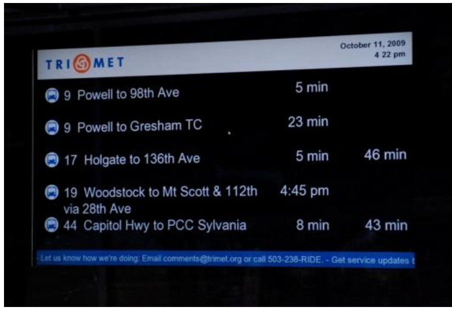

Transit Overview

MODES | OPERATIONS | FACILITIES | URBAN CONSIDERATIONS

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INFORMATION ORGANIZATION

- Facts
- Population Groups
- Urban Transit Networks
- Transit Modes
- Operational Strategies and Priority Treatments
- Facilities
- Integration with Urban Places

MetroTransit Hiawatha Line LRT, Twin Cities (Minnesota)

TransitFirst Showcase, San Diego (California)

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- Who uses transit?
- What makes transit successful, regardless of mode?
- How does transit work in urban environments?
- Why will people who wouldn’t use buses use bus rapid transit?

England

Portland

Las Vegas

Transitway Planning in Other Cities

(video to be played)

INTERESTING TRANSIT FACTS…

1630
Water Transit

1830
Rail

1905
Bus Service

- **1630 Boston--reputed first publicly operated ferryboat**
- 1740 New York--reputed first use of ox carts for carrying of passengers
- **1830 Baltimore--first railroad (Baltimore & Ohio Railroad Co.)**
- 1832 New York--first horse-drawn street railway line (New York & Harlem Railroad Co.)
- **1835 New Orleans--oldest street railway line still operating (New Orleans & Carrollton line)**
- **1884 Cleveland--first electric street railway line (East Cleveland Street Railway)**
- 1895 Chicago--first electric elevated rail line (Metropolitan West Side Elevated Railway)
- **1897 Boston--first electric underground street railway line (West End Street Railway/Boston Elevated Railway Co.)**
- 1904 New York--first electric underground (& first 4-track express) heavy rail line (Interborough Rapid Transit Co.)
- **1905 New York--first bus line (Fifth Avenue Coach Co.)**
- 1916 Saint Louis--first public bus-only transit agency (St. Louis Division of Parks and Recreation Municipal Auto Bus Service)
- 1917 New York--last horse-drawn street railway line closed
- 1923 Bay City, MI, Everett, WA, Newburgh, NY--first cities to replace all streetcars with buses
- **1926 highest peacetime public transportation ridership before World War II (17.2 billion)**
- 1939 Chicago--first street with designated bus lane
- **1946 highest-ever public transportation ridership (23.4 billion)**
- 1969 Washington--first transitway (Shirley Highway)
- **1972 public transportation ridership hits lowest point in 20th century (6.6 billion)**
- **1973 Washington--some public transportation service required to be accessible to disabled (Rehabilitation Act of 1973)**
- 1991 Washington--first general authorization of use of highway funds for public transportation (Intermodal Surface Transp. Efficiency Act)
- 1992 Washington--first limitation on amount of tax-free employer-paid automobile parking benefits and tripling of value of tax-free benefit for public transportation use (National Energy Policy Strategy Act)
- 2005 Federal transit law (SAFETEA-LU) reauthorized extending federal funding through 2009
- 2008 American Recovery and Reinvestment Act authorization

TRANSIT IN ALEXANDRIA

- Metrorail (WMATA) - stations at Braddock Road, King Street, Van Dorn Street, and Eisenhower Avenue
- Virginia Railway Express (VRE) – station at King Street
- Fairfax Connector
- Metrobus
- DASH bus system
- King Street Trolley
- DOT (paratransit)
- Metro Access (paratransit)

Metrobus, WMATA

King Street Trolley, Alexandria (Virginia)

DASH, Alexandria (Virginia)

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Population Groups

- **Transit Captive** – people in this group do not have access to a car or are unable to drive. Reliant on transit for mobility.

Services are typically designed to serve this group

- **Choice** – people in this group may have access to a car, but instead choose to use transit to meet their mobility needs.

Could be very large market if services were made attractive

- **Auto Captive** – this group has little to no inclination to use transit – trips do not lend themselves to transit or the trip maker does not want to use transit

Likely inefficient use of resources and public money to serve

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Distribution of Transit Services

Service

- Paratransit and demand-responsive service
- Circulators
- Local fixed route services
- Line haul and express services

Typical Service Area

- Area covered by fixed route service
- Downtown/special area
- City/Region
- Specific corridor

TransMilenio, Bogota (Colombia)

MetroTransit, Twin Cities (Minnesota)

Service and Mode Interconnectivity

- Increases ridership
- Creates interconnectivity
- Increases mobility
- Increases effective service area of a single route/service
- Too many transfers to reach a destination can be negative for patrons

Transit Modes

Other Bus Transit

- Circulators
- Commuter Bus
- Special Shuttles
- Heritage Trolleys

Standard Bus

- Local bus
- Express bus

Enhanced Bus

- Rapid Bus
- Light BRT
- Full BRT

Rail Transit

- Streetcar
- Light Rail Transit (LRT)

Other Rail Transit

- Heavy Rail
- Commuter Rail
- Intercity Rail

Examples

Other Bus Transit	Standard Bus	Enhanced Bus	Rail Transit	Other Rail Transit
• King Street Trolley • Loudoun County Transit • Employer shuttles	• DASH • Arlington Transit (ART) • Metrobus • Fairfax Connector	• REX (Fairfax/Alexandria) • Eugene Emerald Express (Emx) • HealthLine (Cleveland) • Kansas City MAX BRT • Las Vegas MAX	• Toronto Streetcar • Portland Streetcar • Seattle Streetcar • Baltimore Light Rail • Twin Cities Light Rail	• Metrorail • VRE • MARC • Amtrak

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Circulators and Shuttles

StarTrans Senator Vehicle based on Ford Platform

King Street Trolley, Alexandria (Virginia)

Description

Circulators and shuttles are common in most urban areas and typically serve a specific local mobility or destination-specific purpose. Many circulators and shuttles operate fare free and are subsidized by local business districts, businesses, or other organizations. Circulators and shuttles run on varied headways often based on local traffic conditions and vehicle availability.

Service Type: Destination specific or localized

Operating Speed: varies

Station Spacing: Several blocks

Runningway Type: Mixed flow

Example Systems: King Street trolley, employer shuttles

Features/Characteristics

- Destination or area-specific service
- Often uses heritage vehicles or cutaways
- Operating speeds can be high, but are often not much more than walking speed
- Often fare free

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LOCAL BUS

Metrobus, WMATA

VTA, Santa Clara Valley Transportation Authority (California)

DASH, Alexandria (Virginia)

<u>Description</u>

Local bus services are common in nearly any metropolitan area in the world. Local buses often stop every block or every other block along a route several miles long. This is by far the most common type of bus service. In Alexandria, DASH and Metrobus operate service on a number of local routes.

<u>Service Type:</u> Local

<u>Operating Speed:</u> 8 to 12 mph

<u>Approximate Cost Per Mile:</u> $50,000 or less

<u>Station Spacing:</u> Several blocks to ¼ mile

<u>Runningway Type:</u> Mixed flow

<u>Example Systems:</u> DASH, Metrobus, ART

<u>Features/Characteristics</u>

- Proven technology across the United States and world
- Short headways are a key to increased ridership
- Essential to extending the reach of line-haul transit and building ridership systemwide

Modern Streetcar

Both images: Portland Streetcar, Portland (Oregon)

Description

Streetcars are rail transit vehicles designed for local transportation. They are typically powered by electricity received from an overhead wire; however some use batteries and diesel electric technologies for some power needs. Streetcars typically take the place of local bus service in high density downtown areas with very high bus ridership. Modern streetcars usually operate in mixed (traffic) flow in local streets with other downtown vehicles.

Service Type: Urban Circulator

Operating Speed: 8 to 12 mph

Approximate Cost Per Mile: $10 to $25 million

Station Spacing: ¼ mile or less

Runningway Type: Mostly shared with traffic, limited dedicated

Example Systems: Portland, Seattle, Toronto

Features/Characteristics

- Fully implemented systems are in existence in many U.S. and international cities
- Streetcars were one of the first transit modes implemented in many U.S. cities more than 100 years ago
- Streetcars are used as circulators and are designed to provide local mobility
- Not typically used in city-to-city commuter systems

Express Bus

REX, Alexandria and Fairfax County (Virginia)

CTA, Chicago (Illinois)

Description

Express bus service reduces travel time on longer trips, especially in major metropolitan areas during heavily patronized peak commuting hours by operating long distances without stopping. Examples of this type of service include park-and-ride routes between suburban parking lots and the central business district that operate on freeways, and express buses on major streets that operate local service on the outlying portions of a route until a certain point and then operate non-stop to the central business district.

Service Type: Regional/Urban

Operating Speed: 15 to 19 mph

Approximate Cost Per Mile: $50,000 or less

Station Spacing: Limited stops

Runningway Type: Mixed flow

Example Systems: Most major cities

Features/Characteristics

- Commuter bus is prevalent in most metropolitan and some fringe areas
- Compatible with travel patterns in most areas
- Efficient use of right-of-way
- Some line/service-specific branding and identity

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Rapid Bus

Alameda-Contra Costa Transit District (California)

Metrobus (WMATA)

Description

Typically the least cost to implement of BRT modes, rapid bus typically operates in shared travel lanes and may benefit from transit signal priority, dedicated/specifically designed stops, and improved passenger amenities. Vehicles may be specifically branded. Rapid bus typically benefits from TSP and queue jump lanes at some locations.

