Transit Streets

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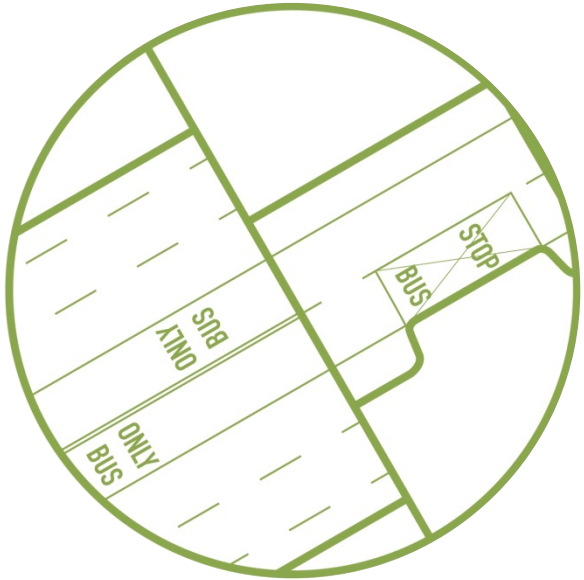
Transit Street Principles

Transit Streets are Living Streets



Prioritize Transit at Every Scale

Design for Growth

Transit Street Principles

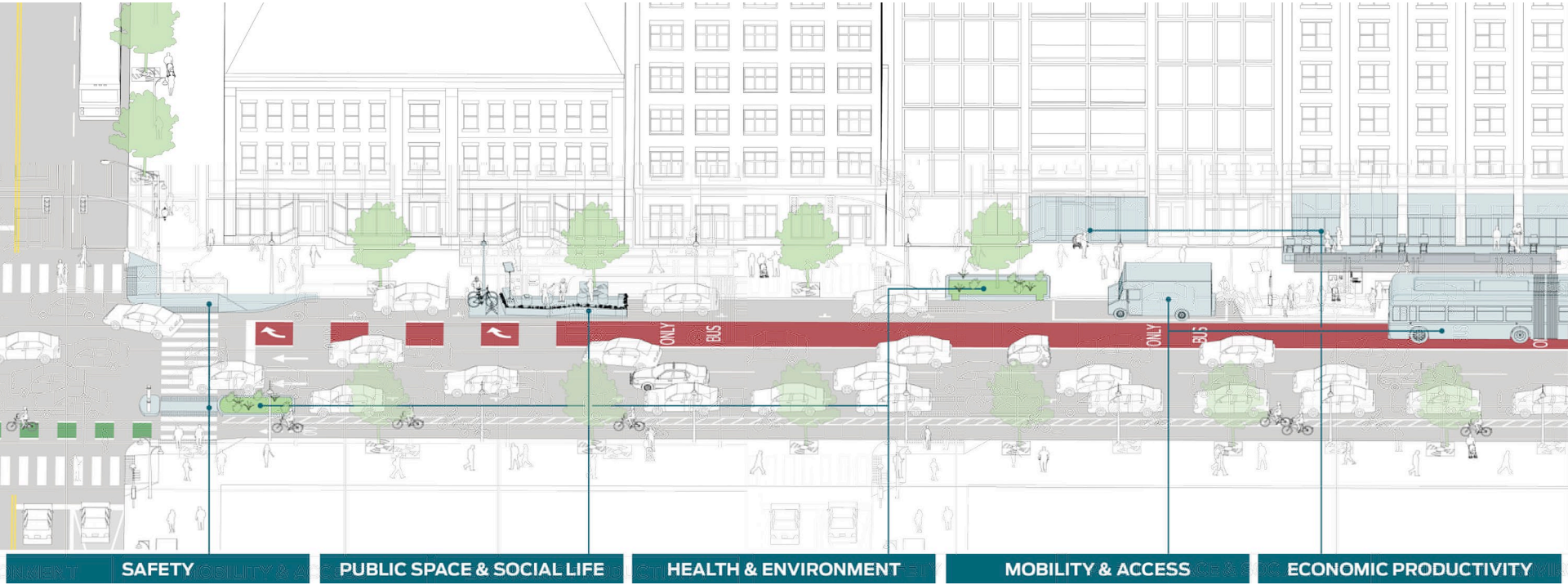
Transit Streets are Active Streets

Design Changes Demand

Near-Term Projects, Long-Term Plans

Design Controls

Design Controls



Mobility and Access

- Counting people
- Transit travel time
- Access to the city
- Private motor vehicles

