

Light Rail & Streetcar Systems

How They Differ;

How They Overlap



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This publication is a joint effort of APTA's Light Rail Technical Forum and Streetcar Subcommittee.

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A second edition of this brochure has been prepared to capture the new light rail and streetcar systems which have opened or are under construction since the original printing, to update photographs and statistics, and to add information regarding the introduction of new technologies.

What's Inside?

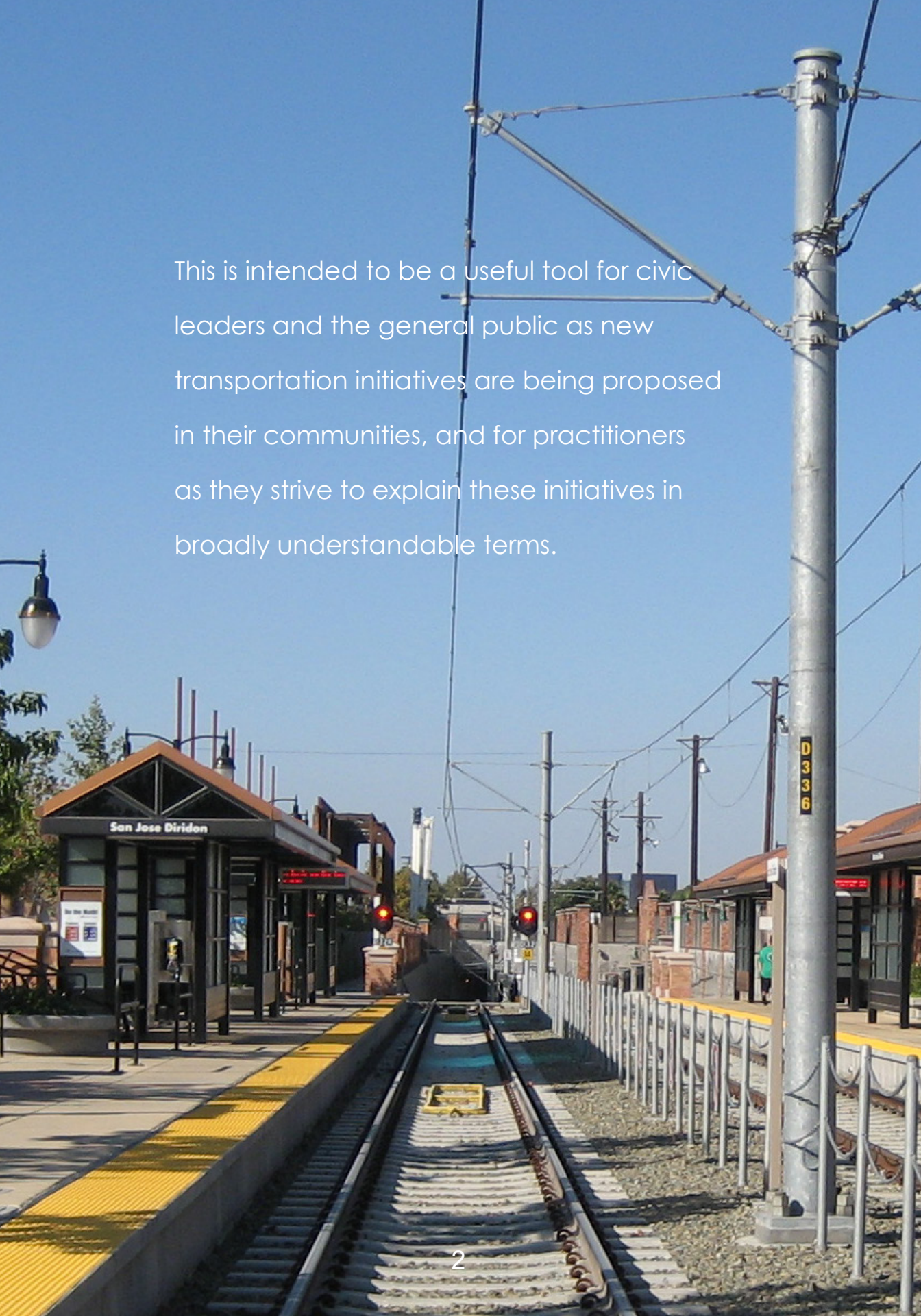
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Purpose

This brochure provides an easy-to-use guide that explains the typical characteristics of light rail and streetcar systems, highlighting what sets them apart and where the differences become fuzzy.