Service Type: Regional/Urban

Operating Speed: >12 mph

Approximate Cost Per Mile: $3 million

Station Spacing: ¼ mile to 2 miles

Runningway Type: Mixed flow with queue jump lanes at some locations

Example Systems: Bay area, New York, Chicago, Los Angeles

Features/Characteristics

- Fully implemented systems are in existence in many US and international cities
- Efficient use of right-of-way
- TSP and queue jump lanes to bypass traffic
- Line/service-specific branding and identity

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LIGHT BUS RAPID TRANSIT

Kansas City MAX BRT (Missouri)

Metro Rapid, Los Angeles (California)

Description

Light bus rapid transit combines much of the quality of rail transit with the flexibility of buses. It typically operates in a combination of mixed flow and dedicated lane conditions. Light BRT systems utilize sections of dedicated lane, queue jump lanes, transit signal priority and similar technologies to increase operational efficiency and reduce travel time.

Service Type: Regional/Urban

Operating Speed: >12 mph

Approximate Cost Per Mile: $5 million

Station Spacing: ¼ mile to 2 miles

Runningway Type: Balance of dedicated and mixed flow

Example Systems: Kansas City, Las Vegas, Los Angeles

Features/Characteristics

- Fully implemented systems are in existence in many US and international cities
- Efficient use of right-of-way
- Many rail-like features without rail capital and operating costs
- Line/service-specific branding and identity

Full Bus Rapid Transit

Both images: Emerald Express BRT, Eugene (Oregon)

Description

Bus rapid transit combines much of the quality of rail transit with the flexibility of buses. It can operate in exclusive runningways, in HOV lanes, on expressways, or on ordinary streets in mixed traffic. Full BRT systems are based on light rail transit principles, but instead of the required capital investment in trains and track, they utilize buses integrated with key components of the existing automobile transportation infrastructure, such as roads, rights-of-way, intersections, and traffic signals.

Service Type: Regional/Urban

Operating Speed: >12 mph

Approximate Cost Per Mile: $10 to $15 million

Station Spacing: ¼ mile to 2 miles

Runningway Type: Mostly dedicated, some mixed flow

Example Systems: Cleveland, Eugene, Los Angeles, Boston

Features/Characteristics

- Fully implemented systems are in existence in many US and international cities
- Many rail-like features without rail capital and operating costs
- Line/service-specific branding and identity

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Light Rail Transit

MetroTransit Hiawatha Line LRT, Twin Cities (Minnesota)

TRIMET MAX LRT, Portland (Oregon)

Description

LRT is an electrically powered, two-rail technology capable of providing a broad range of passenger capacities. LRT typically operates in single vehicle or short trains on a variety of alignment types. LRT operates primarily on a partially controlled right-of-way and at higher speeds than streetcars.

Service Type: Regional/Urban

Operating Speed: 20 mph (on street) to 60 mph (dedicated lanes)

Approximate Cost Per Mile: $20 to $60 million

Station Spacing: ½ to 1 mile

Runningway Type: Mostly dedicated, minimal shared with traffic

Example Systems: Baltimore, Portland, Minneapolis, Dallas, Salt Lake City, Denver, Charlotte

Features/Characteristics

- Proven technology in the U.S. and internationally
- More typically implemented in areas of high development density
- High capacity vehicles
- High platform stations

Heavy Rail Transit

Both images: WMATA Metrorail, Washington D.C. Area

Description

Typically referred to as a “subway,” is an electric railway with the capacity for a heavy volume of use. It is characterized by high speed and rapid acceleration passenger rail cars operating singly or in multi-car trains on fixed rails; separated right-of-way from which all other vehicular and foot traffic are excluded; sophisticated signaling; and high platform level entry loading.

Service Type: Regional/Urban

Operating Speed: 50 to 70 mph

Approximate Cost Per Mile: $50 to $250 million

Station Spacing: Core ~ ½ mile; Periphery ~ 1 to 5 miles

Runningway Type: Exclusive dedicated

Example Systems: Los Angeles Metro, Chicago “L”, New York City Subway, BART, Washington, D.C. Metrorail

Features/Characteristics

- Proven in major metropolitan cities
- Heavy rail not compatible with other transit modes in the same ROW
- Requires completely segregated right-of-way
- Used to serve very dense populations

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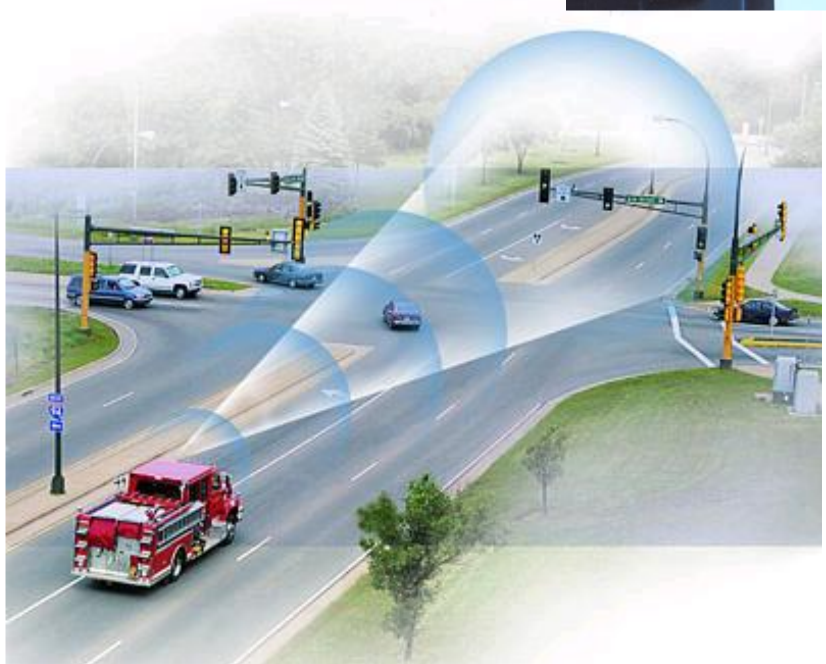
Operational Strategies and Priority Treatments

- Traffic signal coordination
- Transit signal priority
- Traffic signal pre-emption
- Near side/far side bus stops
- Off-board fare collection
- Boarding through all doors
- Mixed flow
- Queue jump lanes
- Dedicated lanes
  - Side
  - Median

Traffic Signal Operations

- Coordination
- Transit signal priority (TSP)
- Signal pre-emption



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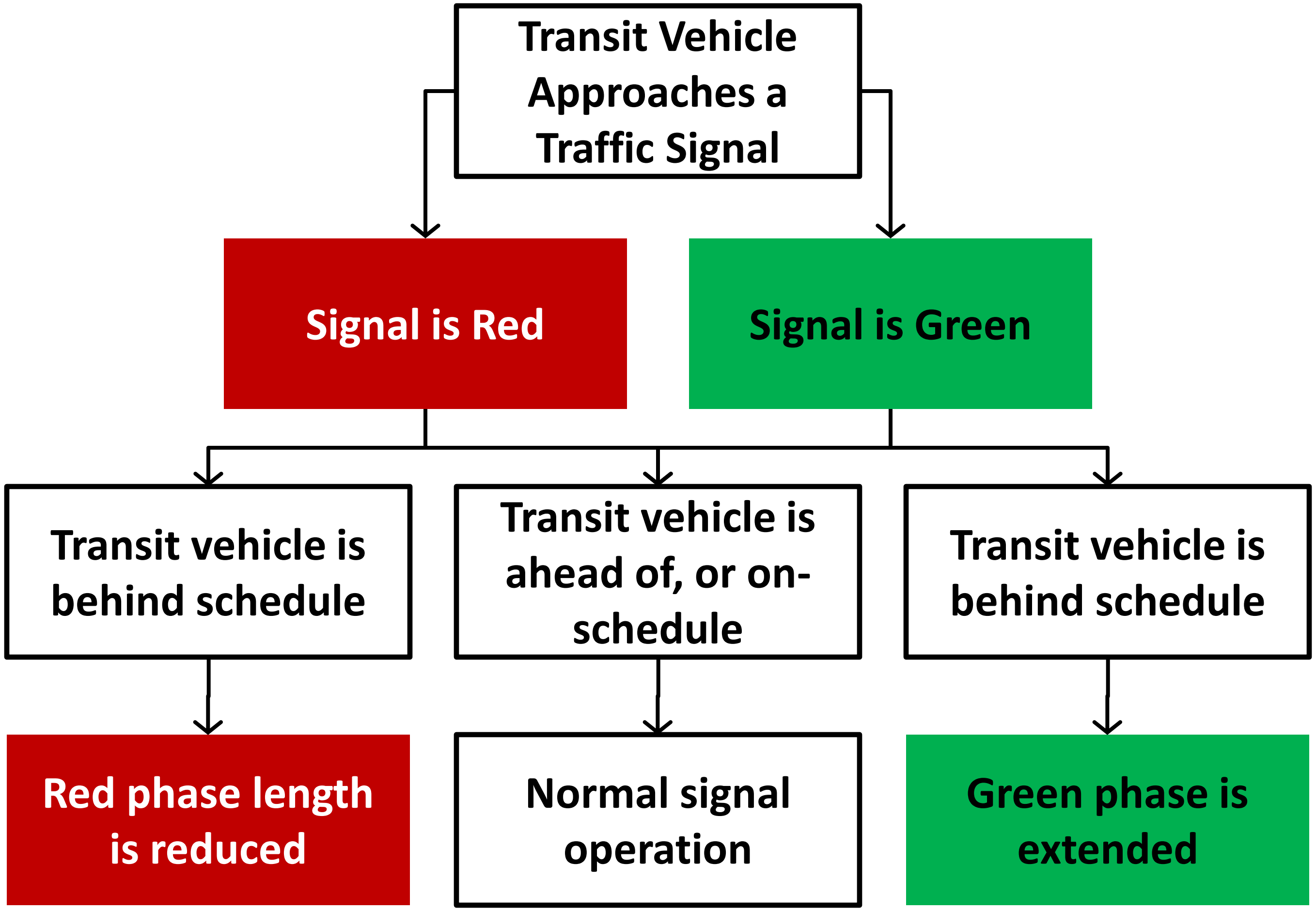
Overview of Transit Signal Priority (TSP)



