LIGHT RAIL TRANSIT AND TRANSIT-ORIENTED DEVELOPMENT

Light Rail and the American City
State-of-the-Practice for Transit-Oriented Development

G. B. ARRINGTON
Parsons Brinckerhoff

Over the past two decades a growing number of communities have married light rail transit (LRT) and transit-oriented development (TOD) as part of an integrated strategy to revitalize American cities. Along the way LRT has evolved to become both a people-moving and a community-building strategy. The FTA has come to recognize that link in elevating land use as an important consideration for New Starts recommendations. With the competition for federal funding at an all time high, land use can make a difference in which projects are recommended for federal funding. Yet transit-adjacent, not transit-oriented, development remains the norm in most communities.

Capturing the opportunities and benefits of TOD has important implications for the planning, design, and implementation of LRT systems. The essential elements of a successful integrated LRT and TOD strategy—designing development-oriented transit and achieving supportive public policy—are examined along with the underlying market forces helping to drive a growing demand for transit-friendly compact, urban living. There is a wide diversity of TOD implementation approaches and agencies in a lead role across the country. A snapshot is provided of TOD implementation experience in Dallas, Texas; Portland, Oregon; Denver, Colorado; and San Jose and San Diego, California. Finally, communities interested in pursuing an integrated LRT and TOD strategy are offered five lessons learned and ten steps to success in planning for LRT and TOD.

Over the past two decades a growing number of communities have pursued LRT and TOD as part of an integrated transportation and land use strategy to help revitalize American cities. This paper looks at the progress and implications of that journey for the planning, design, funding, and implementation of new LRT systems.

The first wave of LRT systems was justified largely on conventional measures—ridership, efficiency, and energy savings. Broader community measures such as economic development and land use were not allowed as a consideration in the federal funding. To the consternation of many in the transit industry, the Urban Mass Transportation Administration (UMTA) argued that those "secondary benefits" of transit were "captured in the single roll-up measure" of cost effectiveness.

Times have changed. UMTA has become FTA, and the New Starts evaluation process has taken on a new character. Where it was once off the table, FTA now gives special consideration to land use in their New Starts evaluation.

Subsequent generations of cities interested in implementing LRT systems have learned from the experience of early systems like Portland, Oregon, and San Diego, California. LRT in combination with land use planning can be a powerful tool to help shape growth. Land use is now playing an increasingly important role in local and federal decision-making for new LRT investments.

WHAT IS TOD?

Transit-oriented development (TOD) focuses compact growth around transit stops, thereby capitalizing on transit investments by bringing potential riders closer to transit facilities and increasing ridership. At an individual station TOD can increase ridership by 20% to 40%, and up to 5% overall at the regional level (*1*) (Figure 1).

TOD can also produce a variety of other local and regional benefits by encouraging walkable compact and infill development. Just as importantly, TOD is being embraced by a growing number of communities as part of a strategy for accommodating growth without diminishing livability

TOD draws on many of the same planning and development principles embraced by New Urbanism, Smart Growth, and the Livable Communities Movement:

- Moderate to high density development in relation to the existing pattern of development;
- A mix of land uses, horizontally or vertically;
- Compact pedestrian-oriented design and streetscapes;
- Building design and orientation to street which allows easy pedestrian and transit access;
- A fine-grained connected street pattern without cul-de-sacs; and
- A system of parks and open spaces.

By focusing compact growth around transit stops, TOD capitalizes on transit investments by bringing potential riders closer to transit facilities and increasing ridership. TOD can also produce a variety of other local and regional benefits by encouraging walkable compact and infill development. A successful TOD will reinforce both the community and the transit system. TOD has broad potential in both large and small communities using bus and rail transit systems. Figure 1 illustrates all the basic elements of good TOD design in a development along the Embarcadero line: moderate to higher density, a mix of uses, development at a pedestrian scale and civic spaces. The similarly designed Eastside Village station in Plano, Texas, is shown in Figure 2.

FIGURE 1 Embarcadero light rail transit, San Francisco, California.

FIGURE 2 Eastside Village, Plano, Texas.

NEW STARTS AND LAND USE

With national interest in new light rail projects at an all time high, the demand for federal funding far outstrips the supply. In the scramble for federal funding, land use has become an important differentiator in determining which projects FTA recommends to Congress. In FTA's evaluation of projects, land use is second only to the strength of the local financial commitment. In choosing what projects to fund, FTA and Congress are interested in projects that demonstrate merit; they want to see projects receiving federal funding succeed. Current and future land use patterns are important indicators of that success.

A review of the fiscal year 2004 New Starts Report reveals that land use is having a material effect—both positive and negative—on how FTA rates the justification of projects. Communities such as Charlotte, North Carolina, have seen their rating improve: "The *Medium* project justification rating reflects the strong transit-supportive land use policies in place to support the proposed light rail project." In communities such as Miami, Florida, land use has had a different impact: "The *Medium* project justification rating reflects the marginally transit-supportive policies and existing land use along the proposed alignment" (*2*).

FTA's land use criteria have provided additional motivation at the local level to incorporate TOD early in the planning and design of New Starts projects. In evaluating the land use potential for a successful New Start transit project, FTA applies eight transit-supportive land use measurement factors on a sliding scale. The closer the project is to moving into construction, the higher the standard. The significance for projects chasing federal funding is that the bar for a high rating will literally be a moving target as the project progresses through the project development cycle. The eight land use factors FTA uses to evaluate local projects are:

1. Existing land use;
2. Impact of proposed New Starts project on land use;
3. Growth-management policies;
4. Transit-supportive corridor policies;
5. Supportive zoning near transit stations;
6. Tools to implement land use policies;
7. The performance of land use policies; and
8. Existing and planned pedestrian facilities, including access for persons with disabilities.

TOD OR TAD: TRANSIT-ORIENTED OR TRANSIT-ADJACENT DEVELOPMENT?

To realize the benefits of TOD it is not enough for development to be *adjacent* to light rail. The development must be shaped by transit. Within the family of TOD you might say there are two "brothers"—TOD and his "evil brother," transit-adjacent development" (TAD). TAD can be defined broadly as development in close proximity to transit, generally within one-quarter mile. The development is close to transit, but not oriented to transit. Unfortunately for light rail transit (LRT) in America there are many more TADs than TODs.

Comparatively, in the case of TOD, the projects are also located within a quarter mile of the station, but the development has been, through public policy or private initiative, partially molded by transit. The reshaping in relationship to transit might include one or all of the following:

- A compact site design, oriented for the pedestrian;
- Higher density and intensity of uses, in relation to the norm for the community;
- Buildings oriented to transit, (i.e. doors located convenient to a transit stop);
- Limited parking, the parking supply has been "pinched" or placed in multi-level parking structures; and
- Pedestrian access and high-quality, safe facilities.

TOD OVERLAY ZONES

One of the reasons we have more TADs than TODs is that in most of the United States, TOD is "illegal"—illegal in the sense that local development codes and zoning do not allow for the compact, mix of uses, with reduced parking requirements, urban style setback, and side yard requirements typical of TOD-style development. An essential first step in planning for TOD is to change local planning codes and ordinances to allow TOD where it is desired.

Transit overlay zones are an approach that has been used in a variety of American cities to further TOD implementation. In 1978, Dade County, Florida, established a Rapid Transit Zone along the entire length of Miami's heavy-rail system. In San Diego and Los Angeles, California, their TOD overlay is an option developers can use. San Diego's "floating" Urban Village Overlay Zone allows developers to apply TOD principles to any site adjacent to a planned or existing light rail station. Both the cities of Phoenix and Tempe, Arizona, have developed TOD overlay zones for their proposed Valley Metro LRT line. The City of Mountain View, California, has likewise established a combination floating-overlay zone called the Transit District, or "T" Zone. Use of this designation is

restricted to properties currently zoned for either industrial or commercial and that lie within 2000 ft of a rail-transit station (*3*).

Portland, Oregon, and Seattle, Washington, have taken a different tactic and used the overlay to replace underlying zoning. In Portland, the city has instituted an overlay zone called the Light Rail Transit Zone. This designation increases permitted densities, restricts auto-oriented uses, and encourages pedestrian-oriented development in LRT station areas, including small retail shops, restaurants, outdoor cafes, benches, and kiosks.

DETAILED STATION AREA PLANS

LRT communities have come to learn that "build it and they will come" is a theory that has not played out in reality without supportive public policy. For the areas up to .25 to .50 mi around proposed LRT stations, detailed station area plans have become a popular way to help leverage the development potential of TOD. Station area plans can offer both the neighborhoods and the development community certainty and predictability. The planning is typically funded as an activity eligible for federal funding as part of the transit investment, just like the engineering of the line.

Communities that have undertaken detailed station area plans for LRT include San Diego and Sacramento, California, Minneapolis, Minnesota, Portland, and the San Francisco Bay Area. San Jose has successfully used the Planned Unit Development designation to shape the location and design of several TODs near its light rail system stations, such as the Almaden Lake Village. An example of the use of Specific Plans to implement TOD policies comes from Mountain View. Called "Precise Plans" by the city, the Whisman Station Precise Plan introduced land-use and design standards for properties near this Silicon Valley light-rail stop (*4*).

A detailed station area-planning program typically involves a detailed assessment of the area up to .25 to .50 mi around each station area resulting in:

- The preparation and local adoption of a station area plan including a vision;
- A land use plan map of future land uses;
- A description of zoning to accompany the land use map; and
- An urban design plan and a schedule for TOD and economic development projects and programs.

Communities along Portland's East and Westside Light Rail lines adopted station area plans for each of the areas surrounding the stations well before the lines opened for service. Local governments along the corridors participated in a coordinated multi-jurisdictional planning program, because they saw light rail as a means to implement their comprehensive plans.

The core objectives of station area planning in Portland have remained pretty constant over the years. They include

- Reinforcing the public's investment in light rail by assuring that only transit friendly development occurs near the stations;
- Recognizing that station areas are special places, and the balance of the region is available for traditional development;
- Seizing the opportunity afforded by light rail to promote transit-oriented development as part of a broader strategy;

- Rezoning the influence area around stations to allow only transit supportive uses;
- Targeting public agency efforts at stations with the greatest development opportunity;
- Building a broad-based core of support for transit-oriented development with elected officials, local government staff, land owners, and neighborhoods; and
- Setting up a self-sustaining framework to promote and encourage transit-oriented development once the planning is complete (*5*).

DESIGNING LRT WITH TOD IN MIND

Successful TOD starts with the earliest decisions on the shape and design of the transit system. It is amazing how many new LRT lines have been designed in a manner that is hostile to TOD—surrounding the stations with parking, locating stations in areas with little or no development potential, and providing for poor pedestrian connections from the station to the community.

Communities that have constructed a second, third, or forth LRT line have started the process of planning for TOD earlier than with their previous line. San Diego, Sacramento, San Francisco, Baltimore, Maryland, and Salt Lake City, Utah, are all examples of systems where their interest in TOD manifested itself after their first line opened for service.

Transit agencies have come to realize decisions on alignment, station locations, and station layouts can have a large impact on the success of a TOD strategy. By bringing engineers, transit planners, architects and urban planners into the process early, the opportunity to meet multiple community objectives is enhanced. The earliest decisions on alignment, station location, and design can have a major impact on TOD, as seen in developments like Central Park Commons in Denver, where the Central Platte Valley LRT is expected to be the focus of more than 2,000 residents along its 1.6-mi length (Figure 3).

FIGURE 3 Central Park Commons, Central Platte Valley LRT, Denver, Colorado.

Portland's Westside LRT alignment was designed specifically with future development in mind. As *Newsweek* put it in May 1995, Portland is "building transit first, literally in fields, in the hope development will follow." All told, in 1994 there were approximately 1,500 acres of vacant developable land in the vicinity of Westside stations. That gamble paid off. Before the Westside LRT opened for service in 1998, more than half a billion dollars in new development consistent with the TOD plans had occurred (*6*).

In a similar innovative twist on rail design, the Purple Line, a proposed circumferential light rail line in suburban Washington, D.C., is being designed around TOD. Rather than approaching TOD as an after thought, the state of Maryland sought to identify the opportunities for TOD in advance of the engineering so the rail line could be designed with TOD in mind. Once the best opportunities for stations are located they can be linked with the rail line to create a classic "string of pearls"(*7*).

There are a series of design principles to keep in mind in designing a new transit facility with an eye toward enhancing the opportunity for TOD. The principles of "development-oriented transit" include:

- Is the station located in an area with development potential?
- Are transit facilities designed in a compact manner with pedestrians in mind?
- Does the design of station facilities allow for direct pedestrian connections from the transit facility to adjacent communities?
- Has the park-and-ride been designed in a manner that is does not separate the station from the community it is intended to serve?
- Has TOD been appropriately incorporated into the transit facility design?

Designing a new LRT line to be development friendly does not mean that any of the transit requirements will be sacrificed. They will be successfully incorporated, and the system can be integrated into the community. LRT designers can learn a lot by looking at how older established commuter rail, such as Metra in Chicago, has been well integrated into the communities it serves. For example, Metra parking tends to be dispersed in a number of small lots.

COMMUNITY BUILDING AND MOVING PEOPLE

There is no simple recipe for TOD implementation. The ingredients for successful TOD implementation are part community partnerships, part understanding real estate, part planning for growing smart, part transit system design and part offering the right mix of incentives to make TOD work in a particular station area market.

More often than not, the "master chef" for successful TOD implementation has been the local jurisdiction, not the transit agency. This certainly has been the case in Portland. Indeed, cities and counties are equipped with the right tools to realize TOD—they have the planning, development, and political clout necessary to succeed.

The nature of TODs is that their implementation tends to involve many public and private players. Transit agencies can play an important role in the education, advocacy, and planning of TOD. Local governments can play a significant role in promoting TOD through plans, policies, zoning provisions, and incentives for supportive densities, designs, and a mix of land uses.

As the motivation and support for LRT has morphed from simply an alternative way to provide transportation to being part of a broader transportation, "community building," and "economic development" strategy, new partnerships and skills are essential for success. The communities that have tended to be the most successful with TOD are the ones that use the coming of rail as a means to the end of achieving their community's vision for growth. Few communities are willing to embrace the notion that their community needs to accommodate more density to make the rail line more successful.

One of the important lessons for transit agencies is that getting the city to the table as a partner in TOD can be an essential step toward success. The communities that have cities playing a strong role in TOD are the communities that are the most successful with TOD.

GROWING MARKET FOR TOD

TOD has evolved from balloon adorned architectural renderings of "what could be," to an increasing inventory of "what is"—built projects. Across America, more and more TODs have been built and are performing well in the marketplace. This indicates that the viability of TOD at many locations in today's real estate market is not a significant concern. Over the past decade, development trends have demonstrated the growing attractiveness—and market value—of TOD projects.

Successful TOD projects all have one common thread—the development project has to be successful without transit in order to be successful with transit. In other words, these are transit-oriented, not transit-dependent projects. LRT lines do not deliver the volume of customers on their own to make TOD viable.

Underlying the growth of TOD is a fundamental shift in demographics that is helping drive market demand for more compact, urban living. New Urban News cites the following factors as helping to drive the trend:

- A doubling of the demand for homes within walking distance of stores;
- An increase in buyers who prefer dense, compact homes (this market segment is expected to account for 31% of homeowner growth between 2000 and 2010); and
- A decline in the number of U.S. households with children. In 1990 they constituted 33.6% of households, by 2010 they will drop to 29.5% of households (*8*).

The country's most respected real estate investment forecast—*Emerging Trends in Real Estate,* published by Lend Lease Real Estate investments and PricewaterhouseCooper—gives special attention to TOD market fundamentals in their review of 2002: "Markets served with mass-transportation alternatives and attractive close-in neighborhoods should be positioned to sustain better long-term prospects as people strive to make their lives more convenient;" they also state, "Interviewees (real estate leaders) have come to realize that properties in better-planned, growth-constrained markets hold better value in down markets and appreciate more in up cycles. Areas with sensible zoning (integrating commercial, retail, and residential), parks and street grids with sidewalks will age better than places oriented to disconnected cul-de-sacs subdivisions and shopping strips, navigable on by car" (*9*).

That demand is reflected in the rent and sales premiums commanded by locations next to rail stations like Orenco Station in Portland (Figure 4). These "transit-oriented" premiums for

FIGURE 4 Orenco Station Town Center, Portland, Oregon.

commercial and residential development have been definitively documented for numerous light rail systems (Table 1). The research shows that for both commercial and residential development, values become greater as properties are closer to a light rail station—the closer the higher the value. Moffett Park in Sunnyvale, California, is an illustration of the value of proximity. The developer, Jay Paul Company, approached the transit operator Valley Transportation Authority (VTA) and offered to pay the full cost of constructing a station to serve the site (estimated at $2.5 million) (*10*). The station opened for service in December 2001.

TOD IN AMERICA

A TOD renaissance is underway today across the country. TOD implementation has come in all shapes and favors with varying degrees of involvement from the public sector. To provide a better understanding of the range of TOD planning and implementation, this section provides a brief snapshot of TOD at five established LRT systems – Dallas, Denver, Portland, San Jose, and San Diego.

San Diego is widely acknowledged as a leader in TOD within the state of California. San Diego opened America's first modern light rail system in 1981, but did not initiate any TOD planning until several years later (*11*). Whereas TOD was not considered in planning the first light rail line, TOD projects and plans are now in place at over 15 of the system's 49 light rail stations, such as America Plaza in Figure 5 (*12*). The transit agency, Metropolitan Transit Development Board (MTDB), has been active in pursuing TOD.

At a regional level, the San Diego Association of Governments approved a Regional Growth Management Strategy that calls for increased development in "transit focus areas" (*13*). The city of San Diego has been a willing partner in supporting both mass transportation and TOD. In a unique arrangement, the city has had a land use planner working full-time on TOD

TABLE 1 LRT and Property Values (*29*)

Study	System	Property Type	Result
Dallas (Weinstein & Clower 2003) (*30*)	DART LRT	Office & Residential	Residential values near a station increased 39% more than comparable properties not served by rail. For office buildings, the increase was 24.7% for properties near a station versus 11.5% for other properties, so office values near LRT increased 53% more than comparable properties not near rail.
Santa Clara, County (Cervero & Duncan 2002) (*31*)	VTA LRT	Commercial	Commercial space within ¼ mi of a station received a capitalization benefit of $4 more per square foot, or by more than 23% in relation to parcels further away from a station.
Portland (Dueker & Bianco 1999)	Eastside LRT	Residential	Median house values increase at increasing rates as move toward an LRT station. The largest price difference ($2,300) occurs between the station and 200 feet away.
Portland (Chen et al. 1998)	Eastside LRT	Residential	Beginning at a distance of 100 m from the station, each additional meter away from decreases average house price by $32.20.
Portland (Lewis-Workman & Brod 1997)	Eastside LRT	Residential	On average, property values increase by $75 for every 100 feet closer to the station (within the 2,500 ft. – 5,280 ft. radius).
Portland (Knaap et al. 1996)	Westside LRT	Residential	The values of parcels located within ½-mi of the line rise with distance from the lines, but fall with distance from the stations.
San Diego (Landis et al. 1995)	San Diego LRT	Residential and Commercial	The typical home sold for $272 more for every 100 m closer to a light rail station. No effect found for commercial impacts

within the planning staff of MTDB. The city was one of the first in the nation to adopt "Transit-Oriented Development Design Guidelines" in 1992 (*14*). San Diego has also adopted a unique transit overlay zone that requires reduced parking in areas with a high level of transit service.

With the completion of The Promenade at Rio Vista San Diego's largest TOD will be complete. Developed at 70 units per acre by the Greystone group, the Promenade is the culmination of phased development of a 95-acre site fronting on the San Diego River and the Mission Valley line. According to the promotional literature the 970-unit apartment and retail features "a beautifully landscaped Esplanade of boutiques and retail conveniences surround a majestic fountain. Plus, the Rio Vista Trolley Station is integrated within the south end of the Esplanade, highlighting the stunning urban design plan."

