

Table 1: Transit Technologies and Service Alternatives



Basic Characteristics / Transit Types	Definition:	Service Type:	Station Type:	Distance between Stations:	Service Frequency:	Alignment:	Right-Of-Way Width:	Minimum Turning Radius:	Vehicle Length:	Typical Operating Speed:
 <p>Heavy Rail</p>	<p>“Heavy Rail is high-speed, passenger rail cars operating singly or in trains of two or more cars on fixed rails in separate rights-of-way from which all other vehicular and foot traffic are excluded” (APTA)</p>	Urban/Regional	Raised high-floor level platform. Location: Center or Side	1 to 3 miles apart (except in CBD)	5 to 10 minutes during peak	Separate right of way	25 to 33 feet (Double Track)	330+ feet	40 to 70 feet per car	30 to 80 mph
 <p>Commuter Rail</p>	<p>“Commuter Rail is long-haul rail passenger service operating between metropolitan and suburban areas, whether within or across the geographical boundaries of a state, usually characterized by reduced fare for multiple rides, and commutation tickets for regular, recurring riders.” (APTA) Commuter Rail can operate along existing freight tracks with freight trains if cars meet FTA safety standards (i.e., are FRA compliant).</p>	Interurban/Regional	Raised high/low floor level or low-level step up platform. Location: Center or Side.	2 to 5 miles apart	20 to 30 minutes	Uses existing tracks (at grade or grade separated crossings)	> 37 feet (Double Track)	140 to 460 feet	90 to 105 feet per passenger car	30 to 79 mph
 <p>Light Rail</p>	<p>“An electric railway with a ‘light volume’ traffic capacity compared to heavy rail. Light rail may use shared or exclusive rights-of-way, high or low platform loading and multi-car trains or single cars” (APTA). Light rail is an intermediate rail transit between high speed rail and streetcars.</p>	Urban/Regional	Sidewalk sign, raised high/low floor level or low-level step up platform. Location: Center or Side.	1/2 mile to 1 mile	5 to 30 minutes during peak	Either center or side of street in separate or shared right of way with other traffic; exclusive right of way also sometimes provided	25 to 33 feet (Double Track), 11 to 13 feet (Single Track)	50 to 150 feet	50 to 95 feet per car	20 to 60 mph
 <p>Diesel Multiple Unit (DMU)</p>	<p>A passenger vehicle similar to a commuter rail but with lower capacity used for providing passenger service on short or medium distances. DMUs are self propelled vehicles typically powered by diesel. DMUs can operate as a single unit or multiple units based on the demand. Limited options exist in U.S. for FRA-compliant vehicles, limited DMU applications in active freight corridors.</p>	Urban/Regional	Raised high/low floor level or low-level step up platform. Location: Center or Side.	2 to 5 miles apart	Varies. Typically 15 to 30 minutes	Can use existing freight tracks (at grade or grade separated crossings) if meeting FRA requirements; separate guideway is a more expensive alternative.	25 to 37 feet (Double Track)	> 250 feet for single car and > 300 feet for multi cars	85 feet to 135 feet	25 to 40 mph
 <p>Modern Streetcar</p>	<p>Streetcars are rail transit vehicles designed for local traffic movement and are powered by electricity from overhead catenary wire.</p>	Urban Circulator	Sidewalk sign, raised low-floor level platform or low level stepup platform	approximately every 1/4 mile	8 to 15 minutes during peak	On street with traffic	19 to 24 feet (Double Track), 11 - 13 feet (Single Track)	40 to 80 feet	35 to 60 feet	6 to 12 mph
 <p>Heritage Streetcar</p>	<p>Same definition for Modern Streetcar applies, except replicas of 20th century trolley are used and typically are nonarticulated.</p>	Urban Circulator	Sidewalk sign, low level step-up platform	approximately every 1/4 mile	8 to 15 minutes	On street with traffic	19 to 24 feet (Double Track), 11 - 13 feet (Single Track)	40 to 50 feet	35 to 50 feet	6 to 12 mph
