APPENDIX A: BRT EXAMPLES

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
AC Transit—East Bay BRT	Berkeley, Oakland, and San Leandro, CA	Rapid bus moving to bus only lane on arterial with some mixed flow; Mixed traffic on 2x2 arterial	2012 (expected operation date)	$230 M	Route will run partly on SR 185. Various agreements are in place guiding cooperation between the State and Alameda County Congestion Management Agency. When complete, nearly 90% of the operation will use exclusive, dedicated median lanes. Final implementation of the BRT will use bus-only lanes on arterials, also with some mixed flow with special pavement delineation and mountable curbs.	Goals of the project include: improving access to major employment and educational centers and enhancing connections to other AC Transit services, BART, ferry services, and other transit providers; to improve transit service reliability; to provide frequent transit service; to ensure security, cleanliness, and comfort waiting and riding on transit; to increase the percentage of trips made by transit, and reduce the percentage by automobile; to identify a set of transit improvements that has a high probability of being funded; to improve the ease of entry and exit on vehicles for all transit riders, including persons with disabilities; and to provide an environmentally friendly transit service that contributes to air quality improvement. North to south, the route is planned to connect downtown Berkeley and the Berkeley BART Station with the south side of the UC-Berkeley campus, and then follow Telegraph Avenue to downtown Oakland. Planners are studying a new BRT corridor that would operate on both arterial streets and I 80 Bay Bridge in order to reduce congestion and make improvements in travel on the corridor.
Adelaide North East Busway (ANEB)	Sydney, Australia	Guided busway	1986	$100 M	Runs on a specially-built track, combining elements of both bus and rail systems. The track is 12 kilometers (7.5 mi) long and includes one station and two interchanges.	Frequency advantage of busway stations makes them very attractive. Conceived by Daimler-Benz to enable buses to avoid traffic congestion by sharing tram tunnels in the German city of Essen. The route was introduced in 1986 to service Adelaide's rapidly expanding northeastern suburbs, replacing an earlier plan for a tramway extension. A main consideration of the project was property value growth.

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
Auckland Northern Busway	Auckland, NZ	Unguided, mixed freeway shoulder, 2 way busway and single lane busway, ITS	2008	$266 M (NZ)	Incorporates a one-direction busway using tidal flow operations. This design is a compromise between constrained right-of-way width and other road demands. This plan also uses freeway shoulders as a right-of-way in outer suburban sections.	The completion of the busway has brought huge improvements to passenger transport connections to the Auckland Central Business District (CBD) and also meets the people-carrying demands necessary to sustain the existing Auckland Harbour Bridge. Dedicated for buses only, the busway makes travel to the CBD fast, frequent and reliable. The region's transport and road network requires a coordinated approach, and involves participation from a number of different agencies. The Northern Busway is part of a public transport network linking North Shore City and Hibiscus Coast with the CBD. Express services and local bus services link into the busway through five new stations.
B-Lines	Vancouver, Canada	Mixed traffic (street), dedicated lanes, running way ITS	1996 (#99 B-Line); 2001 (#98 B-Line); 2002 (#97 B-Line)	$52 M (#98 B-Line)	Busway: The two 3.5-meter busway lanes were created in the center of the street by eliminating of a two-way left turn lane and by narrowing general purpose lanes from 4 meters to 3.5 meters. Median busway lanes were chosen over curbside lanes since reliability and time savings would be compromised by conflicts with driveways and right turning traffic at intersections.	Vancouver's B-Line BRT was developed in the 1990s to meet need for transit services that bridge gap between local bus service and future development of full Intermediate Capacity Transit System (ICTS - defined as segregated busway, light rail transit or automated rapid transit services capable of carrying up to 10,000 passengers/hour/direction).

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
Bottineau Boulevard BRT	Minneapolis, MN	Designated lanes, mixed traffic (street)	2020	$130 M	4 miles of exclusive center bus lanes will be constructed between Bass Lake Road and 85th Avenue, initially, and potentially could be extended further north with future reconstruction of the roadway.	More recently, a Hennepin County updated traffic forecast has indicated that growth in traffic would completely fill area roadways in 10 to 15 years. This has generated questions about a median busway alignment and sparked further interest in rerouting the busway alongside the BNSF rail line. The plan is for buses to travel in both mixed traffic and on bus-only lanes.
Bravo! (Bristol/State College Boulevard)	Orange County, CA	Signal synchronization	2010		Will link the cities of Brea, Fullerton, Anaheim, Orange, Santa Ana, Costa Mesa, and Irvine. Five major transportation centers will be served via direct or transfer connections, including the Fullerton Transportation Center, the future Anaheim Regional Transportation Intermodal Center (ARTIC), the Depot at Santa Ana, John Wayne Airport, and the Irvine Station.	Part of the Compass Blueprint Planning Program.
Bravo!; BRT (Harbor Blvd)	Orange County, CA	Mixed-flow arterials and freeways	2009	$127 M	Interface with I-5, I-405, SR 22, and SR 91. The Harbor Boulevard Bravo! Corridor will provide service from California State University, Fullerton to Newport Beach.	Bravo! service is designed to decrease travel time for customers and improve travel speed within high ridership corridors. Harbor Boulevard is the busiest bus route in the county. Harbor Boulevard Bravo! Corridor will be the first of three BRT projects to be implemented by OCTA within the next two years. Other projects: Westminster/17th Street and Bristol/State College. Part of the Compass Blueprint Planning Program.

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
Bravo! (Westminster/ 17th Street)	Orange County, CA	Signal synchronization	2010		23-mile east-west route between the Depot at Santa Ana and downtown Long Beach. First regional BRT service operated by OCTA to provide direct connections to multi-modal transit services in LA County at the Long Beach Transit Mall.	Part of the Compass Blueprint Planning Program.
Brisbane Inner Northern Busway (BINB)	Sydney, Australia	Un-guided, ITS, dedicated lanes	2004 (original); late 2008 (current phase)	$250 M		The first stage of the project provided a dedi-cated 2.8 km busway link from Roma Street to the Royal Children's Hospital (Gilchrist Avenue, Herston). The current project is to build a 600m long bus tunnel to connect the existing underground Queen Street Bus Station (Myer Centre) to Roma Street.
Brisbane South East Busway (BSEB)	Sydney, Australia	Un-guided, ITS, dedicated lanes	2000	$350 M (Aust)		The department's aim was to design a transport system where cars, buses, trains, ferries, pedestrians and cyclists work together in more efficient ways for the benefit of the people and the environment. The South East Busway is used exclusively by buses and emergency vehicles.
Bus Rapid Transit	Colorado Springs, CO	Dedicated lanes, mixed traffic (street), running way ITS	Approved 2004; Construction has not begun	Around $2 B	Preliminary technology assessment performed that examined local land use and transportation conditions in the city.	In the early initial stage of rapid transit development, buses will operate in mixed traffic. Later, buses will on an exclusive lane during peak periods. Once BRT begins, the city will develop an exclusive dedicated travel way. This system was developed with consideration for the long-term needs of the community.

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
Ebus	Sacramento, CA	Mixed-traffic (street), running way ITS	2004	$5 M	Future routes possibly on parts of SR 65. Looking to expand the system with four more routes along higher-density residential and employment corridors and linking major activity centers within and possibly beyond Sacramento County boundaries.	The 50E service utilizes signal prioritization at three key intersections along Stockton Blvd. This, combined with a queue jump lane at Stockton and Fruitridge and a limited number of stops, allows the 50E service to operate at a faster schedule speed than the 51 line local service. Sacramento Regional Transit District has been operating an "Enhanced Bus" service along Stockton Blvd. since January 2004. EBus runs limited stop service on weekdays from Florin Mall to downtown Sacramento. The 7.7 mile route is straighter than the route it replaces.
EmX	Eugene, OR	Combination of mixed-flow arterials (Franklin) and at-grade transitways (Pioneer Parkway)	Jan. 2007 (Franklin); 2010 (Pioneer Parkway)	$24 M (Franklin); $38 M (Pioneer Parkway)	Constructed the Gateway EmX Extension, formerly called the Pioneer Parkway EmX Corridor. Design elements include the use of transitways; single-lane, two-way BRT operations; and block-traffic signaling. The EmX system transitways are located in the median of the street to distinguish them from conventional bus services that operate curbside.	Lane Transit District likes the BRT concept because it is appropriate in scale and cost for the community's size, it results in a more efficient transit operation, and can be developed one line at a time, as warranted by community demand and as allowed by funding. BRT is a system that the community can grow around. It is much easier and less expensive to put a rapid transit system in place before transportation problems become severe, rather than wait until the problems reach a crisis level and then try to implement a transit solution. LTD will complete the final design and construct the Pioneer Parkway EmX during 2009-2010. This will be the area's second EmX corridor and will link downtown Eugene and Springfield stations with the Gateway area.