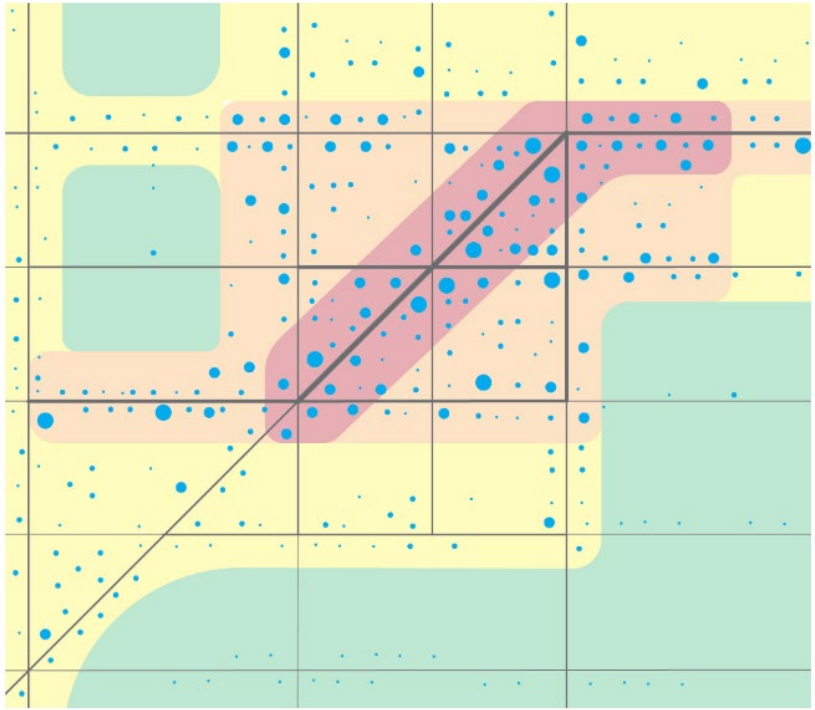

Here are 200 people in 177 cars

Transit Travel Time

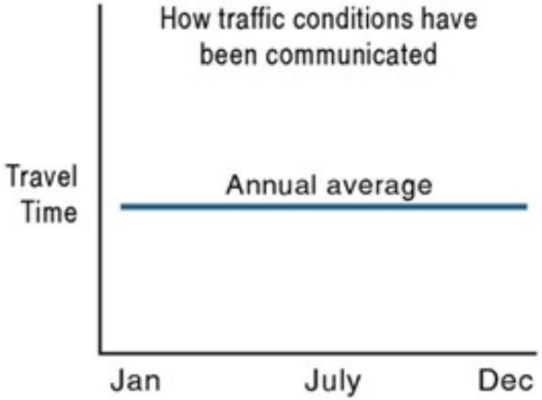
AM Peak Passenger Travel Times

Access to the City

- Measure the number of destinations reachable within a given timeframe
- More important than distance traveled



Auto Traffic Measures



Source: Federal Highway Administration

Safety

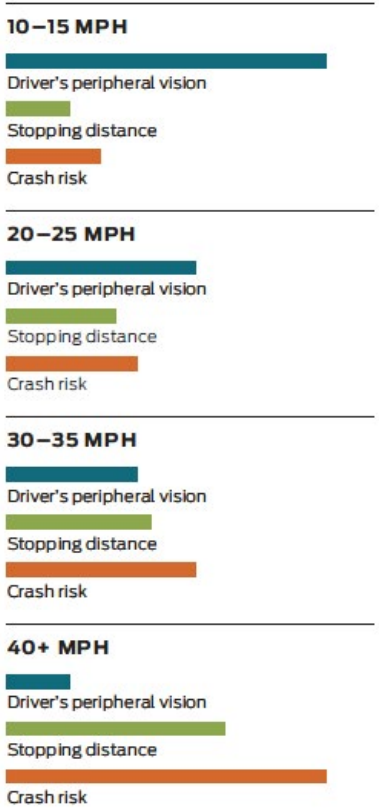
- Crash History
- Potential Conflict Analysis

Crash History

- Analyze safety across all modes
- Assess crash history per mile or by user type
  - Highlight crashes involving vulnerable road users

Minimize Conflicts

- Control speeds



Minimize Conflicts

- Design for desired speed
- 95th Percentile Speeds
- Percent of vehicles exceeding desired speed

Reactive:
Operating (85%) → Design → Posted

Proactive:
Target → Design → Posted

Minimize Conflicts

- Control speeds
- Identify conflicts

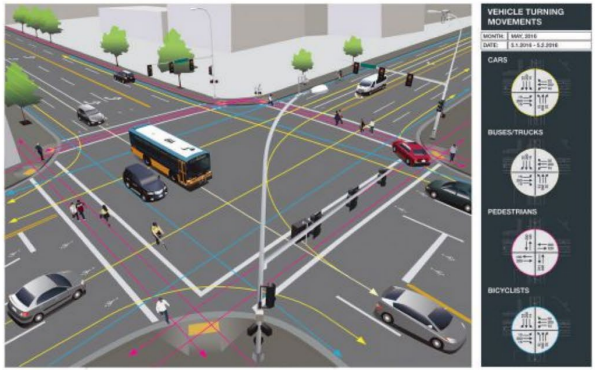


Figure 1.

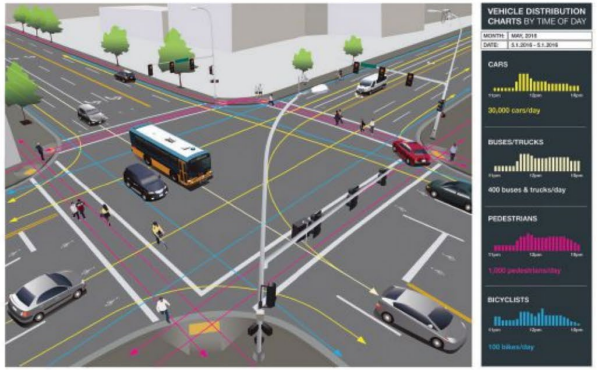
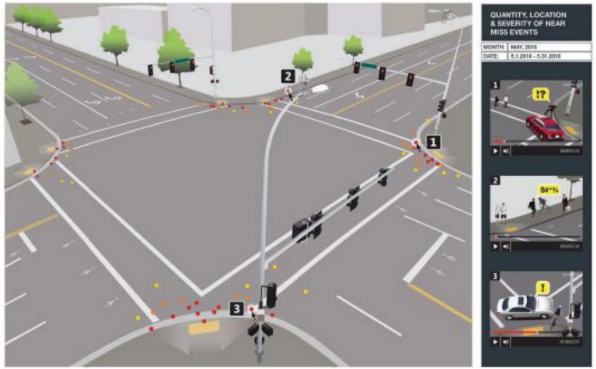


Figure 2.



