

Streetcar and Light Rail Design Differences

March 2015

**PARSONS
BRINCKERHOFF**



How Are Streetcar and Light Rail Different?

The design differences between streetcar and light rail are tied to the distinctions in the markets served by each technology.



What Markets Are Best Served by Each Technology?

■ Streetcar

- Intended for short connections within a compact urban setting
- Focus is on local access and circulation – a “walk extender”



MARKETS SERVED

■ Light Rail

- Intended for longer-distance trips across a city or from suburbs into city
- Focus is on regional mobility



How Do Markets Affect the Design Differences?

Markets Served

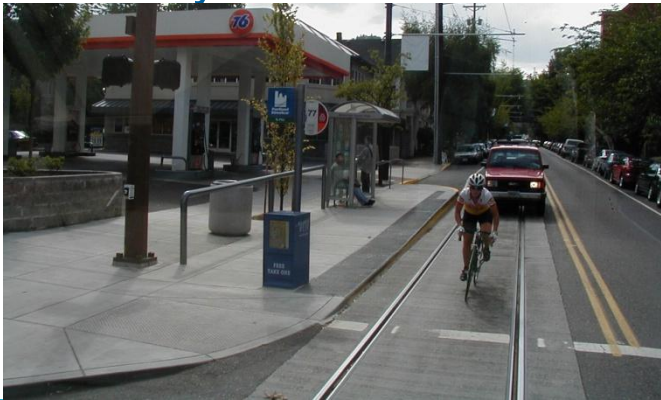
- Long or short-distance trips?
- Circulation within a “place”, or moving between “places”?
- Quick walk-up access or large capture area?

Design Differences

- Type of right-of-way
- Station spacing and design
- Type of vehicle
- Track design
- Power source
- Signals and control

Key Design Differences

- Streetcar
 - Does not require its own right-of-way
 - Typically shares lanes with autos in mixed traffic (like a bus)
 - Must avoid in-street utility conflicts



RIGHT OF WAY

STATION
SPACING AND
DESIGN

TYPE OF
VEHICLE

TRACK
DESIGN

POWER
SOURCE

SIGNALS AND
CONTROL

- Light Rail
 - Typically has own right-of-way, with limited interaction with autos and fewer utility conflicts
 - Can operate in its own corridor or in-street (separated from autos)



Key Design Differences

■ Streetcar

- Stations (stops) every 2-3 blocks
- Simple platforms at a lower height blend into urban streetscape
- Intended for walk-up access



RIGHT OF WAY

STATION SPACING AND DESIGN

TYPE OF VEHICLE

TRACK DESIGN

POWER SOURCE

SIGNALS AND CONTROL

■ Light Rail

- Stations every 1-2 miles
- Larger stations to serve longer trains
- Some stations have park-and-ride access
- Higher platforms enable level boarding



Key Design Differences

■ Streetcar

- Smaller and more nimble than light rail
- Operates as single car
- Typical length = 60'-70'
- Speed = up to 40 mph
- Capacity = 120-150 (seated + standing)



RIGHT OF WAY

STATION
SPACING AND
DESIGN

TYPE OF VEHICLE

TRACK
DESIGN

POWER
SOURCE

SIGNALS AND
CONTROL

■ Light Rail

- Larger vehicles (for higher capacities)
- Can connect 2-4 cars
- Typical length = 90'-100'
- Speed = up to 60 mph
- Capacity = 170-200 (seated + standing)



Key Design Differences

■ Streetcar

- Shallow (12" deep) concrete track slab
- Can make tighter turns than light rail
- Lots of interaction with peds and bicycles