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
Euclid Corridor Transportation Project	Cleveland, OH	Dedicated lanes, mixed-traffic (street), running way ITS	2005 (construction); 2008 (in use)	$200 M	Plans include the elimination of on-street parking and, where possible, the relocation of loading zones.	The goal of the Euclid Corridor Transportation Project is to improve transit service, as well as support increased development along Euclid Avenue. The project will provide shorter travel times along Euclid Avenue and linkages with other RTA services for better access to work, home, medical, educational, and cultural centers in Greater Cleveland. Euclid Avenue will be served by a unique, aerodynamic, 62 foot Euclid Corridor Vehicle (ECV), which will be quiet and environmentally friendly. Exclusive bus lanes, one lane in each direction for auto traffic. Buses will operate on a 5.5-mile exclusive, two-lane center median busway along Euclid Avenue from Public Square to University Circle, then transition to a mixed-traffic curbside lane for the remainder of the journey to Stokes Rapid Transit Station in East Cleveland. The total project length is 6.7 miles. A 2.7 mile Transit Zone is planned along parallel roadways in downtown Cleveland, on St. Clair and Superior Aves. ITS features will include traffic signal priority, vehicle tracking, advanced communication system and precision docking.

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
Geary Corridor BRT	San Francisco, CA	Dedicated lanes, running way ITS	2012 (assuming study completed by 2009)	$200-$2012 M	EIS being conducted. Issues discussed are: "Would we lose on-street parking?" and "Would reducing a traffic lane on Geary divert traffic to nearby streets?"	An independent survey of San Francisco voters, conducted on behalf of the San Francisco Planning and Urban Research Association, has found that 78% of respondents support the creation of a BRT network in the city. Geary Boulevard is the most heavily used transit corridor in the northern part of San Francisco. Almost 50,000 daily transit riders rely on Geary bus service that can be slow and crowded. The implementation of BRT features, such as dedicated bus lanes and high-quality bus shelters, are being considered to improve service for existing riders, attract new transit riders, and prevent increased auto congestion caused by existing riders switching to driving because of dissatisfaction with transit. In November 2003, 75% of San Francisco voters approved the Prop K Expenditure Plan, which calls for an expanded network of fast, reliable transit including bus rapid transit (BRT) in San Francisco. Geary is the key east-west corridor identified for BRT improvements.
Golden Empire Transit District--GET Bus	Bakersfield, CA	Mixed-traffic (street)	1973			Serves the Bakersfield metropolitan area
Martin Luther King, Jr. East Busway	Pittsburgh, PA	Grade-separated transitways, running way ITS	1983; 2003 addition	$113 M	9.1 miles. Two-lane, bus-only roadway constructed adjacent to an operating railroad right-of-way with a separating walls between the railroad and busway. Buses exit the Busway and operate in mixed traffic through Pittsburgh's central business district.	Designed to help alleviate traffic on the congested Penn Lincoln Parkway, which would experience a seven mile traffic backup during peak commuting hours. The original plan had been to rebuild the parkway and add a third tube to the tunnel, but since this would take seven years and severely disrupt traffic, the East Busway was a common solution. There is residential, retail, recreation, office and institutional development along and near the busway right-of-way.

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
Metro Rapid	Los Angeles, CA	Mixed-traffic (street), semi-dedicated lanes	Between 2000-2007	$30 M (Line 720); $350 M (all BRT systems in LA)	Designed system to complement, not replace, local bus service. Issues with getting approval for designated lanes. Local merchants concerned about losing parking lanes during rush hour. Phase II will incorporate exclusive lanes, higher capacity buses, multiple door boarding, off-vehicle fare collection, coordinated land use planning and an enhanced network of Rapid-to-Rapid and Rapid-to-Rail transfers within the Metro system. 24/7 bus lanes were not recommended by LADOT since they would create significant mixed flow traffic congestion and because delays are not generally experienced during off-peak and weekend hours.	The primary goal was to increase operating speeds, as well as to increase ridership and attract new riders, increase service reliability and effectiveness, devise simple route layouts, improve fleet and facility appearance, and build positive relationships with the community. Critics see the Metro Rapid system as insufficient to meet Los Angeles' growing transit needs. Limited funds, they say, would be better spent on growing the region's rail network. Rapid buses do not have the capacity or efficiency of light or heavy rail technology. 20 routes in operation. Wilshire Rapid Express (Line 920) and Hawthorne Rapid Express (Line 940) only operate during peak periods.

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
Metro Rapid--Wilshire Boulevard (Line 720)	Los Angeles, CA	Temporary take progressing toward designated lanes; Mixed-traffic (street), semi-dedicated lanes	2000	$28.6 M	Improve bus speeds and travel time. Planners chose the Wilshire and Ventura corridors for the demonstration because of high passenger demand, designing Rapid to complement, not replace, local bus service. The demonstrations have proven successful, improving travel times by an average of 25% and increasing ridership by at least 45% over previous standard bus service. An expansion is being planned that may include high-capacity buses, exclusive/bypass lanes, multiple-door boarding, and integration with a feeder network.	In April 2007, a Los Angeles Department of Transportation study recommended that peak period (7-9 am and 4-7 pm), end-to-end bus lanes along Wilshire Boulevard be implemented in order to significantly improve bus travel times and operating speeds. Estimated improvements include a 24% reduction in travel time (from 48.0 to 36.3 minutes, an 11.7 minute time savings) and a 32% improvement in bus speeds (from 11.9 to 15.7 mph). The study indicated that negative impacts to the adjacent mixed use lanes - through the loss of a mixed use lane during peak travel hours to serve as a bus lane - could be minimized by widening portions of Wilshire Boulevard to create additional roadway capacity for bus lanes. The cost of the bus lane extension project, including engineering enhancements, is estimated at $14-$16 million, which includes widening of Wilshire Blvd. between Barrington and Federal Avenues, minor curb lane repairs and installation of 200 concrete bus pads. Curb lane repairs could be implemented in 18 months and bus lanes could be installed upon completion of the widening of Wilshire between Barrington and Bonsall Avenues, which could take three to five years. Both the Department of Transportation and the City Council have endorsed the full implementation of end-to-end, peak hour dedicated bus lanes along Wilshire Boulevard, from downtown Los Angeles to Santa Monica. However, until the bus lane extension is implemented (expected in 2011), the Department of Transportation has recommended (April 2007) the temporary removal of the short bus lanes along Wilshire due to the increased congestion in the adjoining mixed traffic lanes. The bus lanes are to be re-instated upon further expansion of the Wilshire bus lanes beyond the initial one-mile segment.

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
Neighborhood Express Bus	Chicago, IL	Mixed-traffic (street), running way ITS	1998		Operates as an overlay onto the existing CTA route network. Has eliminated 75% of bus stops associated with the local routes, decreasing overall travel time.	The 18-mile Neighborhood Express limited bus service connects to CTA's heavy-rail lines, the Red, Green and Orange "L" lines, Midway Airport, the Metra Mayfair station and other bus lines.
QuickBus (QB40)	Baltimore, MD	Not designated as of yet	2005		Minimal	Marketed only to those who do not own vehicles who depend on a neighborhood bus stop.
Rapid Blue	Santa Monica, CA	Mixed-flow operation, transit signal priority	2005	$7 M	Mixed-flow operation on Lincoln Blvd.	Part of the LA County BRT network that is gradually being expanded and will consist of 28 lines in 2008. 8-mile stretch of Lincoln Blvd. from downtown Santa Monica to Los Angeles International Airport and Metro's Green line light rail station, through the beach cities of Santa Monica, Venice, Playa Vista, and Marina del Rey. Replaced old Rapid 7 line.
Rapid Blue--Big Blue Bus/ Rio Hondo Connector High-Speed Shuttle Bus Service	San Juan, Puerto Rico	Mixed-flow arterials, dedicated arterials, HOV lanes	2003	$65 M	Shuttles will bypass expressway auto congestion by using special highway lanes, and will use various ITS elements to speed their travel. The Rio Hondo connector is a 2.5-mile length of highway currently under construction, extending PR 5 to PR 199. The connector will be a divided, limited-access highway with six traffic lanes, including one lane in each direction to be reserved for high-occupancy vehicles.	This service is part of the overall Alternativo de Transporte Integrado (ATI) system that coordinates and integrates the city's transportation services. An important component of the Tren Urbano rail system, the high-speed buses employ HOV lanes to shuttle commuters between the suburban Rio Hondo Tren Urbano parking plaza (park-and-ride facility) to the Tren Urbano rail station at Bayamon. ITS elements are incorporated into the system design to speed the journey. The objective of this program is to endow the Region with a transport system that is functional, efficient, cost effective, socially and environmentally responsible, and which enhances the Region's overall development. Uses enhanced stops, intermodal terminals, pedestrian-friendly areas, clean diesel, signal manipulation, vehicle tracking, and passenger information and security.

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
RapidRide	Albuquerque, NM	Not designated as of yet	2006		Minimal--Started service along Central Avenue and it has since become one of the system's most used routes. Rapid Ride is a faster alternative to traditional local bus service. The buses run more often but stop less frequently – usually only every half-mile to mile – and benefit from traffic signal priority.	Trying to increase ridership among those that would not normally take public transit. Decreased waiting time, increased appeal. Pilot project for light rail system. 18 60-foot articulated buses are used on two Rapid Ride routes - the Red Line (Central Avenue) and the Blue Line (West Side to UNM). The service boasts speed, iconic red shelters and the enviable ability to make traffic lights turn green.
Richmond Highway Express (REX)	Richmond Highway, VA	Mixed-traffic (expressway) ITS	2004		Part of South County Bus Plan. Runs along Richmond Highway.	The REX system is part of a plan to restructure bus service on 24 existing Fairfax County connector routes. This route is expected to expand service by 25%. Accepts SmartTrip fare cards. REX stops will include safety features such as crosswalks, pedestrian signals, better lighting and bus shelters.
San Pablo Avenue Rapid Bus	San Pablo, CA	Traffic signal priority, queue bypass lanes	2003	$71 M	San Pablo to Oakland, CA; Interface with SR 123	Various agreements are in place guiding cooperation between the State and Alameda County Congestion Management Agency. Project goals include: enhance economic vitality, enhance quality of life issues, address through-traffic issues, improve mobility and accessibility, and minimize the environmental impacts of transportation. 14 miles traveling through a State Highway under Caltrans jurisdiction. Shared rapid and local stops.