Public Space & Social Life

- Stationary Activities
- Sidewalk Comfort

Quality of Public Space

- Design for desired speed
- 95th Percentile Speeds
- Percent of vehicles exceeding desired speed

Measure social, civic, and market activities

- Number of people engaging in stationary activities
- Quality of space observations/surveys

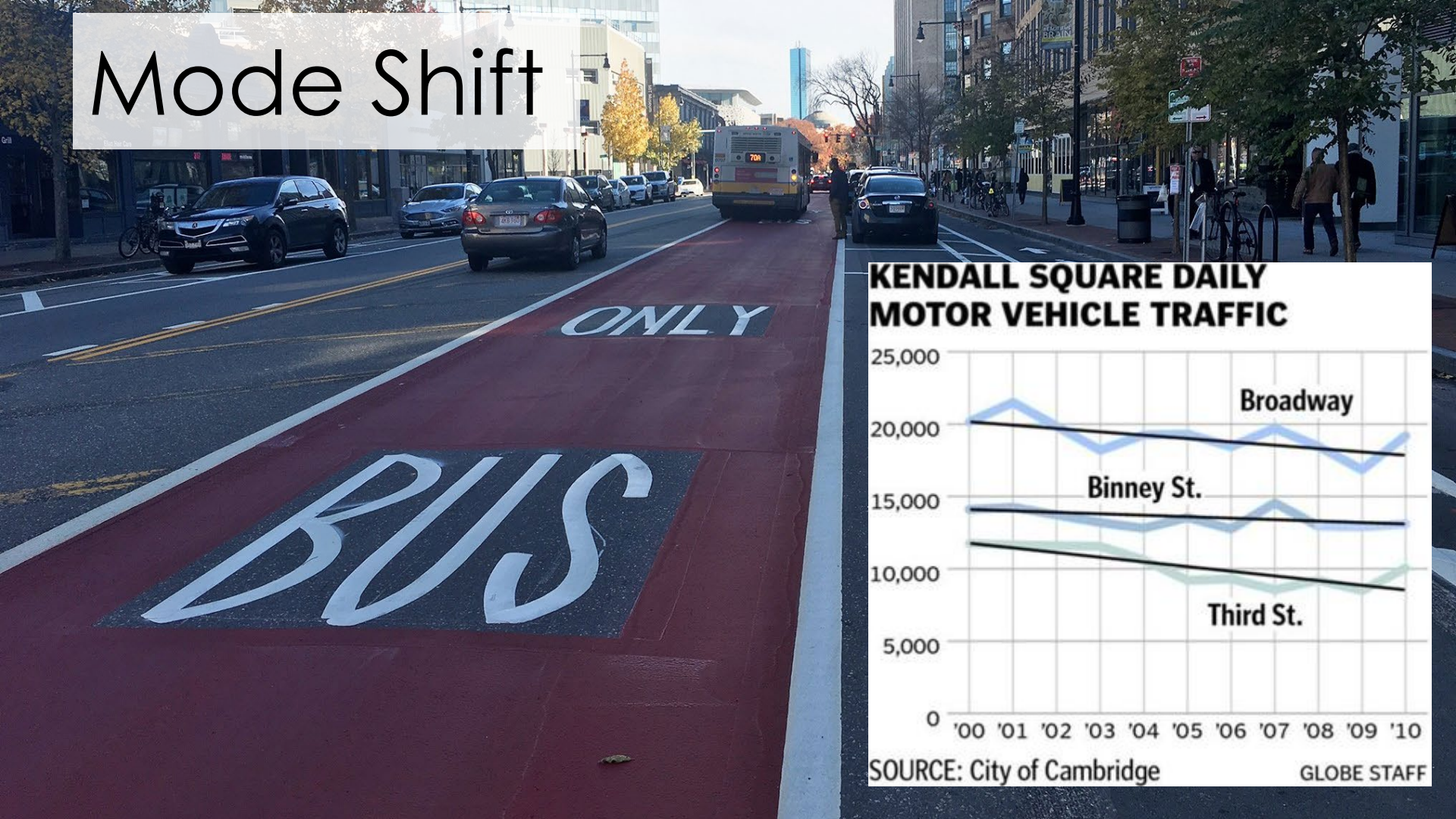
Quality of Public Space

- Sidewalk comfort can encourage/discourage walking
  - Shade
  - Street lighting
  - Active ground floor uses