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NEAR SIDE/FAR SIDE

- Transit vehicle stops before reaching the intersection
  - May create back-ups for traffic
  - May result in a double stop

Bus stop, Portland (Oregon)

- Transit vehicle stops after the intersection
  - Eliminates double stops
  - Can contribute to rear-end collisions

Healthline BRT runningway, Cleveland (Ohio)

Off-Board Fare Collection

- Fare collected before boarding
- Validated upon entering the station or through random enforcement
- Payment can be made using cash or credit/debit
- Decreases boarding time/stop dwell time
- Increases service efficiency
- Allows boarding through all doors


Off-board fare collection, Portland (Oregon)

BRT station, Curitiba (Brazil)

Median BRT station faregates, Bogota (Colombia)

Boarding through All Doors

- People can use any door to board the transit vehicle
- Decreases dwell time, increases service efficiency
- Typically reliant on off-board fare collection
- Common on rail and BRT services, less common on standard bus services

Metro Rapid Orange Line, Los Angeles (California)

Portland Streetcar (Oregon)

Mixed Flow: Transit Shares Lane with Traffic

Alameda-Contra Costa Transit District, Bay Area (California)

Alameda-Contra Costa Transit District, Bay Area (California)

- Low cost
- Simple to construct
- No advantage for transit
- Little incentive to attract new riders

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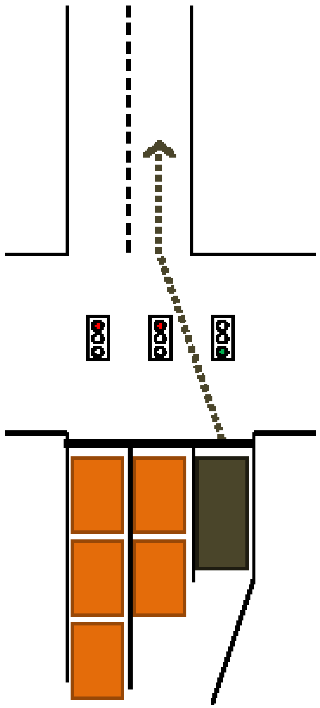
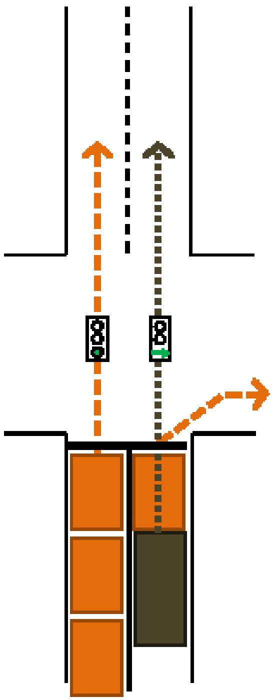
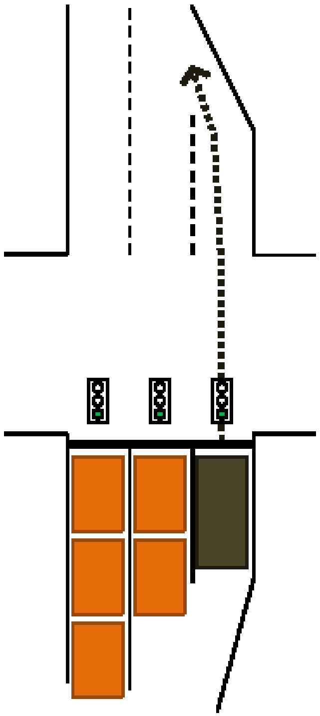
Queue jump lanes

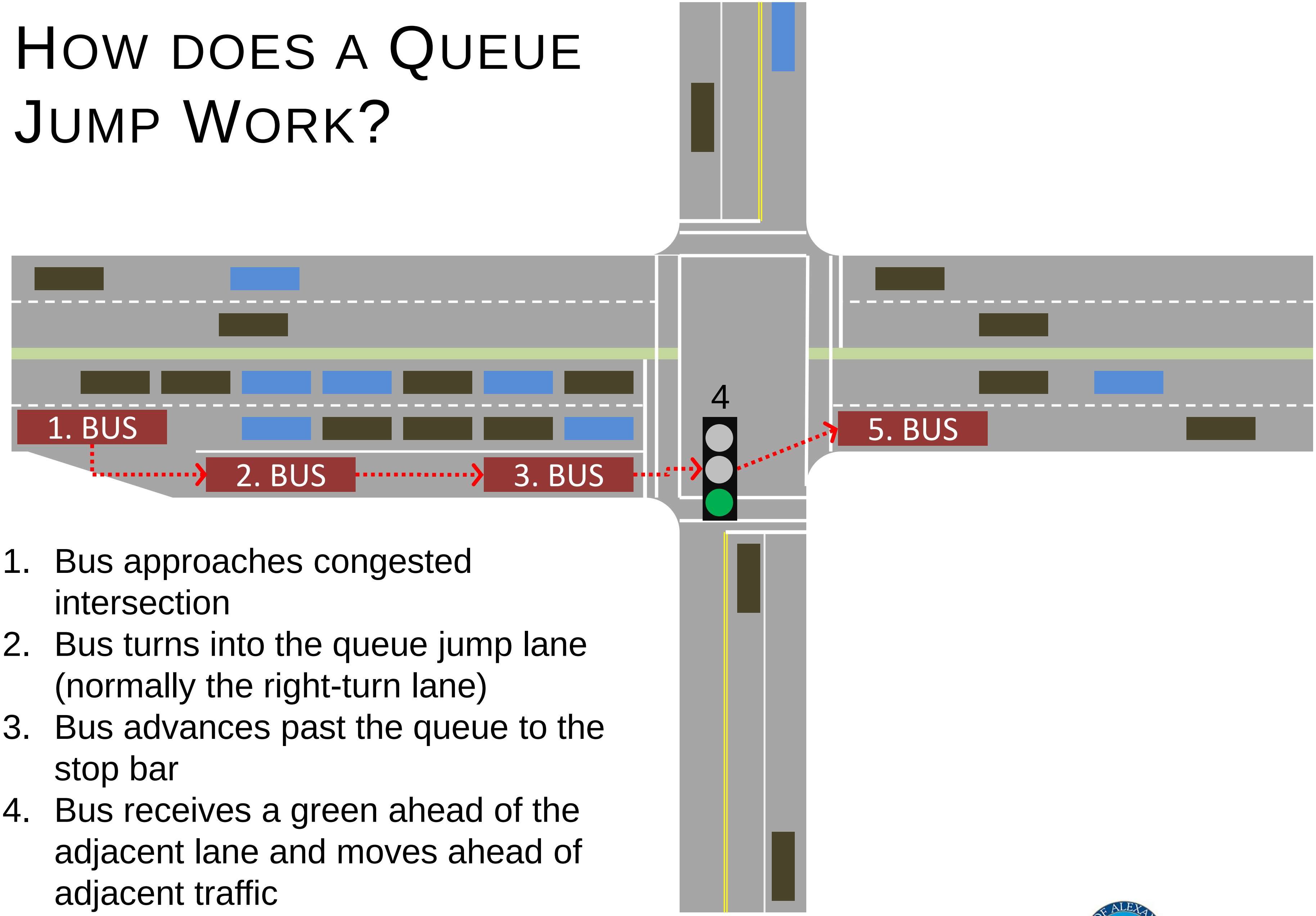
- Do not always require construction of additional lanes
- Allow transit vehicle to bypass stopped through traffic
- Can be operated in several different ways


Queue jump through advance green


Queue jump through transit vehicle exception


Queue jump using a far side merge lane

How does a Queue Jump Work?