This is intended to be a useful tool for civic leaders and the general public as new transportation initiatives are being proposed in their communities, and for practitioners as they strive to explain these initiatives in broadly understandable terms.





Background

A century ago, cities throughout North America were laced with electric streetcar lines, while interurban trolleys connected cities with each other and outlying towns. (See Photos 1 and 2). This network began to shrink after World War I and had disappeared almost entirely by 1960. That left only grade-separated rapid transit systems and commuter rail services in a few major metropolitan areas providing the bulk of rail travel in major corridors, while motor buses provided nearly all surface transit service. Los Angeles was the epitome of this transition, having dismantled a vast network of interurban and streetcar lines and converted to rubber-tired transit. A decade later, transportation leaders began realizing there was a gap in the nation's transit capabilities. Something was needed that could offer improved passenger comfort

at an affordable cost, with carrying capacities between the practical upper limits of buses and the much higher numbers required to justify building new rapid transit systems. The solution is what we now call Light Rail Transit.

In essence, surface electric railway technology that laid fallow for 70 years



1: Interurban service on the Liberty Bell Route of Lehigh Valley Transit; west of Philadelphia, PA; circa 1950

2: Streetcars on Market Street; Philadelphia, PA; circa 1905

or so was updated and rebranded as Light Rail Transit. APTA defined it as "operating passenger rail cars singly or in short trains on fixed rails in right-of-way that is often separated from other traffic for part or much of the way. Light rail vehicles are typically driven electrically with power being drawn from an overhead electric line, driven by an operator on board the vehicle, and may have level loading from high or low platforms, or low level boarding with steps."

The last four decades have seen a rebirth of interest and activity. Now, a variety of light rail systems serve regional travel and, in some places, city streetcar lines again serve as urban circulators.

By the mid-1970s, only eight metropolitan areas in North America were operating legacy streetcar or light rail systems: Boston, Cleveland, Newark, NJ, New Orleans, Philadelphia, Pittsburgh, San Francisco and Toronto. Now, there are 24 completely new regional light rail systems and 21 new streetcar systems serving as urban circulators. These are shown on the map in the centerfold and listed in Tables 1 and 2, respectively. Most of the light rail systems continue to expand, and a few additional metro areas will soon be added to this list. Several new streetcar systems are expanding, and additional ones are in various stages of development.

This maturity has created some confusion as to what is light rail, what is a streetcar, and are they, in fact, one and the same. We hope to dispense with that confusion here.