Health, Sustainability & Environment

- Mode shift
- Physical activity
- Air quality and emissions

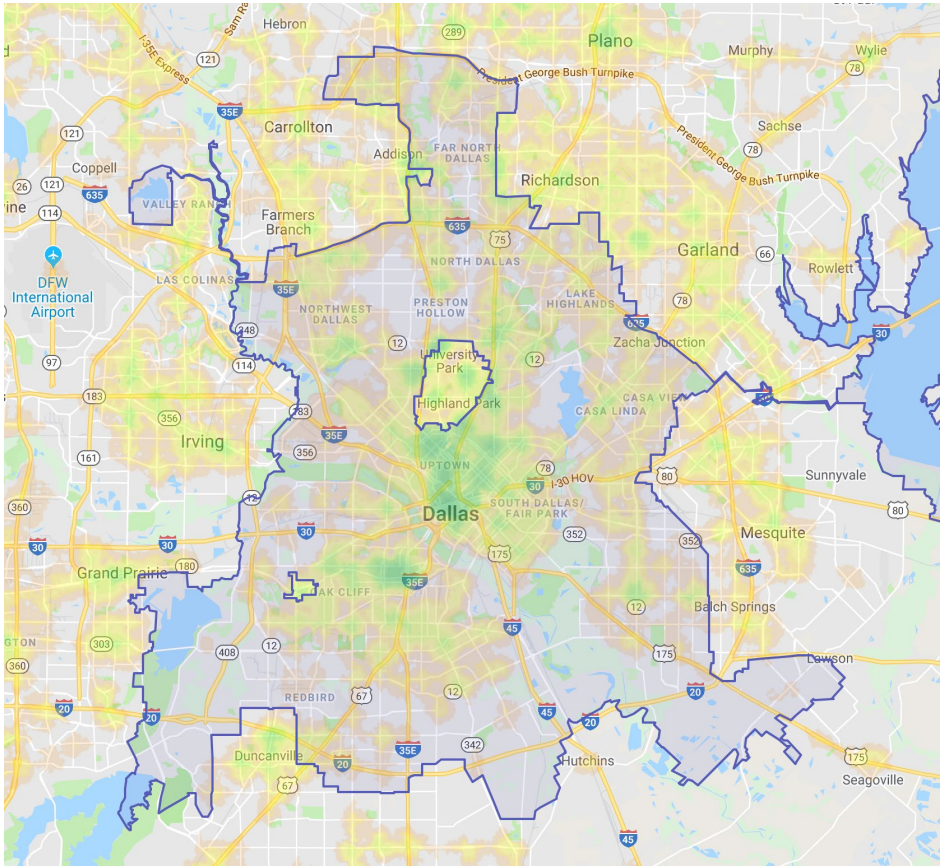
Mode Shift


ONLY
BUS

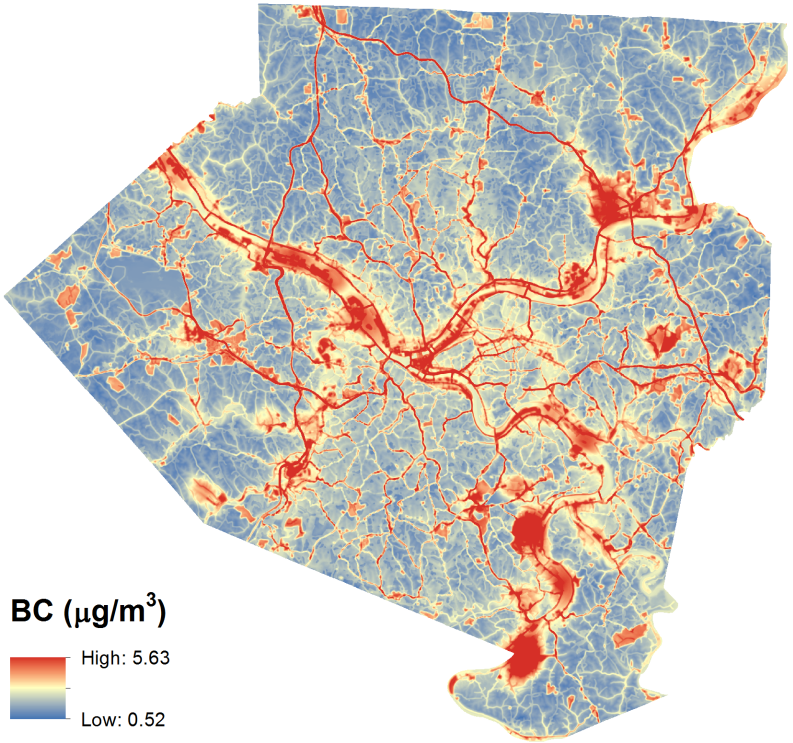
KENDALL SQUARE DAILY
MOTOR VEHICLE TRAFFIC
25,000
20,000
15,000
10,000
5,000
0
Broadway
Binney St.
Third St.
'00 '01 '02 '03 '04 '05 '06 '07 '08 '09 '10
SOURCE: City of Cambridge
GLOBE STAFF

Physical Activity

- Strong relationship between obesity and walkability
- People in communities with sidewalks 47% more likely to get physical activity



Air Quality and Emissions

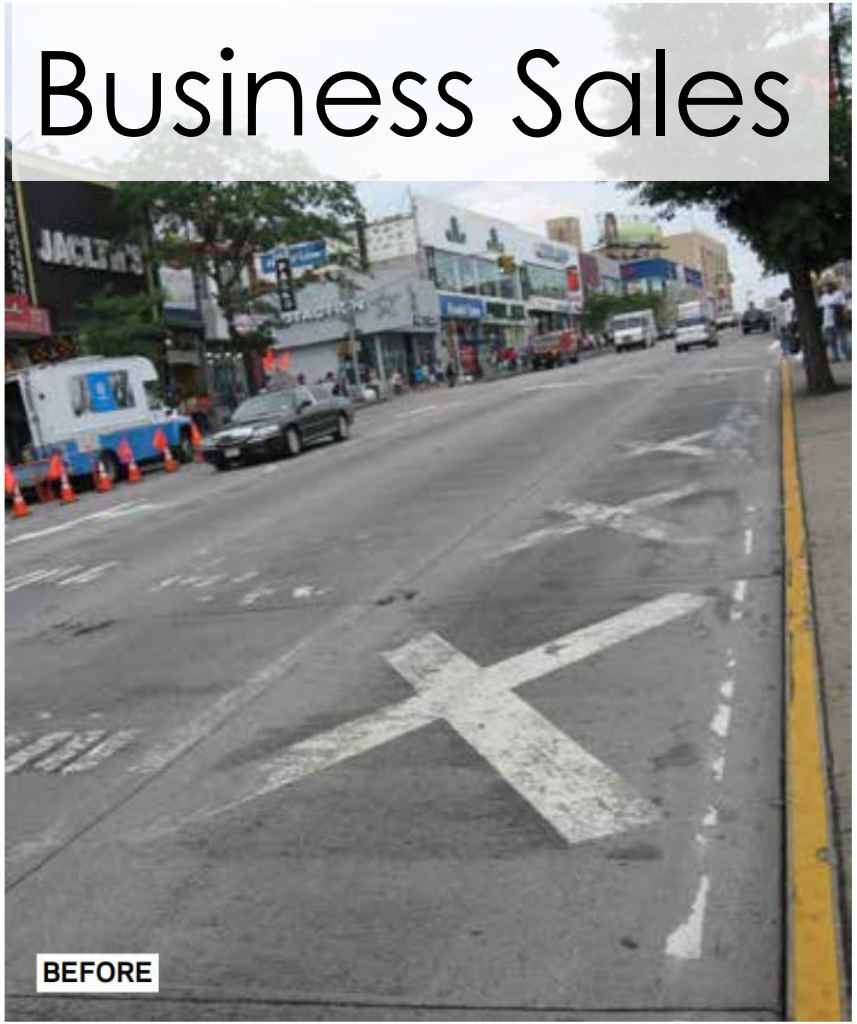


- Particulate emissions linked to cardiac and respiratory disease
- Concentrated around high volume roadways

Economic Productivity

- Business Sales
- Cost Savings and Transit Productivity

Business Sales



Cost Savings and Transit Productivity

- Transit service efficiency saves costs
- Travel time savings – allows fewer buses or better service at same cost

NYC DOT

What are the street's vocations?

- ✓ Economic activities (e.g. office, retail, residential)?
- ✓ Transit service type?
- ✓ Multi-modal network?
- ✓ Functional classification / Network role?

What are the culprits of delay?