1. Bus approaches congested intersection
2. Bus turns into the queue jump lane (normally the right-turn lane)
3. Bus advances past the queue to the stop bar
4. Bus receives a green ahead of the adjacent lane and moves ahead of adjacent traffic
5. Bus merges back into the through lane

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Dedicated Lanes: Separation from Traffic

Healthline BRT runningway, Cleveland (Ohio)

Bus stop, Portland (Oregon)

- Can be median or side (curb) or combination
- Allows transit to avoid traffic and congestion
- Minimizes blockages for transit and to auto traffic
- Improves transit performance and schedule adherence
- Reduces transit travel time
- Can be costly and disruptive to construct

Transit Facilities

- Basic stops
- Enhanced stops
- Support infrastructure
  - Catenary
  - Substations
  - Signaling
  - Maintenance and storage facilities

BASIC TRANSIT STOP

Bus stop, Toronto (Ontario, Canada)

Bus stop, Charlotte (North Carolina)

- Bench
- Shelter
- Lighting
- Service information
- Trash can
- Paved waiting area

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ENHANCED STOPS/STATIONS

- Purpose designed for a line or service
- Substantial shelter
- Larger waiting area
- Real time service information
- Off-board fare collection (optional)
- Climate controlled area
- Level boarding

MetroTransit Hiawatha Line, Twin Cities (Minnesota)

ENHANCED STOPS/STATIONS

Healthline BRT station, Cleveland (Ohio)

Emerald Express BRT station, Eugene (Oregon)

BRT station, Curitiba (Brazil)

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Support Infrastructure

- Maintenance and storage yards
- Traction power components
- Catenary


Traction power transformer, unknown location


Streetcar storage and maintenance facility, Seattle (Washington)


LA Metro LRT storage and maintenance yard, Los Angeles (California)

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and Associates, Inc.

CATENARY

Catenary, Bay Area California

MetroTransit Hiawatha Line, Twin Cities (Minnesota)

Streetcar line, Portland (Oregon)

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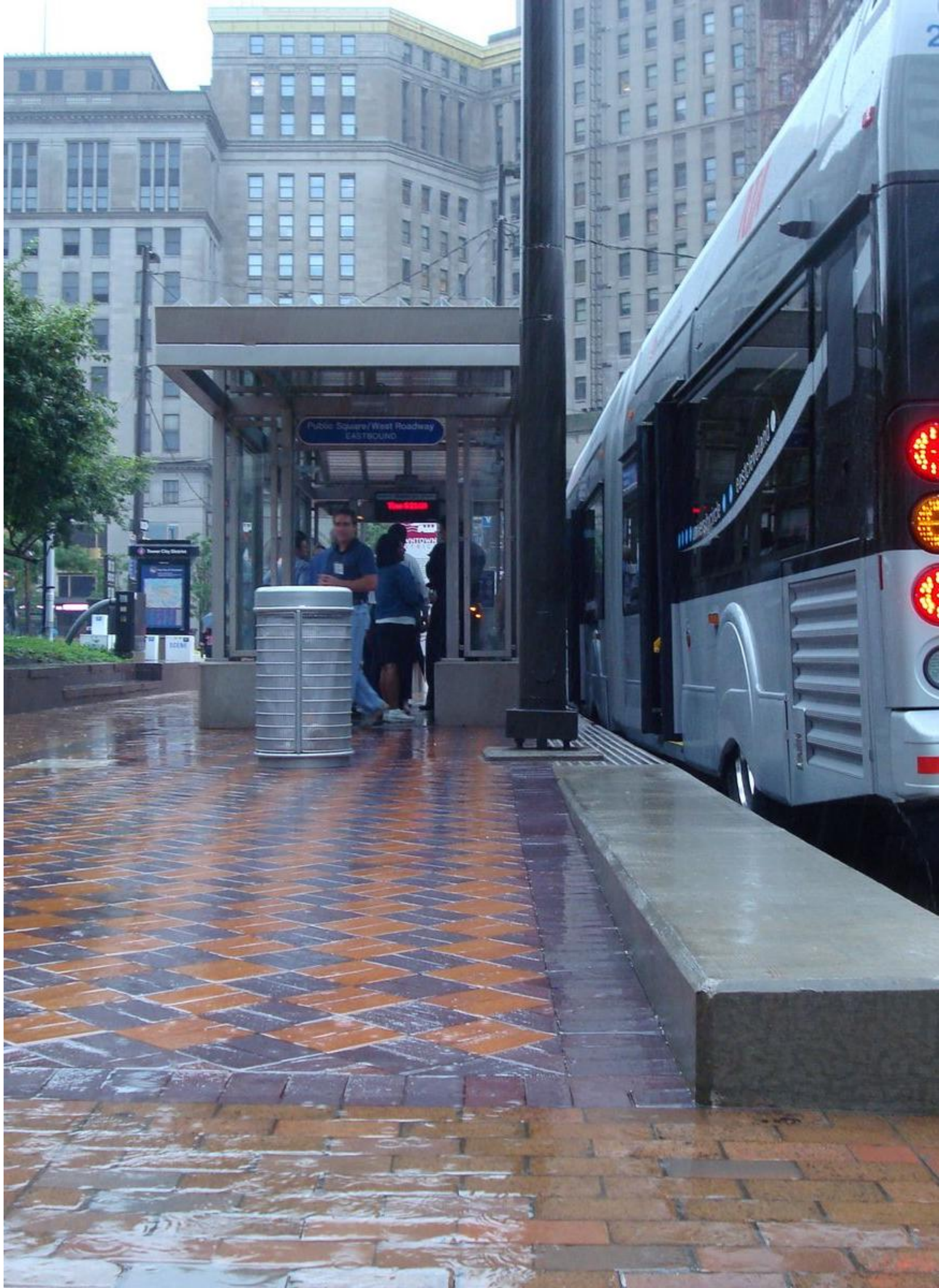
Integration into Urban Places

- Design integration
- Landscape & streetscape
- Multimodal considerations
- Traffic operations



Healthline BRT, Cleveland (Ohio)

Design

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Pioneer Square transit station, Portland (Oregon)

DESIGN

Bus stop, Charlotte (North Carolina)

Bus shelter, Scotland (England)

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LANDSCAPE

- Green runningways
- Landscaped medians
- Catenary does not need to damage the tree canopy

Emerald Express BRT, Eugene (Oregon)

Healthline BRT, Cleveland (Ohio)

Emerald Express BRT, Eugene (Oregon)

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STREETSCAPE

Rail lines, Portland (Oregon)

STREETSCAPE

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Transit street, Portland (Oregon)

STREETSCAPE

CITY OF ALEXANDRIA VIRGINIA

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Bus stop, Portland (Oregon)

Multimodal Considerations: General

- Every mode may not belong on every street
- Alternative configurations warrant consideration
- Special signage, markings, and other measures can be used to improve the interaction between transit and other modes

Bikeway, Portland (Oregon)

MULTIMODAL CONSIDERATIONS: PEDESTRIANS

LUAS Streetcar, Dublin (Ireland)

Streetcar, Seattle (Washington)

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MULTIMODAL CONSIDERATIONS: BICYCLES

Cyclist on rail line, Portland (Oregon)

Traffic Operations

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- Rail vehicles can share space with cars, bicycles, buses, trucks, and pedestrians
- Signage, pavement markings, signaling, and enforcement are required

Streetcar, Portland (Oregon)

Typical Signage


LRT signage, Norfolk (Virginia)

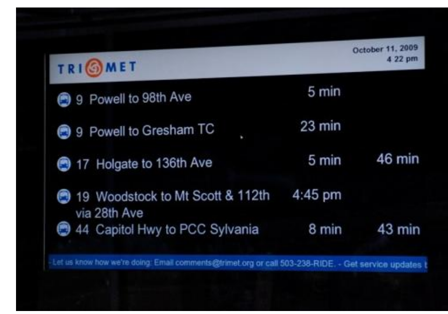
LRT signage, Norfolk (Virginia)

PARKING AND TRANSIT

Transit street, Portland (Oregon)

Service Delivery

- Governmental entities
- Local & regional authorities/agencies
- Commercial providers



Transit Overview

MODES | OPERATIONS | FACILITIES | URBAN PLACES

Kimley-Horn and Associates, Inc.

Introduction

The following briefly describes the general characteristics of transit modes commonly found in metropolitan areas across the United States. Table A.1 summarizes key features, considerations, and elements of each mode described. Descriptions and explanations of elements for different modes are described in further detail below.

Transit Modes

Local and Express Bus Services

Local and express bus transit services rely on relatively large multi-passenger buses of many different types, sizes, ages, and manufacturers. Local and express bus services typically operate within the stream of traffic along specific routes and are very common in urban, suburban, and some rural areas. The locations where local and express bus services stop are commonly referred to as bus stops and can provide information and accommodations for passengers that include the following:

- Paved waiting area and sidewalk
- Crosswalk
- Shelter, bench, trash can, and/or lighting
- Route information and stop marker
- Weather protection from landscaping or a man-made structure

At key locations along local and express bus service routes, additional facilities also may be provided to better accommodate bus operations and passengers. Local and express bus services have the flexibility to accommodate varied physical, operational, and demographic (market) conditions. Common operating strategies for local and express bus services include:

- Fixed Route, Loop Service. Bus follows a looped path within a specific area or between two points.
- Fixed Route, Line Haul (including express). Bus follows a designated route between two points and makes numerous (or few, if express) stops between the two points.
- Flex Route and Route Deviation. Bus generally follows a fixed route; however, at the request of passengers, the service can deviate (within a specific distance) to better accommodate boarding or alighting.