FIGURE 5 America Plaza, San Diego, California. In a pattern repeated with most LRT systems, San Diego's TOD program has grown with the expansion of the system. While TOD was not a consideration in the first line, TODs are now in place at 15 of the systems' 49 LRT stations.

Rio Vista is an important example of the challenges and opportunities with a phased TOD project. The 1985 Mission Valley Plan designated urban nodes and supports higher density in this area. Early phases of the project included a K-Mart and were criticized by some for being too automobile-oriented. Conversely, the high-density Promenade at Rio Vista holds the promise of being one of the most transit-friendly suburban projects in California. The TOD has pushed densities in the area over 10 fold from 4 to 5 units per acre upwards to 70 units per acre.

The Mission Valley LRT line marked the first-time San Diego took extra steps in rail design to accommodate existing and future development. The rail line crosses back and forth over the San Diego River to better link with development, and with the extension to San Diego State University an underground station will allow the line to penetrate the middle of the campus.

Portland, Oregon has pursued an aggressive policy driven strategy of linking transportation and land use supportive of TOD at a number of levels. Planning and implementation programs for TOD are being actively pursued by TriMet (the transit agency), Metro (the regional government), and each of the cities along the region's three LRT lines. Legally binding station area plans were funded by TriMet and adopted by local governments before the East and Westside MAX lines opened for service. Prohibition of auto-oriented uses, minimum densities, parking maximums, and design requirements are features of the plans for areas within walking distance of the stations.

The Portland region arguably has the nation's most aggressive TOD program, but it has also placed the highest stakes on what it expects from its TOD strategy. The region's vaunted growth management strategy is built around transit. The 2040 Growth Management Strategy features a tight Urban Growth Boundary, focusing growth in transit centers and corridors, and requires local governments to limit parking, and adopt zoning and comprehensive plan changes to be consistent with the plan. Two-thirds of jobs and 40% of households are designated to be in centers and corridors served by buses and LRT (*15*).

More than a $3 billion investment in new development has occurred within walking distance of the stations along Portland's light rail lines (*16*). While the vast majority of those TOD projects received no form of public subsidy, the Portland region uses a series of incentives to achieve more density, a greater mix of uses, better design, and lower parking ratios than the market would otherwise provide in TODs. The Oregon legislature enabled 10-year property tax abatement for TOD in 1995. Portland and Gresham currently use abatements. By 2000, Portland had abated seven projects with a combined value of $79.6 million (*17*). Metro operates a TOD revolving fund capitalized with federal clean air Congestion Mitigation and Air Quality funds.

The Portland region's most adventuresome endeavor into TOD has been with the Airport light rail extension. The financing package for the project is built around TOD. Bechtel Enterprises contributed $28.3 million toward the $125 million light rail project. In return, Bechtel, in partnership with Trammell Crow, is developing a 120-acre TOD with office, retail, and hotel uses called Cascade Station at the entrance to the airport. The rail line opened in September 2001, but a slow economy has frustrated the realization of any development so far.

The region's most celebrated TOD is Orenco Station**,** a 199-acre new community being developed by PacTrust and Costa Pacific homes on the Westside Light Rail line. Its pedestrian-oriented master plan provides for a minimum 1,834 dwelling units, including single-family homes, townhouses, accessory units, loft units, and apartments. The project also includes a mixed-use town center with offices and housing above ground-floor retail. Residential sales prices at Orenco Station are running 20% to 30% above the local area average. Commercial occupancies have been high, and rents are estimated to be roughly 10% higher than surrounding properties (*18*). Surveys of residents reveal that 18.2% of work trips are on bus or LRT, and nearly 7 in 10 residents report that their transit use has increased since moving to the neighborhood (*19*).

Efforts to achieve TOD in San Jose have accelerated with the opening of the Tasman West light rail line in December 1999. According to VTA (the transit operator), the Cities of Mountain View and Sunnyvale have actively pursued policies that promote development in proximity to light rail. Mountain View, for instance, rezoned 40 acres of industrial land for 520 housing units adjacent to the Whisman station (*20*).

The City of San Jose has taken an important leadership role in providing a framework for TOD. The city's general plan was revised to provide for high-density development around transit stations (*21*). The Housing Initiative Program and Intensification Corridors Special Strategy targets station areas for high and very high-density housing (*22*). The construction of San Jose's largest TOD is now underway.

Spanning two generations of TOD, Ohlone-Chynoweth on the Guadalupe Light Rail line in San Jose includes housing and community facilities developed on an under-used light rail park-and-ride lot. The former 1,100-space park-and-ride now includes a variety of uses: 240 park-and-ride spaces, 330 units of affordable housing, 4,400 square feet of retail, and a day care center. At 27 dwelling units per acre, the residential density is relatively high compared to the predominantly single family neighborhood surrounding it. The housing was developed by Eden Housing and Bridge Housing in two separate projects (*23*). Ohlone-Chynoweth is a rare example of where a park and ride has been converted to TOD without replacement of the commuter parking in structures or on another site.

In terms of the sheer number of residential units, San Jose has one of America's largest LRT TODs under construction next to the light rail line on North First Street in north San Jose. The Irvine Company is constructing the North Park Apartment Village, an upscale rental project

with 2,600 units. Under a unique California program the city was able to receive additional transportation funding as an incentive for each new residential unit.

Dallas stands out as an example of where market factors, more than supportive public policy, are leading to development next to transit. Since the opening of the Dallas Area Rapid Transit (DART) light rail system in 1996, *The Dallas Morning News* reports more than $800 million in new commercial and residential investment within walking distance of the DART line has either been constructed or is in progress. Arguably, much of this development is transit-adjacent rather than transit-oriented. In the 7 years since the start of DART operations, the city of Dallas has yet to take any steps to change plans or zoning to encourage TOD. From a policy context TOD remains illegal within the city of Dallas.

DART has staff dedicated to TOD, but has adopted no specific policies supporting TOD. However, the agency's mission and goal statement refers to economic development and quality of life. DART is working with its member cities and the Council of Governments to determine ways to link its stations with pedestrian networks. Other than the Cedars Project where an old vacant Sears warehouse was transformed into 450 loft apartments with ground-floor retail space, there has been virtually no TOD subsidy or supportive public policies by the regional planning agency, the City of Dallas, or DART along the starter line in Dallas (*24*).

Dallas's best example of TOD is Mockingbird Station**,** a stunning 10-acre mixed-use TOD. The $145 million 10-acre mixed-use project being developed by UDC Urban features an art house movie theater, 211 loft apartments, upscale retail, a planned new hotel, offices, and restaurants (*25*). Mockingbird Station is the first mixed-use project in Texas specifically designed and built for a LRT station. With the exception of federal contributions towards local infrastructure, the development has been 100% privately financed.

Following a familiar pattern in virtually every LRT city, policy support for TOD has increased after the initial experience. Suburban communities along DART's extensions have been much more aggressive in pursuing TOD. The suburban cities of Richardson and Plano are a case in point. The City of Plano has been actively working to take advantage of the opening of a new light rail line in July 2002 to create Plano Transit Village in their core. The city took one of the first steps in creating their transit village by working with Amicus Partners to redevelop a block of land for a mix of apartment, retail, restaurant and office uses. Eastside Village is a 239,000-square-foot commercial and residential project immediately adjacent to DART's light rail station. The $16 million project includes 246 apartments with space for small shops and other commercial development. The project offers a variety of floor plans including efficiencies, lofts, live/work spaces, and one- and two-bedroom apartment homes. A five-level parking garage is surrounded by the buildings in the interior of the property, providing resident parking as well as public parking on the first level during business hours (*26*) .

Denver is another example of a community that has seen its TOD program grow with the expansion of their system. Both the City of Denver and the Regional Transportation District (RTD) have raised the profile of TOD within each organization. RTD now has a full-time TOD person and has recently forged a partnership with the city and the Denver Urban Renewal Authority to collectively and more efficiently provide TOD incentives. Like other communities, Denver's TOD approach is evolving as it gains experience.

Denver's newest LRT line opened in April 2002. The Central Platte Valley Spur was innovatively financed with RTD, City of Denver, and private contributions. The 1.6-mi line extends from Union Station with stops at Auraria Higher Education Center, Invesco Field at Mile High Stadium, and the Pepsi Center. The 340-unit Central Park Commons apartments are the

largest of recent developments. The area is planned to grow into a mixed-use neighborhood with more than 2000 housing units and more than 3 million square feet of commercial and retail development (*27*).

The region's first TOD is the 55-acre Englewood Town Center, a mixed-use TOD created on the site of the failed Cinderella City mall. Adjacent to Denver's Southwest Corridor light rail, the one million square foot, $160 million TOD combines a transit hub with a civic and cultural center, as well as retail uses and entertainment. The city and RTD made $21.2 million in public improvements to the site. More than 500 residential units have been constructed by Trammel Crow along park and open space. The city purchased the property, developed a master plan focused on light rail, and sold parcels to developers (*28*). RTD built the track and paid for a 910-space park-and-ride.

RTD is now actively involved in pursuing TOD at the 13 stations on the "T-REX" LRT line now under construction in the Southwest corridor along 1-25 and I-225.

FIVE LESSONS LEARNED AND TEN STEPS TO SUCCESS

After nearly two decades of experience, a growing list of communities have come to learn that in combination with supportive public policy LRT can be a powerful tool in the regeneration of American cities (Table 1). Along the way these communities have also come to understand that capturing the development opportunities afforded by LRT has important implications for how they plan, design, and implement LRT. If LRT is to be both a community building and a people-moving tool, transit agencies and cities will need to bring a new cast of characters to the table in order to plan, design, and implement development-oriented transit.

At the risk of being overly simplistic, there are 5 lessons and 10 steps to success (Table 2) communities should keep in mind as they plan for TOD:

1. The early bird catches the TOD—the earliest decisions on the planning and design of LRT systems shape the opportunities for TOD. Without exception, transit agencies are undertaking TOD work earlier with each of their subsequent LRT lines.
2. TOD can enhance LRT project viability—TOD can add riders to the system, increase property values, enhance the prospects for federal funding, and leverage additional local government support for LRT.
3. TOD is illegal in most of America—most of the development near LRT is transit-adjacent, not transit-oriented development. Changes in local land use plans will be necessary to achieve more TOD. Much of this planning can be done with flexible federal transportation funds.
4. The market for TOD is real and growing—the market desire for compact, urban residential development is growing significantly. Locations next to LRT demonstrated average land value premiums as great as 39% for residential and 53% for offices.
5. Success means bringing new people to the table—the communities with cities playing a strong role in TOD have been the most successful with TOD. Designing for TOD needs to involve developers, local planners, architects, transit planners and engineers.

TABLE 2 Ten Steps to Success in Planning for TOD

1. Transit Village Partnerships Successful TOD planning is done in partnership with local governments, transit agencies, neighborhoods, and developers.	**2. Station Area Planning** "Flexible" federal transportation funds have been used in many communities as a source to pay for TOD land use plans up to .5 mi from stations.
3. Revise Development Codes In most communities development codes will need to be revised to allow TOD as a clearly permitted use.	**4. Development Ready Transit** Plan and design transit improvements to welcome and encourage TOD by connecting transit to the community.
5. Plan for a Mix of Uses Mixing uses in a TOD or along the line (residential, shopping, work, leisure) helps reduce automobile use and increases walking and transit use.	**6. Link TOD to Community Livability** For most communities a successful TOD strategy and a successful community livability strategy are one and the same.
7. Pedestrian-Friendly Projects Focus on pedestrian-friendly projects to avoid the complication of sequencing development with new transit facilities.	**8. Put Limits on Parking** Parking is one of the most important land uses in a TOD. Attention needs to be put on controlling the amount and location of parking.
9. Increase Density Density makes a difference in travel behavior, establishing minimum densities and raising maximums are effective strategies.	**10. Places to Come Back To** When done best, transit investments can be a powerful place-making tool to help create places to come back to, not simply to leave from.

REFERENCES

1. Parsons Brinckerhoff. Factors for Success in California's Transit-Oriented Development. Sacramento: California Department of Transportation, Statewide Transit-Oriented Development Study. 2002.
2. FTA. Annual Report on New Starts 2003. Jan. 23, 2003. http://www.fta.dot.gov/library/policy/ns/ns2004/appendixatoc.html. Accessed March 28, 2003.
3. Transit Oriented Development and Joint Development in the United States: A Literature Review Project H-27, Transit Cooperative Research Program. http://gulliver.trb.org/publications/tcrp/tcrp_rrd_52.pdf. Accessed March 28, 2003.
4. See (*3*).
5. Arrington, G. B. Reinventing the American Dream of a Livable Community: Light Rail and Smart Growth in Portland.: Presented at 8th Joint Conference on Light Rail Transit Investment for the Future, Washington, D.C., 2000.
6. See (*5*).
7. Parsons Brinckerhoff. Purple Line Transit-Oriented Development Assessment, for the Maryland Department of Transportation. Dec., 2002 .
8. New Urban News. America must urbanize as the population ages. Jan./Feb., 2003. http://www.newurbannews.com/housingmarketing.html. Accessed March 28, 2003.

9. PricewaterhouseCooper LLP and Lend lease Real Estate Investments, Inc. Emerging Trends in Real Estate 2002, pp. 33–37.
10. See (*1*).
11. Arrington, G. B., and G. Frank. Light Rail Implementation: A Comparison of the Procedures Used to Implement the San Diego Trolley and the Portland, Oregon, Banfield Light Rail Project, for San Diego Association of Governments. San Diego, Calif., 1984.
12. Metropolitan Transit Development Board. Transit-Oriented Development in San Diego. San Diego, Calif.
13. Metropolitan Transit Development Board. Mission Valley West Light Rail Project. San Diego, Calif., July, 1999.
14. City of San Diego. Transit-Oriented Development Design Guidelines. San Diego, Calif., Aug. 4, 1992.
15. Arrington, G. B. At Work in the Field of Dreams: Light Rail and Smart Growth in Portland. Tri-Met, Sept., 1998.
16. TriMet, Facts 2002.
17. Warner, J. F. Transit-Oriented Development Property Tax Abatements. Portland Development Commission, Aug. 22, 2000.
18. Parsons Brinckerhoff. "Orenco Station Profile," for Urban Land Institute, July, 2001.
19. Podobnik, B. *The Social and Environmental Achievements of New Urbanism: Evidence from Orenco Station*. Department of Sociology, Lewis and Clark College, Portland, Or., Nov., 2002.
20. Valley Transportation Authority. Tasman West Light Rail Project. San Jose, Calif., June, 1997.
21. Porter, D. R. Transit Focused Development. *Synthesis of Transit Practice 20*. TRB, National Research Council, Washington, D.C., 1997.
22. Valley Transportation Authority. Rail System TOD Program. San Jose, Calif., March, 2000.
23. See (*1*).
24. Parsons Brinckerhoff. Factors for Success in California's Transit-Oriented Development. Sacramento: California Department of Transportation, 2001.
25. Parsons Brinckerhoff. "Mockingbird Station Profile," for the Urban Land Institute, Sept., 2001.
26. City of Plano. Plano's Transit Village. http://www.planotx.org/amicus/text.html. Accessed March 28, 2003.
27. Downtown Denver Partnership. Housing, Neighborhood: Central Platte Valley, March 2003. http://www.downtowndenver.com/housing/cpv.htm. Accessed March 28, 2003.
28. Simpson, R., City of Englewood. "Englewood, Colorado." Presentation from Congress for the New Urbanism, June, 2002.
29. Parsons Brinckerhoff. The Effect Of Rail Transit On Property Values: A Summary of Studies. NEORail II, Cleveland, Oh., Feb. 27, 2001.
30. Weinstein, B. L., and T. L. Clower. DART Light Rails Effect on Taxable Property Valuations and Transit-Oriented Development**.** University of North Texas, Jan. 2003.
31. Cervero, R., and M. Duncan. Transit's Value Added Effects: Light and Commuter Rail Services and Commercial Land Values. In *Transportation Research Record: Journal of the Transportation Research Board, No. 1805*, TRB, National Research Council, Washington, D.C., 2002.

Hudson–Bergen Light Rail System and Economic Development on the Waterfront

NEAL FITZSIMMONS
Booz Allen Hamilton

WHITNEY BIRCH
Booz Allen Hamilton

The introduction of the Hudson–Bergen Light Rail (HBLR) line on the Hudson River waterfront in April 2000 was the result of a long planning and construction process that largely started in the mid-1980s. The system has both benefited from and helped shape an even longer cycle of economic recovery, redevelopment, and expansion in Jersey City, New Jersey, and on the waterfront.

Development activity in the area, key HBLR project milestones, and some lessons learned along the way are described. While it would be unreasonable to directly attribute the many economic successes on the waterfront to the development of the light rail line, clearly there is a symbiotic relationship between the two that has existed over the past 15 years as the system has been planned, constructed, and implemented.

Major development projects were constructed on the waterfront in the late 1980s and through the 1990s because of factors such as the proximity to New York City and the access provided by Port Authority Trans-Hudson (PATH), the aggressive upfront planning process, and the available tax incentives or other economic benefits that could be realized.

Now, as light rail has been implemented, the pace of development appears to have quickened, and the expansion is beginning to move away from the core waterfront areas developed first. Developers have begun to shift away from the PATH stations hubs. They are investing in properties along the light rail alignment, they are showing more attention to the residential market, and they are "selling" the amenities and connectivity that the light rail line provides.

INTRODUCTION

Jersey City, the second largest city in New Jersey and just across the Hudson River from lower Manhattan, was first and foremost an industrial center. It was home to thousands of immigrants who passed through nearby Ellis Island. These newcomers found work in its factories, and the railroads carried manufacturing products throughout the region. Here in the shadows of Wall Street's financial mecca, Jersey City grew as a thriving manufacturing town.

But over the last half century, population has shifted to the suburbs and a once dominant rail freight industry has seen traffic greatly diverted to trucks and other modes. With these overriding trends and the decline of manufacturing in the inner cities, Jersey City changed. The booming waterfront rail yards and ports were abandoned, the economy declined, and by the 1960s and early 1970s, the future looked dim.

But it was the vacant waterfront and its empty industrial centers that ultimately led Jersey City to once again be considered a land of opportunity. Through the late 1980s and early 1990s, things started to change for an area that was now sometimes called "Wall Street West."

Tomorrow's history is now being made, as abandoned properties are being developed, new businesses are arriving, and thousands of residents are settling in the area. The transportation network is one of the critical elements shaping the re-emergence of Jersey City as a thriving community, and the new Hudson–Bergen Light Rail (HBLR) transit system is certainly a key part of the story.

The Light Rail System

The planning for a light rail system to serve New Jersey's Hudson County waterfront area started well before it was ever termed the Gold Coast, with its majestic office towers across from Manhattan and upscale luxury housing. In the early 1980s, the waterfront was a different kind of place—a wasteland of abandoned rail lines, rotting piers, and vacant lots. Drug abuse plagued the area, along with the crime that goes with it. However, rents were cheap and an arts community began to emerge because of the proximity to New York City (NYC).

A small handful of firms like Nat West had located at Exchange Place largely because of the direct Port Authority Trans-Hudson (PATH) connection to NYC and the cost benefits of being outside Manhattan. These were pioneers who sought office space adjacent to the PATH station, and worked here for some 15 or 20 years before the HBLR system emerged to tie together the various waterfront parcels lying north and south along the Hudson River.

By 1984, a planning study was underway, looking at the area's transportation needs. A draft transportation plan for the Hudson River waterfront was released in 1985, with recommendations on a new north–south transit system stretching between Bayonne, Jersey City, Hoboken, and other New Jersey municipalities to the north. The study called for a transportation solution that could address the long-term needs of the area.