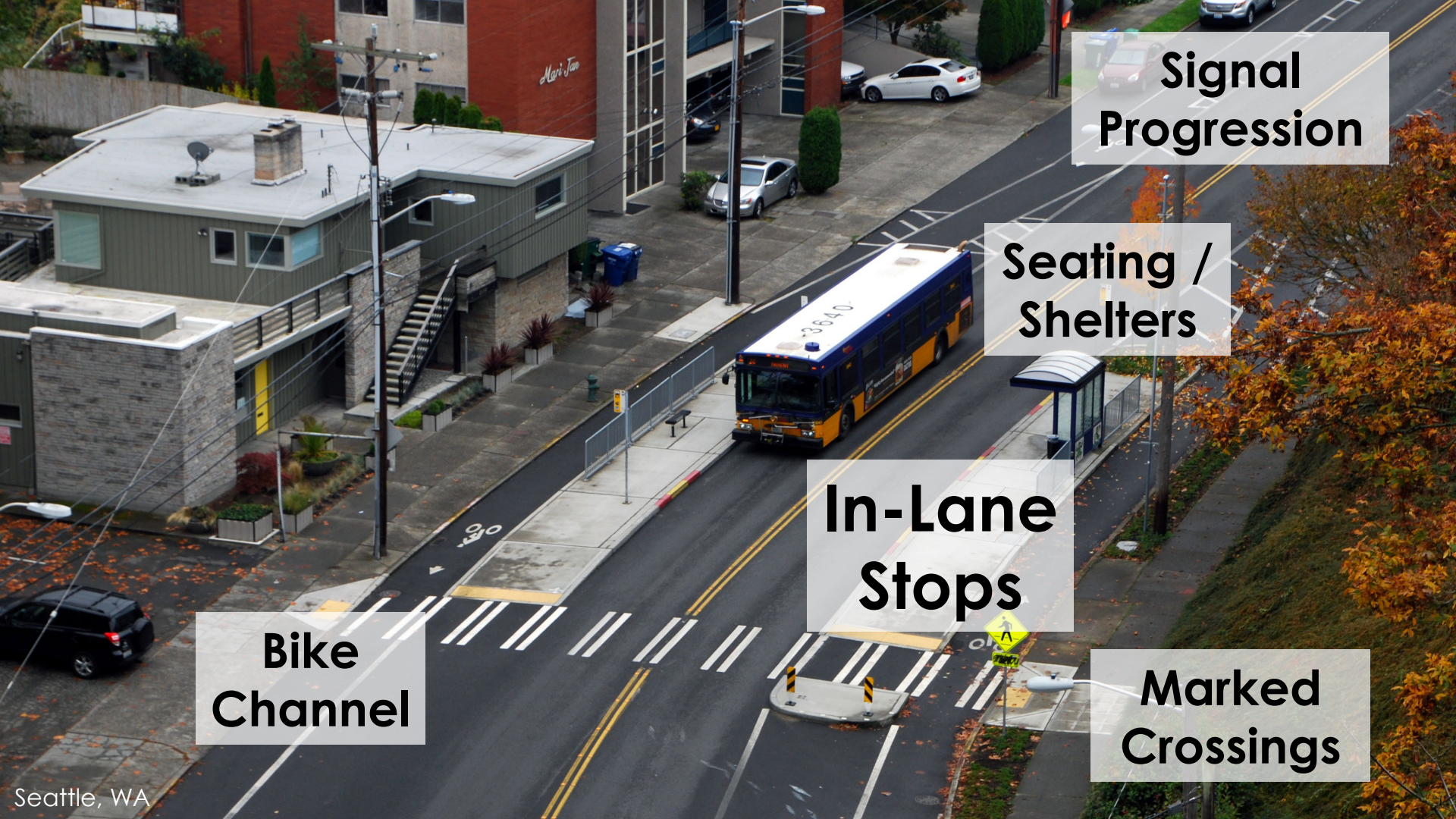
- ✓ Curb access / double-parking?
- ✓ Traffic volume & congestion?
- ✓ Boardings & dwell time?
- ✓ Signals & intersections?

What are the opportunities?
(with & without moving the curb)

- ✓ Cross-section width?
- ✓ Directionality & Operations?
- ✓ Modal Plans & Goals?
- ✓ Service Modifications?