Differing from local bus services, express and commuter bus services typically operate during limited periods of the day. They typically run only during peak travel periods in the peak direction of travel. Many commuter and express services do not provide service in the off-peak direction of travel. Express and commuter bus services are often commonly operated by private operators or regional agencies. Express and commuter services are typically structured to minimize overall travel time between a limited number of specific points. For example, a commuter or express service may stop at one to two park-and-ride facilities and then travel without stopping to one to two destinations.

Alameda-Contra Costa Transit District, California

Table A.1: Summary of Elements of Different Transit Modes

Element	Transit Technology							
	Standard Bus			Bus Rapid Transit			Streetcar	Light Rail Transit
	Loop	Line-Haul	Express	Rapid Bus	Light BRT	Full BRT		
Typical Service Area	Urban/ Suburban - specific area	Urban/ Suburban - corridor	Urban/ Suburban - point-to-point	Urban/Dense Suburban				
Running way	Mixed		Mixed (may have queue jump lanes)	Mixed (may have queue jump lanes)	Mixed & Dedicated	Mostly dedicated	Mixed	Dedicated
Vehicle	Standard bus			Bus (may use special "branded" vehicles)	Special bus (low floor, branded, rail like)		Railcar (low floor)	Railcar
Operating Speeds	Low	Moderate	Moderate	Moderate	Moderate-high	High	Low to Moderate	High
Typical Frequency (headway)	Varies Widely			10 (peak) and 15 minute (off-peak)			15 minute (minimum)	
Stops/ Stations								
Spacing	1 to 2 city blocks to 1/4 mile		1/2 mile or more	1/4 to 1/2 mile (approximate)			1 to 2 urban blocks (or more)	1/2 to 1 mile (varies according to density)
Facilities	Bus stop			Enhanced bus stop	Purpose-built stop with extensive amenities	Substantial station	Purpose-built stop with extensive amenities	Substantial station
Amenities	Signs, benches, lighting, trash can, shelter, paved waiting area, route information, crosswalk, and similar			Signs, benches, lighting, trash can, shelter, paved waiting area, route information, crosswalk, off-board fare collection, bicycle parking, real-time service information, wayfinding, and landscaping				
Fare Collection	On-board			On-board (may use off-board)	Off-board (may use on-board in limited instances)			
ITS	Limited (some online/handheld-based arrivals information and limited transit signal priority)			TSP	TSP and real-time arrivals information	Signal preemption, TSP, and real-time arrivals information		
Accessibility	Lift likely to be required at most stops			Level boarding at most stations/stops				
Cost	Low	Low	Low	Moderate	Moderate-high	High	High	Very High
Branding	System-level (unless circulator)	System-level (unless circulator)	System-level	Some	Route or service-specific			
Development Incentive	Limited	Limited	Limited	Some	Moderate	Considerable		
Operational flexibility	High		Moderate	Moderate	Limited		Little-to-none	
				Extensions and branched services possible with possible operational compromises				
Implementation Horizon	Short	Short	Short	Short to moderate	Moderate		Moderate to long	Long

Source: Kimley-Horn and Associates, Inc., 2010.

Los Angeles Metro Orange Line BRT (left)
Cleveland Healthline (above)

Bus Rapid Transit

The term bus rapid transit (BRT) refers to an integrated system of facilities, equipment, services, and amenities that improve the speed, reliability, and identity of rubber tire transit. Unlike standard bus services, BRT generally operates in dedicated or preferentially treated running ways. These running ways, whether for the exclusive use of transit vehicles or shared with other traffic, typically provide priority treatments that reduce bus travel times.

In many respects, BRT incorporates operational efficiencies similar to those used by more expensive rail transit technologies such as light rail transit (LRT) and streetcars with greater operating flexibility and significantly lower costs. For planning purposes, BRT can be grouped into the following based on level of investment and system elements:

- Rapid Bus. Typically the least cost to implement of BRT modes, rapid bus often operates in shared travel lanes and may benefit from transit signal priority, dedicated/specifically designed stops, and improved waiting passenger amenities. Vehicles may be specifically branded; however, this is not a requirement.
- Light BRT. This type of BRT may operate partly or entirely in dedicated lanes. Where it does not operate in a dedicated running way, special features such as queue jump lanes may be provided at intersections to reduce delays and improve performance. This type of BRT almost always includes transit signal priority at intersections and dedicated/specifically designed stops/stations. It may utilize off-board fare collection and usually has improved passenger waiting areas. Vehicles may be specifically branded; however, this is not a requirement.
- Full BRT. This type of BRT operates similar to the way light rail transit operates. It typically runs mostly or entirely in dedicated lanes (or a running way) and benefits from transit signal priority treatment. High Investment BRT typically includes permanent station facilities at stop locations that include passenger accommodations similar to those provided at light rail stations. Vehicles are typically specifically branded in this type of BRT and often closely resemble rail cars in their appearance.

Example of a typical BRT vehicle (NABI)

Example of station signage and system branding (Los Angeles Metro)

Portland Streetcar (both images above)

Streetcar

Streetcars are lightweight electric (some are hybrids) rail vehicles that operate along high-demand transit routes or within areas with multiple closely-spaced destinations. Streetcars can run in exclusive running ways or in mixed travel lanes. Streetcars have low floors and are designed to load and unload passengers quickly and efficiently. Their low-floor design in combination with appropriately designed stations (for level boarding) makes them highly accessible to people with mobility impairments without the use of a lift or ramp. Similar to any other rail vehicle additional cars can be added to a train (within practical limits) to increase capacity.

The right-of-way required for a streetcar has the potential be less than that of light rail transit (LRT) due to the narrow width of cars and more modest station requirements. Streetcar stops are often integrated with streetscape or median treatments and frequently offer shelters, lighting, benches, landscaping, off-board fare collection, a service-specific identity, and level boarding.

MetroTransit (Twin Cities) Hiawatha Line

Light Rail Transit

LRT is a form of public rail transportation that has lower capacity than heavy rail and subway systems, but more capacity than bus or streetcar systems. LRT generally operates in exclusive running ways that are physically separated from traffic; however, LRT can operate in mixed traffic. LRT generally has a lower stop density (longer distance between stops) than bus, BRT, or streetcar systems and is capable of traveling at higher speeds, which makes it more appropriate for longer distance trip making. Since LRT often operates in corridors separate from traffic and not as constrained by urban block lengths, trains can be of greater length than streetcars. Less constrained by traffic conditions and vehicular congestion, LRT has the potential to operate efficiently in congested corridors.

Typical Transit Vehicle Capacities

Table A.2 shows the observed range of person capacity for different types of transit vehicles.

Table A.2: Transit Vehicle Characteristics

Vehicle/ Characteristic	Regular Bus	Articulated Bus	40-foot BRT Bus	60-foot BRT Bus	80-foot BRT Bus	Streetcar	Light Rail Transit
Length	40 feet	60 feet	40 feet	60 feet	80 feet	66 feet	80 to 95 feet
Width (including mirror)	10 to 10.5 feet	10 to 10.5 feet	9.5 to 10.5 feet	9.5 to 10.5 feet	9.5 to 10.5 feet	8 feet	8.75 feet
Height	10 to 11 feet	11 to 12 feet	Varies	Varies	Varies	12 feet (without pantograph)	12.5 feet (without pantograph)
Ground to Floor Height	2.3 feet	2.3 feet	1 to 3 feet	1 to 3 feet	1 to 3 feet	1.15 feet	2.2 to 3.3 feet
Seated Passenger Capacity	40 to 45 pax	65 pax	35 to 40 pax	60 pax	40 to 70 pax	30 pax	60 to 65 pax
Maximum Passenger Capacity	65 to 75 pax	100 to 120 pax	55 to 70 pax	90 to 110 pax	110 to 130 pax	170 pax	230 pax
Source: TCRP Report 90 and 100							

Cleveland Healthline. Median running full BRT

System Elements

The following section briefly describes key elements included along routes of different transit modes. The section is organized into the following subsections:

- Running ways and lane use
- Intelligent transportation systems (ITS)
- Spot and section measures
- Transit stops and stations
- Fare collection
- Transit vehicles

Runningways and Land Use

Mixed Travel Lanes

Mixed travel lanes provide no priority to transit vehicles in terms of space allocation. The mixing of transit vehicles and other vehicles reduces speeds for transit and increases travel time. Transit vehicles stopping to allow passengers to board or alight impedes automobile traffic.

Dedicated Transit/HOV Lanes

This type of lane is designated for use by transit vehicles, high-occupancy (HOV) vehicles, emergency vehicles, and limited turning traffic only. Some jurisdictions also permit motorcycles or taxis to use HOV lanes. HOV lanes can provide for vehicular flow in the same direction as general traffic or in the opposite direction. In some cases, HOV lanes are used in peak periods only and are available to any vehicles during other periods.