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
SbX	San Bernardino, CA	Dedicated ROW, mixed-flow arterials, HOV lanes	2010 (operational)	$164 M	Interface with I-10. The E Street sbX Corridor will stretch approximately 16 miles from northern San Bernardino including Cal State San Bernardino to the civic and business centers in downtown San Bernardino. The route will head south with stations at the Orange Show Fairgrounds and along bustling Hospitality Lane before connecting to Loma Linda University Adventist Health Center and the Veteran's Administration Hospital in Loma Linda.	Expected to help bring economic, environmental, and transit improvements to the San Bernardino Valley. Intermodal transportation center adjacent to a scheduled Metrolink extension. The E Street Corridor sbX will also provide a vital transit option for many low-income residents in the area. "This high-tech project will provide more convenient transit service to meet the region's growing travel demands while helping relieve traffic congestion and improving air quality," said John Roberts, chairman of the Omnitrans Board of Directors and Fontana City Councilman. "This Corridor will be the first in a Valley-wide system of interconnecting sbX lines stretching from the Los Angeles County border to Redlands, offering improved transportation to major activity centers."
Showcase BRT Project	San Diego, CA	Semi-dedicated lanes, dedicated lanes, running way ITS	2011/2012	$355 M	35 mile long project (20 miles of managed lanes, 10 miles of HOV lanes, 4 miles of dedicated lanes, and 1 mile of mixed traffic) between Downtown San Diego and San Diego State University. Interface with I-805 and I-15. Dedicated median lane along portion of Park Blvd; transit-only lane along portion of El Cajon Blvd.	Project connects to trolley lines on both ends of the corridor. Partnering with Caltrans, MTS, and NCTD, SANDAG has shifted into high gear to accelerate a variety of high-priority, TransNet-funded transportation improvements throughout the region. These major construction and infrastructure projects, called Early Action Projects, include I-5; I-15; I-805; State Routes 52 and 76; the Mid-Coast transit extension from Old Town to the UCSD/University Towne Centre area; I-15 Bus Rapid Transit (BRT) from Escondido to downtown San Diego via Mid-City; the South Bay BRT from Otay Ranch to downtown San Diego via I-805; and the Mid-Coast Transit Super Loop in the University City area. Several of the major interstate projects, such as I-15, also include the incorporation of managed lane systems.

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
Silver Line (Phase III)	Boston, MA	Dedicated lanes, running way ITS	2016	$1.43 B	Environmental assessment conducted (results in as of late summer 2008), underground tunnel construction	To provide high frequency and high quality service from Dudley Square and lower Roxbury through the South End, Chinatown, downtown and on to the South Boston Waterfront and continuing service to Logan International Airport. Designed to increase mobility and support economic development in Boston's neighborhoods. MBTA's seven-mile Bus Rapid Transit (BRT) project will ultimately provide high frequency and high quality service. It is the only MBTA transit service to connect the Red, Orange, and Green subway lines.
South Bay Bus Rapid Transit	Chula Vista, CA	Not designated as of yet	Still in planning stages			Considering queue jump lanes, long stretches of dedicated ROW lanes, curbside running transit lanes, median running transit lanes, and exclusive or separate transit lanes, and transit signal priority treatments.
Sydney Liverpool-Paramatta Transitway (SLPT)	Sydney, Australia	Dedicated lanes, mixed unguided busway and on-street bus lanes, ITS	2003	$200M (Aust)	Includes much on-street bus lane operation. 31 km transitway. 20 km of new bus-only roads and 10 km of bus-only lanes will be provided on existing roads. 35 stations total, mostly along the curb.	Will connect major activity centers in southwestern Sydney. The design of the Transit-way can allow conversion to light rail if demand warrants.
Sydney North West Transitway (SNWT)	Sydney, Australia	Dedicated lanes (unguided, mixed ROW), ITS	2007	$524 M (Aust)		The North West Transitway (NWT) forms part of the dedicated busway network to provide a public transport solution for the north west sector of Sydney. It is an important extension to the existing Liverpool to Parramatta Transitway, which began operation in 2004. This project follows the concept of SLPT.

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
Transitway	Ottawa, Canada	Dedicated lanes, running way ITS	1983 (Initial opening)	$500 M	Ottawa's Transitway is 25.8 km of bus-only, two lane, grade-separated roadway constructed primarily on a railroad right-of-way. The Transitway widens to four lanes at stations to allow express buses to pass buses that are loading. Paved shoulders are provided for snow storage and to accommodate broken-down buses. The system also includes 35.3 km of reserved lanes on freeways and arterial roads.	Transitway provides an exclusive rapid transit link across much of the City's urban area, with service operating 22 hours a day.
Van Ness Avenue Bus Rapid Transit	San Francisco, CA	Dedicated, physically separated bus lanes	2011 (construction scheduled) 2012 (service scheduled)	$85-$90 M	About 2 miles from Mission to Lombard on Van Ness Ave.	The next stage of project development is now getting underway: an environmental analysis along with preliminary engineering of potential alternatives. Alternatives include no project, curb lane BRT, center-side BRT with two medians, center-side BRT with one median, and center-center BRT. Provides rapid, reliable transit including transit signal priority, high-quality stations, and more. This project may serve as first phase of implementing LRT.

Project Title	Location	Running Way	Start Date	Cost	Impact	Considerations
VTA Rapid 522	San Jose, CA	Progressing toward BRT	2005	$470 M	The new "Queue Jump Lanes" use an exclusive right-turn lane as well as a "receiving" lane on the other end of the intersection to allow buses to bypass traffic at busy intersections. These lanes are currently located on El Camino Real at Page Mill Road and Arastradero intersections in Palo Alto.	This route aims to cut transportation travel times and increase usage of public transportation in Santa Clara County. According to VTA officials, the Rapid 522 is only the precursor to the Bus Rapid Transit (BRT), which is part of the long-term plan for further advancing Valley transportation. Bus Signal Priority, reduced stops, frequent service, headway-based schedules, queue-jump lanes, all low-floor buses, fully accessible.
	Changzhou, China	Segregated busways/bus-only roadways	2008			Will soon encounter capacity limitations.
	Fresno, CA	Not designated as of yet	2008 (Planning)	$1 to 3 B		The majority of stakeholders supported the concept of BRT implementation. Stakeholders agreed that rapid transit would improve mobility in the region, particularly when a larger rapid transit network is established.
	Riverside County, CA	Not designated as of yet	Planning Phase			Dedicated bus lanes. Plan supported by cities along corridor.

APPENDIX B: INTERVIEW RESULTS

Berkeley, Oakland, and San Leandro, CA

AC Transit—East Bay Bus Rapid Transit

Jim Cunradi, Project Manager at AC Transit for the East Bay BRT Project

Project Summary: The East Bay Bus Rapid Transit route runs North to South connecting downtown Berkeley and the Berkeley BART Station with the south side of the UC-Berkeley campus, and to downtown Oakland. The project involves a Rapid Bus system that is planned to progress to a Bus Rapid Transit system. Construction of the project began in 2006, and will continue through 2009. When construction is complete, the system will operate almost exclusively (nearly 90 percent of the route) on dedicated median BRT lanes. The other 10 percent of the route will operate in some mixed-flow with special pavement delineation and mountable curbs. The system expects to use 46 hybrid-electric, clean diesel buses with articulated low floors, enhanced aesthetics, passenger amenities, additional doors, wider aisles, and they will be quieter than non-BRT buses. The anticipated projected cost is $200 million.

Background Information

a. Before beginning construction, AC Transit had to obtain approval to use the street on which they planned to operate. This was difficult because they are part of a special district entity with an elected board and do not have jurisdiction over the street. Implementation involved a long, consensus-building process before they finally gained approval from three cities and Caltrans (which controls the right of way for the street.)

b. Completed a Draft EIS in May 2007

c. Current status: working to build consensus, get agreement on the final plan, and meet people's concerns

d. BRT was proposed because the arterials that run parallel to the expected route would be able to accommodate an increased capacity of several hundred cars. A small diversion to other routes is possible, but not likely due to the capacity on the parallel arterials. AC Transit is currently developing a method to look at the potential diversion to local and/or neighborhood streets to determine the effects of converting a general purpose lane to a bus-only lane.

e. BRT was initially proposed by - NA

f. The top concerns of the public that AC Transit worked to address were (in order of importance):

    i. Parking: in Berkeley, using 1 way couplets saves 85 parking spaces

        1. Used mixed-flow operation for BRT in some areas because they were not able to mitigate the loss of parking.

        2. AC Transit purchased lots for parking to mitigate parking loss

3. Joint-use parking with provided amenities

ii. Diversion onto local streets: the traffic analysis did not reveal this to be an issue; however, it was brought up as an issue during the public comment period. AC Transit is currently investigating the extent to which this is an issue that should be mitigated by examining the level of service on the main streets along the bus route as well as the parallel arterials.