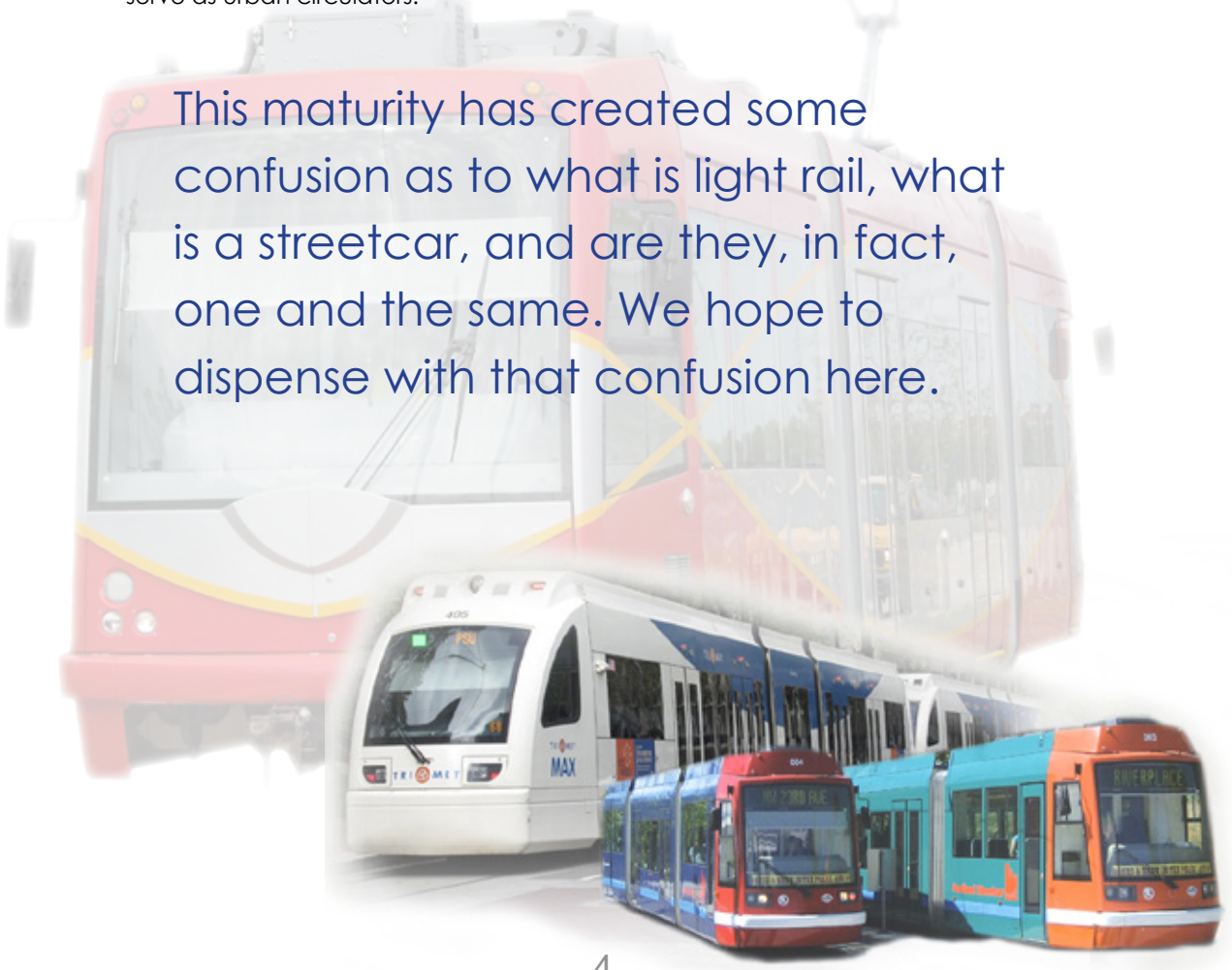


Table 1

New Start Light Rail Systems through 2019						
City	Opening Year	New Extensions			Route Length in Service (Mile/Km)	
		Built	Under Construction	Planned		
Edmonton	1978	✓	✓	✓	14.8	23.7
Calgary	1981	✓		✓	36.3	58.4
San Diego	1981	✓	✓	✓	53.6	86.3
Buffalo	1985			✓	6.4	10.3
Portland	1986	✓		✓	59.9	96.4
Mexico City	1986	✓			8.0	12.9
Sacramento	1987	✓		✓	42.7	68.7
San Jose	1987	✓		✓	42.2	67.9
Guadalajara	1989	✓	✓		15.7	25.3
Los Angeles	1990	✓	✓	✓	96.7	155.6
Baltimore	1992	✓			30.0	48.3
St. Louis	1993	✓		✓	45.5	73.1
Denver	1994	✓		✓	59.7	96.1
Dallas	1996	✓		✓	91.5	147.3
Salt Lake City	1999	✓		✓	45.1	72.6
Jersey City	2000	✓		✓	17.0	27.4
Houston	2004	✓		✓	22.7	36.5
Minneapolis	2004	✓	✓	✓	23.0	37.0
Charlotte	2007	✓		✓	18.9	30.4
Phoenix	2008	✓		✓	28.2	45.3
Seattle	2009	✓	✓	✓	20.4	32.8
Norfolk	2011	✓		✓	7.4	11.9
Kitchener/Waterloo	2019	✓		✓	11.8	19.0
Ottawa	2019	✓	✓	✓	7.7	12.4