Dedicated Lanes

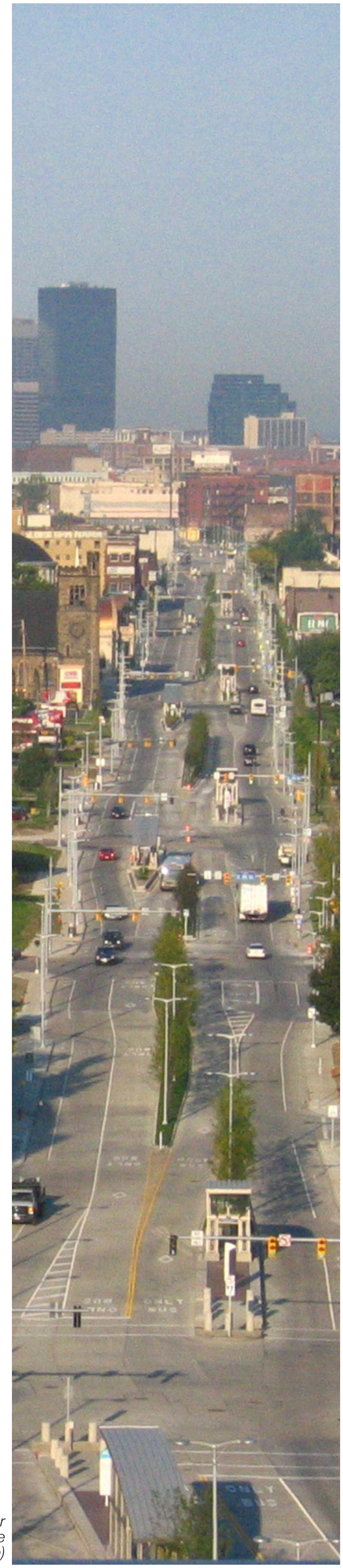
Travel lanes for the exclusive use of transit to support optimal operating conditions for transit vehicles. Dedicated lanes are differentiated from general purpose travel lanes through the use of physical barriers, pavements, signs, and pavement markings. Dedicated transit lanes typically remain under signal control. The three primary types of dedicated lanes include the following:

- Median running. Lanes are located within the median of a roadway. (Figure A.1).
- Side running. Lanes are located along the outer curb of a roadway (Figure A.2).
- Grade-separated. The running way does not have at-grade intersections.

Advantages and disadvantages of dedicated side-running and median lanes are briefly summarized in Table A.3.

Combination of Lane Types

It is reasonable to expect and practical to plan on the use of a mixture of different lane types and uses. It is possible to implement a BRT or streetcar system that has dedicated lanes within a central business district or congested sections of a corridor, but operates in mixed traffic in lower-density or less-congested sections of the same corridor.



Median Runningway for the Cleveland Healthline (Cleveland, Ohio)

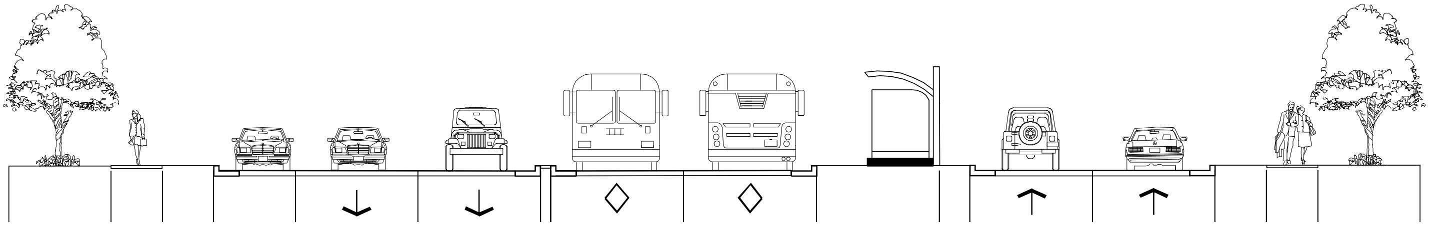


Figure A.1: Schematic Illustration of a Median Running Configuration

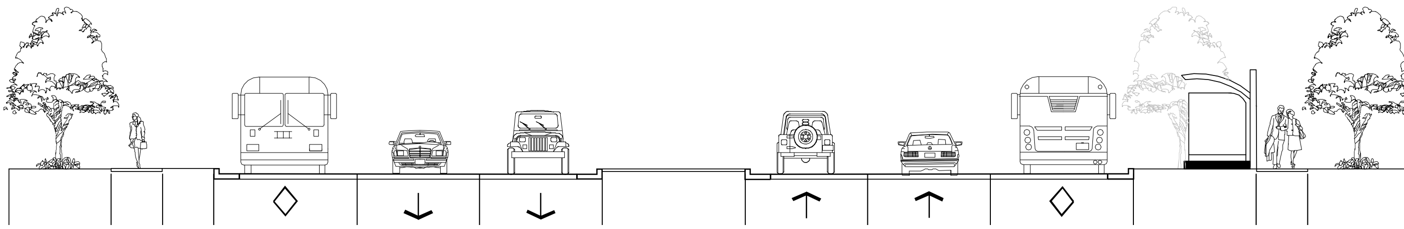


Figure A.2: Schematic Illustration of a Side Running Configuration

Table A.3: Comparison of Side Running and Median Transit Lanes

Lane Type	Advantages	Disadvantages
Side Running	Easier to co-locate BRT stations with local bus stops, since local buses already use the right lane. Transfers are facilitated.	On-street parking, if it remains, will partially conflict with bus movements.
	Allows use of standard vehicles with right-side boarding.	BRT lane is interrupted by right-turning vehicles at intersections.
	Stations are located outside the traveled way; patrons may feel safer waiting at the side of the road near pedestrians and businesses, rather than in the center of the road.	Requires two separate stations at each stop (one for each direction) and, therefore, greater infrastructure cost than "center" (or single) median stations. Infrastructure costs are similar or somewhat less than median transitway with side median (or two) platforms.
	Easier access to stations and stops.	
	Lane is shared with local bus services.	
Median Running	More efficient use of space at stations since buses can board from both sides of a single center platform.	Requires contra-flow configuration with buses traveling on the left side of the centerline, unless specialized left-boarding vehicles are used.
	Eliminates conflicts with right turns, parking maneuvers, and bicycles. Easier to implement completely dedicated transit lanes as opposed to shared lanes with general traffic.	Depending on available space, may require reduction or elimination of landscaped medians.
	Single "center platform" station serves both directions of travel, and station costs are lower for both initial construction and ongoing maintenance. Left side boarding and alighting buses are required.	Requires all patrons to make a street crossing to reach the station or to connect from local buses.
	Double platform "side median" stations can be served with conventional right side boarding and alighting buses.	Has higher construction and maintenance costs than a single "center platform" and similar or somewhat more than side running transit lanes and stations.
	May be more acceptable to the business community since stations are not located in front of businesses.	Typically, the existing median width is already being used for left-turn pockets. The median transit lane would either remove the left-turn lane or relocate it. Removal of the left-turn lane can cause backups and safety concerns for the adjacent through lane. Left turns across a transit lane can cause line-of-sight difficulties and safety issues. Some left-turn lanes may need to be closed, which would concentrate access at fewer intersections.

Source: Kimley-Horn and Associates, Inc., 2010.

Intelligent Transportation Systems

Traffic Signal Coordination

Traffic signal coordination is an important measure that can be implemented and significantly reduce transit travel times and improve service reliability. The coordination of signals improves the overall flow of general traffic and is well received by most people in the community. It has environmental benefits that include improvement to air quality, reduction in vehicle noise, increase in user safety, and reduction in traffic congestion. Traffic signal coordination provides significant benefits at a relatively low cost and creates few negative impacts on the community.

The implementation of traffic signal coordination in a corridor or for a system typically consists of the creation of a physical connection between traffic signal controllers (conduits with wires, fiber-optic cables, or wireless communications) along a contiguous roadway segment or within an area. After sufficient hardware is installed, traffic signal timing plans are designed and implemented to most efficiently move peak direction vehicular traffic through intersections and along the corridor. Timing plans are designed to minimize delays for off-peak direction traffic to the extent possible.

Transit Signal Priority and Preemption

Transit signal priority (TSP) is a technique used to reduce delays for transit vehicles created by red traffic signals. The most common form of TSP, known as “green time extension/ red truncation,” consists of traffic signal modifications to allow the signal controller to recognize the presence of an approaching bus and adjust signal timings to efficiently advance the bus through the signal. Generally, the following conditional signal timing logic is used after an approaching bus is detected by a traffic signal:

- Signal is currently green, but about to turn red. The controller adds a few seconds of extra green time (extends the green) to allow the bus just enough time to move through the intersection. The controller then returns to its normal timing program and runs through the remainder of the signal cycle.
- Signal is red. The controller begins the process to truncate the red phase for the approaching bus. Upon cycling through appropriate clearance intervals, the signal presents a green indication allowing the bus (and other traffic) to proceed.
- Controller evaluates bus on-time performance. The controller determines whether the bus is behind schedule, on time, or ahead of schedule and responds accordingly by providing preferential treatment or normal treatment to the approaching vehicle depending on schedule.

The highest level of transit priority is full preemption. In this operating scenario, as soon as an approaching bus is detected, the signal automatically turns green. In practice this is seldom used due to the severe impact on general traffic and pedestrians who may be in the middle of a crossing.

Several forms of technology can be utilized in TSP systems to allow the controllers to detect approaching buses, but the most common type is the optical strobe system such as the Opticom system. Traffic signal systems along the corridor must have appropriate detector hardware and controller firmware to be able to recognize and respond to the approaching transit vehicle. If similar optical systems are already in use in the area for emergency vehicle preemption, all signals within line-of-sight of the transit line would need to be upgraded to allow them to distinguish transit vehicles from emergency vehicles. This system requires all transit vehicles to be outfitted with emitters.