2. Did you convert any travel lanes to BRT use?

   a. Yes—there are plans to convert a general purpose lane to a bus-only lane.

   b. The bus-only lane is expected to run for 17 miles within three jurisdictions. Plans include dedicated lanes for 85 percent of the route and mixed-traffic for the remaining 15 percent. Per suggestions made by local elected officials, AC Transit opted to convert general purpose lanes to bus-only lanes rather than taking parking lanes due to the controversy over loss of parking.

   c. Most of the corridor runs through low-income neighborhoods where parking was underutilized; however, part of the corridor also runs through a thriving commercial development area where parking is highly utilized. The decision to convert a general purpose lane and to use the median rather than parking lanes was highly motivated by the characteristics of the smaller part of the corridor where parking is an important issue.

   d. The lane conversion was BRT focused?

3. Was an option to convert a general purpose lane to BRT use considered? Yes

4. Perceived and observed barriers or obstacles to implement lane conversion for BRT included:

   a. Preserving parking can be more important than preserving travel lanes.

   b. Parking loss does not result in a loss across most of the route, but it is key in commercial areas—most of the parking loss for this project was at station locations.

   c. Negative impacts on traffic congestion largely occur during peak hours.

5. Is the BRT line likely/proposed to be converted to a rail line in the future?

   a. This route is most likely going to remain BRT largely due to the lack of funding available for converting the route into a light rail line. The project was designed for light rail in terms of radii, but this was largely a precautionary measure. In constructing this route, utilities were not relocated in order to keep implementation costs low.

6. To what degree were managed lanes considered?

    a. The route was designed so that a rail or trolley could operate along it, but it is not likely that the route will ever be used for anything other than BRT.

7. Minimum acceptable levels of service for traffic on facilities with BRT?

    a. The minimum acceptable level of service (LOS) in the areas through which the route travels is "E." For San Francisco where improvements can only be made in terms of improved transit rather than increased capacity, the minimum acceptable level of service is "F."

8. How is the LOS calculated? - NA

9. Did you conduct any public education programs in connection with the BRT project?

    a. AC Transit spent a great deal of time on consensus building in order to get the three local jurisdictions and Caltrans to agree on the plan. They also spent time organizing public meetings in order to hear and respond to public concerns.

10. Do you have any data related to:

    a. Project Costs: The project received $75 million from Small Starts funding[1] as well as $162 million from local funding. The BRT line will help reduce traffic on the bridge, and therefore is eligible for funding from the local 5% sales tax that is available for transit improvements.

        i. AC Transit is still working to acquire about 2 feet of right of way on each side of the street in order to create another general purpose traffic lane and to mitigate issues with a couple of intersections.

        ii. Cost/benefit analysis is in the form of Transit System User Benefit (TSUB) or the cost to reduce one hour of a transit passenger's travel time. Because the project involves taking traffic lanes and converting them to bus lanes, AC Transit subtracted the added time for motorists who have greater congestion. Their preliminary estimates show that the benefit (to transit users) is about nine times the cost (to drivers).

    b. Project benefits include the incorporation of solar benefits. Instead of building a new "Park and Ride" lot, AC Transit teamed up with a local business in Oakland, CA to use their excess parking spaces. They covered the lot with solar panels to create shaded parking and then gave the energy credits to the company whose parking lot they were using.

[1] AC Transit applied for Small Starts funding and received money for the project by calculating Transportation System User Benefits, which looks at the cost of reduce travel time by 1 person/hour. This calculation looks at subtracting delays to auto riders from transit user's benefits. The calculation for this project was benefits: delays = 9:1. The cost of reduce 1 hour of person travel time was calculated to be $10/rider—which results in a "high" ranking by FTA.

c. Impacts on traffic volumes/Level of Service: Most of the corridor does not have a traffic problem. The congestion that does occur varies widely depending on the segment. The Level of Service is fairly good for most of the day. Even so, buses can be unreliable due to traffic congestion or other reasons unrelated to traffic conditions.

d. Travel times: - NA

e. Ridership: - NA

f. Environmental/Community Conditions: AC Transit hopes to complete their final Environmental Impact Report (EIR) by December 2009. This final draft will involve additional community consensus meetings to refine and determine the locally preferred alternative.

g. Safety/Accidents NA

11. Lessons Learned

a. Look to low-income neighborhoods when planning a bus route. Low-income neighborhoods tend to have the strongest transit-ridership. Building in these neighborhoods offers the additional benefit of improving the environmental justice characteristics of the project by providing improved transit service for these areas.

b. Identify the most controversial issues of the project and focus on them.

c. Look at where transit use is/has been the heaviest. Do not operate on the idea that "if you build it, they will come." Instead, build your route according to the areas where it has been proven that people use the system. This is the best place to start because there is already an established pool of riders.

12. What went right?

a. Identification and proactive approach to parking for commercial areas.

13. What went wrong—things to avoid in implementing such a project –s See Lessons Learned

14. Additional comments:

a. Van Ness is a tricky project. It has great potential, but it will run into problems with how to accommodate express service on the corridor.

b. Caltrans was willing to look at person throughput for the Berkeley project—same Caltrans district as San Francisco. This means that the Van Ness project may run into similar problems with converting state right of way from general traffic to public transit.

c. Van Ness has much more traffic than International Boulevard where traffic volumes have been largely static since the 1970s when the freeway was built.

Follow up Discussion 3/9/09 with Jim Cunradi

1. What is the current status of the project?

   They released a Draft EIS in May 2007. They are currently working with three local jurisdictions to get permission to convert three travel lanes for BRT use. They are working with these cities to minimize impacts and determine if mitigation is required. They are working segment by segment (for the 17 mile proposed BRT lane project). They submitted their application for FTA funding through the Small Starts program in December of 2008.

2. What alternatives were considered in addition to the lane conversion for the BRT implementation?

   A Major Investment Study was done for this corridor to examine alternative investments, including light rail transit and BRT, among others. This led to the decision to pursue BRT. In the current EIS they evaluated different levels of BRT and different degrees of lane conversion that would be required for each alternative.

3. Why was lane conversion chosen?

   The area the route passes through is 100% urban with buildings fronting on the roadway. There was no chance of widening the road for transit. The public wanted to conserve parking so they looked at converting a mixed flow traffic lane instead of converting parking to accommodate the BRT system.

4. How did you make the decision to proceed with lane conversion?

   The proposal calls for narrowing the roadway from four lanes to two through lanes with BRT lanes in the middle of the roadway; and with left turn lanes at signalized intersections. In the earlier MIS they compared transit ridership and the costs to implement the alternatives.

5. Did you use a model to evaluate the alternatives?

   We used the Alameda County model to evaluate traffic impacts, transit ridership and potential diversion of traffic to other facilities. The model results showed that there would not be a big impact on traffic. The traffic volumes on the facility have been pretty static since the 1970's.

6. If so, what model was used?

   The regional travel demand forecasting model was used for the transportation analysis. The Transit System User Benefit Model was used for additional analysis. (A FTA model used for Small Starts projects.) The FTA Summit model was used to evaluate the net benefits of the proposed action.

7. Did you do a benefit/cost analysis?

   The completed analysis of operating and capital costs using FTA standard cost categories.

8. If not, what did you use?

   They used the Transit System User Benefits procedure. FTA had them modify this to account for dis-benefits resulting from delay for motorists.

9. If yes, please explain how this was done.

   Did not use a benefit/cost model per se.

10. What criteria were used to evaluate the lane conversion?

    Had established service objectives so the analysis focused on the extent to which the alternatives met the objectives. These included things like improving air quality, reducing SOV drivers and increasing transit use, improving conditions for existing transit riders, encouraging TOD.

11. Were they quantified and/or weighted?

    Some measures were quantified like transit ridership, air quality, traffic impacts. Others were qualitative, e.g., encouraging TOD.

12. To what extent was the evaluation based on FTA's Small Starts Program criteria?

    They used the Small Starts criteria since they have applied for funding under the Small Starts Program. They submitted their application for funding in December 2008, received a high rating; and are on the list for funding in 2010.

Additional Comments

There are many players "at the table" who would like some sort of process and criteria to use when determining if lane conversion is a good idea. Criteria that have been discussed include the carrying capacity of the facility, persona level of service, travel delay, travel time savings for transit users and so forth. The FTA TSUB model is a start. It compares the cost to reduce 1 hour of person travel time to annualized operating and capital costs for the system. In their case FTA had them subtract out the dis-benefit of delay to motorists (determined through their travel modeling) to get a net measure of the benefits.

Another potential source of information for the lane conversion issues is to look at examples of "Great Streets." In their area there have been three Great Streets projects (Marin Avenue, Foothill Blvd. and Market Street) where four lane roads were converted to three lane roads with improved bicycle and pedestrian facilities. This has been done in Charlotte, NC, and other areas. It might be useful to look at the results of these lane conversions.

In the future he anticipates that at the Federal level, and at the state level in California there will be less emphasis on evaluating these kinds of projects using traditional Level of Service measures.