This was an area with much potential. In 1987, the forecasts called for 35 million square feet of new office space; 36,000 new residential units; 3.2 million square feet of retail space; and numerous hotels, restaurants, marinas, and other attractions.

The Alternatives Analysis and Draft Environmental Impact Statement (EIS) was begun in 1989 and completed in 1992. The Locally Preferred Alternative Report was issued in 1993, and in summer 1994, a decision was made by NJ Transit to utilize an unconventional (for transit projects) turnkey approach to build the initial 10-mi segment of the HBLR line. The use of this design-build-operate-maintain (DBOM) procurement strategy was employed to shorten the construction cycle and allow a faster delivery of the needed transit service.

A supplemental EIS report was issued in 1995 for Bayonne. By 1996, the Final Alternatives Analysis and EIS Document was issued, and the Full Funding Grant Agreement was received from the FTA. In September, a contractor was hired and given notice to proceed on building the light rail system. Under the DBOM terms, this same contractor who handled the construction would also be responsible for the operation and maintenance of the line over a 15-year term. This shift to a single entity streamlines the process and encourages quality control because the contractor has an ongoing role.

Construction of the HBLR system was completed by fall 1999, and after a period of system testing and required operating demonstrations, the service was implemented on April 15, 2000, between Bayonne and Southern Jersey City to Exchange Place, as depicted in Figure 1. Future segments were completed and the alignment reached Hoboken in September 2002. A southern

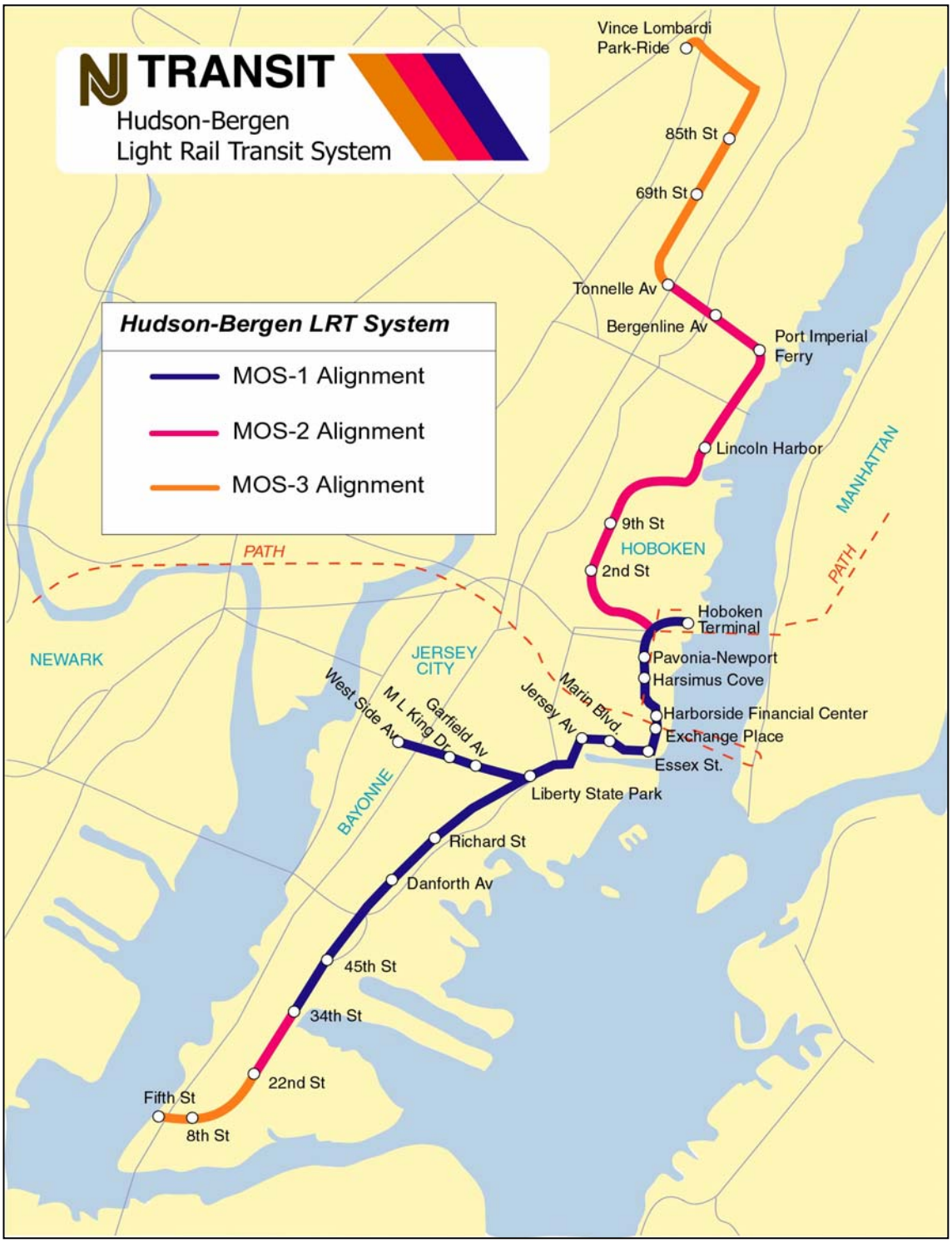


FIGURE 1 HBLR system.

extension further into Bayonne is planned to open in late November 2003. In February 2004, a northern extension to Weehawken and the Port Imperial ferry complex will open. A future extension north and west to Tonnelle Avenue will be put in place in 2005.

Development Activity

Exchange Place

The focus for much of the development along the Hudson River waterfront, from the beginning, was Exchange Place in downtown Jersey City. As an employment center, Exchange Place boasted those few early companies and a handful of restaurants which were perhaps the only real amenities on the waterfront. Things improved with the success of the huge Harborside complex, which benefited from being directly adjacent to PATH and also included a small indoor strip of stores and restaurants facing out on the river. Furthermore, Exchange Place was home to numerous vacant or abandoned parcels of land in the Colgate section, just south of the PATH station. There was a key alignment decision by NJ TRANSIT, and the Hudson–Bergen line followed the "City South" routing rather than a "City Center" option that would have served the already established Grove Street area. With this choice, the southern Exchange Place section of the waterfront was essentially primed for redevelopment, with its light rail stations stretching away from the PATH through vacant parcels.

Buildings went up quickly, and major tenants began to move in, such as Merrill Lynch, Morgan Stanley, and Lehman Brothers. More recently, in the late 1990s, the investment firm Goldman Sachs decided to build its 1.3 million square foot complex in the Colgate section of Exchange Place. As New Jersey's tallest building, this project is just being completed, and will be well served by the PATH system and the Hudson–Bergen line at both the Exchange Place and Essex Street stations.

Newport

Another key location in between Exchange Place and Hoboken, in the center of Jersey City's waterfront, is Newport. Once home to a large rail freight yard, the Newport site was mostly vacant in the early 1980s. It had its own PATH station, and a pair of residential towers that offered quality housing just a few minutes by train away from New York City jobs.

In the mid-1980s, with the aid of a massive $40 million Housing and Urban Development block grant, Newport began to expand. While preserving that critical transit corridor through the very heart of the waterfront region, Jersey City worked with the development community and in 1988, a one-million square foot retail shopping mall, Newport Centre, was opened along with four high-rise residential towers. Initially, PATH provided the critical transit linkage and later the promise of the north–south Hudson–Bergen line brought more activity. Through the latter half of the 1990s, the Newport site grew dramatically, with large-scale office and residential development following the earlier residential and retail investments.

Growth occurred on the fringes of these major sites, between Exchange Place and Newport and the PATH stations that had once offered the only quality transit connectivity in the area. Sites like Harsimus Cove developed later and now continue to expand, along with other locations that were no longer within an easy walk of the PATH station. Areas that had remained vacant for a decade or more, in times of economic prosperity, were now building up. With the light rail line funded and under construction, the developers turned their attention in the later 1990s to the

pockets of open space too far from PATH. The pace of development moved south following the light rail alignment, with office and residential activity that was unquestionably spurred by the mass transit line.

Away from the Waterfront

Just south and west of Exchange Place, and well away from the waterfront, lies the Liberty Harbor North site. On a location that essentially spans the Jersey Avenue and Marin Boulevard station stops on the HBLR line, there is only now in the last 18 months a viable plan for a major office and residential complex. On a vacant 70-acre parcel that has been undeveloped for decades, located about five or six minutes by train (light rail) from Exchange Place, there will likely one day be more than 6,000 new residential units. There are proposals for office space here too, on a huge scale up to 4.5 million square feet.

To the west, across Jersey Avenue, the Jersey City Medical Center complex will be relocated to a site that boasts convenient access on HBLR to points throughout Hudson County. This Medical Center was originally built in the early 1930s, and it is being moved to a brand new state-of-the-art facility located next to the Jersey Avenue light rail station. This center is proposed to open fully in 2004, serving thousands of patients, visitors and hospital employees each day.

On the western side of Jersey City, an economically depressed urban neighborhood appears to be rebounding. Alongside the light rail station at Martin Luther King Drive, a new retail shopping center is now in place and other residential construction is underway. This is unusual, as most of the retail centers are located on the highways that surround the city. At West Side Avenue Station, one stop further west, joint development is being discussed as the Hudson–Bergen line and the link to the waterfront and PATH has created new opportunities.

In sum, the story of development in Hudson County and on the Hudson River waterfront is largely the story of what happened and is happening in Jersey City. This is the result of many different factors, including the up-front planning steps taken by the Jersey City Department of Planning, the existence of available land, the presence of the PATH access to New York, and certainly supported by the early phases of the HBLR line built within Jersey City (and northern Bayonne).

The type and rate of the changes in Jersey City are dramatically different than those occurring in virtually all of the other major urban centers in New Jersey. From 1980 to 2000, Jersey City's population increased to more than 240,000 while the population in other major cities such as Newark, Camden, and Trenton all experienced major declines. State forecasts for the period between 2000 and 2020 project an increase of nearly 28,000 new residents, or 11 percent growth, and the residential development occurring on the Hudson Waterfront is cited as a contributing factor.

To illustrate the role that Jersey City has with regard to the area growth, Figures 2 and 3 show the proposed and approved commercial and residential development, respectively, that is occurring in Hudson County. Of note, the four municipalities on the left (Bayonne, Hoboken, Jersey City and Weehawken) have HBLR station stops existing or under construction.

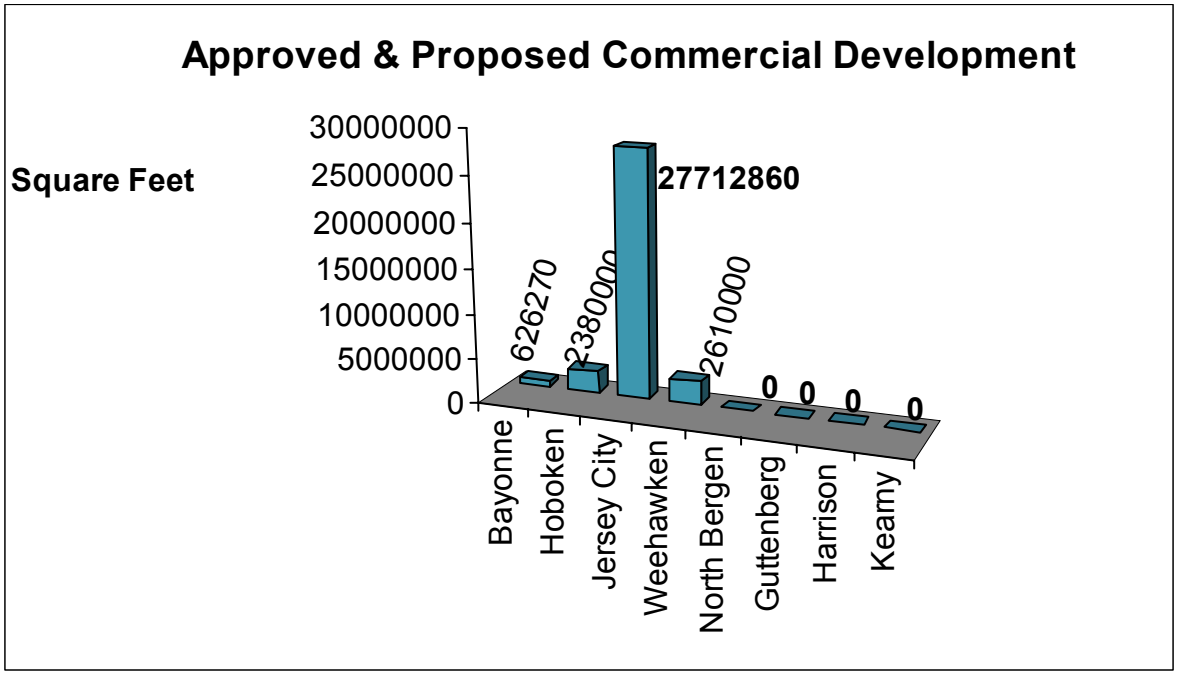


FIGURE 2 Commercial development in Hudson County.
(Source: Jersey City Planning Department.)

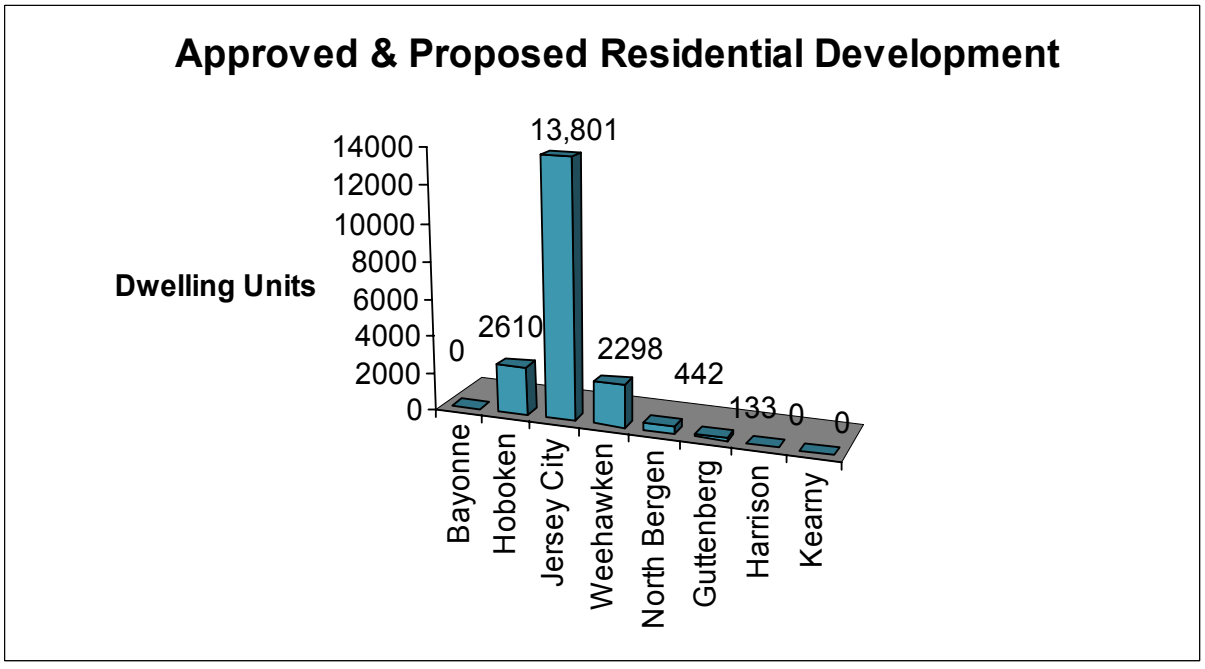


FIGURE 3 Residential development in Hudson County.
(Source: Jersey City Planning Department.)

The Future

Even if we look only at those firmly committed projects on the waterfront, the fast pace of development is not slowing. In Figure 4, the office, retail and residential development on the Hudson River waterfront has been broken down into different stages. Beyond what is shown as existing in 2002, there is significant activity on projects that are either under construction or are proposed or approved.

This development of committed projects adds a total of nearly 7.5 million square feet of new office space, which would project to a workforce of up to 22,000. This tally shows 6,489 new residential units as well.

The Hudson–Bergen line is a stimulus for the development that has occurred and what will occur in the future. With the dramatic data in Figure 5, the investment value of the area's construction has been compared with the key milestones in the development of the light rail system over the past 12 years.

Development projects have come on line rapidly as the construction on the rail alignment and stations has been completed. From 1996, with the selection of the contractor up to the opening of the first two segments of the system in 2000 and 2001, the construction activity on new development projects has been impressive.

Lessons Learned

There have been many successes in Jersey City, with both the waterfront development and the implementation of the light rail line. And there are lessons learned and inferences that can be drawn.

Jersey City is a prime example of where, if you can "get your planning in place," the

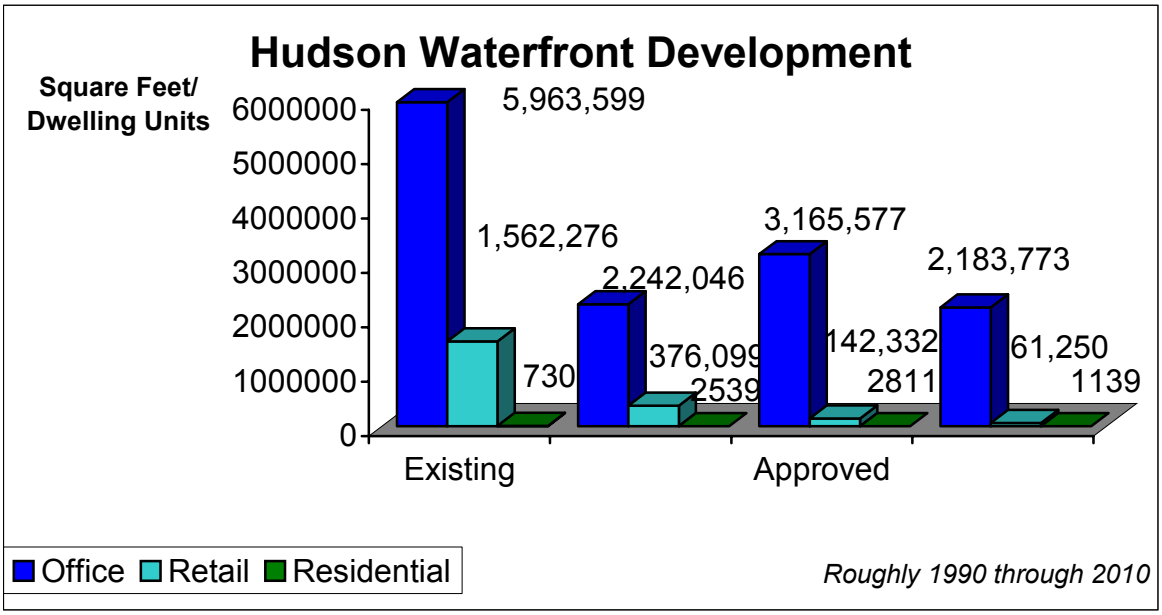


FIGURE 4 Office, retail, and residential development in Hudson County. (Source: Jersey City Planning Department.)