Automated Vehicle Location (AVL)

AVL systems can be used to manage bus and BRT services. AVL is a computer-based system that enables transit agencies to perform real time vehicle tracking. With this information, the transit agency can make schedule adjustments and equipment substitutions to ensure more regular intervals between buses to improve reliability. Information collected through AVL systems can be shared with passengers in web-based applications that track the progress of individual buses and provide arrival information to waiting passengers. This information can be made available to any web-enabled wired or wireless device.

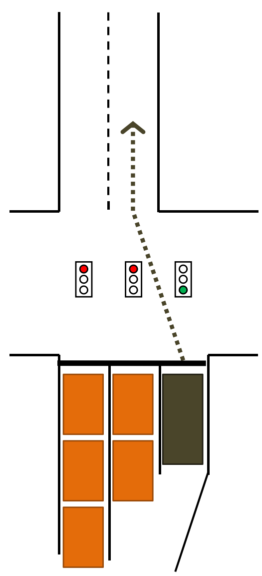
Spot and Section Measures

Queue Jump Signals and Lanes

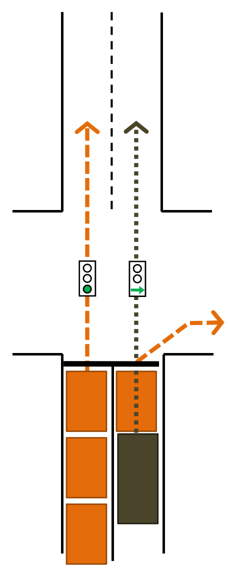
Queue jump lanes are a corridor improvement element that have the potential to significantly reduce running times along a corridor and improve schedule adherence. This measure allows transit vehicles operating in mixed traffic lanes to bypass the vehicle queue at an intersection and move up to the stop line. Through the use of an advance signal lasting a few seconds, transit vehicles in these lanes advance through the intersection ahead of adjacent traffic. The two most common forms of queue jumper lanes include the following:

- Transit only lane between the through lanes and the exclusive right-turn lane. This type of queue jump lane provides transit vehicles with an exclusive lane leading up to the stop line at the intersection. The presence of a transit vehicle within the lane actuates the signal to provide a transit only signal phase and allows transit vehicles to proceed through the intersection in advance of adjacent vehicles. To provide this type of queue jump lane may require increasing the right-of-way at an intersection to accommodate the additional lane. Since a separate lane is provided for the transit vehicle, the system can use conventional detector loops to alert the signal to the presence of a bus.
- Shared right-turn only lane with transit vehicles exempted from any through movement prohibition. This type of queue jump lane provides a right-turn signal phase to clear the queue in the lane when a transit vehicle is detected. It also allows transit vehicles to use the right-turn lane to avoid through traffic queues and obtain a transit-only signal phase to advance ahead of adjacent traffic. This form of queue jump lane requires some form of signaling device such as an optical transmitter to alert the controller to the presence of a transit vehicle. This type of queue jump lane is typically less costly to implement since it has less right-of-way impact. Though beneficial to operations, it may not provide the same level of benefit as the transit-only queue jump lane since transit vehicles still must wait behind vehicles turning right.

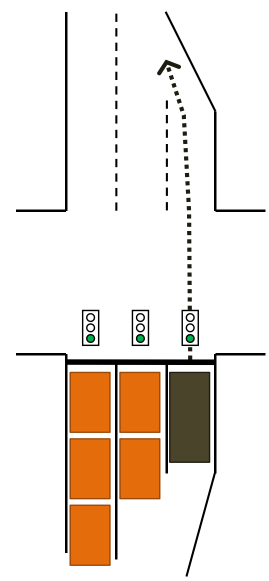
Queue jump lanes are effective marketing and branding tools due to their physical presence at intersections. People tend to take notice when a transit vehicle bypasses stopped traffic. The obvious benefit provided to transit in queue jump lanes serves to reinforce public awareness of the transit route as well as enhance public perception of transit systems as a rapid form of transportation. However, queue jump lanes require additional space at intersections that increases intersection crossing distances for pedestrians and bicyclists.



Queue Jump through Advance Green Signal. The transit vehicle receives a green signal indication ahead of adjacent travel lanes to allow the transit vehicle to advance ahead of the adjacent travel lanes.



Queue Jump through Transit Vehicle Exception. Transit vehicles are permitted (through signage and pavement markings) to travel through the intersection using the rightmost lane. All other traffic must turn right from the rightmost lane.



Queue Jump through Transit Receiving/Merge Lane. All traffic receives a green indication at the same time and a far side (of the intersection) merge lane is provided to allow the transit vehicle to return to the stream of through traffic.

High quality streetscape along a Portland street where transit runs

Transit Stations and Stops

One of the required features for FTA-funded Small Starts and Very Small Starts projects is the provision of "substantial stations." There is some flexibility in the interpretation of this term; however, it generally means that for BRT or streetcar systems, shelters that are larger and more attractive than standard bus shelters be provided. Shelters and other station amenities contribute to the "branding" of the project and the public perception of the system as a high-quality form of transit. By being highly visible, the stations also contribute to public awareness of the transit alignment.

Bicycle parking Reston, VA

Features of Stations and Stops

A variety of features can be incorporated into transit stations. The following list should be considered as a "menu" from which items can be selected depending on budget or quality goals:

- Passenger information displays or kiosks. Includes transit information or maps of the surrounding community.
- Bus arrival displays based on data from an Automated Vehicle Location (AVL) system. This advises passengers of the waiting time until the next bus arrives.
- Adequate station signage. This should have lettering large enough to be legible from inside the transit vehicle.
- Accessible boarding area. Must comply with the Americans with Disabilities Act (ADA) guidelines.
- Increased height curbs. Taller curbs to allow for level boarding (floor of bus approximately level with the platform area).
- Pedestrian access enhancements. Improved crosswalks, enhanced sidewalks, or additional curb extensions beyond those used for the station/stop.
- Bicycle access enhancements. Bike lanes, paths, and other facilities in the surrounding area.
- Bicycle storage enhancements. Lockers and racks at stops and in surrounding areas.

- Landscaping/street trees. Provide protection from weather and enhance the appearance of stops/stations.
- Curb extensions. These would be the width of the parking lane. They effectively move the curb line out to the edge of the right-most through lane or transit-only lane. They allows transit vehicles to stop at stations and return to traffic without having to pull over or merge. Curb extensions also afford the opportunity to transition to transit vehicle floor-level curb heights if level boarding is being used. Curb extensions also provide extra space for station facilities.
- Separate boarding areas for different services. Local buses should not stop at BRT, streetcar, or LRT platforms since they usually lack provisions for expedited boarding and could delay the other transit service.
- "Substantial" station structure. This mandatory project element under some federal funding requirements is usually a purpose-designed shelter unique to a corridor, service, or area and provides refuge, seating, and accommodation for mobility impaired persons. Station structures also can accommodate other desired elements at stops such as lighting, trash cans, information displays, and real-time service information.
- Ticket vending machines. Prepaid fares result in significantly faster boarding and reduced dwell times for transit vehicles. Customers find off-board payment for transit fares to be convenient since they often have the ability to pay by credit/debit or cash and make change. The presence of fare vending machines adds to the overall impression of permanence of a transit service.
- Ticket validation devices. These may be required as a result of the fare collection system.

Station/stop structure for TransMilenio (Bogota, Colombia)

Real time service information (Portland, Oregon)

Ticket vending machine (San Diego, California)

Far side (of the intersection) bus stop in Cleveland along the Healthline BRT

Near-side bus stop and bus bay (Portland, Oregon)

Far-side Bus Stop Locations or Near-side Locations with Countdown Clocks

In most cases, to maximize travel speed, the preferred location for transit stations and stops is on the “far side” of intersections. In other words, the stop is located beyond the intersecting street, in the direction of travel. The far-side location allows the transit vehicle to take advantage of a coordinated signal system and TSP before stopping.

By comparison, at near-side stops, a transit vehicle may stop to load passengers while the signal is green, only to have the signal turn red just as the vehicle is ready to move. An additional disadvantage of near-side stations is potential conflicts with right-turning vehicles that must turn directly in front of the stopped vehicle or wait while the transit vehicle stops twice, once to load/unload passengers and again when the signal turns red.

In spite of the preference for far-side stations, there are some locations where local conditions require a near-side stop. These include locations where there is a major traffic generator on the near-side corner or where right-of-way conditions or obstructions make it impractical to locate the station on the far side. In these cases, the use of a countdown clock is recommended. A countdown clock is a digital display showing the number of seconds remaining in the red signal. This allows the driver to prepare for immediate departure and to move forward to the stop line. In many locations, this function is served by countdown-style pedestrian signals displays.

Types of Stations and Stops

Along the most uniform transit corridors, each station or stop is likely to experience unique circumstances attributed to physical conditions and transit users themselves. Stations along the transit system are often generally defined by level of investment as basic, moderate, and high-level. The key within basic and moderate stations is to build in the flexibility with the initial design to ensure that they can eventually be upgraded as demand dictates.

Generally station/stop design should reinforce continuity along the transit corridor and provide distinguishable features reflecting the character of the surrounding community. The consistent recognizable style of the stations is a key element of system branding and public awareness of a transit service alignment. Many transit properties choose to include some form of public art or other unique element at each stop to tie in to neighborhood themes.