New light rail system under construction: Maryland Purple Line

Table 2

New Start Streetcar Systems through 2019						
City	Opening Year	New Extensions			Route Length in Service (Mile/Km)	
		Built	Under Construction	Planned		
Lowell	1983			✓	2.0	3.2
Dallas	1989	✓		✓	4.6	7.4
Memphis	1993	✓			6.3	10.1
Kenosha	2000				*1.7	*2.7
Portland	2001	✓		✓	7.2	11.6
Tampa	2002			✓	2.7	4.4
Tacoma	2003		✓	✓	1.6	2.6
Little Rock	2004	✓			3.4	5.5
Seattle	2007	✓	✓	✓	3.8	6.1
Salt Lake City	2013			✓	2.0	3.2
Tucson	2014			✓	3.9	6.3
Atlanta	2014			✓	*2.7	*4.3
Washington, DC	2014			✓	2.4	3.9
Charlotte	2015		✓	✓	1.5	2.4
Kansas City	2016			✓	2.2	3.5
Cincinnati	2016				*3.6	*5.8
Detroit	2017				3.6	5.8
Milwaukee	2018		✓	✓	2.1	3.4
El Paso	2018				*4.8	*7.7
St. Louis	2018				2.2	3.5
Oklahoma City	2018			✓	*4.8	*7.7
* Single-track loop length						

New streetcar systems under construction: Orange County, CA and Tempe, AZ



Characteristics of a Rail System

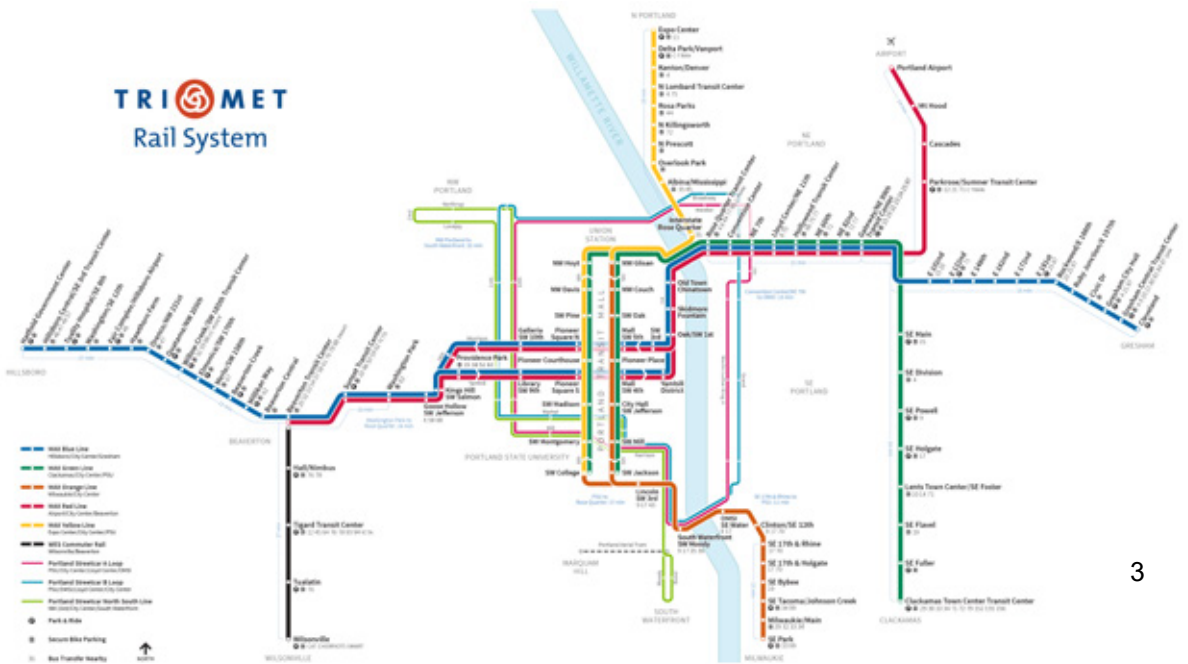
As with any other transportation network, rail systems can be characterized and distinguished by the locations and markets they serve, how their infrastructure is configured, the types of vehicles they use, and how they operate. Let's see how they compare.