Neighborhood Streets

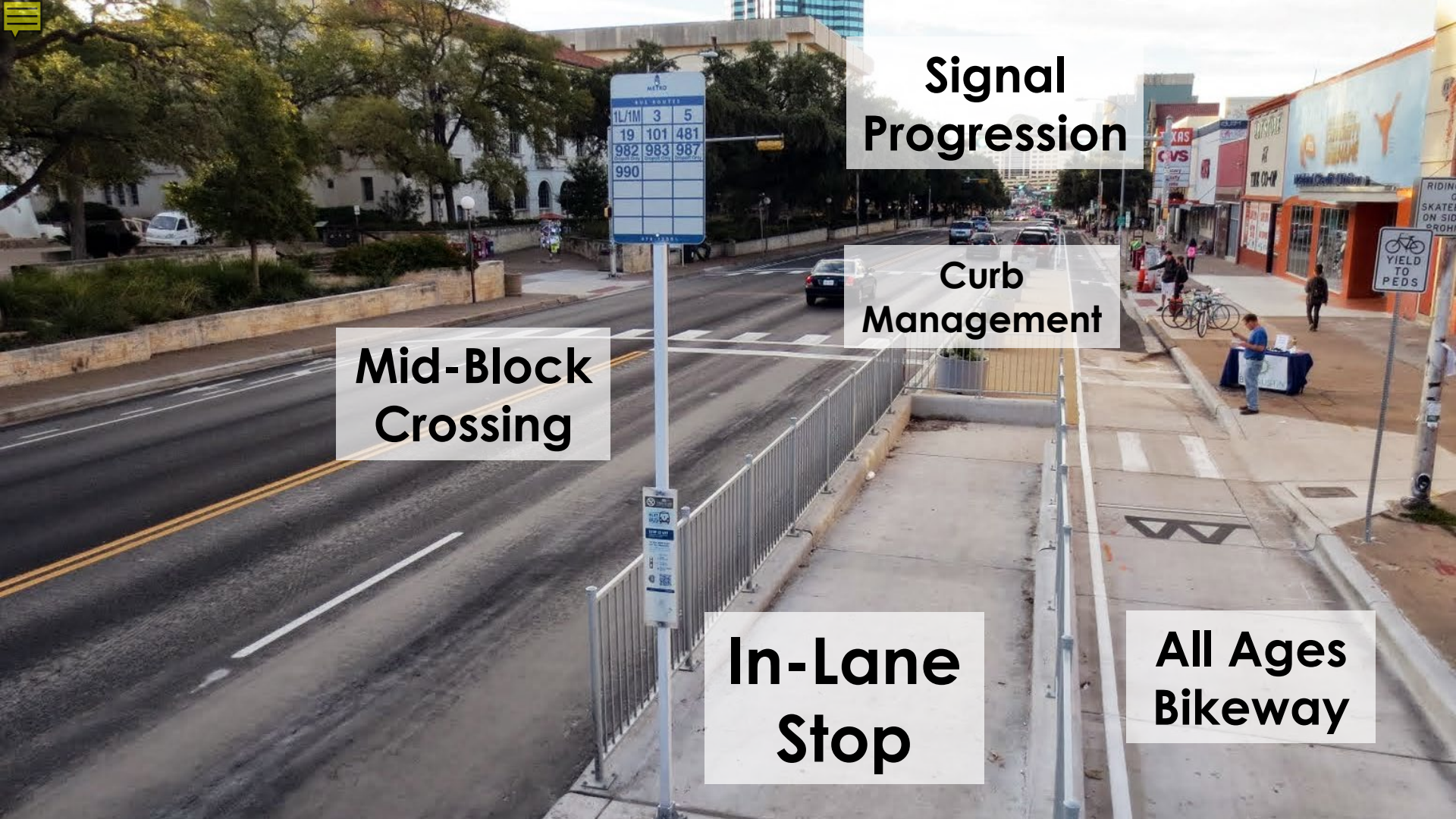
- Main streets, residential streets
- Local access & turnover
- Low speeds, mixed modes


Signal Progression
Seating / Shelters
In-Lane Stops
Bike Channel
Marked Crossings
Seattle, WA

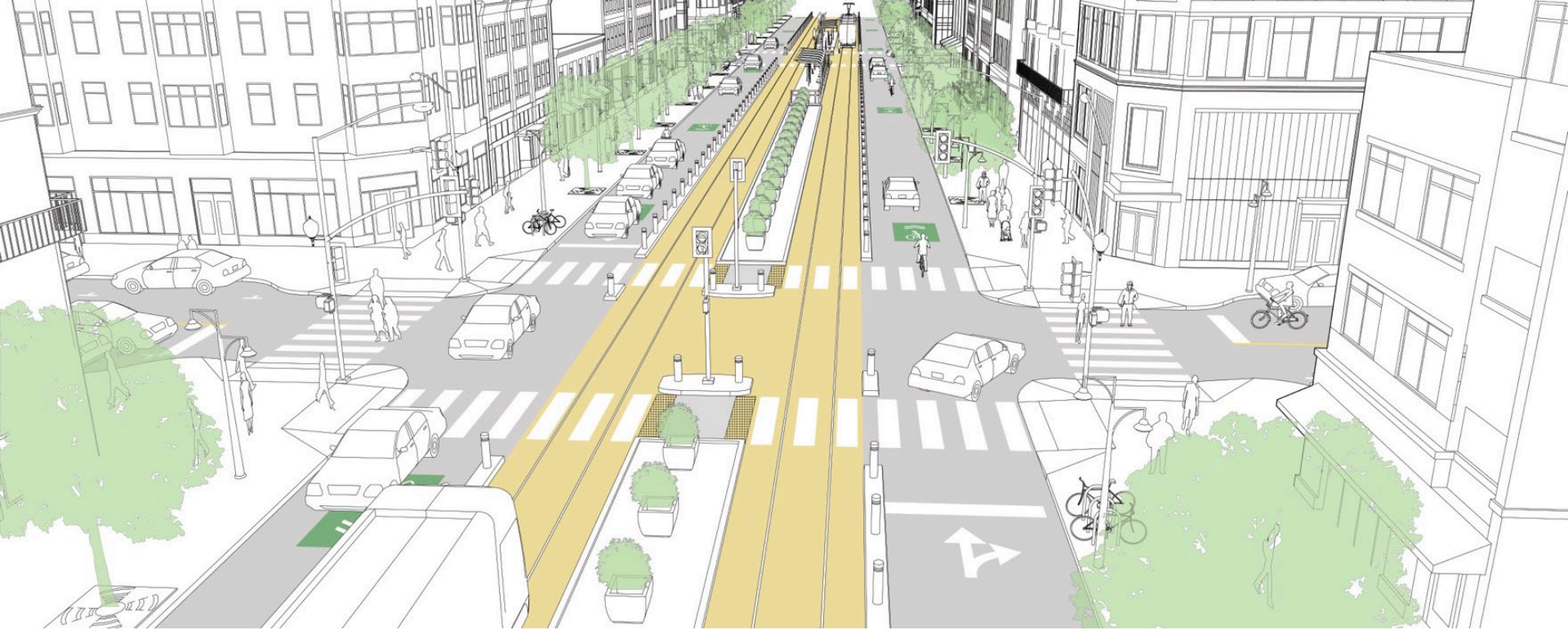

Shelters
In-Lane Stops
Near-Level Boarding
Pedestrian Scale
Safe, Frequent Crossings
NW 23rd Ave, Portland

Corridor Streets

- Prioritize person throughput
- May have long block / few crossing opportunities