Certain features and amenities, once installed at a single station or stop should be considered for systemwide implementation, such as transit vehicle arrival technology. With some exceptions to take demand and location into consideration, the level of investment at stops and stations should be consistent along a corridor.

The following “stop,” “basic station,” “moderate station,” and “high station” descriptions are points of reference in a wide range of possible station and stop types and levels of amenity.

- Stops. The term “stop” is typically used to describe the locations where standard bus services pick-up and discharge passengers. The term “stop” is not usually used to describe the locations where BRT, streetcar, or LRT services pick-up and discharge passengers. Stops provide a minimum level of amenity and include a shelter, signage, paved waiting area, trash and recycling receptacles, wayfinding signage, and landscaping.

Bus Shelter
(Vancouver, Canada)

Bus Shelter
(Toronto, Canada)

Transit Station (Portland, Oregon)


Transit Station (Eugene, Oregon)

Hiawatha Line (Twin Cities, Minnesota)

- Basic stations. These provide a minimum station level of amenity and include a shelter, lighting, system signage, special paving, trash and recycling receptacles, wayfinding signage, landscaping, and ticket vending machines (assuming off-board fare collection). Basic stations are generally recommended where stations are integrated into existing sidewalks without a curb extension.
- Moderate stations. These provide a higher level of amenity and include a substantial shelter, system signage, upgraded paving, trash and recycling receptacles, real-time traveler information, wayfinding, landscaping, additional seating and lighting inside and outside of the shelter, and ticket vending machines. Moderate stations may include an extended or secondary shelter for locations experiencing higher passenger volumes. Moderate stations are generally recommended for locations where curb extensions or a wide pedestrian realm is available. They also are generally recommended for segments where dedicated lanes are provided and boardings exceed the capacity of basic stations.
- High investment stations. These provide the highest level of amenity. This type of station is placed at locations with the highest ridership and visibility. Amenities and elements at high investment stations include those described for moderate and basic stations as well as purpose designed shelters, system signage, significant hardscape and landscaping, an information kiosk, and other functional and decorative features. High investment stations are generally recommended for the busiest locations and are able to accommodate more than 15 to 20 people per transit vehicle arrival.

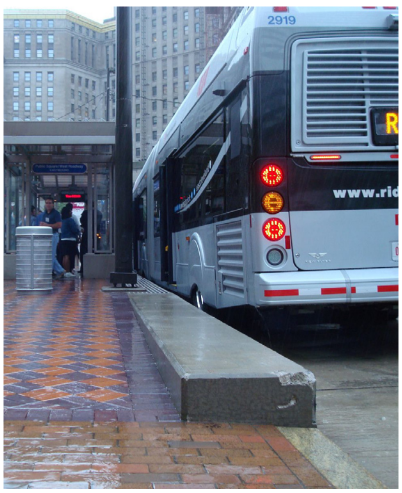
Fare Collection

Physical modifications and transportation system technology can provide operational benefits along a transit corridor. The use of alternative fare collection methods also can improve running time by reducing vehicle dwell time at stations through more efficient collection of passenger fares. The discussion of alternative fare collection methods most often centers around the use of electronic payment (on or off a vehicle) through the use a card, fob, or similar device and off-board fare collection.

Exact delay reduction as a result of alternative fare collection methods depends on a number of factors. A number of methods of alternative fare collection are available and include:

- Standard monthly passes. These are a form of off-vehicle fare collection in that the customer has effectively paid for their trip prior to boarding a vehicle. The use of this method typically does not require any or a substantial investment since the distribution network for passes already exists in most locations.
- Ticket vending machines (TVMs). These are typically located at stations and allow patrons to purchase a ticket before boarding. An advantage of this system is that it allows the use of credit or debit cards, eliminating the barrier to ridership that results from the requirement for customers to have exact change. Not having to have exact change can be highly attractive to "choice" riders. The cost of installing TVMs is significant (around $50,000 or more per machine) and a centralized communications system is required, including a central processing center and either a fiber-optic or wireless link to each station to transmit payment data. Additional operating costs can be expected with this type of system due to the need to service TVMs and collect cash. These costs have the potential to be partially offset by increased ridership and ticket sales. The availability of TVMs also adds to the image of BRT systems as a "rail-like" form of transit.
- Smart cards. For many urban transit systems, the use of "smart cards," which are proximity cards containing embedded computer chips for processing fare information, are becoming the standard. Cards can be sold at retail distribution locations, through mail order, or via TVMs. To accept these cards, transit vehicles need to have a validation device near the entry (or entries). This allows boarding passengers to wave (or tap) their card near the reader without stopping as they walk onto the vehicle. The decision to implement a smart card system carries with it a significant investment that has benefits and costs affecting the entire transit network. Smart cards or similar technology are rarely implemented along a single transit line.

All of the above off-vehicle fare collection methods can involve an operational-oriented decision by the transit agency as to whether or not multiple door boarding will be allowed. Using all available doors for boarding provides the fastest boarding time by allowing passengers to disperse themselves to multiple entry points rather than forming a single queue at the front door. The use of multiple door boarding usually requires roving inspectors to check for fare compliance, which adds to operating costs. The alternative is to require all passengers to enter through the front door, which allows the driver to check for fare compliance, but with a penalty of somewhat longer boarding times.



Examples of line and system-specific vehicles, AC Transit (top), Healthline (center), and eMX (bottom)

Transit Vehicles

Transit vehicle choice can be an important strategy to increase ridership, improve system performance, and mitigate negative environmental impacts. Propulsion systems, vehicle interiors, and type of boarding and door configuration impact dwell time at stations, travel time, and passenger comfort. Transit vehicles can be a primary marketing device in attracting a "choice" rider.

- Propulsion System. Options include diesel, hybrid, and electric propulsion systems. The type of system affects sound levels, service times, emissions, and operating and maintenance costs.
- Interior of Vehicle. Options to improve the interior of the transit vehicle include better and more energy-efficient lighting, climate control, sound reduction technology, and seating. Physical vehicle size; aisle width; and the number, width, and arrangement of doors influence transit vehicle capacity.
- Level Boarding and/or Low-Floor Vehicles. The use of level boarding and/or low-floor vehicles can reduce station boarding time by about 20 percent compared to standard high-floor vehicles. Additionally, it is a required project feature for any system that desires to use FTA Small Starts or Very Small Starts funding. Level boarding usually involves constructing curbs at the station site that are somewhat higher than standard curbs (from 8 to 14 inches is typical) so that the elevation of the boarding platform is nearly level with the floor of the entry door on the vehicle. This facilitates easy entry for able-bodied passengers. Wheelchair users may still require a ramp to be extended to the platform; however, the use of a lift is usually not necessary in a level-boarding configuration since the elevation difference is small. Most contemporary buses that do not have stairs at their entries could be classified as "low-floor" buses.

  Other features can be incorporated in vehicles or stations to further improve the walking surface at entry doors. These include magnetic, optical, or mechanical guidance systems to maneuver the vehicle as close as possible to the curb. These measures add cost to the system, but the most sophisticated installations may achieve ADA-compliant transit vehicle access without the use of mechanical ramps or lifts.
- Vehicle Doors. More and wider doors allow for more efficient loading and unloading. As mentioned previously, the use of all doors for boarding and alighting is a significant decision for transit properties and has the potential to provide significant benefit and carry cost in its implementation.
- Vehicle Capacity. Vehicle capacity is highly dependent on vehicle length and interior configuration. General vehicle characteristics are summarized in Table A.3.

Passenger Information Systems

Passenger information systems provide patrons or prospective patrons the ability to access both static and real-time information on transit services. Relatively recent advances in the provision of real-time service information allow people the opportunity to make informed decisions on how and when they will travel and when they need to leave an origin to reach a transit stop. In the past, real-time service information was limited to permanently mounted dynamic message boards and web sites accessible only by desktop and laptop computers. Today, real-time service information is delivered through the aforementioned means as well as through web-enabled handheld devices at system and stop/station levels of specificity.

Pretrip Information

Telephone and web-based information systems can allow patrons to obtain static (published) and real-time schedule and service information. AVL systems provide the data behind real-time information delivery systems that passengers access from web-enabled devices. Real-time information often includes transit vehicle arrival estimates (length of wait based on selected stop location) and vehicle tracking information.

Service information display (Portland, Oregon)

Stop and Station Information

Real-time information also can be provided at bus stops and stations using dynamic message boards and through other dynamic displays. Many transit systems are providing real-time information for locations without dedicated displays through the internet to personal web-enabled devices such as laptop computers and mobile phones.

On-Vehicle Information

On-vehicle information systems can be used to automatically announce approaching stops, upcoming transfer opportunities, and nearby local attractions to provide advance information to riders. Providing riders information in advance of stops has the potential to reduce stops/station dwell time by decreasing the duration of passenger indecision during stops.

LA Metro Rapid Bus (Los Angeles, California)

MaxBRT (Kansas City, Missouri)

Transit market pedestals
Los Angeles (top)
Washington, D.C (right)
Portland (bottom)

System Branding and Identification

Special vehicles and stations provide a unique opportunity to create an identity (or brand) for special transit services, routes, and modes. While branding is important to a system to announce its presence, it is equally important in allowing casual and otherwise unfamiliar transit users to identify the system or service easily. Branding typically involves the implementation of a specific design standard for running ways, shelters, support facilities, information, and transit vehicles.