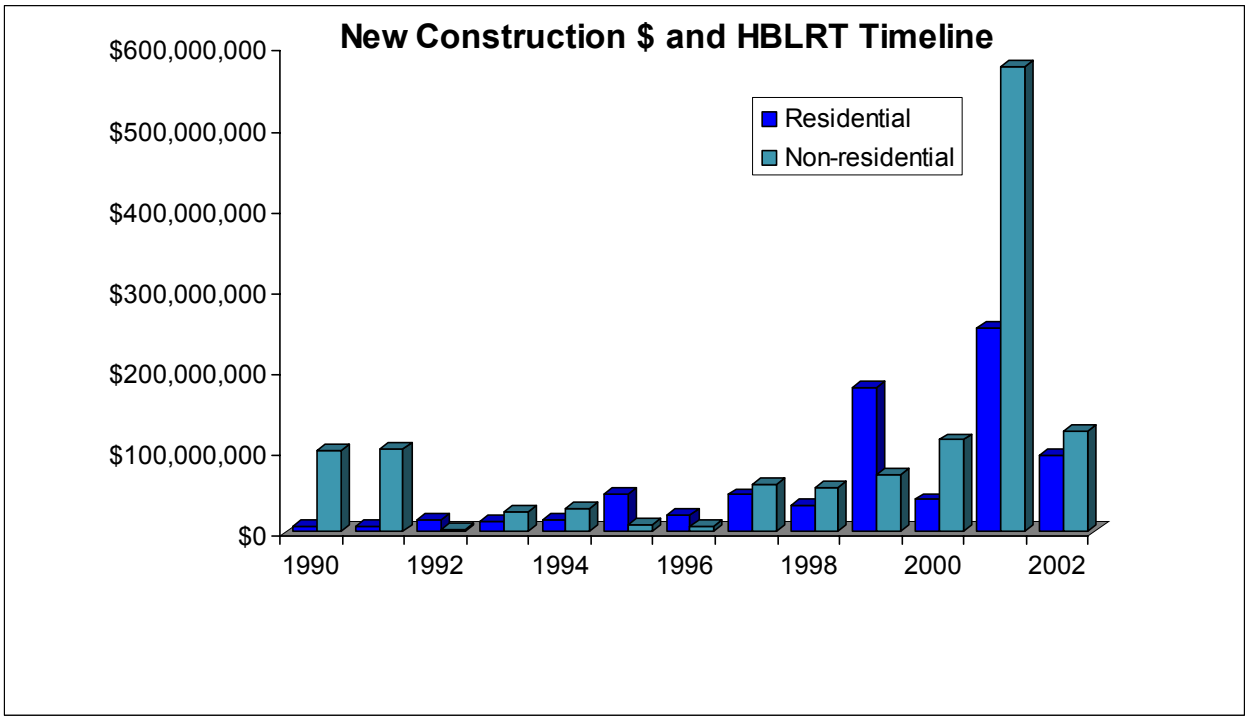


FIGURE 5 Investment value of Hudson County construction and light rail system timeline. (Source: Jersey City Economic Development Department.)

development will follow. At the municipal level, time was spent early in the process on the needed zoning changes and on other efforts that would support and encourage future development. According to Bob Cotter, long time Planning Director for Jersey City, decisions were made and the necessary steps were taken in the mid-1980s. The municipality spent time developing a Master Plan for the waterfront area that assumed mixed-use development and the inclusion of a light rail system even before the system had been designed.

Through a three-part process that addressed site acquisition, custom zoning, and tax abatement, Jersey City was prepared. As a result, when major corporations were looking to invest in properties with good transportation access, the waterfront area was attractive. This worked in the late 1980s and into the 1990s, with the PATH system, and it is working perhaps at a more feverish pitch now with the arrival of the Hudson–Bergen line.

There was regular ongoing dialogue between the development community and Jersey City. Ultimately when the formal site plan application was submitted, the planning approvals could literally be handled in 20 minutes because it was consistent with the Master Plan requirements. When considering the cost of money, this resulted in significant savings to developers and it offered new tenants the ability to quickly relocate. Jersey City was an attractive alternative, in comparison to many of the other sites in the New York City region.

Waterfront development permits administered by the Department of Environmental Protection were essentially the mechanism used to regulate any developments proposed within 200 ft of the Hudson River. Through this process, a number of state agencies were brought in to evaluate proposals and approvals were typically granted with a series of conditions.

The state transit agency secured no-cost transit easements through the waterfront area and developers were also required to provide a continuous waterfront walkway that allowed public access all along the river. This 3- to 6-month process included a public hearing, and identified and addressed issues associated with the particular development.

In approving developer projects on the waterfront, Jersey City was able to implement a very aggressive parking ratio policy, at only one parking space per 1,000 square feet of office space. Currently, this ratio is even lower, at .67 space per 1,000 square feet. It is important to note that this policy was not a deterrent, either to the project lenders or the development community. In fact, it allowed them to maximize the tenant space in the building while minimizing the investment in parking. This worked in large part because of the transportation alternatives that were in place. While this was begun initially with PATH and local and regional bus service, it was given a dramatic boost as the connectivity of the HBLR line encouraged development with the institution of low parking space ratios.

The initial growth on the waterfront, especially with office space, was most dramatic at Exchange Place and Newport, as developers built and tenants settled alongside the PATH stations offering the direct PATH link to nearby Manhattan. This space filled, and the light rail line emerged to connect the other developable properties up and down the waterfront. This is illustrated in Figure 6. With these changes, and in a positive economic climate, the development activity continued but it has moved away from PATH. Perhaps as a result of the fixed rail connection, office development and dramatic residential growth are occurring further and further from the heart of the Gold Coast waterfront. Space that will be served by the Hudson–Bergen line, in western Hoboken and Weehawken and in southern Bayonne, is being cleared, construction is underway, and expansion is continuing.

The residential activity has jumped also, following the initial success of office development on the waterfront and along the Hudson–Bergen alignment. Since the light rail line opened in April 2000, there has been a major expansion of residential space. The residential decision seemed to come later, as the employees waited to see the light rail system in operation, to see what the service would be like and whether they wanted to live nearby.

Due to the closer spacing of light rail stations, the Hudson–Bergen line may have also facilitated greater density over the line than could be achieved with the localized, concentrated, heavily office-based development occurring within a .25-mi radius around PATH stations. In other words, the light rail line has facilitated the infill of residential properties, and this has brought development into locations that office space developers would not be interested in.

Part of this expansion by residential properties farther out from the central hub is simply explained by basic land economics, with higher-order uses locating near the core. Further, however, it can show how the new transportation access from the rail line has helped to make otherwise undesirable locations attractive. In doing so, it also helps to facilitate a twenty-four hour environment around the hub location as residents are now in a position to support other mixed uses in the area.

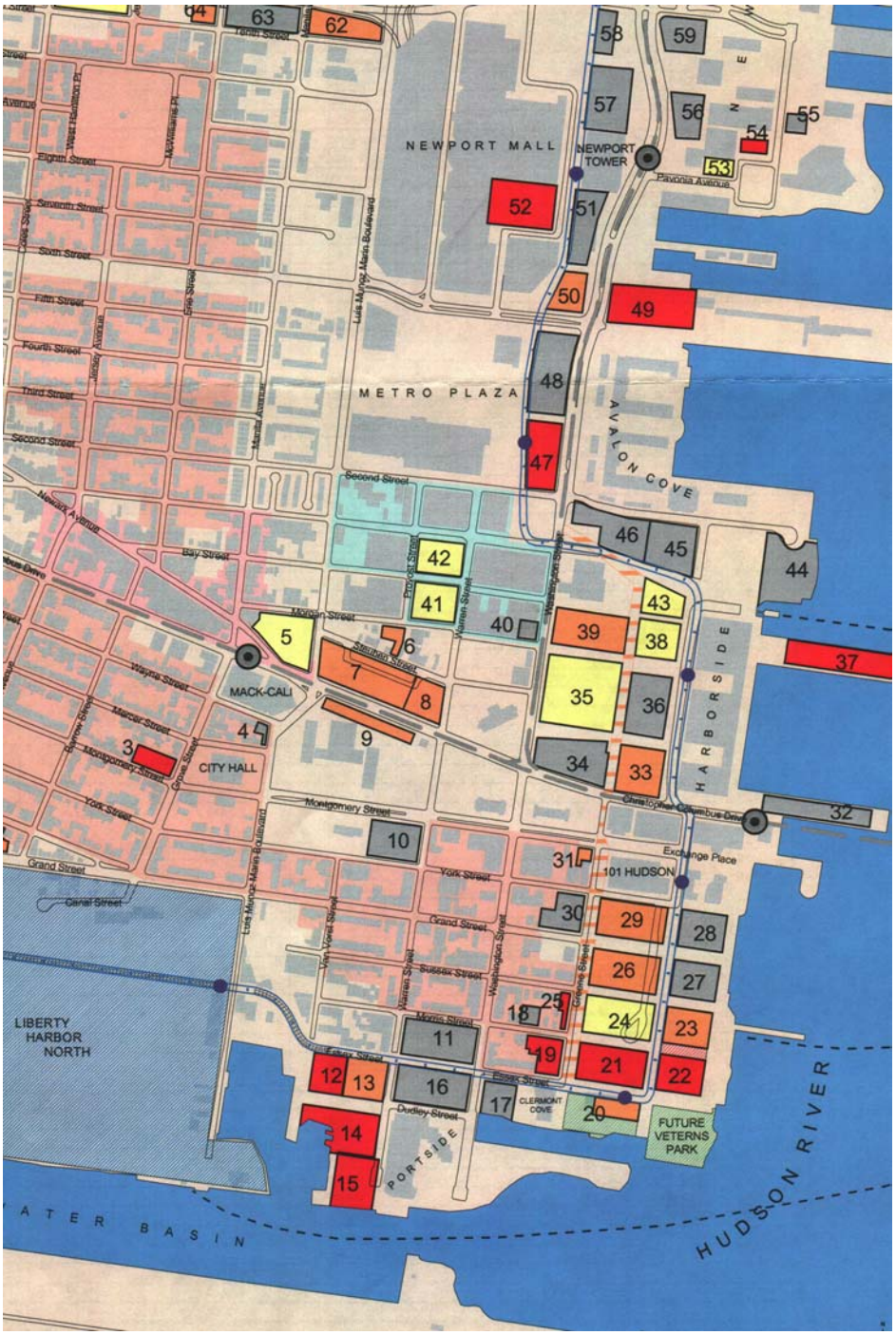


FIGURE 6 Jersey City downtown development map, October 2002. (Source: Jersey City Economic Development Department.)

Third Street Light Rail Project Southern Terminal

JOHN P. BEATTY
Korve Engineering, Inc.

Much of San Francisco's recent growth has been south of its traditional center, and public transportation has been following this growth with new service. The existing southern leg of the Route N Judah line service runs south from the foot of Market Street along the Embarcadero to its terminus at Fourth and King Streets near Pacific Bell Baseball Park and the Caltrain Terminal. The recent extension is proving successful in attracting riders. San Francisco is building the dual track Third Street Light Rail Project from the end of the current line near Pacific Bell Park to the city and county southern boundary. A public transportation terminal is needed at the southern end to complete the transportation infrastructure for the future urban corridor. The Southern Terminal at San Francisco's southern boundary would be the southern gateway to the San Francisco Municipal Railway system. It would be the public transportation center for the southern end of the Third Street corridor. The proposed Southern Terminal location actually lies in the neighboring city of Brisbane, which increases the complexity of its development, but also increases it potential.

THIRD STREET LIGHT RAIL SYSTEM

Third Street will be a major north–south transportation corridor in San Francisco between the city's downtown Market Street area and its southern boundary. The corridor begins at Market and Third in San Francisco's downtown and continues south through the south of Market area, Mission Bay, Central Waterfront, and the communities of Baypoint and Visitation Valley. The San Francisco Municipal Railway (Muni) Metro Third Street Light Rail Project in the center of the corridor will provide light rail public transportation from Union Square and Chinatown in the city center on the north to Visitation Valley on the San Francisco southern boundary.

Phase 1 of the Third Street Light Rail Project is currently under construction. It begins at Fourth and King Streets and extends the existing Route N Judah Line approximately 5.4 mi further south along Third Street and Bayshore Boulevard to its southern terminus at the San Francisco county line. Phase 2, the new Central Subway, in preliminary engineering, will follow the initial operating segment and will complete the line segment. It will extend the Third Street light rail transit (LRT) system north from Fourth and King Streets to a new downtown terminus in Chinatown at Stockton and Clay Streets in a new subway section that begins near Bryant Street, crosses beneath Market Street, Geary, and Stockton Streets, and ends at the downtown terminus.

A primary objective of Phase 1 is to serve as a catalyst for new development through improved public transportation along Third Street. The city's plan is for a public transportation corridor south of the downtown that will enhance the areas it passes through. It is investing in landscaping and street amenities in an established business district between Evans and Donner Avenues in the Bayview Hunter's Point area, which will serve as the entrance to the new

redevelopment area of the former Hunters Point Naval Shipyard. Phase 1 construction will provide public transportation rail service connections to this corridor from the Muni light rail lines in the central downtown tunnel and Bay Area Rapid Transit (BART) to the north and from Caltrain at the San Francisco limits to the south.

REDEVELOPMENT ALONG THIRD STREET

San Francisco is structuring its urban development to balance employment and housing. Businesses have stated that affordable housing is the biggest problem facing them when considering San Francisco against other competing business locations. There is a lack of middle-income housing that is forcing non-executive workers to commute large distances, up to 60 mi or more from San Francisco. Most new development projects in San Francisco are required to include affordable housing to get permitted.

The Third Street LRT line passes through a traditional industrial and blue-collar residential area that is changing. Development plans for the corridor include 10,700 new residential units and 5 million ft^2 of new commercial space. The major north south commercial corridor south of the city's center should develop along Third Street. The largest redevelopment projects underway in San Francisco are along the Third Street corridor in former industrial sites (Figure 1). Mission Bay, a former Southern Pacific rail yard and associated industrial area, is at the north end. Hunters Point is just east of the corridor at the central portion. Redevelopment of these sites is important part of San Francisco's general plan. The available of the large sites reflect a loss of many traditional industries along the southern waterfront. The replacement of traditional housing and commercial uses in the area is a sensitive issue.

Mission Bay is a 300-acre redevelopment between Pacific Bell Park and 20th Street that is centered on the new University of California at San Francisco Medical Research Center. The 2.65 million ft^2campus will employ 9,100 scientists, researchers and students. Adjacent to the medical center, the developer is planning to build a 500-room hotel, 6,000 residential units, 750,000 $ft^2$of retail space, and 49 acres of parks and open space. Third Street bisects Mission Bay and will be the primary street access.

Hunters Point is a redevelopment of the former U.S. Navy Shipyard. The shipyard is being developed in four parcels. Approximately 63 acres of Parcel A, being developed first, will include 1,600 new homes for ownership and rental, 300,000 $ft^2$of commercial space, and a 5-acre multipurpose community campus. The developer will set aside 32% to 44% of the homes for low- and moderate-income residents. The current schedule is having build-able lots in early 2005 and the first housing units by the end of 2005. The primary street access into the first phase of the Hunters Point development is through Innes and Galvez Avenues to Third Street.

SOUTHERN TERMINAL REDEVELOPMENT AREA

The Southern Terminal is in a redevelopment area straddling the boundary between the cities of San Francisco and Brisbane. It is situated in an industrial area that includes a former Southern Pacific rail yard and adjacent factory sites. The development site is one of the last large redevelopment sites fronting San Francisco and an opportunity for a new direction. As a major residential and commercial center at the southern boundary, the southern terminal center can

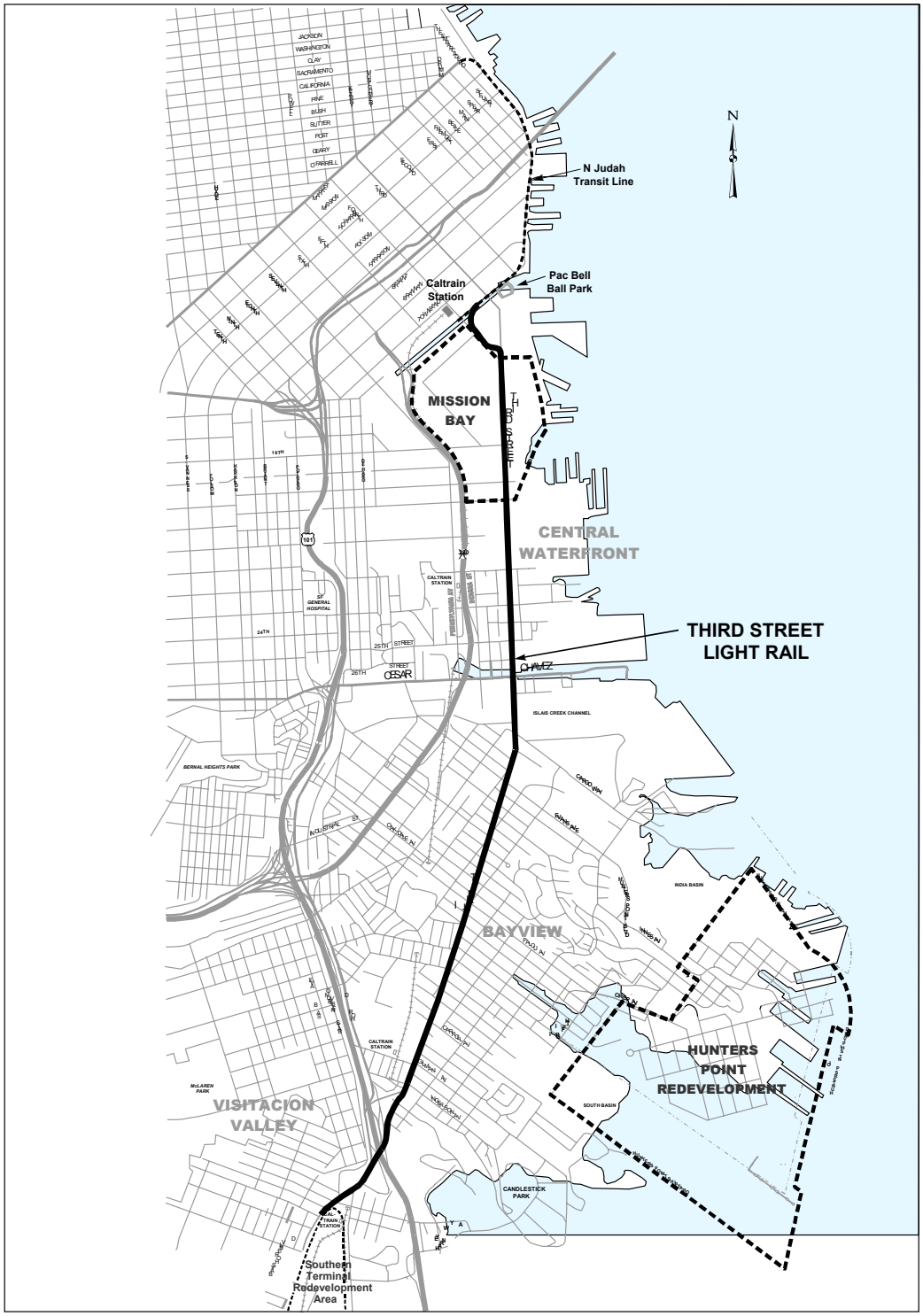


FIGURE 1 Third Street light rail corridor.

anchor the southern end of the Third Street corridor. Infill development associated with the Mission Bay, Hunter's Point, and Southern Terminal should grow towards each other along the corridor.