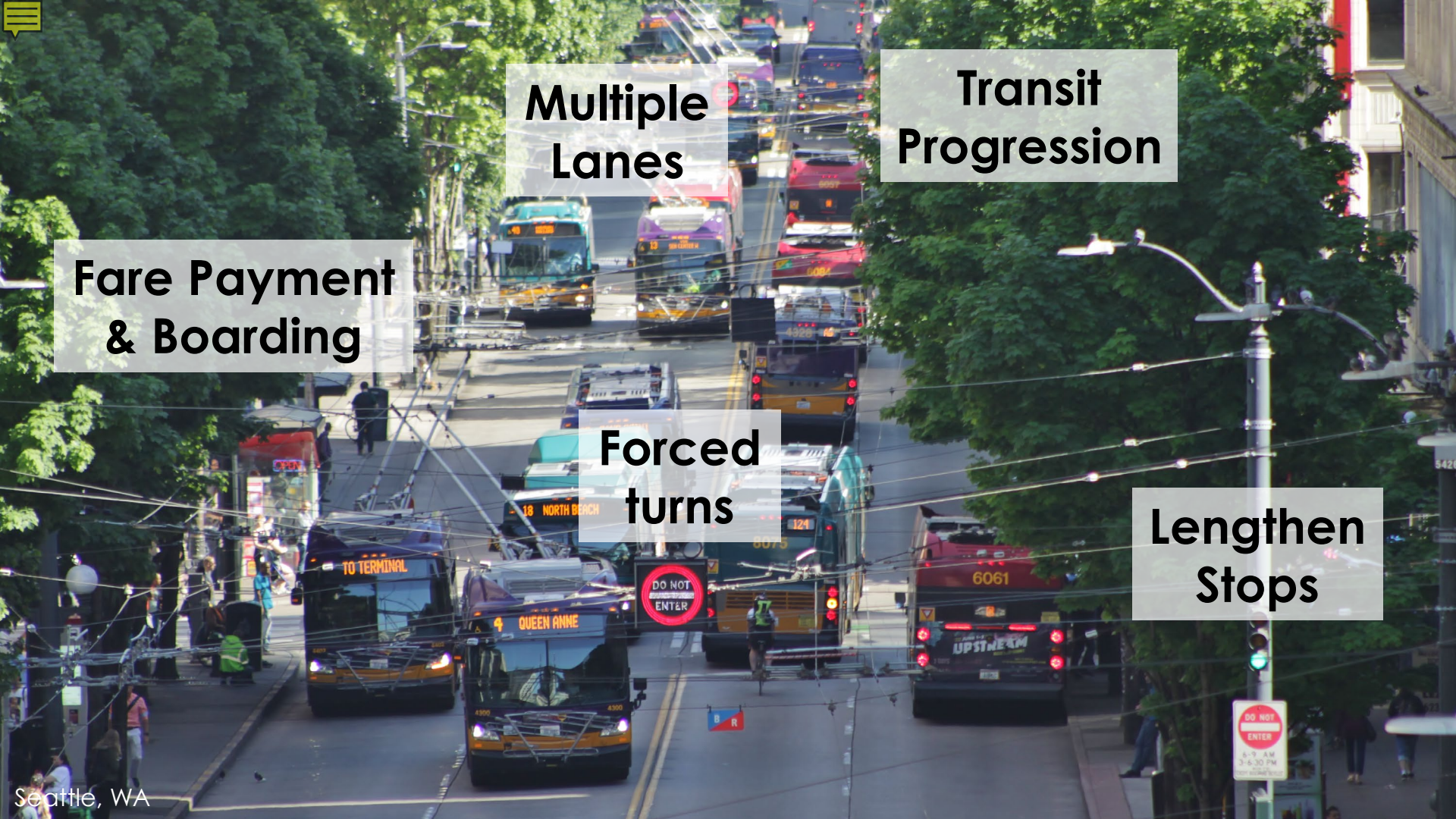

Signal Progression
Curb Management
Mid-Block Crossing
In-Lane Stop
All Ages Bikeway
METRO
BUS ROUTES
1L/1M
3
5
19
101
481
982
983
987
990
YIELD TO PEDS


Infill Development
Transit Signals
Station Stops
Enhanced Crossings
Transitway
BUS
SIGNAL
NO THRU TRUCKS
AUTHORIZED VEHICLES ONLY
metroway



