Triangle Regional Transit Program
our transit future

Service & Technologies

APRIL 2008

Light Rail Transit (LRT)

A Technology Brief

Description

Light Rail Transit:

- Operates on tracks (fixed guideway) that can be in an exclusive corridor or dedicated lanes on streets
- May be operated in corridors with freight railroads by complying with Federal Railroad or Federal Transit Administration regulations; time separation and/or specific distances between freight and LRT will be required
- Vehicles are powered by overhead electrical wires (catenary) and designed to operate as permanently fixed, flexible (articulated) pairs or with up to 6 cars linked together to support peak and off peak passenger loads

Typical Service Characteristics

Corridor lengths: 5 to 20 miles

Station spacing: ¼ to 2 miles

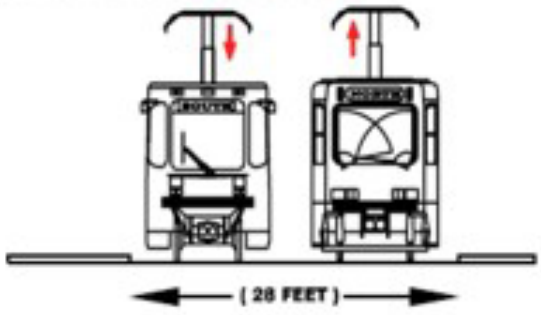
Service frequency: 5 - 15 minutes peak
10 - 20minutes off peak/weekends

Average operating speed: 15 - 30 mph

Maximum speed: 65 mph

Vehicle capacity: 40 - 60 seated; up to 125 with standees
articulated pairs - 72 seated; up to 150 with standees

Typical Cross Section



Typical at-grade cross section requires at least 28 feet of track way. Wider sections are needed at stations and passing tracks.


Photo Credit: Regional Transportation District—Denver

Typical Costs

Capital: $25 - $60 million per mile (double track) (Exact costs contingent on environmental constraints, operating agreements, number of stations at, above or below grade, land/right-of-way costs, topography and other site specific design considerations.

Operating: $230 per hour per train, which may be one rail car or several linked rail cars.

Important Notes

1. Funding to purchase rights-of way for LRT corridors and land for stations will vary greatly, depending on the corridor and station locations, availability and current uses; options for use of existing rights-of-way; prior reservation or dedication of a corridor, public or private property for transit and other site specific factors.
2. LRTs may operate in roadway medians where transit patrons access the platforms using crosswalks at intersections; in lanes adjacent to one or both sides of the street or in exclusive rights-of-way.
3. Stations may be platforms and shelters in medians; shelters along sidewalks or include bus transfers and park and ride areas

Land Use and Light Rail Transit (LRT)

LRTs are used to provide high frequency rail transit service. Stations in the urban core are spaced less than a mile apart and farther apart in suburban areas. Market forces respond to high frequency peak, off-peak and weekend LRT service by implementing transit oriented development.

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Commuter Rail

A Technology Brief

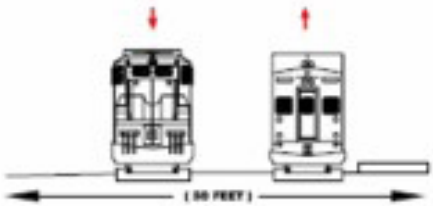
Description

Commuter Rail:

- Must operate on a fixed guideway completely separated from automobile traffic with signalized at-grade highway/railroad crossings or grade separations
- Generally includes locomotive engines pulling multiple push-pull passenger cars that may be single level or double decked
- Can operate in freight railroad corridors and often shares tracks with freight trains

Mountain View, CA - Photo by: Triangle Transit

Typical Cross Section



Typical at-grade cross section required is 50 feet. Wider section required at stations or where passing tracks are needed

Typical Service Characteristics

Corridor lengths: 20 to 80 miles

Station spacing: 2 to 10 miles

Service frequency: 20 - 60 minutes peak
60 or more minutes off peak

Average operating speed: 40 to 60 mph

Maximum speed: 79 mph

Vehicle capacity: standard cars - 56 to 88 seated
bi-Level cars - 124 to 136 seated
standing/crush loading - ±35% more

Typical Costs

Capital: $8 - $17 million per mile
(Exact costs contingent on environmental constraints, railroad agreements, number of stations at, above or below grade, land/right-of-way costs, and other site-specific considerations).

Operating: $440 per hour, which may be one locomotive and a single or several linked passenger cars.

Important Notes

1. Lease or purchase costs for use of a rail corridor can vary; whether or not new tracks are required for commuter rail service will affect costs.
2. Shared operations involving the use of freight tracks can impact service frequency, characteristics and quality.
3. Compared to the BRT, LRT and DMU examples, this commuter rail technology brief assumes fewer stations and less frequent service.

Land Use and Commuter Rail

Service using Commuter Rail is usually less frequent and more likely to be peak hour with longer distances between stations, therefore its influence on station area development does not appear to be as substantial as rail transit service with more stations separated by shorter distances and more frequent service during peak and off peak hours and weekends.