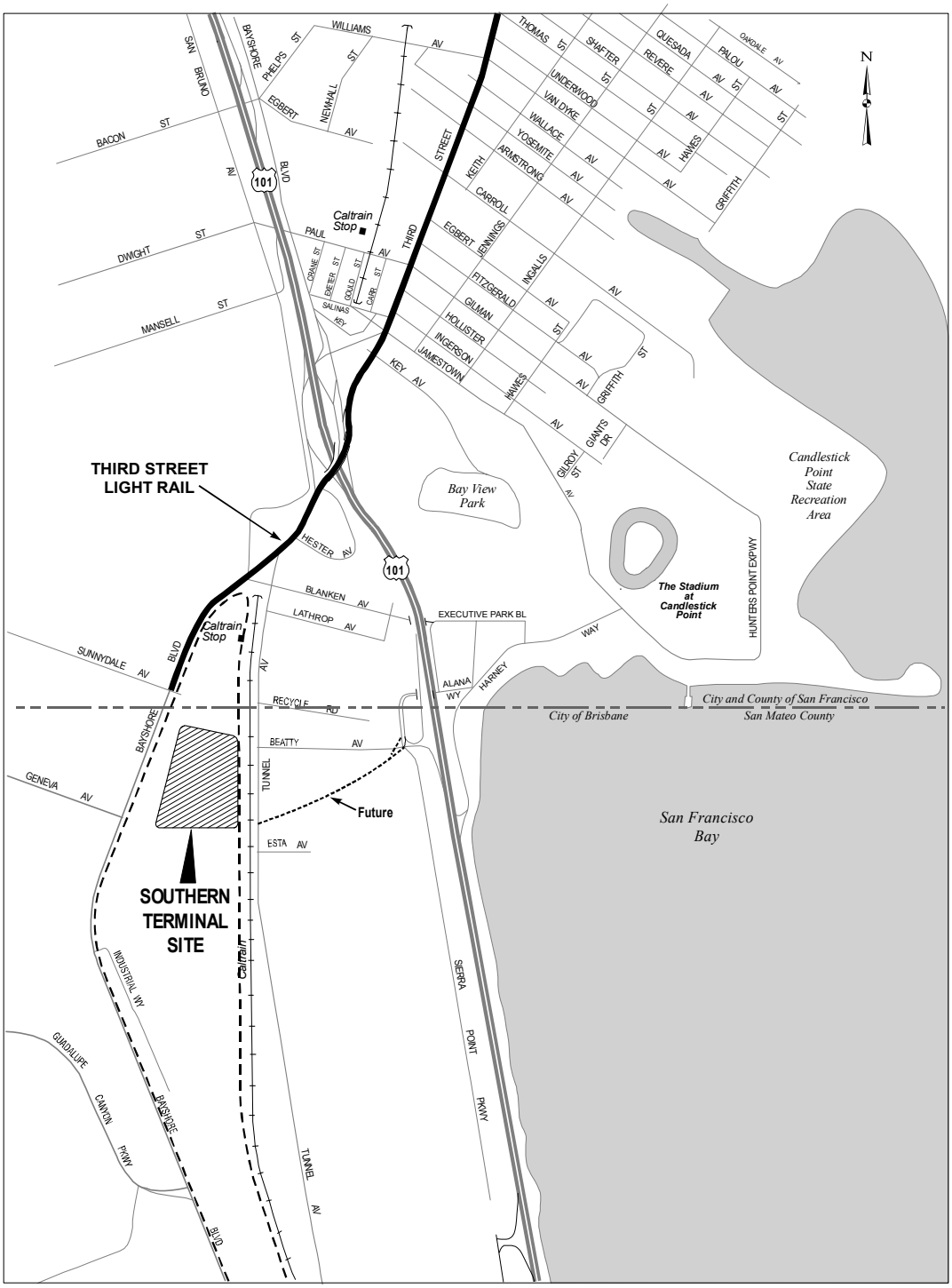
Universal Paragon Corporation (UPC), as the owner/developer, is redeveloping the site working with both the city of San Francisco and the city of Brisbane. UPC, in the planning and environmental phase of the project, is in the process of obtaining permits for this area is negotiating the type of development with both cities. UPC has recognized the advantages of good pubic transportation access to the development area from San Francisco to the north and the Peninsula to the south. In early planning efforts, UPC has studied building residential space in San Francisco coupled with commercial space in Brisbane. Both types of developed could be centered on the Southern Terminal. UPC would donate land to Muni to build the Southern Terminal in the redevelopment area. The land for the terminal was located just over the Brisbane city limits. The location would also serve as transportation center for new development in Brisbane.

Within San Francisco, the owner/developer will build a transit village that will provide much needed housing and associated residential activities. The transit village concept promotes a life style that is centered on public transportation and orients development to public transit. Conversely, it also designs transit facilities to be compatible to the development. Its intention is to divert travel away from the single passenger automobile to public transit and other high vehicle occupancy alternatives. The Southern Terminal, as the village transit center will be the physical center for the redevelopment area's transportation system.

SOUTHERN TERMINAL JOINT DEVELOPMENT

The Southern Terminal is an ideal site for joint development. It is adjacent to the major San Francisco Peninsula corridor for north and south regional travel. The combined Route 101/CalTrain transportation corridor connects San Francisco with the Peninsula and is the primary corridor for this market. The peak travel demand along this corridor is both north- and southbound, which reflects strong employment centers in both San Francisco to the north and the Silicon Valley to the south. Job growth has been good to the south creating a reverse commute business. Muni would also serve workers coming from the peninsula to jobs south of the downtown. The role of the Southern Terminal is to divert personal trips to public transportation along this corridor providing congestion relief to Route 101.

The convergence of alignments at the Southern Terminal site (Figure 2) offers opportunities for a public transportation center. At the southern end, the Third Street LRT tracks in the median of Bayshore Boulevard, cross over Route 101, and run parallel to the west of the original Southern Pacific track alignment, which is used for the Joint Power's Board Peninsula Commuter Railroad (Caltrain) service. An intermodal station that provides bus and light rail connections to the Caltrain service by taking advantage of a convergence of alignments can be the primary connection for long haul commuter service south to the peninsula and San Jose. The Southern Terminal location adjacent to the Caltrain Bayshore Station can link the LRT and the commuter rail systems within walking distance.



THIRD STREET LIGHT RAIL CORRIDOR STUDY

Figure 2

SOUTHERN TERMINAL SITE

FIGURE 2 Southern terminal site.

PUBLIC TRANSIT IMPROVEMENT

The natural features surrounding the city and county of San Francisco limit the available area for development and its associated transportation infrastructure. In response, the city has promoted public transportation as a solution to development within its confined area. Its goal is to significantly enhance the role of public transit in personal trips to decrease passenger car trips. This strategy is important in reducing traffic congestion impacts and the rate of traffic growth on major corridors.

Muni is the public transportation agency within San Francisco responsible for building and operating its bus and rail systems. Most Muni service is structured in a hub and spoke system with lines centered on the downtown business center along Market Street. The primary light rail lines radiate out from the foot of Market Street to the western areas. Connecting bus service is provided from the stations along the rail system. Because there is no current light rail service to the southeast, the area is served by buses. Routes 9, 15, and 52 provide bus service along Geneva Avenue, serving the southern end of San Francisco to the downtown; but the service tends to be indirect and slow.

The Third Street Light Rail System will replace the Route 15 Third Street bus service. It will provide a higher speed service along the eastern end of the city and will connect to feeder bus service. The Southern Terminal will be a transfer point for Muni service for the southern part of San Francisco. It is a good location for connections to the Geneva Avenue corridor. Initially, the service will be bus service feeding the Third Street line. In the future, a light rail line could be built along Geneva Avenue connecting into existing systems on the western and eastern ends.

The Southern Terminal bus and LRT service with the adjacent commuter rail service at the Bayshore Caltrain station could provide service by three transportation agencies: Muni, San Mateo County Transportation Agency (SamTrans), and Caltrain. Muni will operate light rail service on the Third Street LRT and bus service to the north and west into San Francisco. SamTrans will operate bus service to the south into San Mateo County. Caltrain will operate commuter rail service to the peninsula down to San Jose and Gilroy.

INTERMODAL POTENTIAL

The terminal would be a major sub-regional transfer point for bus service. Three types of bus service could be provided. The primary service would be Muni and SamTrans scheduled bus service using the terminal as a layover and passenger transfer point for inter-county service. The second type of bus service would be Caltrain and BART shuttles operating between Bayshore and Balboa Park stations via San Mateo and San Francisco neighborhood collector routes. The third type of bus service would be dedicated shuttles sponsored by organizations such as UPC and the San Francisco 49ers Football Club operating between the Southern Terminal and nearby developments.

Caltrain and the Bay Area Air Quality Management District sponsor dedicated shuttles with participating employers. Caltrain also sponsors special service for events at Pacific Bell Park and Candlestick Park. An arrangement for dedicated shuttles with an organization like the 49ers is an example of the potential for expanding this type of service at Bayshore Station. Special service for events at the nearby Candlestick Stadium where the 49ers play would provide

an attractive alternative to private passenger cars. It would help eliminate vehicle congestion leaving the parking areas.

Caltrain has embarked on the largest track improvement program in its history. This ambitious track program is building express tracks to reduce the current 1½-h trip time between San Francisco and San Jose through a Baby Bullet express trains. The program improvement from Bayshore to Brisbane will add two express tracks and rebuild the train control system. The improved track section at Bayshore Station has two express tracks in the center and two local tracks on the outside. Although Bayshore Station has local service only, passengers could board local commuter trains at Bayshore and transfer to express trains at a station further south. The reconstructed track section will have a new centralized traffic control system. Constructing the new tracks for express service involves realigning tracks, reconstructing the signal system, and the relocation of the existing Bayshore Station south. A new intermodal station with BART has been built at Millbrae, two stations south of Bayshore Station. The Southern Terminal would be the intermodal station with Muni.

ORGANIZATIONAL ISSUES

The connection between these services involves the developer and three public transportation agencies with the resulting organizational issues. Muni, Caltrain, and UPC have continued to negotiate for several years to reach agreement on access and facilities. An agreement is needed that will allocate responsibilities based on the resources of each party. In general, Caltrain would retain commuter rail capital improvements, constructing a new station with outside boarding platforms to the south of the current Bayshore station and constructing track improvements within its right of way. Muni would construct the bus and LRT turnaround and platforms and construct heavy rail track improvements outside the Caltrain right of way. UPC will provide land for Muni bus and LRT turnarounds to the terminal and platforms including public access and substation. The three organizations have been planning the intermodal terminal and working on developing a conceptual plan that is acceptable to all parties.

A fourth participant is the Union Pacific Railroad (UP) because of operating rights for freight trains on the Caltrain tracks. Caltrain has to maintain UP's customers sidings to accommodate the UP's continuing freight operations. This requirement is complicated by the centralized traffic control system in the segment, which adds to the cost of siding relocation.

Stakeholder interests limit the potential size and cost of the Southern Terminal site. Cost is important to all the major stakeholders, who have budget constraints for various reasons. Market forces and investment return criteria limit the possible developer investment. Muni and Caltrain must work with funding limits. Revenue for both agencies is down in the current economic slowdown.

THE SITE

The temporary southern terminus for the Third Street LRT System is in the center of Bayshore Boulevard just north of Sunnydale Avenue. It is a double crossover with tail tracks that allows trains to reverse direction and change tracks. The tail tracks provide for train storage between runs. A double crossover was also used at the existing terminus at Fourth and Townsend near

Pacific Bell Park. A double crossover is not the most efficient track layout at a terminus, because the operator is required to change from one end of the train to the other end. But a more efficient loop track layout requires land outside the street right of way. The ultimate Southern Terminal would have a loop track south of Sunnydale Avenue and east of the temporary terminus. The terminal site is located just south and across the tracks from the existing Caltrain Bayshore Station.

Access to the Southern Terminal site from Bayshore Boulevard and the interim terminus needs to be improved. Sunnydale Avenue east of Bayshore Boulevard is a very narrow little used street. The public right of way on Sunnydale is 66 ft from property line to property line. The minimal public access easement width requirement is 53.5 ft for combined LRT and street access for buses and emergency vehicles. If LRT tracks were placed along the south right of way limit for Sunnydale Avenue, it would provide a 30-ft roadway width. This location affects access to the property owners on the south side of Sunnydale Avenue, but it could be a short-term expediency until a larger right of way is developed.

The new Bayshore Station will have a pedestrian overpass for pedestrians to reach the outbound platform on the west side of the tracks from the inbound platform and parking on the east side of the tracks. The existing Bayshore Station is on the east side of the tracks and has limited parking, which will be retained. The overpass connection to the outbound platform could also provide pedestrian access to the Third Street LRT System and the San Francisco and San Mateo bus systems.

Caltrain must maintain existing UP freight service in their track section, which affects the design of the Southern Terminal tracks. A still active existing freight spur cuts through the redevelopment site on a long arc leaving odd shape parcels on either side. The existing turnout for the freight siding is part of the track relocation. Caltrain will construct a new relocated UP freight spur switch and stub out to its right of way just south of the Southern Terminal, put the new switch into service and take the old switch out of service. Muni will construct the spur track from the Caltrain right of way to the freight customer's sidings.

The relocation of the freight spur further south and out of the way will help the redevelopment planning. UPC is interested in developing large build able blocks on its site, and the freight spur cuts across a block of land on a diagonal. A new turnout and connecting spur are being built to the south using either a new track crossing of Bayshore Boulevard or the existing track crossing of Bayshore Boulevard. The existing crossing required a back in movement, which was acceptable to the UP. A new crossing requires California Public Utilities Commission (CPUC) approval, which is a time issue due to the schedule for Caltrain's express tracks. A new Bayshore crossing for the spur remains an issue.

TERMINAL REQUIREMENTS

Adequate dedicated public land is needed for the LRT turnaround, LRT platform, and bus platform and traction power substation. The bus platform and substation require street access. The site allocated to the Southern Terminal is compact, providing enough land for the turnaround and connections using minimum criteria. The terminal is planned within a constrained space.

As the Third Street Light Rail southern terminus, the Southern Terminal requires a loop track for southbound LRT trains returning north, queuing tracks for service requirements and storage tracks for breakdowns. It also requires tracks for access to the revenue tracks on

Bayshore Boulevard at Sunnydale Avenue. The most direct access is along Sunnydale Avenue. The turnaround will operate in counter clockwise direction to avoid the need for a track crossing. Trains will not wait at the boarding platform prior to a scheduled departure, since Muni has found that passengers expect a train to leave shortly after they board.

Trains in revenue service can operate in one-, two-, and three- or four-car consists, but the platforms along the Third Street operating segment are sized for two-car consists. Required terminal track speed is within the terminal is low, 5-mph with a maximum speed through the turnouts of 3 mph. Following Muni practice, station facilities for light rail vehicle (LRV) operations at the turnaround will be minimal. There will not be an operations office or waiting room for operators.

Parking will not be provided for LRT passengers at the intermodal terminal, since Muni does not build parking around their platforms, relying instead on passenger use of feeder bus services. Parking is usually provided for commuter rail stations, but limited parking is provided at the existing Bayshore Station. There is a possibility that commuter rail passengers will park in the redevelopment area and then use the pedestrian walkways and grade separations to reach the commuter rail platforms. Diverting commercial development parking spaces to transportation parking use could reduce spaces available to commercial tenants. The control of parking will be addressed as the Southern Terminal planning progress.

Efficient and safe passenger movement between the different modes is a key to the success of the terminal. Pedestrians will move between the three public transportation modes and potential car parking areas nearby. Passenger circulation between the different modes involves three different property owners with different requirements. Within the Southern Terminal site, pedestrians will use sidewalks, signals, and gates to move safely between private property and public transportation platforms.

COMPLETED PLANNING

Muni retained Korve Engineering, Inc. to help with conceptual track and bus design issues at the Southern Terminal. UP retained the services of Chi-Hsin Shao to develop transportation plans for development and to work with Muni on the Southern Terminal conceptual plan.

The LRT track layout for the conceptual design followed criteria established for the line segments of the Third Street Project, which is based on the basic physical and operating characteristics of the Breda Costruzioni Ferroviarie LRV-2 as the primary vehicle with provisions to accommodate Muni's President's Conference Committee (PCC) car and Historic Streetcar (HSC) fleets as the secondary vehicles. The Breda LRV-2 car is a double-ended, single-articulated car with six axles in three trucks. It is double-sided with four high/low-level doors per side. The Breda LRV-2 has a car length over couplers of 22.86 m (75 ft) and a minimum turning radius of 13.72 m (45 ft).

In California, CPUC General Orders determine track clearances for the LRT tracks. These are related to worker and pedestrian safety on and adjacent to the tracks. Relevant General orders include Nos. 95, 128, 143A, section 9.6 and 143B. On station platforms and other locations where passengers are permitted while trains are in motion, the minimum clearance is 30 in. At locations and in areas where passengers are normally prohibited while trains are in motion, the minimum clearance is 18 in. The minimum clearance can be less than 18 in. for fixed wayside structures less than 5 ft in length like catenary and signal pole.

The clearance envelope of the LRV-2 was set by combining the dynamic envelope, construction and maintenance tolerances plus mid-overhang, end-overhang, and super elevation adjustments. Construction and maintenance tolerances include track wear, wheel wear, track construction tolerances, and wayside structure construction tolerances. These clearances also accommodate the dynamic envelope of a number of historic PCC and the HSC street cars being used by Muni. The track alignment criteria are shown in Table 1.

RAIL PLATFORM HEIGHTS

A common platform and loading area for LRT and commuter rail passengers would improve efficiency of passenger movement between these systems, aid transfers and reduce loading times. Alternatives using a common platform between adjacent LRT and commuter rail tracks were studied, but use of different platform heights by the adjacent causes construction problems. The commuter rail platform height is at 8 in. (.192mm), while the LRT platform height is at 30 in. (813mm). To achieve a common track height, the LRT track would have to be lowered, since it would be costly to raise an active commuter rail track. There are technical problems with lowering the LRT tracks, involving drainage and grading within the plaza area, and unknown underground risks. It was determined that the preferred alternative is to keep the platforms at separate heights. Ramps approximately 34 ft in length and stairs have to be located at points along the platform to accommodate the height differences. The net affect on the terminal layout is a requirement for a greater site width for adjacent platforms.

BUS PLATFORMS

The Southern Terminal will provide bus platforms for Muni and SamTrans scheduled inter-county bus service, scheduled shuttles, and dedicated shuttles. This requires accommodating a range of different bus sizes. The platforms will accommodate buses that are loading and unloading passengers and holding on layover for later scheduled departures. The buses will have a turnaround off Sunnydale Avenue to enter, turnaround, and exit in the opposite direction similar to the LRT operation.

The bus platform layout is based on the basic physical and operating characteristics of the combination of articulated bus types as the primary buses with single unit bus types as the

TABLE 1 LRT Track Geometry and Clearance Requirements

Preferred minimum curve radius	22.9 m (75 ft)
Absolute minimum curve radius	19.8 m (65 ft)
Preferred minimum length of tangent between curves	7.62 m (25 ft)
Minimum length of tangent preceding a point of switch	3.05 m (10 ft)
Preferred curve length (one car length)	22.9m (75 ft)
Minimum track spacing for tracks without OCS poles between tracks	4.3 m (14 ft)
Minimum clearance from LRT track center to platform edge	1.5 m (5.2 ft)
Minimum clearance from LRT track center to fence line	6.1 m (20 ft)
Minimum clearance from freight track center to fence line	4.6 m (15 ft)
Minimum platform length (2 car train)	43.1 m. (150 ft.)

secondary bus type. The articulated bus is 60 ft long, and single-sided with three low-level doors. The standard single unit bus is 35 ft long, and single sided with two low-level doors. The articulated and standard buses would board at a low saw tooth platform with six articulated positions and four standard single unit positions. A single unit bus could also use an articulated position.

PEDESTRIAN SAFETY

Passenger movement across LRT tracks will be controlled by signals similar to the rest of the Third Street system. Train speeds will be low coming into the terminal and LRT system operators are trained to move with pedestrians crossing or near the tracks. Pedestrian crossings are only permitted across commuter rail tracks with gates or grade separation for safety reasons because of the train speeds and tain stopping capabilities. The connection to Bayshore Station within Caltrain right of way will use a pedestrian overpass, and it is logical that the overpass would be continued for access to the LRT area.