 <p>Bus Rapid Transit</p>	<p>Bus Rapid Transit is an integrated system of facilities, equipment, services, and amenities that improve the speed, reliability, and identity of bus transit.</p>	Urban and Regional	Sidewalk sign, raised low-floor level platform or curb level step-up platform	approximately every 1/2 to 1 mile	10 minute (peak) and 15 minutes (off peak)	On street with traffic, dedicatedlanes	12 feet (single lane), 25 feet (double lane)	40 to 70 feet	40 to 60 feet	Varies, 15 to 20 mph on mixed flow lanes and up to roadway speed limit on dedicated lanes

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 <p>Express Bus</p>	<p>A bus service which is intended to run faster than the local bus. It is an intermediate service between the local bus and the bus rapid transit.</p>	<p>Urban and Regional</p>	<p>Sidewalk post sign or shelter, curb-level stop</p>	<p>Approximately every 1/2 mile</p>	<p>10 to 30 minutes</p>	<p>On street with traffic</p>	<p>10 to 12 feet (preferred 12 feet)</p>	<p>40 to 70 feet</p>	<p>40 to 60 feet (latter for articulated vehicle)</p>	<p>Varies, 15 to 20 mph in mixed flow lanes; up to roadway speed limit on freeways/expressways</p>
 <p>Local Bus</p>	<p>A bus service which is intended for passenger pick up and discharge at designated stops along road corridors.</p>	<p>Urban and Regional</p>	<p>Sidewalk sign post or shelter, curb-level stop</p>	<p>Varies from couple of blocks to every 1/4 mile</p>	<p>5 to 60 minutes</p>	<p>On street with traffic</p>	<p>10 to 12 feet (preferred 12 feet)</p>	<p>40 to 70 feet</p>	<p>30 to 60 feet (latter for articulated vehicle)</p>	<p>Varies 9 to 15 mph in mixedflow lanes but depends on the speed of the traffic</p>
 <p>Automated Guideway Transit (AGT), Monorail, and People Mover</p>	<p>A fixed guideway transit mode where electrically propelled, rubber-tired vehicles straddle atop or suspend from a single guideway beam, rail, or tube. These vehicles ride along grade separated guideway. Typically operates automatically and without operators as a shuttle service at tourist attractions and airports.</p>	<p>Urban - Theme parks, Airports</p>	<p>Station, high-level platform for level boarding</p>	<p>Approximately 1/2 mile to 1 mile</p>	<p>Typically 5 to 15 minutes</p>	<p>Grade separated, dedicated right-of-way</p>	<p>Typically 25 ft (over city streets); 6'x8' support pillars</p>	<p>75 to 150 feet</p>	<p>Varies, could be combined to form trains</p>	<p>25 to 45 mph</p>
 <p>Demand Responsive (Para Transit, Taxi's etc.)</p>	<p>Demand responsive transit (includes paratransit, dial-a-ride, taxi's, etc.) is comprised of passenger cars, vans or small buses operating in response to calls from passengers or their agents to the transit operator, who then dispatches a vehicle to pick up and transport passengers to their destinations. (APTA) While many agencies offer demand responsive service, most limit the service to persons with disabilities, their attendants and companions, and older Americans (with the exception of taxis).</p>	<p>Urban, Local and Regional</p>	<p>Flexible routes; typically curb stops and no set stations</p>	<p>Varies</p>	<p>Varies</p>	<p>On street with traffic</p>	<p>10 to 12 feet (preferred 12 feet)</p>	<p>Varies, approximately 25 feet</p>	<p>Varies, generally less than 30 feet</p>	<p>Varies, depends on the speed of traffic.</p>