Boston, Massachusetts

Massachusetts Bay Transportation Authority—Silver Line (Phases I, II, III)

Joe Cosgrove, Director of Planning and Development

Project Summary: The Silver Line is a three-part project that connecting Dudley Square and lower Roxbury through the South end, Chinatown, downtown, and the South Boston Waterfront, with continuing service to Logan International Airport. It will be the only MBTA transit service to connect the Red, Orange, and Green subway lines. So far the first two phases of the line have been completed. The

completed BRT line will run on dedicated lanes with running way ITS. The line is expected to cost $1.43 Billion and its anticipated completion date is 2016.

Planning for this route began in the 1970s when the Orange Line was relocated. Phase I of the line began running in 2002. This 2-mile route involved taking some parking lanes and constructing a contra flow lane on Marginal Street. The general traffic capacity was ultimately reduced as a result of the new project.

Phase II runs for 3 miles on mixed-flow arterials, mixed-flow freeways, at-grade transit ways, subways, partially by overhead electric power in a newly constructed tunnel that runs from South Station to Boston's World Trade Center, and partially on a surface reserved right of way. The tunnel was constructed in conjunction with the "Big Dig" project. It opened in 2004 operating with dual-mode buses and switched to CNG buses in 2005. The portions within the newly constructed tunnel are dedicated right-of-way. Above-ground portions are mixed-flow operating with signal priority (D Street in particular) and signal coordination (Washington Street).

Phase III connects the first two phases via an underground busway (1+ mile tunnel) from Boylston station on the Green Line to South Station. The environmental review and preliminary engineering are expected to be completed by the end of 2008 with a federal funding decision expected in 2010 and construction beginning in 2011. The line is expected to open in 2016.

1. Background Information

    a. BRT was proposed in the 1970s when the Orange Line was elevated. This freed up space to be used by buses and pedestrians. MBTA proposed the BRT line after Interstate 95 was not relocated through Boston and funds for the highway relocation project were used to relocate the Orange Line instead. In 1997, after submitting many applications for a replacement service, MBTA selected and received approval for a bus rapid transit service. The main goal of this project was to offer replacement service along the previous Orange Line route.

2. Did you convert any travel lanes to BRT use?

    a. The contra-flow lane from Phase I is the only converted lane.

3. Was an option to convert a general purpose travel lane to BRT use considered?

    a. More than anything, this project had issues with the location of the route. Planners considered the option of building in the median, which would have required taking travel lanes that were expanded where the elevated line was removed. This option was ultimately discarded.

    b. Parking became the largest issue, largely because it became a political issue.

4. Perceived and observed barriers/obstacles to implement lane conversion for BRT:

    a. Taking parking and sidewalk space

    b. Issues of environmental justice due to the decision to route the bus through low-income neighborhoods.

5. Is the BRT line likely or proposed to be converted to a rail line in the future?

    a. One of the neighborhoods along the route, Roxbury, was heavily in favor of a rail line during the initial planning phases. Light rail was discarded as an option because FTA indicated they would not contribute funding to a new light rail project due to its proximity to the existing and relocated Orange Line. Converting the BRT line to a rail line would involve moving service from the curb lane to the median, which would present many difficulties. In the late 1990s the mayor made the final decision and decided against light rail.

6. To what degree were managed lane concepts considered?

    a. No indication that they were considered.

7. Minimum acceptable LOS for traffic or facilities with BRT - NA

8. How is the LOS calculated? - NA

9. Did you conduct any public education programs in connection with the BRT project?

    a. Six neighborhoods became very involved in the project in voicing their concern that choosing a bus system over light rail was inequitable treatment of neighborhoods. They each had different desires and the project became very controversial. MBTA spent a great deal of time and money coming to an ultimate decision on the plan. The mayor's leadership was also very important in reaching a final agreement.

10. Do you have any data related to:

    a. Project Costs: 40% of the Phase III project costs are covered for construction. Operating costs are still not covered.

    b. Benefits of the project include economic redevelopment along the line including 750 new housing units.

    c. Impacts on traffic volumes, LOS - NA

    d. Travel Times - NA

    e. Ridership - NA

    f. Environmental/Community Conditions

        i. EIS completed

    g. Safety/Accidents

11. Lessons Learned:

    a. Operate in the median. It is difficult for people to navigate parking in-between the parking lane and the bus lane.

b. Do not design shelters through a community process. They may ultimately look nice, but they will likely not be functional. When MBTA installed their community designed shelters, they received a negative reaction from users. There was a backlash against the architects because they were expensive but did not protect people from the elements.

c. Find an appropriate vehicle to use. Boston's mayor passed an edict that no more diesel buses could operate in Boston. At the time of the Silver Line's installation, the technology had not yet been developed for their system, which operated on both tunnels and streets. The buses they ultimately decided to use do not perform well in snow, which has been a problem.

12. What went right?

    a. The area along the Silver Line was recently named one of APA's "great places of America" due to the great increase in redevelopment that has occurred in connection with the Silver Line.

13. What went wrong?

    a. MBTA is currently experiencing many issues related to financing. Construction costs keep rising and funding is not secured.

Los Angeles, California

Los Angeles County Metropolitan Transportation Authority—MetroRapid, Wilshire Boulevard (Line 720)

Rex Gephardt, Director, Regional Transit Planning, Los Angeles County Metropolitan Transportation Authority

Martha Butler, Michael Richmeyer

Project Summary: The Los Angeles Department of Transportation conducted a study recommending putting peak period (7-9 am and 4-7 pm) end-to-end bus lanes along Wilshire Boulevard, which runs from downtown Los Angeles to Santa Monica. This route would include a temporary take of a general purpose lane progressing toward a designated bus-only lane, mixed-flow, and semi-dedicated lanes. The main goal of this project was to significantly improve bus travel times and operating speeds. The study indicated that negative impacts to the adjacent mixed use lanes (losing a mixed use lane during peak travel hours) could be minimized by widening portions of Wilshire Boulevard to create additional roadway capacity for bus lanes. The cost of this project is estimated at $28.6 million for engineering enhancements, widening Wilshire Boulevard, minor curb lane repairs, and installing bus pads. This project was fully endorsed by the LA Department of Transportation as well as the City Council. The bus lane extension project is expected to be completed in 2011.

The route was initially implemented in 2000 and so far the system has successfully achieved its goals of improved bus speeds and travel times. Travel times have been improved by an average of 25 percent and ridership has increased by at least 45 percent over previous standard bus service. The success of this project has led to discussion about an expansion project that may include high-capacity buses, exclusive/bypass lanes, multiple-door boarding, and integrating the route with a feeder network.

1. Background Information

    a. At the time this project was first conceived, in the late 1990s, the Federal government argued that dedicated lanes were an integral component of BRT's definition. The Wilshire Boulevard project proved that BRT projects could be implemented quickly and improve travel times without installing dedicated lanes.

    b. Currently, within Los Angeles there are 400 miles of mixed-flow BRT routes running within 27 corridors that connect to one another or to the rail system. There was a dedicated bus-only lane for one mile along Wilshire Boulevard, but it was eliminated after three years. Creation of this lane involved taking parking on both sides of the road during peak periods. It was created as a test trial and demonstrated that taking parking lanes was not an issue during morning rush hour when businesses were not open; but it created congestion problems during the afternoon peak hours.

    c. The Wilshire Boulevard project was designed from 2000 to 2002 as two separate BRT lines operating in mixed-flow. Planners looked at each corridor separately to evaluate the needs and uses of each corridor. They ultimately settled on BRT as a way to support and induce more concentrated land use practices. Construction on the route should begin once the environmental process is completed (estimated 2009), assuming there is a finding of no significant impact. A bus-only lane should be in operation within 2 ½ years after that. Bus-only lanes became a necessary component for the project due to congestion issues and in order to create the conditions to encourage travelers to shift to transit.

2. Why was BRT proposed?

    a. The Los Angeles County Metropolitan Transportation Authority consulted with the General Manager of the Los Angeles Department of Transportation and determined that using person throughput rather than vehicle throughput would make more sense in determining the extent to which a mode shift from driving to transit might occur.

    b. The Los Angeles Department of Transportation proposed placing dedicated lanes for BRT along Wilshire Boulevard. The current structure of the project was created by the Los Angeles County Metropolitan Transportation Authority.

    c. The goals/objectives of the project include creating a mode shift by building dedicated lanes in order to create a system that is consistently fast and frequent.

3. Did you convert any travel lanes to BRT use?

    a. Wilshire Boulevard is constructed in such a way that there are between two and four lanes at various points. Constructing a BRT lane could result in some portion of traffic diverting to alternate routes. Planners are currently working to model and evaluate the degree to which creating a BRT lane will negatively impact congestion levels.

    b. Plans include 12.5 miles of new bus-only lanes. The creation of these lanes involves taking parking, taking the through lane, and adding a lane—all in various sections of the route in order to provide space for the BRT line. At this point in time, only peak-period bus lanes are in place, operating on bus lanes created by taking the parking lanes in both directions. To date, this has not had a significant negative impact on parking.

c. While developing plans for the project, planners had to work with the traffic engineers to resolve issues with the traffic signal system to prove that installing signal priority for the BRT line would not degrade the current traffic operations. They hired a consultant to model the lane conversion effects using TransCAD and will be completing intersection modeling with the help of VISSIM.