CONCEPTUAL PLAN

The initial alternative track and bus platform layouts for the Southern Terminal were reduced to three alternatives that had the most potential. These were continued and developed further. At the completion of the initial conceptual work, one alternative was selected as a basis for an agreement and further development. Based on planned scheduled service and operating procedures, the turnaround has two loading positions on two sides at the platform that accommodate up to eight LRVs in two to four trains depending upon consist size. There is an additional five LRV queuing positions on the inbound side and return curve. On the inbound side there is one siding track for train breakdowns.

The developer has recommended shortening the 99.06- (325-ft) outbound platform to 74 m (242 ft), which reduced the platform length capacity from two two-car trains to one three-car train, and replacing the lost storage track length with a second storage track on the inbound platform side. This would shorten the track turnaround to match the shorter platform. Their second suggestion was to shorten the bus platform and to use a saw tooth edge layout, reducing the platform length capacity from eight buses to six buses, and shortening the bus turnaround to match the shorter platform.

There was concern about reducing the bus platform length at that time, since the extent of bus service anticipated was unknown and the requirement for the number and type of buses loading at the platform was still not determined. The types and levels of feeder service at the commuter rail Bayshore Station is being studied by the Caltrain and the bus service routes that would serve the Southern Terminal are being studied by Muni. As this work becomes available, the Southern Terminal layout can be refined to incorporate the recommendations.

The city of Brisbane has taken an interest in the project. Since the Southern Terminal is located within its boundary, it will be an active stakeholder for further development and will be providing its requirements and goals. The addition of another interested public entity at the site increases the number of issues, but it also increases the planning area and expands the joint development potential. The addition of a larger area should improve the joint development plan.

The growth of the Southern Terminal planning area means that the project is early in its development and could be revised substantially before it is built.

CONCEPTUAL PLAN REFINEMENT

One joint development goal is a terminal that is efficient and fits into new commercial and retail and even residential developments. The models would also work with other similar intermodal locations. The most efficient intermodal exchange between commuter trains, light rail, and buses is by a parallel arrangement of alignments. The most restrictive alignment is the commuter rail system, which is established in a straight alignment. The second most restrictive alignment is the light rail tracks, which typically have a minimum radius of approximately 75 ft. The Third most restrictive alignment is for buses, which typically have a minimum radius of 45 ft. Automobiles provide the fourth tier.

Conceptual alternatives have been developed based on a tight loop versus large loop track layout. Alternative 1 uses Sunnyvale Avenue as the entrance and exit corridor while Alternative 2 uses separate streets for an entrance and exit. Two options were developed for Alternative 1. The primary difference was the location of LRT and bus platforms in relation to the commuter rail platform. One option is to have separate debarking and boarding platforms and the second is to have one platform for both debarking and boarding.

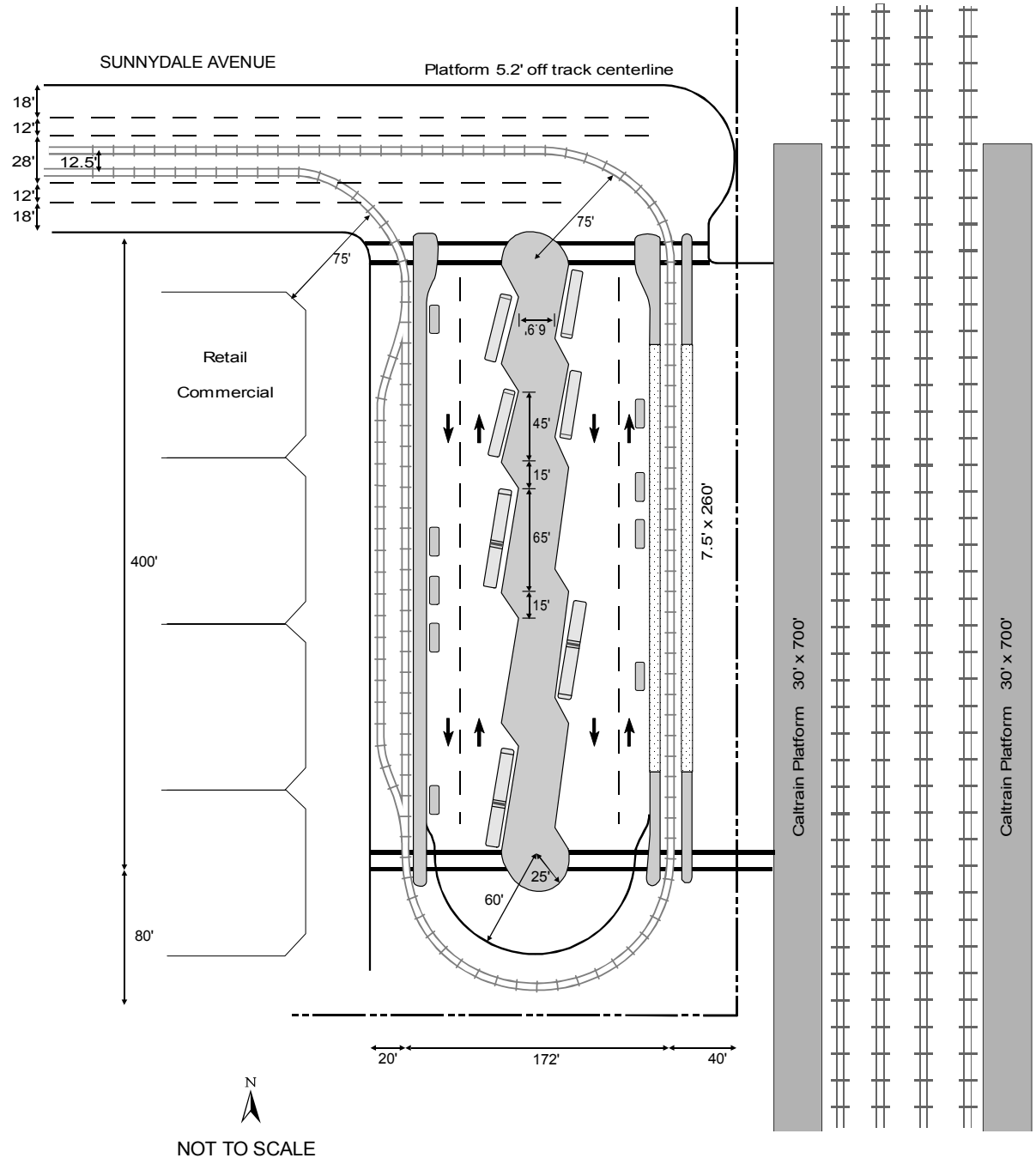
ALTERNATIVE 1A

LRT inbound platform for debarking is on west side of terminal (Figure 3). The outbound platform for boarding is adjacent to the commuter rail southbound platform. The commuter rail and LRT outbound platform could be merged and at the same height or at different heights. In the figure the commuter rail and LRT outbound platforms are at different levels. The platform could be placed either on the left or right of the outbound track or on both sides. The bus platform is in the center of the terminal close to the LRT platforms. Drop off parking is along curbs adjacent to the LRT platforms that could be used by small vans, cabs and passenger cars. Pedestrian access between passenger vehicles, buses, and LRT/commuter rail is at the north and south ends of the terminal platforms.

The Alternate 1A terminal site requires an area approximately 232 ft by 400 ft for the LRT turnaround and platforms, bus turnaround, and platform and drop-off curb. Retail, commercial and residential land uses that are compatible with a transportation center could be placed along the west side of the terminal opposite the commuter rail station.

ALTERNATIVE 1B

The combined LRT inbound platform for debarking and LRT outbound platform is adjacent to the commuter rail southbound platform separated by an outbound track (Figure 4). The commuter rail and LRT platforms are at different heights. The platform is a center platform between two outbound tracks. There is a siding on the west side of the terminal for one two-car train. The bus



SOUTHERN TERMINAL

ALTERNATIVE 1A

Figure 3

FIGURE 3 Alternative 1A.

platform is in the center of the terminal close to the LRT platform. One drop-off parking curb is adjacent to the LRT platform, and the second is along the siding on the west side of the terminal for small vans, cabs, and passenger cars. Pedestrian access between passenger vehicles, buses, and LRT/commuter rail is at the north and south ends of the terminal platforms.

The Alternate 1B terminal also requires an area approximately 232 ft by 400 ft for the LRT turnaround and platform, bus turnaround, and platform and drop off curb. Retail, commercial, and residential land uses that are compatible with a transportation center could be placed along the west side of the terminal opposite the commuter rail station.

ALTERNATIVE 2

Alternative 2 uses a large loop circling one block (Figure 5). The combined inbound/outbound platform for debarking and boarding is a center platform between two outbound tracks adjacent to the commuter rail southbound platform. One LRT track separates the platforms. The commuter rail and LRT platforms are at different heights. There are two approach tracks on the south side of the terminal. Each track for has space to hold one two-car train. The bus platform is in the center of the terminal close to the LRT platform. One drop-off parking curb is on the west side of the terminal for small vans, cabs, and passenger cars. Pedestrian access between passenger vehicles, buses, and LRT/commuter rail is at the north and south ends of the terminal platforms.

The Alternate 2 terminal site requires an area approximately 116 ft by 520 ft for the LRT turnaround and platform, bus turnaround, and platform and drop off curb. Retail, commercial, and residential land uses that are compatible with a transportation center could be placed along the west side of the terminal opposite the commuter rail station. Since this alternative requires less area, the additional space could be used for a plaza serving the passengers or as additional retail, commercial, and residential space.

Planning efforts are continuing. A conceptual layout and facility requirement analysis have defined land and access requirements for a successful operation. The next phase will depend upon the developer and city of Brisbane. The developers will establish their requirements at the terminal site based on market conditions and costs. The city of Brisbane, who is the public entity, will confirm the plan. Input from local residents, officials from the cities involved, Caltrain, and landowners will address land use in the Southern Terminal vicinity and station access for pedestrians and vehicles.

CONCLUSION

Redevelopment of the Third Street corridor is an important part of the general plan for San Francisco. The area is one of the few available for development. The Third Street corridor provides sites for large urban centers at either end and the center. Redevelopment of these sites will anchor infill development generated between the centers. The resulting developed corridor should provide a balanced mix of residential, commercial, and industrial land uses with a mix of buildings reflecting different periods. It will also provide public transportation access.

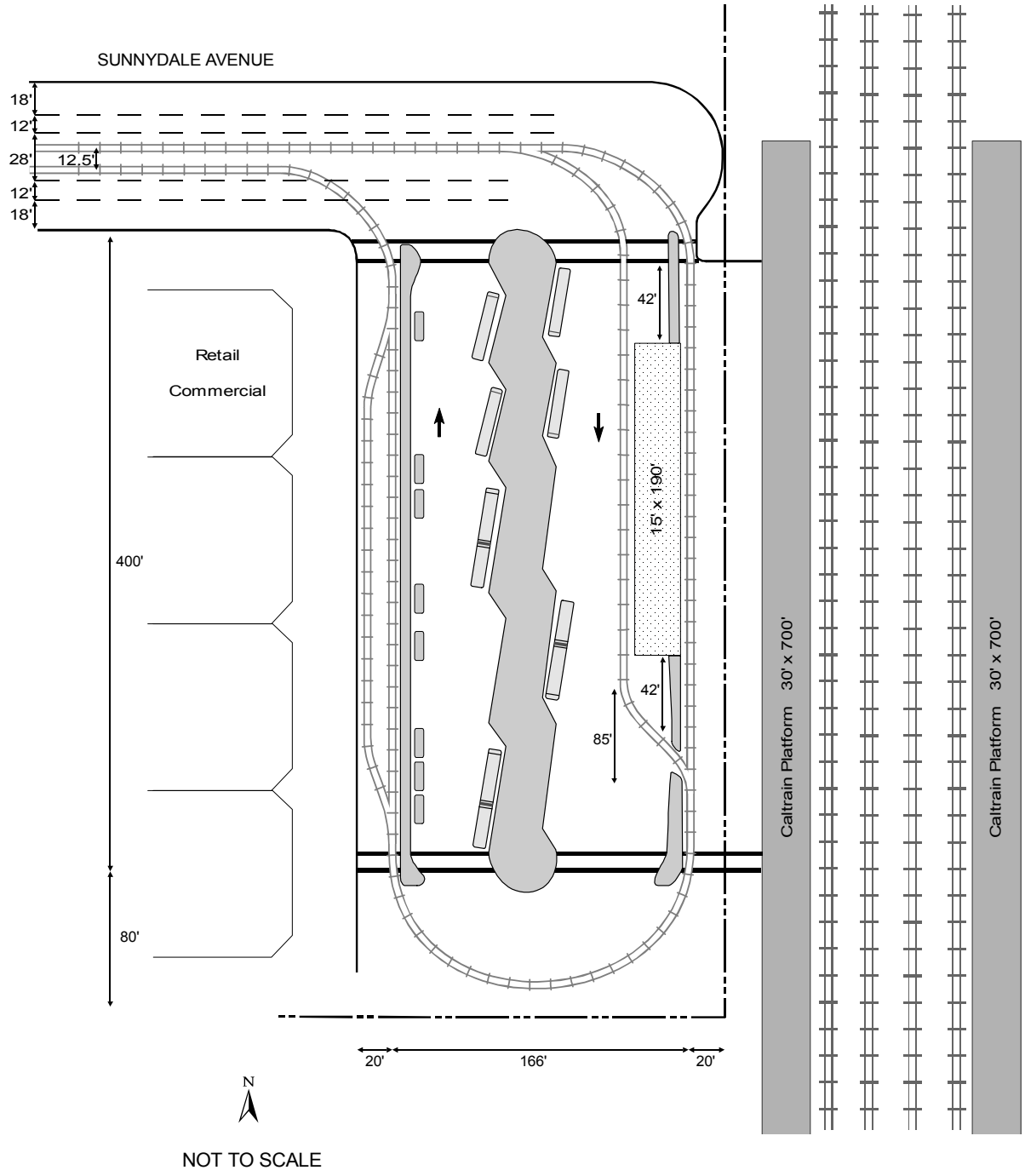
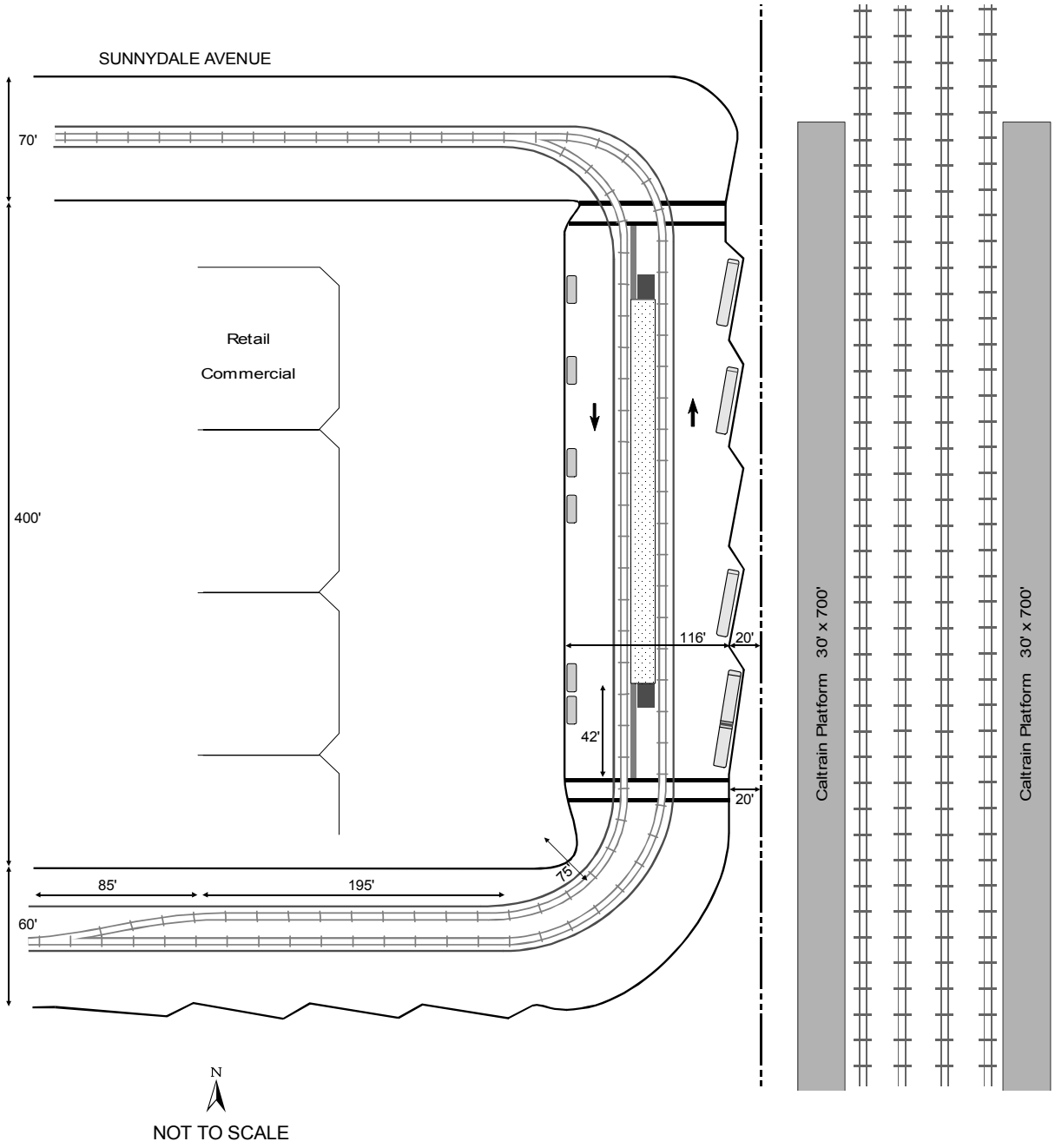


FIGURE 4 Alternative B.



SOUTHERN TERMINAL
ALTERNATIVE 2
Figure 5

FIGURE 5 Alternative 2.

The Southern Terminal is a key element of that plan. It provides a public transit center for the southern end. It works well with the Transit Village concept favored by San Francisco for development in its limits. It is important to the commercial development planned for the city of Brisbane in its limits. Building a major intermodal station at the southern terminus for the Third Street LRT will generate benefits to the stakeholders in the redevelopment, which include the owner/developer and the cities of San Francisco and Brisbane. It could become a major public transportation interchange. The Southern Terminal will provide residents and workers with a selection of public transportation services.

The Southern Terminal, as a joint development, could become a center and focus for the redevelopment based on good public transportation. The city and county of San Francisco could achieve a transit village that provides needed housing served by public transportation. The city of Brisbane could achieve a commercial center served by three different public transportation systems. It has potential to become an asset for the owner/developer, the transportation agencies and the cities, but it requires a collaborative effort between these parties to address and resolve the major issues early with their goal of a major intermodal public transportation facility that enhances the adjacent community.

Delineating an Integrated, Multifaceted Light Rail Corridor for Northeast Baltimore City

HAZEL RUTH EDWARDS
CLAUDIA GOETZ PHILLIPS
Morgan State University

Limited transit options not only impact individual residents but also relate to the economic development opportunities of a community. Growth patterns have separated people from the goods and services they require. During the past two decades, numerous metropolitan areas in the United States have embraced the concept of transit-oriented development (TOD) as a means to control and manage the negative environmental and social impacts of dispersed growth. TOD supports the creation of more concentrated mixed-use activity nodes connected by high-quality public transportation. The city of Baltimore, Maryland, is currently served by one heavy rail line (the Metro) and one light rail line (Central Light Rail Line), in addition to commuter rail service (MARC train) connecting to Washington, D.C. The combined Baltimore transit system now provides limited service to city residents; however, many socioeconomic groups are ill-served due to inadequate or nonexistent linkages to their neighborhoods. As Baltimore begins to expand its transit network, TOD principles are being explored as potential catalysts for neighborhood economic growth. This paper will present the findings of a 2-year research project that defined community-based criteria for decision-making for the provision of light rail into underserved areas of Baltimore, Maryland, and delineated key areas along the light rail corridor to promote economic development opportunities, increase visual character, and strengthen community linkages. The research defined the guiding principles and strategies, hence, the framework in which a light rail line that is a clean, quiet, fast, and efficient mode of urban transportation, and that is likely to attract a diverse ridership, can be developed in Baltimore.