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Conventional Express Bus

A Technology Brief

Description

Conventional Express Bus:

- Operates on highways and turnpikes with few stops, offering faster trips than local buses
- Does not have roadway improvements that would provide higher travel speeds than adjacent traffic
- Cannot be implemented in active railroad rights-of-way
- Can use a range of vehicles including typical transit buses, specially designed modern buses and elongated flexible (articulated) buses

Typical Service Characteristics

Service Distance: 10 to 30 miles

Station spacing: 2 to 10 miles

Service frequency: 5 -15 minutes peak
15 - 60 minutes off-peak

Average operating speed: 25 to 45 mph (depending on traffic congestion)

Maximum speed: 60 mph

Vehicle capacity: typical - 35 seated; up to 60 with standing passengers
articulated - 65 seated; with up to 90 with standing passengers

Land Use and Conventional Express Bus Service

Conventional Express Bus stops include park and ride lots, shelters and other passenger amenities. This service will provide commuters with free time and less costly trips but does not avoid highway congestion. Highway capacity is enhanced when commuters park and ride, however weekday transit service with low off-peak frequencies does not appear to induce transit oriented development.

Typical Costs

Capital cost of individual buses:

- 35' to 40' Transit Bus: $277,000 to $354,000
- Articulated Bus: $495,000

Operating: $80 per hour per bus

Important Notes

1. Based on FTA standards, buses last approximately 12 years. Capital costs for buses must therefore include life cycle replacements.
2. Additional individual buses must be deployed when the overall capacity of each bus has been reached, therefore bus operating costs increase as ridership grows
3. Conventional Express Bus service is usually supported by park and ride facilities which include kiss and ride/drop off areas; parking for vehicles and bicycles; shelters and ticket vending.
4. While not typical, some park and ride lots may also include bus transfer options.

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Bus Rapid Transit (BRT)

A Technology Brief

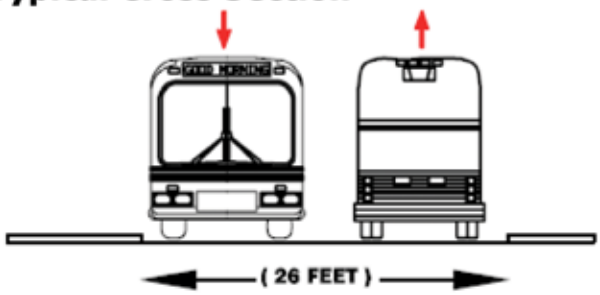
Description

Bus Rapid Transit:

- Can operate in a separate guideway (transitway) or on streets in dedicated lanes (not mixed with other traffic)
- Cannot be implemented in railroad rights-of-way with freight operations
- Can use a range of vehicles including typical transit buses, specially designed modern buses and elongated flexible (articulated) buses
- Curb Guided BRT operates within separate guideways using retractable horizontal guidewheels which allow buses to operate at higher speeds in narrower lanes, as well as on-street, where the driver resumes control

Quito, Ecuador—Photo by Steve Gaddis

Typical Cross Section



Typical at-grade cross section required is 26 feet. Wider sections at stations or where passing lanes needed.

Typical Service Characteristics

Service Distance: 5 to 20 miles

Station spacing: ¼ to 2 miles

Service frequency: 5-15 minutes peak
10-20 minutes off peak

Average operating speed: 35 to 55 mph

Maximum speed: 60 mph

Vehicle capacity: typical - 35 seated; up to 60 with standing passengers
articulated - 65 seated; with up to 90 with standing passengers

Typical Costs

Capital: $16 – $40 million per mile (dual lanes) (Exact costs contingent on environmental constraints, number of stations at and above grade, land/right-of-way costs, topography and other site specific considerations)

Operating: $80 per hour per bus

Important Notes

1. Funding for right-of way will vary depending on the location of the corridor; availability of and cost to use existing, dedicated or reserved rights-of-way, or the need to acquire new property for the BRT transitway.
2. The term "bus rapid transit" (BRT) is applied to a wide range of service quality: from buses in completely separate transitways similar to rail transit to "enhanced" bus service supported by "queue-jumping" or bus priority lanes at intersections. This technical brief defines BRT in separate transitways.
3. Curb Guided BRT segments are found in 11 different transit systems located in Germany, Great Britain, Japan and Australia. These guideway segments range from 600 ft to 11 miles long and are typically part of High-Level Bus Priority systems that include other improvements which help maintain bus speeds.

Land Use and Bus Rapid Transit (BRT)

Comprehensive BRT systems using separate transitways have shown evidence of supporting transit-oriented development in Bogotá, Columbia, Curitiba, Brazil and other countries. To date, BRT systems of similar quality have not been built in the US. There is no conclusive evidence of market forces responding to create transit-oriented development around the low-to-medium level BRT investments currently operating in the US.