4. Was an option to convert a general purpose travel lane to BRT use considered?

    a. Yes. Plans include taking a general purpose traffic lane, and in some places it involves widening the corridor and adding a lane. Ninety percent of the project involves taking an existing traffic lane in both directions.

5. Perceived and observed barriers or obstacles to implement lane conversion for BRT include:

    a. They were very interested in modeling the estimated impact of taking a lane in order to estimate clearly the project's impacts—both negative and positive. A large concern right now is how to mitigate the *perceived* negative effects of converting a lane?

6. Is the BRT line likely/proposed to be converted to a rail line in the future?

    a. Yes. This project is intended to show transit demand in order to establish support for a light rail project.

7. Minimum acceptable LOS for traffic on facilities with BRT?

    a. Planners found that the volume of traffic at intersections does not shift by more than 1%. The LOS for about 16 intersections along the route is at "F" or "D."

8. How is the LOS calculated? - NA

9. Did you conduct any public education programs in connection with the BRT project? Yes

10. Do you have any data related to:

    a. Project Costs - NA

    b. Benefits of the project - NA

    c. Impacts on traffic volumes/ LOS – See above

    d. Travel times

        i. The current minimum headway is 3 minutes or less in the peak periods and 8 minutes or less in the off-peak periods.

    e. Ridership

        i. There has been a 1/3 ridership increase among people who previously used cars instead of transit and a 1/3 ridership increase among people who did not previously use public transit.

f. Environmental/Community Conditions

    i. They have not completed any Environmental Impact Assessments or Statements for the mixed-flow BRT systems, but they are planning on completing an EA for the bus-only lane construction project.

g. Safety/Accidents

    i. The accident rate for the BRT buses is consistently lower than the rate for the local buses.

11. Lessons learned:

    a. Bus-only lanes on arterials are not essential for generating a significant improvement in speed. Speed is an extremely important component for a successful BRT project.

    b. Real-time bus displays cut the perceived wait time in half. They should be one of the first things installed in stations.

    c. Once the BRT system is in operation, if congestion or inconsistency (slow travel speeds) begin to occur, bus-only lanes will become a necessity. Rail has consistency, which is why people love using it. If BRT cannot offer similar reliability, people will not use it.

    d. In order to sell a BRT system, you must first implement the system. Implementation of a test BRT system can provide many benefits.

    e. Get government support. With this project, the LA DOT began with a successful demonstration and they worked to gain mayoral support early on. The mayoral support helped them to get road improvements needed for implementation.

    f. Work closely with transit operations staff. The design for a BRT project—which corridor to place the route along, how to operate the system—should come from the planning department.

12. What went right?

    a. Answered in Question 11

13. What went wrong?

    a. Having trouble getting the stations in place. The designs have been approved and the funding is available, but they are having issues constructing the stations as quickly as they would like due to issues with the city and advertising rights.

Cleveland, Ohio

Greater Cleveland Regional Transit Authority—Euclid Corridor Transportation Project

Maribeth Feke & Mike Schipper

Project Summary: The $200 million Euclid Corridor Project involves 5.5 miles of two exclusive bus lanes operating in the median along Euclid Avenue with one lane in each direction open for auto traffic. For the other 1.2 miles of the project, buses operate in mixed-traffic curbside lanes. The plans for the project included eliminating on-street parking and relocating loading zones where possible. The goal of this project was to improve transit services as well as to support increased development along Euclid Avenue. Now that this route is in place, travel times along Euclid Avenue will be reduced and people traveling in the area will be connected to other RTA services that run throughout the Greater Cleveland Area. The project involves quiet and environmentally friendly diesel-electric hybrid vehicles, enhanced stops, pedestrian-friendly areas, enhanced aesthetics, and articulated low floors. The project's construction lasted from 2005 to 2008.

1. Background Information

    a. BRT was proposed as a result of an alternative analysis completed in the late 1990s-early 2000s for the Transportation System Management evaluation for the Greater Cleveland area. Once the idea of BRT was agreed upon, the project went forward to ultimately become one of ten demonstration projects for BRT in the United States.

    b. Objectives for the project included linking the Euclid area and downtown Cleveland in order to stimulate economic development in the Central Business District. In addition, planners involved in the project wanted to improve the overall efficiency of the bus system along the Euclid corridor. The previous bus carried 20 percent of the area's overall bus riders, but was unreliable and slow.

2. Did you convert any travel lanes to BRT use?

    a. Yes—4.5 miles of one lane in each direction along Euclid Avenue were converted to a dedicated lane. Initially the project involved taking a general purpose lane in each direction and converting it to a dedicated lane in the middle of the street; and constructing platform stations in the middle of the street along with crosswalks for people to reach the platforms. They ultimately added 24 hour bus lanes along the curb, which caused many issues with people continuing to park along the curb. The lanes were changed to peak-hour bus-only lanes in the transit zone downtown due to issues with parking.

    b. There are two streets that run parallel to Euclid Avenue that offer alternatives to people when congestion issues arise.

    c. The lane conversion was BRT focused.

    d. Converting lanes involved buying ROW at intersections for temporary use—about 250 parcels overall—and obtaining temporary construction easements.

3. Was an option to convert a general purpose travel lane to BRT use considered?

    a. Yes—see Question 2

4. Perceived and observed barriers/obstacles to implement lane conversion to BRT:

    a. The Euclid Corridor was specifically selected because of the parallel routes that run alongside it. These alternate routes offered a convenient displacement option for auto drivers to use if congestion issues arise along Euclid Avenue.

5. Is the BRT line likely/proposed to be converted to a rail line in the future?

    a. The project was initially designed with the idea of conversion to rail in mind; however, the project has taken a long time to plan, implement, and construct. Currently, there are no plans to convert the BRT route to light rail. There is no money to convert the route. If additional funding does become available, it will likely be used to expand the BRT line into additional corridors rather than convert it to light rail.

6. To what degree were managed lanes considered?

    a. Not at all. Managed lanes are generally used along highways and therefore did not apply to this project, which runs only on arterials.

7. Minimum acceptable LOS for traffic on facilities with BRT?

    a. The standard in the Cleveland urbanized area is “D” or better. In those areas with LOS between A and C, BRT was not permitted to degrade the LOS.

8. How is the LOS calculated?

    a. Project planners used the signal system integral to calculate intersection’s LOS.

9. Did you conduct any public education programs in connection with the BRT project?

    a. Yes—Planners held 2000+ events for public education. These events continue as the system opens in order to educate people and riders on how the system operates. They have invested in VISSIM simulations to demonstrate how the actual BRT systems will work.

    b. One of the issues they worked to address during public comment periods was the degree to which delivery zones would be affected. This issue was resolved by creating drop-off-only areas and pocket parking.

10. Do you have any data related to:

    a. Project Costs

        i. Fifty percent of the funding came from FTA, 20 percent from the State, and 25 percent from RTA, the City, and local MPOs. Overall, 84 percent of the funding was a form of federalized money (pass through federal funds).

    b. Benefits of the project

        i. The route opened in 2008, and is already close to meeting its projected 20-year development goals. There has been lots of interest in development along the Euclid Corridor--$3 billion in committed investments so far.

c. Impacts on traffic volumes/LOS

    i. During the planning phase, they demonstrated that the LOS would not decrease on parallel routes. The LOS along the corridor was initially "A" or "B" with 7,000 car/day on average traveling on Euclid Avenue. Currently, Euclid's LOS is still "A" or "B" and the parallel routes are mostly "A" or "B" and occasionally "C."

d. Travel Times

    i. The signal priority system along the corridor has reduced travel time for the buses significantly.

e. Ridership

    i. The opening day ridership is expected to be 15,000, building to 19-20,000/day.

f. Environmental/Community Conditions

    i. The project uses hybrid buses, which were very well received by the public. The increased traffic along the corridor has also improved the previous "dead zone" of boarded of buildings that existed along the route between the two urban centers.

g. Safety/Accidents

    i. No information.

11. Lessons Learned

    a. Evaluate the network within which you are operating and building. BRT does not operate on its own, but rather within the surrounding environment.

    b. Select your corridor carefully. Cleveland presented a unique opportunity for converting a general purpose lane along the Euclid Corridor because of the three existing parallel corridors—one that is now transit-oriented and two that are auto-oriented. Anchor institutions are located at each end of the corridors, too, providing motivation for people to travel along them.

    c. Work to address perceived as well as real issues. This requires a great deal of analysis and outreach to the surrounding community members. It is important to talk to stakeholders, e.g., community leaders and representatives of diverse interests, in addition to transit agencies.

    d. Work with utility companies.

    e. It is difficult to obtain funding for BRT projects.

12. What went right?

    a. By using overlay zoning, project planners successfully got the city to replace the old water line running along the BRT route with a new one.

b. Planners worked with utility companies to coordinate a deal where the private utilities paid for improvements and the Greater Cleveland Regional Transit Authority paid for their relocation expenses.

c. They successfully worked with and coordinated with the local community development corporations.