INTRODUCTION

Baltimore, like many cities across the United States, is comprised of numerous neighborhoods, many of which are now aging and in transition. Some of these areas have aged gracefully and offer magnificent houses on streets lined with mature trees. Property values are high and this is reflected in the services that are provided to the residents. Little evidence of neglect is apparent. Contrasted to these areas are those once vibrant neighborhoods that are now experiencing a growing number of social, physical, and economic challenges. Housing vacancy rates are high and homeownership rates are declining. The condition of the effected housing stock is marginal. Limited open space and poor landscaping give the appearance of an overdeveloped, densely populated area. Scattered commercial development does little to stimulate economic growth. Services are scarce and resources are limited. Drug and gang activities are pervasive. In short, the quality of life for individuals and families is decreasing. Some areas within the northeast quadrant of Baltimore, Maryland, face such challenges as these. The question arises as to the best

means for balancing these dynamics and for stimulating economic development and overall community revitalization.

Compounding these issues are the impacts of transportation networks that have favored automobile travel and separated residential areas from commercial and employment centers. In many instances, transportation decisions have fragmented neighborhoods leading to decay of the housing stock and overall residential environment. While transportation strategies are often seen as a way to alleviate broader social issues such as employment, housing, and social services, such planning processes have failed to create more livable and sustainable environments. Access is a key component in these strategies—people must be able to reach better paying jobs, higher quality and more affordable housing, and quality social services. Consideration is being given to expanding Baltimore City's transit network to provide service to the northeast section of the city. It will be important to determine the manner in which access can be enhanced or improved to positively impact the personal mobility of a wider range of citizens so that their choices are not limited by an underdeveloped transit system.

Limited transit options not only impact individual residents but also relate to the economic development opportunities of a community. Growth patterns have separated people from the goods and services they require. During the past two decades, transit-oriented development (TOD) concepts have been embraced as means to address the negative and often detrimental social and environmental externalities of dispersed growth, also known as "sprawl." TOD supports the creation of more concentrated mixed-use activity nodes connected by high-quality public transportation. While many jurisdictions have been receptive to TOD, others have not created the policy or regulatory framework to support it which have been shown to stimulate economic development and growth while reducing the negative environmental impacts of transportation and lower density development. As Baltimore begins to expand its transit network, TOD principles are being explored as potential catalysts for neighborhood economic growth.

This project was timely. Until 2001, the interest had been largely driven by business and citizen groups, the media, and universities (e.g., Citizen's Planning and Housing Association, Baltimore Metropolitan Council, and Morgan State University's National Transportation Center). Only recently has the Maryland Mass Transit Administration (2002) begun planning and holding public forums to promote a new regional mass transit system for the Baltimore metropolitan area. Federal initiatives have brought considerable attention to the need for systems that are more responsive to disadvantaged populations and that focus on improving the connection of such communities to local transit systems. The combined Baltimore transit system now provides limited service to city residents; however, many socioeconomic groups are ill-served due to inadequate or nonexistent linkages to their neighborhoods. The city of Baltimore is currently served by one heavy rail line (the Metro) and one light rail line (Central Light Rail line), in addition to a commuter rail service (MARC train) connecting to Washington, D.C. Compared with cities such as Boston and Washington, D.C., Baltimore's rail transit is underdeveloped.

This project continued the 2000-2001 research funded by the National Transportation Center (NTC) that addressed the possibility of expanding Baltimore's light rail network and improving its integration with the Metro line and bus system. Building upon the findings from the prior research, this project created tangible strategies for developing the northeast corridor in Baltimore City as a viable alternative for not only connecting residents and potential users with employment opportunities within the city, but also for creating employment and commercial centers within neighborhoods and communities along the transit line.

The northeast corridor of Baltimore City was identified in the 2000-2001 NTC research as the area that needed better public transportation options. After analyses of numerous corridor options a single corridor—the Harford Road Corridor—was selected for further investigation. The research applied the experience of other North American cities that have implemented (or are in the process of constructing) light rail systems (as studied in 2000-2001 NTC research). It also investigated the opportunities and constraints to TOD by looking at the existing zoning regulations and ordinances in Baltimore City as well as those of other cities with light rail systems. The focus of this research was to define the guiding principles and strategies, hence, the framework in which a light rail line that is a clean, quiet, fast, and efficient mode of urban transportation that is likely to attract a diverse ridership can be developed in Baltimore.

The study addressed the importance of corridor and station design as essential elements of "placemaking" that could help to promote transit-centered community development such as that proposed by Calthorpe (1993). Urban design guidelines and landscape and land use strategies were created to promote a well-designed system. An underlying outcome of this research was to enhance the personal mobility of a wider range of citizens in Baltimore City so that their employment choices are not limited by an underdeveloped transit system.

METHODOLOGY

This research included several types of data collection and manipulation. It relied most heavily on methodology that is accepted practice in the disciplines of urban planning and landscape architecture. Field surveys and site analyses were the primary method used for collecting data. These data were used to: (1) develop urban design principles for TOD based on a review of the literature; (2) develop appropriate landscape/land use strategies; and (3) design TODs or transportation hubs along the selected northeast corridor. Specific tasks include:

- Zoning ordinances and regulations of Baltimore City were evaluated for opportunities and barriers to TOD. As a point of reference, the zoning ordinances and regulations of cities (i.e., Portland, Oregon; Atlanta, Georgia; Denver, Colorado; and Toronto, Canada) studied in 2000-2001 NTC research were reviewed to determine the language that supports such development.
- Conventional or accepted principles of TOD (such as those defining or impacting density, location, and quality of growth) were also evaluated for their usefulness within the Harford Road corridor and for their consistency with Maryland's Smart Growth legislation. These principles were analyzed within a framework that includes elements of the Department of Transportation's strategic plan and within the confines of zoning regulations. A set of criteria and guiding principles were developed that can be used to evaluate alternatives, examine tradeoffs, and define priorities for line and hub locations.

Potential locations for TOD within the Harford Road light rail corridor were determined based on these guiding principles. Goals of the TOD selection process are to maximize opportunities for community-based economic development, improve the overall quality of life of the residents, enhance or improve the personal mobility of a wider range of citizens, and reduce sprawl.

During fall 2001, graduate landscape architecture students developed a Greenway Master Plan and site designs within the Herring Run watershed—which is the watershed for the Harford

Road corridor. As part of the project, the students designed "green" pedestrian and bicycle connections to the adjacent communities and the proposed Harford Road light rail system.

Comprehensive landscape and land use strategies based on TOD principles were developed for the Harford Road corridor. These strategies were based on the outcomes of the 2000-2001 NTC research, site assessments, and other factors. Schematic diagrams of alternative landscape and land use concepts were prepared. The concepts were incorporated into the TOD-based guiding principles. An appropriate strategy is suggested that should maximize development potential while serving a wide range of community members. The strategy also seeks to improve the overall quality of life of the residents in the northeast corridor. Hub design goals included promoting a greater sense of community in neighborhoods and commercial centers, creating multimodal transportation hubs that service the local communities, facilitating opportunities for economic prosperity for the surrounding communities, and providing greater transportation options. Additionally, areas needing streetscape improvements, enhancement projects, and stronger linkages to existing neighborhood assets were identified.

RESULTS

During the first year of this research effort, the project team explored the potential of the northeast quadrant for expansion of Baltimore's transit system. Six alternative routes were examined for the development potential as a more community-based addition to the existing system. Of these alternative routes, four were determined to fit the criteria that had been developed for analysis. Several factors were used to evaluate the segments of the alternative routes against the criteria for existing conditions and feasibility/impact. Specific factors addressed community profile, commercial/business districts, and transportation issues. One route was determined to score the highest in the evaluation. It is this route, the one that connects to the existing Metro station near the Johns Hopkins University Medical Center and continues to Baltimore County via Harford Road, which has been used for the design exercises in the second year research project. The selection of this alternative route coincides with the rail line corridor proposed by the Maryland Transit Administration (MTA). The proposed Green Line will nearly follow the corridor that was selected by this project team. The difference in the two corridors is that our route turns east to Harford Road (considered to be more community oriented) unlike the MTA route that travels the entire length of Hillen/Perring Parkway. The demographic characteristics of the project corridor were a significant factor in the selection of this route. The selected corridor was deemed to serve a broader range of residents in the northeast corridor.

Promoting Healthier Communities Through Transit-Oriented Development

The dilemma of how to handle the growing problems associated with automobile traffic is being experienced across the country, especially in the Baltimore–Washington metropolitan area, and leaving officials searching for alternatives. A primary focus of this activity is the best manner in which communities can become healthy and more livable without the dependency on car travel. The movement towards creating healthier, more livable communities has been spearheaded by a number of federal agencies. The FTA has been at the forefront of these efforts. With the release of their document entitled, "Building Livable Communities through Transit," FTA presented strategies for improving personal mobility and hence the quality of life in communities, among

other issues. Overall, through its initiatives, FTA is demonstrating "ways to improve the link between transit and communities." The goal is to encourage and promote communities that are less auto-dependent. TOD is a focal point of these initiatives.

The national attention that TOD has received has come from transportation planners and others who are concerned with the negative environmental and social impacts of dispersed growth and subsequent automobile usage and dependency. In fact, during the past two decades, numerous metropolitan areas in the United States have embraced the concept of TOD in an attempt to control and manage the negative environmental and social impacts of dispersed growth patterns (Porter, 1997). It is suggested that TOD will increase pedestrian and transit trip taking while also reducing the number and length of automobile trips. It will contribute to the livability that some feel is lacking in modern suburban development (Calthorpe, 1993).

Phillips and Edwards (2001) reported that TOD calls for the creation of denser, mixed-use activity nodes connected by high-quality public transportation. Proponents believe that a combination of design features will encourage travel mode shifts that result in reduced area-wide traffic congestion and improved air quality. These features include improved street connectivity, public amenities, and a concentration of residences and jobs in proximity to transit stations and commercial businesses. As an additional benefit, the enhanced pedestrian environment will increase casual encounters among neighbors that can contribute to a sense of community. These efforts typically begin with the implementation of major new mass transit investments—often light rail systems that are designed to link central city cores, suburban downtown, and other major activity centers. TOD is possible without new transit, but most metropolitan areas choose to make the transit investment. Bernick and Cervero (1996) suggest that for TOD to succeed a "transit metropolis" must exist, meaning, a sufficient number of TODs having balanced or special uses that are connected and allow for efficient rail travel with bidirectional travel flows.

TOD is derived from the basic concepts of new urbanism: These concepts encourage the usage of several design elements including defined edges; circulation systems functional for pedestrians; public space on prime ground—an important early consideration rather than afterthought made up of leftovers; hierarchy of land uses (cultural centers, commercial, business, residential); mixed land use for working, shopping, learning, worshipping, and playing; and a priority to public space and appropriate building location and a balance between affordable housing and jobs (Farnsworth, 1998). While most proponents of TOD have focused on undeveloped suburban areas for testing and implementing TOD principles, the implications for built-up urban areas are almost untapped.

Applying TOD in Inner-City Neighborhoods

Howland and Dunphy (1996) looked at ways in which TOD can be implemented in inner city neighborhoods. Their study found that TOD principles can be utilized when they play on the strengths of individual communities. This can be achieved by translating TOD principles into the design of transit stations as focal points of their communities, integrating them into community fabric, paying careful attention to pedestrian links, and emphasizing safety. They indicated that, subsequently, transit stations can make a neighborhood look better, enhance the labor force advantages of the area, and support the variety and density of community activities by providing a focal point and broadening the local market area. Howland and Dunphy (1996) state that many TOD principles are consistent with inner-city goals for sustainability. These include encouraging

viable neighborhoods, diversity of land uses, mixed-use development, jobs/housing balance, around-the-clock activities for families and youth, and pedestrian-friendly design.

TOD Success

Successful residential projects that use TOD principles are heavily influenced by pre-existing land uses, the alignment of a rail line, and the placement of stations. If local conditions and goals—strong market demand, low-cost available land at attractive sites, and supportive land use policies—are consistent with TOD then rapid development can occur. Thus, TOD is successful when it is achieved with other local development goals. Challenges, however, exist for integrating TOD into existing areas. Existing land use patterns near rail stations can cause limitations leading most importantly to difficulties in assembling large parcels of land pose other obstacles. Municipalities need to have the tools for land assembly through redevelopment zones. Also, available undeveloped land is necessary for TOD.

Although many communities support the principles of TOD, many others fight higher-density housing, especially multifamily dwellings. Surveys show that 95% of Americans prefer single-family homes to multifamily dwellings (Cervero and Bosselmann, 1998). Many people associate noise, overcrowding, urban blight, and stress with high-density areas. This also suggests that negative perceptions of residents of multifamily housing still persist in the United States. It is not clear whether greater value is placed on homeownership and privacy gained through single-family housing that is typical in the United States.

Zoning for TOD

Achieving variety and balance of uses within the TOD is important. The zoning ordinance is the best vehicle to promote diversity of uses and activities as well as design character. Jeer (1994) found that allowable uses and density are necessary to support TOD. TOD areas outside the central business district (CBD) need zoning ordinances that allow for an "urban oasis" around the transit station. Such ordinances must do the following:

- Include a substantial residential component in densities far higher than the average in the community;
- Relax setback and parking requirements;
- Provide density bonuses for public and private amenities; and
- Adopt a site plan and development standards than are more typical for urban center.

Jeer (1994) also suggested that alternative zoning techniques are necessary to achieve TOD. Jeer indicated that an ad hoc approach works better in situations where the TOD plan is parcel-specific in its recommendations by making almost all development proposals within the TOD area adhere to an overlay district (as in Portland) or go through a special exception process specified in the overlay district (as in Fairfax County, Virginia). Additionally, the development of a more generic set of standards and special zoning designations that can be applied through the rezoning process of all nonresidential and mixed-use proposals in the TOD area is important.

Some municipalities have adopted what amounts to multiple codes, with specific provisions for traditional neighborhood development, TODs, and planned unit developments that differ from the general codes (Farnsworth, 1998). It is evident that because many zoning

ordinances are based on early 20th century legislation that encouraged the separation of uses, municipalities must embark upon an evaluation of not only the land use regulations but also the development and design review process to reveal the opportunities and barriers for TOD. In many areas current zoning ordinances do not support the pedestrian focused principles necessary for such development.

Baltimore City's Current Zoning Ordinance

Baltimore City is not unlike many municipalities that have antiquated zoning regulations. It's zoning ordinance was created in 1971 after a comprehensive plan was approved. The ordinance has been amended several times since then but requires a major overhaul to support new theories in community development as well as market demand for neighborhood uses.

A review of the zoning ordinances for other cities indicated that TOD is best accommodated when zoning ordinances permit flexibility in uses. TOD proponents suggest that, in order to be successful, TOD must offer a mix of residential and commercial uses. Lessons learned from places like Atlanta, which created districts that promote a mixture of residential and commercial uses, are very important. Atlanta's new Mixed Residential Commercial district is intended to protect and rebuild the commercial districts by "establishing appropriately designed and scaled commercial uses mixed with significant residential uses in a pedestrian-friendly manner."

Review of zoning ordinances and comprehensive plans of other cities that are targeting more pedestrian-friendly development over automobile reliant places shows that a linkage between these two documents is very important. The comprehensive plan provides a vision for future growth of an area while the zoning ordinance indicates how that growth is to be developed through specific bulk regulations.

While these issues are important it must be noted that a combination of factors, inclusion of language in the zoning ordinance to support TOD and public incentives and subsidies to encourage such development, are necessary to create pedestrian-friendly, automobile-reduced environments. Baltimore City is beginning the necessary next step of evaluating and revising its zoning regulations with the expected outcome of promoting such environments.

Potential of TOD Development Along the Proposed Corridor (Analysis of Inventory)

Analysis of the potential of TOD within the study corridor was important for this research effort. Two segments were considered:

- Terminal Hub (Harford at Joppa) Going South to the Hub of Harford at Moravia/Cold Spring From the terminal hub (Harford at Joppa) going south to the hub of Harford at Moravia/Cold Spring, most of the principles of TOD can be implemented. Creating high-density residential development cannot be a short-term goal in this area of stable homeownership. However, the segment of the hub has existing businesses. Hence, the foundation of commercial development within walking distance of the hub is already present. The businesses that currently thrive along Harford from Joppa to Moravia/Cold Spring meet the needs of local residents. Thus, it is presumed that simply changing the streetscape and facades would attract more consumers living outside the local neighborhood who use the light rail to travel to work and urban

recreation. TOD is more attainable along this segment because there would be less community opposition since high-density residential development would not be a major goal.

- The Corridor South of Morgan State University The area south of Morgan State University presents opportunities to implement TOD principles at an urban scale. Most of the route is residential with some commercial and community links." This area is generally plagued by poor conditions of the housing stock and high vacancy rates (40%). Despite these indicators of decline, a community organization is involved in revitalization efforts. Therefore, there is a potential market and possible champion for TOD in this area. The current revitalization goals as well as the need for employment opportunities increase the chances of TOD implementation. There are defined edges through neighborhood boundaries recognized by the local government. Many of these boundaries have only a five-block radius; they are not as extensive as the neighborhood boundaries in Northeast Baltimore.

Public Policies to Support TOD

Smart Growth laws in Maryland pursue two principal goals: channeling growth into already developed areas and preserving rural land. The first goal addresses currently developed areas through the following initiatives:

- Smart Growth Areas Act, which creates "priority funding areas," i.e., zones in which development may qualify for state funds.
- The state's cities and towns are automatic priority funding areas.
- Every county government has designated additional areas that meet specific requirements for use, water and sewer service, and residential density.
- Maryland Building Rehabilitation Code.
- The legislature also passed a bill requiring the Department of Planning to draft optional "smart codes" for infill and mixed-use developments.
- Additional new layers in the smart growth legislation include revisions in the brownfields redevelopment program.

In terms of preserving rural land, to date the Rural Legacy program has designated 47,000 acres in 20 of Maryland's 23 counties for protection. The governor's Special Assistant for Smart Growth John Frece (personal communication, February 12, 2002) states that the state's 15-year goal is to preserve 250,000 acres. The Community Legacy program is an urban alternative to this rural focused initiative.

In addition to its historic town centers, Maryland has viable models for smart growth in the several new urbanist projects that predate the smart growth legislation. The greenfield projects, Kentlands, Lakelands, and King Farm, have shown compact neighborhoods to be both aesthetically and financially successful. Hope VI developments such as Pleasant View Gardens and The Terraces in Baltimore set new standards for infill and mixed-income housing. Of the new generation of smart growth projects, the largest and most prominent is the new mixed-use center for Downtown Silver Spring just north of the Washington, D.C., city limits. In its latest report on sprawl, the Sierra Club featured this project as the state's foremost model for combining new employment facilities and residential housing with rehabilitation of historic structures and links to transit. Great hopes are also pinned on Owings Mills Town Center, a

transit-oriented, main street development that would replace 46 acres of parking lot adjacent to a Metro line stop in Baltimore County.

TOD Design Guidelines

Calthorpe (1993) recommends that TODs devote at least 20% of the land area to housing. That criterion is also specified in the city of San Diego's (1992) transit-oriented guidelines. According to Calthorpe average residential densities within TODs should be at least 10 dwelling units per acre for neighborhood TODs and at least 15 dwelling units per acre for more centrally located, or urban, TODs. Calthorpe also suggests minimum floor area ratios (FARs) of 0.3 for retail with surface parking and 0.35 for offices without structured parking, but he encourages higher FARs for both types of development. Ways of making higher density projects acceptable include:

- Extensive landscaping;
- Adding parks, civic spaces, and small consumer services in neighborhoods;
- Varying building heights to break the monotony of structures;
- Detailing roof lines and varying building materials;
- Design mid-rise buildings on podiums with tuck-under;
- Below-grade parking; and
- Replacing row apartments connected by exterior breezeways with eight-plex buildings (two-story stacked flats with four ground-level patios and second-level decks).

