ridership coming from single-occupant motorists. These facilities intercept regional trips that would otherwise enter congested urban cores.
- **Suburban Stations.** These stations are a hybrid that recognizes the context of surrounding land uses but continue to try to accommodate some commuter parking, generally by local residents with poor feeder transit, biking, or walking access. Often the more limited parking supply is somewhat separate from the station to emphasize walking, biking, and bus access, and parking is sometimes by local municipal permit only.
- **TOD Stations.** In key development areas, TOD stations may provide some commuter parking open to the public – like a park & ride – or reserved for local permit holders – like a suburban station. However, the emphasis is on dense mixed-use development near the station creating the majority of ridership.
- **Older Urban & Village Stations.** On older commuter rail systems, many station areas have developed as part of the surrounding urban fabric. They are located in village centers or neighborhood squares and often have little or no parking. Ridership profiles are very fixed, with most riders arriving at the station with set routines and expectations. Regional access to these stations is difficult, and commuter parking is hard to find.

Parking regulation and pricing at rail stations varies dramatically by the agency. In general, most park & ride stations have a low daily fee, much below the average price to maintain a parking structure (which is over $7/day at current construction financing rates). In high demand areas, these prices have increased to meet demand, though typically the municipality has to enact measures to control spill-over demand, including heavy enforcement. In locations where park & ride parking is more scarce, spill-over parking also tends to be less of a problem, and local controls can include resident permits and time-limits.

Assessment of Belmont

No commuter parking is provided for Waverly Station, but riders are free to park on nearby residential streets that do not have time-limits. Generally, the Town seeks to discourage this by posting nearby streets with time-limits. At Belmont Center, commuters frequently park in the most distant Claflin Street lot, which is primarily designed for employee parking. Closer on-street parking is heavily regulated to prevent commuter parking.

The heavy restrictions against commuter parking, combined with the poor walking, biking and transit access, generally mean that Belmont entirely discourages the use of its rail stations.