13. What went wrong?

a. During the planning process time period, there was a great deal of political turnover, which affected the timing for implementing the project.

b. Scheduling issues also arose as a result of compliance with third party agreements. These agreements resulted in many delays.

c. They encountered design challenges working to accommodate cars, bikes, sidewalks, and sidewalk cafes.

d. Euclid Avenue is a 100-year street, which presented inherent issues with accommodating 100-year old utility services and surrounding historical characteristics.

e. The project generated a great deal of public opposition, which slowed down the implementation process. People thought the project would increase the accident rate and increase traffic congestion. As a result, planners spent a great deal of time and money on simulations to explain the project more fully.

f. Planners made mistakes with the Environmental Assessment due to communication issues. This process could have been improved greatly.

g. They should have hired dedicated staff for key functions right from the very beginning. They ultimately hired people for these tasks, but in the beginning it slowed many things down.

h. There were many issues with agency coordination. The Euclid Corridor Project is the largest project the agency has ever done, and, among other things, it resulted in many issues with contract management.

Follow up Questions 3/9/09, Mike Schipper

1. What is the current status of the project?

The lane conversion started in the spring of 2006. It was finished and became fully operational in October 2008. In addition to the BRT lane, they have implemented a transit zone downtown to improve bus operations in the downtown area. They have a full time bus only curb lane on one street and a peak hour bus only curb lane on a parallel facility. Since 90% of the buses converge on the downtown, this helped with the whole bus network operations.

2. What alternatives were considered in addition to lane conversion for the BRT implementation.

   Study for his corridor started as a subway line over 50 years ago; then it was light rail, and finally BRT. Alternatives Analysis was done when the City was considering LRT. The outcome of this work was the decision to proceed with BRT because it was the only option they could finance.

3. Why was lane conversion for the BRT Lane considered?

   It was the only option they could afford. They did examine how much of the corridor would be dedicated bus lane. They rearranged parking in the mixed flow section of the corridor to improve traffic flow and bus operations when it is operating in mixed flow lanes. They eliminated parking in some sections as needed for the planned bus operations

4. How did you make the decision to proceed with lane conversion?

   Euclid Street is the center of three parallel streets. Euclid had the lowest traffic volumes of the three streets. BRT worked well for the section of the corridor where there were all three streets. The average daily traffic on the street was relatively low with Level of Service of A or B, so there was excess capacity that could be used for transit. At the ends of the corridor there is higher ADT on the streets. In these sections they reconfigured parking to improve bus operations in this section, and did not convert an existing mixed flow traffic lane.

5. Did you use a model to evaluate the alternatives:

   Yes, they did use a model to analyze traffic operations.

6. If so, what model was used?

   They modeled traffic conditions for all three facilities assuming that Euclid was taken completely out of service for mixed flow traffic. The analysis showed that the two parallel streets could handle the corridor traffic adequately and that all intersections were still highly functional. This analysis convinced the traffic engineers that the roadway network could operate fine even if Euclid was totally dedicated to transit.

7. Did you do a benefit/cost analysis?

   They did some cost analysis for the environmental analysis. It is described in the environmental documents. He did not recall use of a specific benefit/cost model for their analysis.

8. If not, what did you use?

   All of the work was done as part of the environmental analysis and documentation. They were going to apply for FTA New Starts funding so they used the New Starts criteria and process. This included an economic analysis, but not a true benefit/cost analysis.

9. If so (Question 7) please explain how this was done.

   They did economic development forecasts and land use analysis to evaluate the impact of the BRT system on redevelopment of the areas along the proposed route. To date they are ahead of the projects for redevelopment. They have stabilized some areas and have new3 development,

especially the ends of the corridor with the growth in the hospital and the expanded Cleveland State University campus.

10. What criteria were used to evaluate the lane conversion?

- Traffic analysis and projected conditions for traffic on Euclid and the parallel facilities
- Transit operations analysis including decreases in travel time for transit
- Increasing travel speed for transit vehicles
- Improvements in travel time for transit users
- The combination of the excess capacity on Euclid and improvements in transit operations made this project feasible.

11. Were the criteria quantified or weighted

The criteria were quantified as needed for New Starts applications for funding.

12. To what extent was the evaluation based on FTA's Small Starts Program criteria?

The BRT project would not have been funded with federal dollars without taking the lane. They needed a high enough level of transit operations improvements, including dedicated right of way, to qualify for Federal funding. They are the only BRT project that received New Starts funding, as opposed to Small Starts funding.

Eugene, Oregon

Lane Transit District—EmX Franklin Corridor

Graham Carey

Project Summary: The first EmX Franklin Corridor opened in January 2007 and the second Pioneer Parkway EmX corridor is expected to be constructed between 2009 and 2010. Eugene, Oregon decided on BRT due to the appropriateness in scale and cost of a BRT system compared to the community's size. At a cost of $24 million, the Franklin Corridor operates for five miles on designated lanes with hybrid-electric buses, signal priority, sophisticated shelters, and uses off-board self-service fare collection. The Parkway Corridor is expected to cost $38 million and run for 7.8 miles on dedicated arterials and at-grade transitways. Currently, the project is waiting on permits in order to begin construction.

1. Background Information

   a. BRT was initially proposed as part of the city's 1995/1996 regional transportation plan, which focused on improving transit rather than building new roads. The city looked at building a light rail system, but the idea was dropped in favor of BRT as the area's ultimate preference. Factors considered in this decision were Eugene's desire to mitigate construction effects to a no-build condition, and to keep the current V/C (volume to capacity) ratio at intersections close to its initial value of 1.

2. Did you convert any travel lanes to BRT use?

    a. The project included eliminating turn lanes, taking travel lanes, and removing 72 on-street parking spots.

3. Was an option to convert a general purpose travel lane to BRT use considered?

    a. Yes, and carried through.

4. Perceived and observed barriers/obstacles to implement lane conversion for BRT:

    a. There were many issues with the public and their perception of the project. Due to the recent introduction of BRT as a transit concept in the United States, the public was nervous about the feasibility of implementing such a project in Eugene. Lane Transit had a difficult time dispelling these fears due to the lack of BRT examples within the United States (successful or not). In addition, elected officials were not entirely confident in the idea of BRT. Lane Transit has had to take extra steps in its public education efforts in order to reassure officials and the public that this project would be a success.

    b. There was also a concern within the community of being able to maintain the state and local standards for capacity. Lane Transit invested in simulations on an intersection-by-intersection basis that demonstrated the impacts of traffic conditions that would result from implementing a BRT route. They also worked to show that the capacity of their planned BRT system (generally transit only carries 5% of people) would be enough to accommodate travelers who changed modes to transit.

    c. Lane Transit worked very closely with the local businesses in order to develop a relationship that would allow them to avoid issues with removing business parking.

5. Is the BRT line likely/proposed to be converted to a rail line in the future?

    a. Eugene is committed long-term to BRT. They did not design their route with conversion in mind. They did not acquire right of way for a light rail operation or design for light rail technology installation.

6. To what degree were managed lane concepts considered?

    a. Not applicable.

7. What is the minimum acceptable level of service for traffic on facilities with BRT?

    a. Eugene has a somewhat negotiable LOS that is generally accepted as “D.”

8. How is the LOS calculated?

    a. Eugene calculates LOS using a V/C ratio and measures it against the state and local standards. The LOS for each intersection varies since the city looks at LOS on a corridor level rather than an intersection level.

    b. Generally, the city would like new policies to plan toward mitigating for no-build.

9. Did you conduct any public education programs in connection with the BRT project?

    a. During the planning stage, Lane Transit worked to generate extensive public involvement.

    b. They worked on a large public education campaign in order to prepare the public for the complex traffic arrangements that would result from implementation of the project.

10. Do you have any data related to:

    a. Project Costs—Lane Transit received 80 percent of their funding from the FTA in the form of discretionary funds. Lane Transit decided to use signal priority rather than another technology in order to keep the run times lower and the maintenance costs lower as well. EmX is relatively inexpensive to operate. There is limited seating on the vehicles with larger areas for standing passengers in order to maximize vehicle capacity. The bus operates in its own ROW for 2/3 of the corridor, so the buses avoid interaction with the surrounding traffic.

    b. Benefits of the project—Eugene's BRT system is really an investment for the future. Currently, there are a limited number of congestion problems within the city/ With this project, they are looking to put themselves in a good position for future population increases by reserving right of way and working to reduce transit operating costs. The impacts on the surrounding development have not been as great as the city would have hoped. Developers are slightly nervous to invest in the area because the ridership is less certain than it is for rail; so they are waiting to see what happens.

    c. Impacts on traffic volumes/LOS—There has not been a noticeable difference; however, it is hard to gauge considering the present conditions with high gas prices and transit use at all-time highs.

    d. Travel times—EmX has succeeded in travel time improvements of between 20 and 30 percent. This has largely been the result of exclusive lane use.

    e. Ridership—The EmX is one of 50 regional transit corridors and carried over 1.1 million people. It carries about 6,000 people a day. Ridership predictions exceeded the 20-year prediction within four months. This increase seems to be unrelated to gas prices, especially as ridership is still growing even though gas prices have decreased somewhat. The system is free for those riders exclusively using the BRT route; however, many riders use the route to transfer between the Eugene and Springfield transit hubs, and therefore pay a fee for transferring between systems.

    f. Environmental/Community conditions—Lane Transit conducted an Environmental Assessment on the first and second legs of the project, which resulted in lawsuits from local environmental groups. For the third and upcoming leg of the project, they are going to prepare an Environmental Impact Statement and work to address any and all environmental issues that could arise from construction.

    g. Safety/Accidents—When the project first opened, there were a number of accidents. Out of the 13 initial accidents, 9 or 10 resulted from illegal L-hand turns and two were unavoidable. Through their public education campaigns and the public's general growing familiarity with the BRT route, the accident rate has decreased.