Neighborhoods oriented toward transit should at a minimum have a mixture of land uses, a commercial center near the train station, prominent public spaces, and a pleasant walking environment (Calthorpe, 1993; Katz, 1993; Audirac and Shermyen, 1994). Cervero (1998) recommends one off-street parking space per unit at transit-base complexes instead of the two normally enforced in the suburbs. Crane contends that the grid pattern—proposed by neotraditional planners and transit-oriented developers—does not necessarily promote pedestrian travel over auto travel. Other community layouts need to be examined.

Herring Run Greenway Master Plan

During fall 2001, graduate Landscape Architecture students developed a Greenway Master Plan for the Herring Run Watershed, which is the watershed for the Harford Road Corridor. Students then designed individual sites within the greenway. As part of their individual site designs, students were to develop "green" pedestrian and bicycle connections to adjacent communities, schools and the proposed Harford Road light rail system.

The light rail station will include a major hub location at Argonne and Hillen Drive where the future Morgan State Hospitality and Hotel Management Complex will be located. To become linked with the greenway, Argonne Drive is landscaped with native species. Paving along this stretch of sidewalk is different from the standard sidewalk to indicate that you are transitioning to a special place—the Herring Run Greenway. Also informational and directional signage is included in this design.

Elsewhere on the proposed line is a stop connection at Argonne and Harford Road to the Herring Run Greenway. Here, the greenway is immediately below the transit stop (under the

bridge). The site design includes Americans with Disabilities Act accessibility from street grade to the greenway. Again, native plantings, paving, and signage are proposed to make the connection between the transit stop and the greenway "readable."

Transportation Hub and Streetscape Designs

Four graduate Landscape Architecture students were hired as research and design assistants to work on this project. As part of the Year 1 research effort, the students completed the inventories and analyses of the designated routes within the northeast corridor. At the end of Year 1, a selection was made of the preferred route that was deemed the route that best promoted community well being, environmental quality, and economic prosperity for all socioeconomic and racial/cultural groups. The Harford Road route was determined to be the preferred alternative. It combines most of the community alternative segments, but is not quite as circuitous and does not adversely impact any suburban neighborhoods.

The great and distinct advantages for using the Harford Road route as a light rail corridor is the ability of this route to serve the numerous intact and thriving neighborhoods and businesses bordering Harford Road. The addition of an efficient transit system along this route provides residents with increased opportunities for employment, services and shopping, and greater access to churches, schools, and cultural centers. The light rail route also benefits those dependent upon mass transit—the elderly, young, and low- to moderate-income residents—by providing them with a cleaner, safer, and more efficient mode of transportation. The neighborhood hubs provide for these community advantages. Based on previous research and experience, the local economy should show a marked improvement with the addition of the new light rail system.

The proposed light rail corridor route has a total of eight station locations with four of these locations being major intermodal hubs. The route begins at the existing Johns Hopkins Metro Station and continues north to terminate temporarily with a loop at the intersection of Harford and Joppa Roads in Carney (the terminus of the earlier streetcar line). The four proposed major intermodal hubs located along this route are: the existing Metro connection at Johns Hopkins Hospital on Broadway; the intersection of Harford Road, North Avenue, and Broadway; the intersection of Hillen Road and Argonne Drive; and the terminus at Harford and Joppa roads in Carney. Four proposed smaller neighborhood hubs also occur along the route and are as follows: Broadway and Gay Street, Harford at Moravia/Cold Spring, Harford at Hamilton, and Harford at Taylor.

Description of Hub Locations

The origin of the new northeast light rail corridor connects with the Metro at the Metro station at Johns Hopkins Hospital. This is the last stop for the current Metro line that runs between Owings Mills and Johns Hopkins.

The next major hub stop is Courthouse Plaza at the intersection of Harford Road, Broadway, and North Avenue. This hub location is to serve as a major connector for the existing east–west MTA bus line. Light rail, buses, pedestrians, and automobiles come together here thus providing a multitude of transit options. There is an existing District Court at the location; the proposed design includes the District Court building as well as the addition of new retail, office space, park space, and parking garages. The third major hub location is at Morgan State

University located at the corner of Hillen Road and Argonne Drive. This hub is to serve the University and the surrounding Northwood community. The location of the hub is at the Northwood Shopping Center site that is slated for redevelopment as Morgan State University's Hospitality and Hotel Management School and University Conference Center. This location would become an activity zone for Morgan students and employees, neighborhood residents, and conference attendees.

The fourth major hub and temporary terminus stop is the Carney Hub located at the corner of Harford and Joppa roads at Carney Town Center. The transportation hub and shopping center support and economically strengthen each other. The Carney Hub at some future time is proposed to serve as a major hub in a larger regional transportation system. The light rail travels in a loop through the Carney Town Center. Buses enter from Joppa Road before taking the ramp underground into Carney Town Center. Automobiles may use the proposed parking garages for shopping or for commuting via light rail or bus to other locations.

The four proposed neighborhood hubs are to serve primarily the surrounding communities and local business and as local transit transfer points.

Hub Designs

Individual hub designs and streetscape improvements were documented in the final project report. When approaching the design of each chosen hub location, several opportunities or constraints arose. We researched, critiqued, and borrowed from transit hub designs from around the world in order to create a thriving design for each of the hub stops. The idea of using themes as an approach to the design process seemed like a logical choice. Many major cities use the idea of local or regional cultural and natural assets as generators of design ideas. For example, Portland, Oregon, highlights its local ecological systems by designing transit hubs that celebrate local wildlife. Portland has also successfully utilized several distinct themes for transit hub stops.

One stop uses punctuation marks as a design theme—the shape of a question mark is used for a bench design.

We decided that it was pertinent that each light rail station be uniquely designed in order to create connections between the surrounding neighborhoods and the new rail line. We chose two main design concepts—Games and Industry—and focused on creating transit hubs that relate to them. Games are a universal pastime, while the industrial theme pertains specifically to Baltimore's history as a city. These two themes were delineated and expanded upon in the detailed hub and streetscape designs.

Baltimore's Industrial History: Revealing the Makings of a City and a People Baltimore's industrial heritage includes such histories as the railroad industry, iron and steel works, brick manufacturing, metal working, and the ship building industry. Baltimore was and continues to be one of the most important ports in America. For over 150 years, Baltimore's industries have provided livelihoods for millions of people and have helped to shape the physical setting of Baltimore as well as the people who have built and inherited this great industrial city.

The design theme that focuses on Baltimore's industrial heritage is a powerful way to enable people to come in touch with the industrial past of their city. Baltimore has historically been a hard working blue collar city. The people and the products that made Baltimore what it is today are celebrated in the design of several light rail hub locations.

Additional local industrial histories are celebrated in the design of other light rail hubs. Baltimore's brick manufacturing industry is brought to light with the design of a light rail hub utilizing bricks manufactured here in Baltimore. The iron and steel work products that dominated Baltimore's industry are revealed by utilizing industrial architectural forms in the design of canopies and benching at a light rail hub.

Games Theme A games theme is one option as a design approach to hub locations along Harford Road. This design theme is centered around games and is intended to bring a fun and exciting atmosphere to each hub location. Sub-themes include: bowling, checkers, chess, soccer, baseball, football, and basketball. The design of the paving, lighting, and signage incorporates images of popular games and sports teams. This creates not only an exciting design element for each hub location, but also helps to give each hub an individual and identifiable character. Each light rail stop becomes distinctly memorable to each transit user and the surrounding community.

There are interactive games at each stop such as an oversized checkerboard to play on as you wait for the train to arrive. Here, paving patterns resemble the design of a checkerboard. At other hubs, the lighting design is in the shape of baseballs or basketballs. Sports figures and Baltimore teams are represented at specific hub locations. Statues and plaques of famous sports figures are displayed in order to learn more about their accomplishments. There is a Baltimore Raven's stop and a Baltimore Orioles stop. The colors of these hub locations reflect the sports teams' jersey colors and are incorporated into new building façade designs, paving pattern designs, and the design of benches and lighting. Even local little league baseball, football, soccer, and basketball teams are represented at specific hub locations giving the neighborhood children and parents in the local area something to identify with and become excited about.

A games theme brings a unique and memorable identity to the light rail hubs and transit stops and provides endless design possibilities along this new transit route. Because we were focusing on community-based design, it was important to choose a route that has existing neighborhoods working side by side with businesses. Providing for the community's needs as well as advantages for local business will be a direct outcome of the new Northeast Light Rail Corridor. Neighborhoods need not be underserved by transit needs as they currently are in the Baltimore region. The newly designed Northeast Light Rail Corridor will become a vibrant asset to the city of Baltimore.

CONCLUSIONS

The purpose of the research was to evaluate ways that the existing Baltimore City Metro/light rail system could be improved to be more integrated and to promote community well being, environmental quality, and economic prosperity for all socioeconomic and racial and cultural groups. The research was approached not from the perspective of the availability or feasibility of one location to another in terms of cost and efficiency. Rather, the selection of potential routes was based on the ability of the network to impact a greater number and more diverse socioeconomic groups. The research placed the needs of the community first in hopes of providing better access to jobs and economic opportunities. The objectives were to:

- Evaluate the feasibility of surface (light rail) routes in Baltimore City that would connect existing Metro and light rail lines;

- Analyze neighborhood characteristics (i.e., physical, social, economic) and factors that are associated with the location of the existing transit system; and
- Plan and design a proposed light rail line corridor as a community based model for developing future transit corridors within Baltimore City and elsewhere.

Early in the planning process, the northeast corridor of Baltimore City was selected for study in developing the community-based model for a proposed additional light rail line because such a line would (1) complement the existing northwest light rail line, (2) tie into the terminus of the existing Metro line in Southeast Baltimore, and (3) connect to the newly proposed downtown Baltimore inner loop light rail line that will connect with the existing light rail and Metro lines and the MARC train at Penn Station. If this community-based model were adopted by MTA, any future corridor selections would, by design, be considered components of an integrated, multimodal system for the city. Enhanced system connectivity is an integral component of our community-based approach.

Comparison of Two Planning Processes

Currently the MTA is looking at ways to expand the transit system. According to MTA, the Baltimore Region Rail System Plan Advisory Committee unanimously adopted their recommended rail system plan in March 2002. If completed over the next 20 to 40 years, the plan would add 63 mi of rail in the Baltimore metropolitan area. In recommending priority projects to the MTA, the committee chose an extension of the Green Line between Johns Hopkins Hospital and Morgan State University. A station is proposed at Northwood Shopping Center at Hillen Road and Argonne Drive, within the project area. The green line extension is proposed to be underground until at least North Avenue and then become an above ground line thereafter. MTA selected several priority projects on which to begin planning and environmental review in the Summer 2002. The site at the Northwood Shopping Center was chosen as one of the priority sites.

The following section compares the approach used by MTA to make these recommendations and the process used here for this research project.

MTA Plan

The MTA states that there is a need for a Baltimore Regional Rail System Plan that is a high-quality, high-capacity passenger rail services to multiple destinations throughout the region. The MTA recognizes the existing Metro and light rail lines do not directly connect to one another and they do not form a functional mass transit system. The framework of MTA's new plan will allow the region's residents and leaders to see a long-term vision of how rail lines can work together to serve all of life's activities. The major goals of the plan are to stimulate Smart Growth and economic development in targeted areas throughout the region (MTA, 2002).

The MTA (2002) lists the 10 guiding principles developed by the MTA advisory committee that they will consider when reviewing the draft plan. The Baltimore Region Rail System Plan should:

- Serve corridors with high concentrations of population;
- Serve major employment centers;

- Serve traffic-congested corridors;
- Serve major activity centers such as hospitals, universities, shopping centers, tourist attractions and entertainment centers;
- Support both existing land use and major targeted growth areas;
- Meet the needs of the transit dependent population, and provide benefits to low income and minority communities;
- Optimize the utilization of the existing transit system;
- Be seamless for the transit rider; and
- Provide a transit trip that is as competitive as possible with the automobile with regard to speed and reliability.

Beyond these principles, the MTA proposes to improve the quality of service and expand transit into new markets as part of the Maryland comprehensive transit plan.

Phillips-Edwards Plan

The MTA's list of 10 guiding principles agrees with elements in our planning process. However, our suggested guidelines go much further than MTA's. While we concur that a regional system is vital to the transit health of the Baltimore region, the neighborhood communities along any proposed route are more important, in our view, to the success of an integrated and fully functioning transit system. Our plan proposes that priority be given to serving these neighborhood communities versus regional destinations (i.e., White Marsh Shopping Center, Baltimore-Washington International Airport, Martin State Airport, Columbia Town Center, Arundel Mills Mall). We base this assessment on the fact that Baltimore City is the heart and soul of the metropolitan region and it needs such a community-based system to become once again a truly great neighborhood-based urban complex.

A metro/heavy rail system by its design constraints can only stop at very densely populated areas—whether they are residential, employment or activity-based. Frequent stops are the exception versus the rule with heavy rail. Typically, heavy rail runs underground for most of a route and consequently this does allow for visual and physical connections by riders to commercial districts, residential life, green spaces, etc., along the route. If the rail does surface, the traditional type of track system used often isolates or bisects the corridor and is thus viewed as a community divider.

The intent of proposing the Harford Road Alternative and then designing transit hubs along the line is because it is to serve as a model for selecting and designing potential light rail line corridors within a larger integrated, community-based system. In addition to the MTA principles, the Harford Road Alternative also offers these benefits:

- Enhance and create community character;
- Build upon the intact commercial districts along the route;
- Reach locally underserved low-to-moderate income populations;
- Serve large numbers of existing community-based social and cultural centers, churches, schools, and neighborhood level population centers;
- Promote pedestrian activities along the route, particularly at hub locations;
- Increase and augment commercial development along the route;
- Provide better access to jobs within the city; and

- Minimize physical environmental impacts.

It may be that the optimal solution is a combined regional transit heavy rail network and an interlinking light rail/trolley and bus system. However, the big question we asked ourselves during Year 1: if only a single approach is financially feasible, is it better to build a regional transit system or a local system that serves predominantly Baltimore City residents? We concluded that Baltimore City is where there is the most need—where most persons dependent upon transit reside, where most low-income persons reside, where long-standing institutional and cultural centers exist, where transit was an established way of life until the mid-1950s, where the supporting commercial centers are already in place, where populations of suitable density already reside, etc. Whereas, most people living beyond the beltway have purposefully selected the automobile as their transportation mode of choice. Even in the regional model, transit users would largely enter the rail system via a park-and-ride lot. Residential densities outside the city are not currently conducive to rail transit and walking distances are too great but for a very few potential riders.

The concept of TOD arose to respond to growth outside central city to make a transportation system a viable option. In the TOD model, development follows transit planning or optimally, simultaneously. In fact, outside the CBD, Baltimore City neighborhoods developed in this manner through the expansion of the streetcar system. For the city's current composition, the TOD process is reversed—Baltimore already has the developed infrastructure (its 66 distinct neighborhoods)—what is missing is an effective community-based transit system! And that is what we have proposed here.

RECOMMENDATIONS

This research developed an alternative transportation model that makes community sustainability the focus of the transportation planning process versus availability or feasibility of one location or another in terms of cost and engineering efficiency. Under this model, the overall goal of any transportation system should be to develop an integrated, multimodal transportation system that serves neighboring communities and thus more diverse socioeconomic groups and that is also efficient (level of service), safe, and affordable for all. To achieve this comprehensive goal, the following objectives must be addressed. Baltimore, and cities like it, should plan and design a transit system that:

- Enhances and creates community character.
- Builds upon existing commercial districts along routes.
- Serves first those dependent upon public transit.
- Extends transit to locally underserved low to moderate income populations.
- Provides linkages to existing community-based social and cultural centers, churches, schools, and neighborhood level population centers.
- Promotes pedestrian activities along routes, particularly at hub locations.
- Increases and augments commercial development along route segments.
- Creates for more green space along route segments.
- Provides better access to jobs within the City boundaries.
- Minimizes physical environmental impacts.

- Ensures safety and welfare of riders and non-riders.

While rapid transit or TOD alone is not necessarily the solution to recent challenges to urban life in Baltimore City, the implementation of these objectives may lead to promoting better quality of life for the citizens and visitors to the city.

REFERENCES

Atlanta Department of Planning. Mixed Residential Commercial (MRC) Ordinance Fact Sheet, 2002. www.ci.atlanta.ga.us/citydir/dpdnc/current.htm

Atlanta Department of Planning. Quality of Life Zoning Districts. 2002. www.ci.atlanta.ga.us/citydir/dpdnc/qolzoning.htm.

Baltimore City Department of Planning. "Baltimore City Zoning Code." 2002. www.ci.baltimore.md.us/government/legislative/zoning/index.html

Bernick, M., and R. Cervero. 1996. Transit Villages in the 21st Century. McGraw-Hill, New York.

Calthorpe, P. The Next American Metropolis: Ecology, Community, and the American Dream. New York: Princeton Architectural Press, 1993.

Cevero, R. Transit-Based Housing in California: Evidence on Ridership Impacts. *Transport Policy*, Vol. 3, 1994, pp. 174-183.

Cevero, R. Rail Transit and Joint Development–Land Market Impact in Washington, D.C., and Atlanta. Journal of the American Planning Association, Winter, 1994, pp.83-84.

Cervero, R., and P. Bosselmann. Transit Villages: Assessing the Market Potential Through Visual Simulation. *Journal of Architectural and Planning Research,* Vol. 9, 1998, pp. 181-96.

Dunphy, R. T. New Developments in Light Rail. *Urban Land*, July 1996, pp. 37-41, 87-88.

Farnsworth, C. Building Community. *Professional Builder*, Oct. 1998, pp. 58-68.

Building Livable Communities With Transit: Planning, Developing, and Implementing Community-Sensitive Transit. Federal Transit Administration, Washington, D.C., 1999.

Howland, L., and R. T. Dunphy. Transit Sparks Redevelopment In St. Louis and Chicago. *Urban Land*, July 1996, pp. 43-46, 88-89.

Jeer, S. Zoning for Transit: A New Orientation. *Zoning News*, Sept. 1994, pp. 1-4.

Markus, H. S. What's TOD Got To Do With It? Presented at the Ninth Annual Land Use Institute of the Rocky Mountain Land Uses Institute, Denver, Colorado, March 9-10, 2000. www.landuselaw.edu/TOD.html.

Maryland Mass Transportation Administration. Planning Baltimore's Regional Rail System, 2002. www.baltimorerailplan.com/pages/planprocess/intro.htm

Phillips, C. G., and H. R. Edwards. *A Socioeconomic, Community-Based Approach for Developing an Integrated Mass Transit System for Baltimore City*. Report Submitted to The National Transportation Center, 2001.

Porter, D. R. Transit-Focused Development: A Synthesis of Research and Experience. *Transit Cooperative Research Program Report 20*. Transportation Research Board, Washington, D.C., 1997.

National Household Travel Survey. Federal Highway Administration, U. S. Department of Transportation, 2001. http://www.fhwa.dot.gov///////ohim/nptspage.htm.

RESEARCH TEAM

Consultant: Yasmin Fozard, MLA, Graduate Program in Landscape Architecture. Graduate Student Research Assistants: Ginger Howell, Landscape Architecture; Kristen Humphrey, Landscape Architecture; Joe Lutz, Landscape Architecture; Liz Ohsiek, Landscape Architecture; Alanna Taylor, Architecture; and Sandra Tydd, Landscape Architecture.