RIGHT OF WAY

STATION
SPACING AND
DESIGN

TYPE OF
VEHICLE

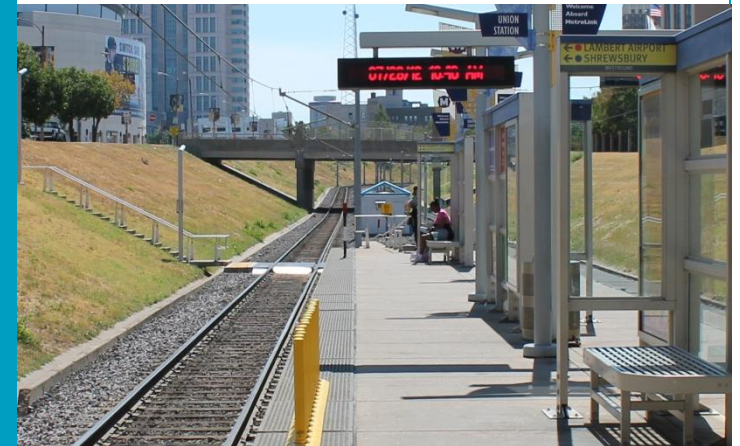
TRACK DESIGN

POWER
SOURCE

SIGNALS AND
CONTROL

■ Light Rail

- Ballasted track or slab
- Larger vehicles require wider turns
- Focus on limiting interaction with autos / peds / bicycles



Key Design Differences

■ Streetcar

- Single contact wire over each track
- Emerging “off-wire” technology
- Smaller substations



RIGHT OF WAY

STATION
SPACING AND
DESIGN

TYPE OF
VEHICLE

TRACK
DESIGN

**POWER
SOURCE**

SIGNALS AND
CONTROL

■ Light Rail

- Double-wire overhead contact system
- Limited “off-wire” options
- Larger substations



Key Design Differences

■ Streetcar

- Obeys existing traffic signals; typically no special signalization
- No special train controls required due to slow speeds



RIGHT OF WAY

STATION
SPACING AND
DESIGN

TYPE OF
VEHICLE

TRACK
DESIGN

POWER
SOURCE

**SIGNALS
AND
CONTROL**

■ Light Rail

- Typically has own signalization system for safety at grade crossings
- Separation between trains maintained by control system



It Doesn't Have to be “Either / Or”

- The same line may have varying design features on different segments
 - Example: Street-running segments with closer station spacing in downtown (like streetcar) and dedicated ROW in suburbs (like light rail)
- Some design elements of a line may be more like light rail, while others are more like streetcar
 - Example: Norfolk light rail operates in single-car trains with limited train controls (like streetcar), but operates in dedicated ROW with wider station spacing (like light rail).



The Streetcar / Light Rail Design Continuum



Portland, OR



Streetcar

- In-street running
- Shared lanes with auto traffic
- Simple platform stops
- Single vehicles
- Obeys regular traffic signals
- Blends in with existing neighborhoods

Level of Infrastructure

Less substantive
/ less complex

More substantive
/ More complex

The Streetcar / Light Rail Design Continuum



Norfolk, VA

Street-Running Light Rail

- Operates in street ROW, but typically in own dedicated lane
- Stations blend into streetscape
- Single or multiple vehicles
- Interaction with traffic at intersections



Level of Infrastructure

Less substantive
/ less complex

More substantive
/ More complex

The Streetcar / Light Rail Design Continuum

Light Rail in Exclusive ROW

- Operates in own dedicated lane
- Significant stations
- Single or multiple vehicles
- Limited interaction with autos (grade separations or at-grade crossings)



Minneapolis, MN



Level of Infrastructure

Less substantive
/ less complex

More substantive
/ More complex

How to Know Which Rail Technology is Appropriate?

- What markets are you trying to serve?
 - Length of trips
 - Regional mobility vs. local access
 - Potential customers
- What types of ROW are available?
 - Dedicated corridors
 - In-street options



Streetcar vs Local Bus

- Similar speed, operating environment, station/stop spacing
- Streetcars provide greater capacity, and are more likely than buses to
 - Provide level-boarding
 - Feature off-board fare collection
 - Provide a more stable, comfortable ride
 - Be more easily understood through system branding, visible route maps, etc. (especially for non-frequent transit users)
 - Spark developer interest, due to permanence of infrastructure
- Buses provide operating flexibility
 - Not fixed to guideway

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