 <p>Carpool/Vanpool</p>	<p>“”Carpool/Vanpool service operates primarily from rural and outer suburban areas into urban area central business districts or suburban employment centers. Most carpools/vanpools serve large urban areas, though a few states have statewide programs.”” (APTA)</p>	<p>Urban and Regional</p>	<p>Sidewalk sign and/or park-andride lots</p>	<p>Varies, with major destination a major activity center</p>	<p>Varies (on demand)</p>	<p>On street with traffic</p>	<p>10 to 12 feet</p>	<p>Varies, passenger vehicles approximately 21 feet</p>	<p>Approximately 15 to 30 feet</p>	<p>Varies, depends on the speed of the traffic.</p>
 <p>Personal Rapid Transit</p>	<p>A concept that offers ondemand, non-stop transportation using small, independent self-propelled, electric vehicles on a network of specially-built guideways. Two different vehicle sizes and operational objectives exist. Smaller vehicles are designed to carry a single travel party and larger vehicles are sized to transport larger groups, all to the same destination.</p>	<p>Urban / Suburban</p>	<p>Station, platform level with vehicle floor; station is off-line from the main guideway.</p>	<p>Approximately 1/4 to 1 mile</p>	<p>Demand responsive and therefore no regular schedule; vehicle waits in station until passengers board and select destination</p>	<p>Separate right-of-way; typically grade separated</p>	<p>10 to 12 feet for single guideway; 20 to 25 feet for double</p>	<p>Varies, as low as 30 feet</p>	<p>Varies, approximately 9 to 25 feet</p>	<p>15 to 35 mph</p>

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 <p>Heavy Rail</p>	4 to 6 percent	60 to 80 seated, 120 to 150 with standees	10 to 30 miles	\$2 to \$5 million	\$50 to \$250 million (excluding right of way)	Electric	25 to 30 years	New York (MTA), Chicago (CTA), Washington (Metro), Atlanta (MARTA), San Francisco (BART), Boston (MBTA)	12 dwelling units/acre (100 - 150 sq. mile corridor); Service Level = 5 minute peak headways
 <p>Commuter Rail</p>	3 to 4 percent	80 to 170 seated	20 to 100 miles	\$1 to \$3 million	\$5 to \$25 million (excluding right of way)	Diesel, Diesel-Electric, or electric with overhead catenary	25 to 30 years	Dallas-Fort Worth (TRE), New Jersey (NJT), New York (Long Island RR), San Jose - San Francisco (Caltrain), Chicago (MetraRail), Los Angeles (Metrolink), Nashville (RTA), Albuquerque (NMRR), Northern Virginia (VRE)	1 - 2 dwelling units/acre (along existing tracks) and requires high density employment centers, such as large central business district, to be viable; Service Level = 6 - 80 trains/day
 <p>Light Rail</p>	5-7 percent	32 to 100 seated, 150 to 200 with standees	8 to 25 miles	\$2 to \$5 million	\$30 to \$70 million (excluding right of way)	Electric with overhead catenary wire	25 to 30 years	Denver, Dallas, Minneapolis, Houston, Salt Lake City, Charlotte, Phoenix, Los Angeles, San Diego	9 dwelling units/acre (25 - 100 sq. mile corridor); Service Level = 5 to 15 minute peak headways
 <p>Diesel Multiple Unit (DMU)</p>	< 3 percent	Typically 80 seated	10 to 35 miles	\$5 (single unit) to \$9 million (articulated or A-B units)	\$5 to \$45 million (excluding right of way)	Diesel, Diesel-electric	NA	New Jersey (River Line), Portland (Westside Express Service), San Diego (NCTD Sprinter Line); Austin Leander Line (2009 revenue opening)	1 - 2 dwelling units/acre (along existing tracks), Service Level = 6 - 80 trains/day
 <p>Modern Streetcar</p>	9 percent	Typically 30 seated, 115 with standees	1 to 8 miles	\$2 to \$3.5 million	\$20 to \$40 million (excluding right of way)	Electric with overhead catenary wire	25 to 30 years	Portland, Seattle, Tacoma	20+ dwelling units/acre and high density office/commercial uses such as in central city; Service Level = 10-12 minute peak and off-peak headways
 <p>Heritage Streetcar</p>	9 percent	Varies, 30 to 45 seated, 70 to 100 with standees	1 to 7 miles	Varies (\$100,000 to \$1 million)	\$5 to \$20 million (excluding right of way)	Electric with overhead catenary wire	Varies but typically 25 years or more	San Francisco, New Orleans, Memphis, Little Rock, Kenosha, Galveston	Same as for Modern Streetcar but often built for excursion/ tourist service