11. Lessons Learned

    a. The mode of travel is less important than providing good service. In creating a BRT system, one should strive to create a system that is simple, straightforward, and effective. People's main concerns are speed and convenience.

    b. As a transit agency, you must work to convince people that you will be able to manage the project in the short-term and carry it through the long-term. This will be easier if you are able to anticipate some of the short-term issues you will encounter and resolve them quickly.

    c. From day 1, work to convince people that you will not impact the current conditions along the route.

12. What went right?

    a. Lane Transit was very persistent in its desire to build a BRT system and it paid off.

    b. One of the main goals of the project was to build for the future in order to position the city for congestion problems that may arise. This forward-thinking will likely serve the city well in the years ahead.

13. What went wrong?

    a. Lane Transit made many compromises in order to get to their end goal. These compromises included allowing federal representatives to place conditions on the project and on the agency in exchange for funding.

Vancouver, British Columbia (Canada)

TransLink—B Lines

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Project Summary: Vancouver developed its BRT system in the 1990s in response to the need for transit services that could bridge the gap between the existing local bus service and the future development of a light rail system. TransLink ultimately decided on creating a BRT system that operated in mixed-traffic for this corridor. They constructed the $52 million (CA) system from 1999-2002. It includes two 3.5 meter busway lanes in the center of the street, which were created by eliminating two-way left turn lanes and narrowing the general purpose lanes by 0.5 meters. TransLink ultimately decided on median lanes instead of curbside lanes due to complications with driveways and right-turning traffic at intersections. They viewed median lanes as an option that would offer reliability and time savings. They expanded the first line to include three others in 2002 and 2006. All lines include low-floor, multiple door vehicles, off-board fare collection, signal priority, and real-time destination information.

1. Background Information

    a. BRT lines were first proposed by TransLink for an intermediate capacity rapid transit service. Vancouver developed the idea of a Frequent Transit Network that would include high service corridors and high frequency transit services. The end goal is to promote transit usage by providing more efficient and reliable transportation.

    b. It was proposed because the provincial highway authority—Ministry of Transportation and Infrastructure BC—was in the planning stages of a major highway expansion. There was a plan for HOV lanes, when the regional transportation authority (South Coast BC Transportation Authority aka TransLink) approached the ministry with this proposal. There are currently no rapid transit services operating in the corridor or near the corridor where this BRT is planned for operation. The Province and TransLink entered into a Memoranda of Understanding which included the following statements:

        i. The Province recognizes economic growth and environmental sustainability are closely related, and has established a goal of reducing greenhouse gases (GHG) by 33% by 2020, the introduction of bus rapid transit ("BRT") service along various corridors, which will provide transit service that will be superior to conventional bus service;

        ii. Along with improvements to the road network, the core rapid transit system will be an integral component of a comprehensive, effective transportation network to address congestion, support economic activity, increase transit and transportation choice and provide better inter-municipal connections;

        iii. The expansion of transit service will improve growth in transit ridership and reduce dependency on single occupancy vehicles for travel and contribute to achieving air emission goals

    c. The 98 B Line was the first line and it runs north-south along Granville and east-west along Broadway. They are currently working on developing a third line, the 95 B Line that would run along Hastings.

    d. Goals for the project include improving growth in transit ridership and reducing the dependency on single occupancy vehicles for travel. Additionally, a BRT system will help achieve air emission goals.

        i. The parties involved in the project plan to reinstate bus service across the Port Mann Bridge and enhance public transit in the Lower Mainland through the construction of transit infrastructure and the implementation of BRT service along the Highway 1 corridor to connect key service areas.

2. Did you convert any travel lanes to BRT use?

    a. The project involved removing parking lanes during the peak hour, which generated issues with the local businesses. The route also involved eliminating 2-way turn lanes and the option of turning left into adjacent properties. This allowed through traffic to flow better and it decreased the number of accidents.

b. There is an exclusive BRT two-way ramp to/from the median HOV lanes, utilizing Government Street for access to the Lougheed Town Centre Station and Transit Exchange in the City of Burnaby; median on/off ramps for HOV and BRT buses at the 156th Street interchange in the City of Surrey; a transit exchange within or in the vicinity of the 156th Street interchange; median on/off ramps for HOVs and buses in the vicinity of 200 Street to 204th Street; a transit exchange in the vicinity of the proposed 200th Street - 204th Street HOV/transit interchange; and a Park & Ride facility with a minimum of parking spaces for 1000 vehicles in the immediate vicinity of the proposed 200th Street - 204th Street HOV/transit interchange.

c. "BRT Service" in Vancouver includes a service that operates on the HOV Lanes constructed on Highway 1 generally between Lougheed Town Centre Station and Transit Exchange and the easterly segment of the Highway #1 improvements in the proximity of 200th Street to 204th Street.

3. Was an option to convert a general-purpose travel lane to BRT use considered?

   a. Within the City of Vancouver, TransLink converted a lane on Broadway to a bus-only lane. The City released a report saying that the benefits did not outweigh the costs. For the 98 B Line project, TransLink gained city approval to designate the curb parking lane as bus only rather than using a general-purpose lane.

   b. The Ministry Highway project known as the Gateway program had already identified the need for additional GP and HOV lanes in travel demand forecasts.

4. Perceived and observed barriers/obstacles to implementing a lane conversion for BRT:

   a. TransLink encountered issues with the local property owners who objected strongly to the traffic changes. They spent a great deal of time on public communication to explain the project in more detail before it was constructed, and they have spent a great deal of money enforcing turning violations now that the project has been constructed. An important lesson TransLink learned was to provide funding for communication and public outreach campaigns so that people fully understand the project and its rules of operation.

   b. The barriers encountered are related to planning and design at this stage, since they will not be operational until 2014. The challenges related to ramp exit/entrance design for HOV and BRT mixed use and accommodation within a very limited right of way. Some additional right of way was acquired for park & ride and bus exchanges/transfer points.

   c. The travel demand forecasts predict that by 2031 bus travel times could be impeded by the volume of HOV sharing the lane, but that has not impeded the implementation of BRT.

5. Is the BRT line proposed to be converted to a rail line in the future?

   a. Yes. In the very long term, TransLink would consider converting the BRT service to rail, but it is not part of current 10-year plans.

6. To what degree were managed lanes considered?

    a. Due to the fact that this BRT service is using a HOV lane, it is the only option being considered.

7. Minimum acceptable levels of service for traffic on facilities with BRT:

    a. The estimated transit travel time from Langley to Burnaby is 25 minutes and estimated ridership targets are in the range of 2700 passengers per hour in peak periods, based on bus frequency between 10 and 15 minutes).

    b. TransLink has invested in a signal priority system with their Main Street Transit Signal Priority project, which they hope will enable them to avoid degradations in the existing LOS. Their signal priority is based on schedule adherence for transit. It could potentially result in a decrease of person throughput for any one signal as a result of congestion in both directions.

8. How is the LOS calculated?

    a. TransLink hired consultants to evaluate their BRT systems.

    b. For BRT the LOS is calculated based on the performance criteria stated above. For HOV, currently planned as 2+, the LOS was calculated based on HCM.

9. Did you conduct any public education programs in connection with the BRT project?

    a. Yes—explained above.

    b. Prior to service implementation and as part of the area transit service changes that are planned there will be public open houses.

10. Do you have any data related to:

    a. Project Costs—TransLink invested in headway articulated vehicles, which ultimately saved them a great deal of money due to the improvements in travel time.

    b. Benefits of the project—Mentioned above.

    c. Impacts on traffic volumes/LOS—evaluating the effects at present.

    d. Travel times—100 minute travel time has been reduced to 45 minute travel time. The reduction in travel time has enabled TransLink to buy and operate fewer buses, which has improved operating and capital cost savings.

    e. Ridership—The 98 B Line carries 10 percent of the local transit traffic. It is the most profitable line.

    f. Environmental/ Community conditions—Did not elaborate. Draft Environmental Impact Report online at http://www.actransit.org/news/articledetail.wu?articleid=42622c20#online.

g. Safety/ Accidents—The accident rate has improved. Left-turn accidents in the "Garden Section" have decreased. The BRT line has ultimately improved safety by enabling traffic to move more smoothly and reducing left turning traffic`````.

11. Lessons Learned:

    a. Involve the community as much as possible. It is important to create an environment where citizens are able to voice their concerns.

    b. Terminology can be very important—for example, the original name for the project, RapidBus, created wariness among senior citizens wishing to use the service.

    c. It is important to create certain feature comforts associated with your particular BRT line that distinguishes it from other local lines. Agencies should spend time branding and marketing their BRT line's distinct identity.

    d. Riders enjoy LED readouts because it provides predictability.

12. What went right?

    a. Answered above.

13. What went wrong?

    a. On the technical side, TransLink experienced issues with vehicle communication. Message signs were inaccurate and they ran into issues with their GPS systems. It is important to invest in good technology that enables two-way communication between the operating system and the display screens. It will greatly improve operations.

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