Location and Markets Served

Light Rail systems, by and large, have filled the gaps formerly served by interurban and suburban trolley lines. They generally provide regional service connecting suburban communities with central business districts, typically in the range of 15-20 miles, with stations spaced between a half-mile and a mile apart. A substantial number of passengers are workers and students, many traveling during weekday peak periods. In contrast, **Streetcars** largely serve as urban circulators. They connect neighborhoods and activity centers with lines that are about 2-5 miles long and have stops less than a half-mile apart. They serve some shorter commute and student trips, but are also heavily patronized throughout the day and on weekends by riders going shopping, keeping medical appointments, attending local entertainment venues, enjoying tourist attractions, and tending to other personal travel needs and preferences. They essentially provide

travel that may be deemed a bit too far to walk and yet inconvenient to use a car. Indeed, Portland, Oregon's former mayor, Charlie Hales, refers to its streetcar system as a 'pedestrian accelerator' as it serves to speed and expand these local trips.

Using Portland as an example, Photo 3 is a map of the regional light rail system operated by the Tri-County Metropolitan Transportation District of Oregon, or TriMet. This system stretches radially 15 miles to the east of downtown, with several shorter branches emanating from it to the north and south, and 18 miles to the west. The newest line extends southeast from downtown about 8 miles. In contrast, the Portland Streetcar shown in the map in Photo 4 operates in a loop configuration through the downtown and close-in neighborhoods, providing local circulation and intersecting with TriMet's light rail system at several locations.



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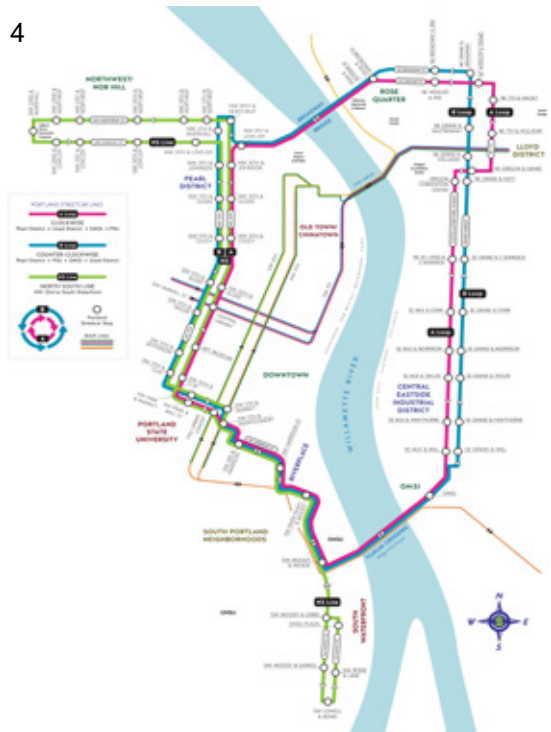
Infrastructure

Infrastructure includes all the elements that comprise the physical features of a rail project. This includes the right-of-way, track, passenger stations or stops, the electric power supply to the trains, any signal controls needed to provide safe operation, the communications equipment used for train operation and for passenger information, and fare collection equipment.