 <p>Bus Rapid Transit</p>	10 to 13 percent	Varies. Typically 45 seated for regular 40 foot bus, 60 for articulated buses	2 to 40 miles	\$500,000 to \$800,000 (articulated vehicle)	\$4 to \$25 million (excluding right of way)	Diesel, Alternative Fuel (CNG), Electric Trolley, Diesel-Electric Hybrid	12 years	Boston, Pittsburgh, Los Angeles, New York, Cleveland, Eugene, Houston	15 dwelling units/acre; Service Level = 10 minute headways

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 Express Bus	10 to 13 percent	Varies. Typically 45 seated for regular 40 foot bus, 60 for articulated buses	Varies, but typically 5 to 20 miles	\$350,000 to \$500,000	Minimal cost for bus stops and passenger amenities unless in busway (\$5 to \$10 million per mile)	Diesel, Alternative Fuel (CNG), Diesel-electric Hybrid	12 years	Any city with a bus system	7 dwelling units/acre, Service Level = 40 buses/ day (Note: Service Level is for Intermediate service bus; it is assumed that intermediate service bus is equivalent to a Express Bus)
 Local Bus	10 to 13 percent	Varies. Typically 45 seated for regular 40 foot bus, 60 for articulated buses	Varies, but typically 2-10 miles	\$300,000 to \$500,000	Minimal cost for bus stops and passenger amenities	Diesel, Alternative Fuel (CNG), Diesel-electric Hybrid	12 years	Any city with a bus system	4 dwelling units/acre, Service Level = 20 buses/ day (Note: Service Level is for minimum service bus, it is assumed that minimum service bus is equivalent to a Local Bus)
 Automated Guideway Transit (AGT), Monorail, and People Mover	6 to 10 percent (rubber tired traction for upper limit)	10 to 40 per vehicle (80 with standees; 240-person maximum with 6-car Monorail)	Varies (1 to 4 miles)	\$2 to \$6 million	\$50 to \$100 million	Electric	10 to 20 years	Lake Buena Vista Florida (Walt Disney World), Downtown Miami (MetroMover), Las Vegas Casino District, Jacksonville (JTA Skyway), and Seattle CBD. Various U.S. and international cities have airport people movers.	Suitable as circulator in amusement parks and in highdensity commercial areas; public transit service would be supported by light rail density thresholds.
 Demand Responsive (Para Transit, Taxi's etc.)	10 to 13 percent	5 to 18 (paratransit van),	Varies (no fixed routes)	Approximately \$60,000	Minimal if operating on city streets	Gasoline, Diesel, CNG	Varies, depends on vehicle type and manufacturer	Any urban area	Suitable for low residential densities or any urban and surrounding rural areas when limited to service for mobility impaired
 Carpool/Vanpool	Varies, depends on vehicle type and manufacturer	5 (car/small van) to 18 (extended van or minibus)	Varies (5 to 30 miles)	“Carpool-none; vanpool costs are often subsidized”	Minimal if converting existing traffic lane to high occupancy vehicle; \$10 to \$30 million per mile if new facility	Gasoline, Diesel, Electricgasoline (Hybrids)	Varies, depends on vehicle type and manufacturer	Many areas and employers offer carpool/vanpool services and incentives.	Requires high employment densities, typically large central business districts, to be effective
 Personal Rapid Transit	5 to 10 percent	3 to 4 for small and 12-15 for large vehicles excluding standees	Varies (2 to 10 miles for first generation systems)	\$50,000 to \$300,000 for first generation systems (no recent examples in U.S.)	Estimated \$10 to \$20 million per mile but no recent systems in U.S.	Electric or Cable	10 to 15 years (estimate for first generation systems)	London Heathrow International Airport (in testing), Morgantown, WVA	Possibly suitable in moderate and high density mixed residential and employment areas