Right-of-way is essentially the real estate the rail system occupies. **Light Rail** typically has dedicated rights-of-way, whether a totally separated strip of land or reserved space in streets. Dedicated routes may cross streets at grade, in tunnels, or on elevated structures. The routes may include extended tunnel sections through downtown. **Streetcars** typically occupy travel lanes in local streets and run with local traffic. Photos 5 through 9 provide several examples of the foregoing. Where **track** is located on separate

rights-of-way, as is typically the case for **Light Rail**, it is usually composed of steel rails fastened

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3: Light Rail system map; Portland, OR; Source: TriMet

4: Streetcar system map; Portland, OR; Source: Portland Streetcar, Inc.



5: Light Rail dedicated right-of-way; Los Angeles, CA



6: Light Rail on aerial structure; Minneapolis, MN



7: Light Rail in tunnel; Seattle, WA



8: Streetcar in local travel lanes; Portland, OR



9: Light Rail in dedicated street lanes; Denver, CO

to wood or concrete 'ties' supported on a bed of crushed stone referred to as 'ballast'. See Photo 11. In some instances, the rails are embedded in concrete in lieu of ballast. The track for **Streetcars** is typically embedded in concrete or asphalt in the street surface, as shown in Photo 10.

Light Rail normally has highly developed **stations** with platforms sized to accommodate the longest trains. Platforms are outfitted with large canopies or shelters, seating, dedicated lighting, signage, and accommodations for communications and fare collection equipment. Light rail stations may also have large 'park-and-ride' lots or parking structures and bus transfer facilities. Two examples are shown in Photos 12 and 13. **Streetcar** systems typically employ sidewalk 'stops' much akin to bus stops, or mid-street safety islands. They often consist of a modest shelter, perhaps some seating, passenger information signage, and possibly some simple fare collection equipment. Illumination is provided mostly by nearby streetlamps. A typical streetcar stop is shown in Photo 14.

The elements of electric **power supply** for both light rail and streetcars are the same. Substations receive high voltage commercial alternating current (AC) electric power from the local utility and convert it to medium voltage direct current (DC). This DC power is distributed by overhead wires above the tracks and picked up by roof-mounted collectors on the rail vehicles, such as 'pantographs' or 'trolley poles'. However, if you visualize a substation as an electrical



10: Streetcar track embedded in concrete in city street; Portland, OR 11: Light Rail track with rail on concrete ties and stone ballast; Charlotte, NC 12: Light Rail high-level platform station; Los Angeles, CA 13: Light Rail low-level platform; Phoenix, AZ 14: Streetcar stop; Cincinnati, OH



'pump' and the wire as the electrical 'pipe', this electrical equipment differs in robustness between the two applications. **Light Rail** normally operates long, high-performance rail vehicles assembled into multiple-car trains. **Streetcars** are usually shorter, operate as single units, and run at lower speeds. This translates to larger substations and more wire in the air and/or underground conduit for **Light Rail**, while **Streetcars** can usually operate with smaller substations and just a single overhead wire. These



North American Light Rail



A map of the United States showing the locations of 25 cities. The cities are color-coded: green for cities with a large population, blue for cities with a medium population, and yellow for cities with a small population. The cities are: Minneapolis, Milwaukee, Kenosha, St. Louis, Dallas, Houston, New Orleans, Tampa, Atlanta, Little Rock, Memphis, Charlotte, Norfolk, Washington, DC, Baltimore, Philadelphia, Jersey City, Newark, Pittsburgh, Cleveland, Detroit, Cincinnati, Buffalo, Kitchener/Waterloo, Toronto, Lowell, Boston, and Ottawa. An inset map of Mexico shows the locations of Guadalajara and Mexico City.