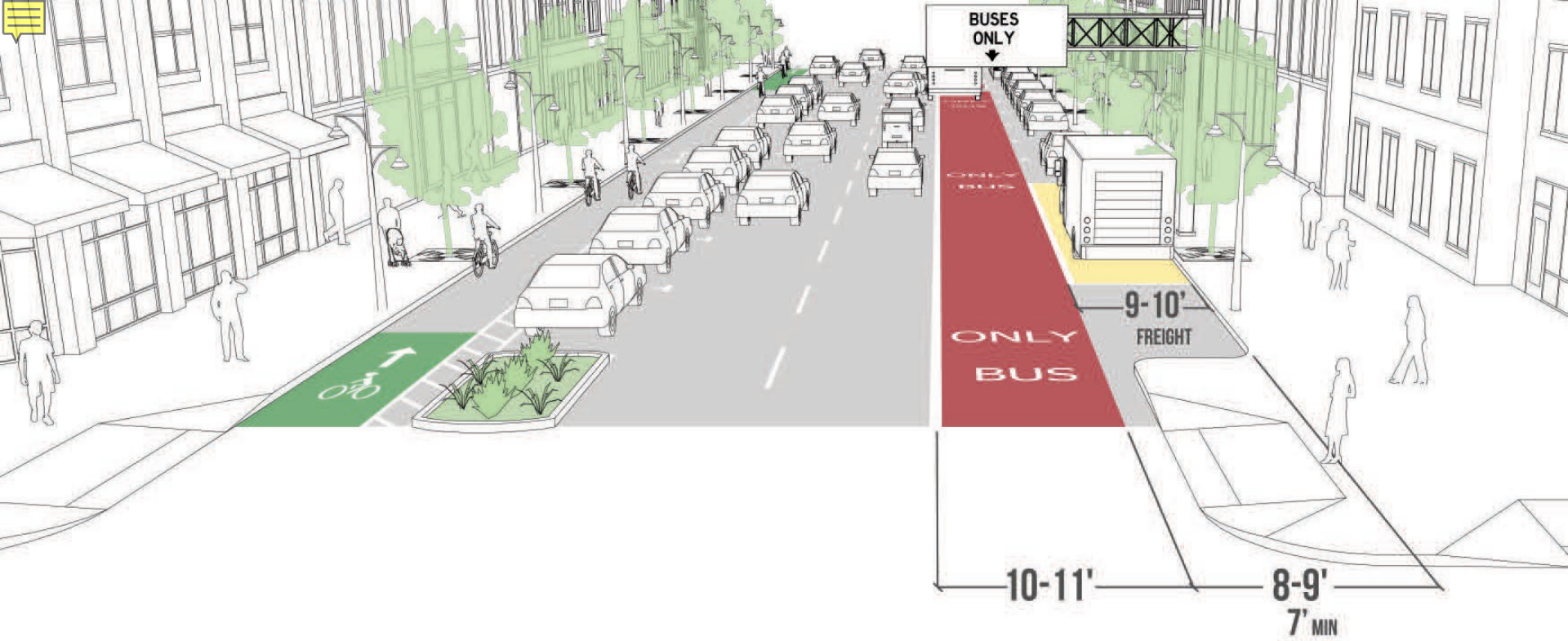
Downtown Streets

- High-density, congestion, destination access
- Reliability, frequency
- Supporting great public spaces


Multiple Lanes
Transit Progression
Fare Payment & Boarding
Forced turns
Lengthen Stops
Seattle, WA


TSP
Branded Fleet
Seating & Fare Validation
Transit Lane
S-Shaped Stops
Brooklyn, NY

Transit Lanes & Transitways



Offset Transit Lane

- Maintains curbside space for other treatments
- Relatively simple & low-cost
- Lacks separation

Offset Transit Lane

Required

- Solid white line along running distance—double white line legally prohibits incursion
- BUS ONLY markings and signs
- Enforcement is critical to maintaining integrity

Recommended

- 10–11' desired width provides a comfortable operating environment
- Red or terra cotta color treatment improves compliance
- Boarding bulbs or island enable in-lane stops
- Adjacent parking or loading lanes are 7—9', and should be marked with parking T's.

Optional

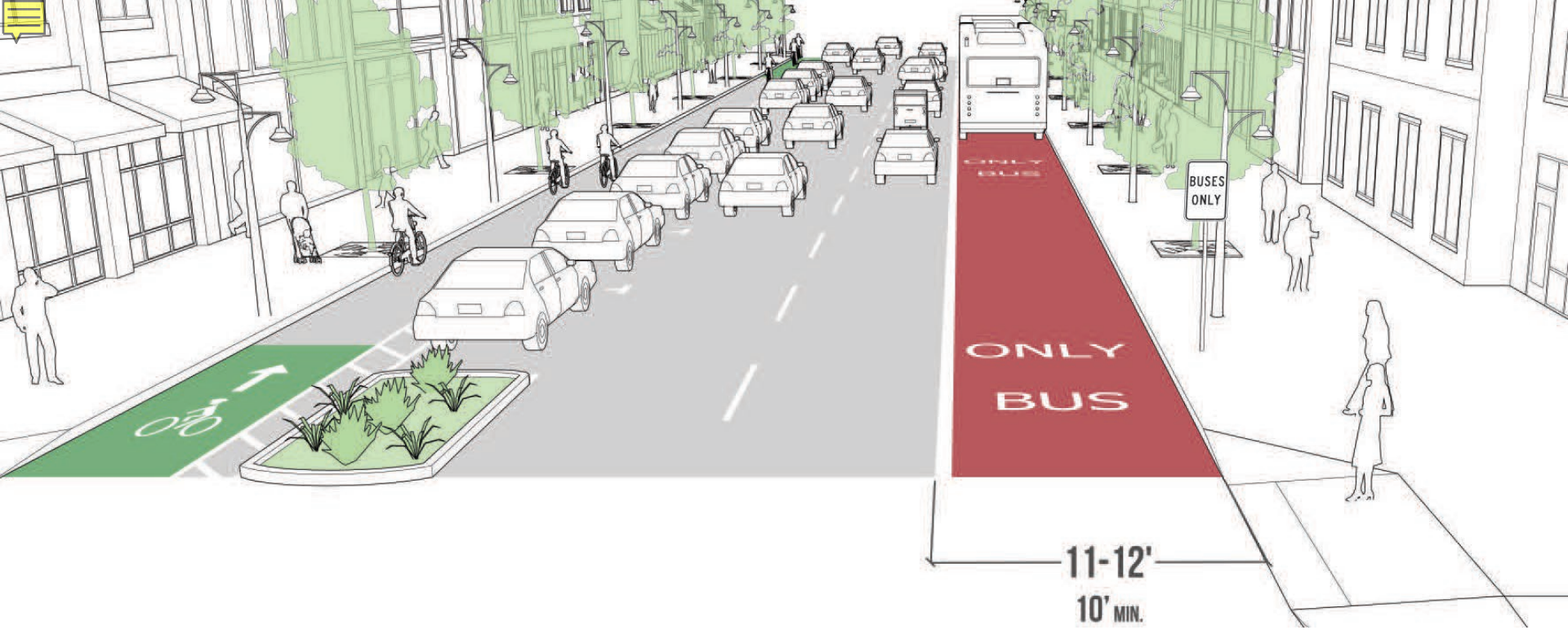
- Combine with intersection treatments where moderate to heavy turn volumes exist (shared right-turn lane, dropped transit lane, or right-turn pocket)

Offset Transit Lane

New York, NY

Offset Transit Lane

Chicago, IL



Curbside Transit Lane

- Prioritizes transit and ensures in-lane stops
- Streets with wide sidewalks
- May be prone to encroachment

Curbside Transit Lane

Required

- Solid white line along running distance—double white line legally prohibits incursion
- BUS ONLY markings and signs
- Enforcement is critical to maintaining integrity

Recommended

- 11–12' desired width
- Red or terra cotta color treatment improves compliance
- Boarding bulbs or boarding island enable in-lane stops
- Adjacent parking or loading lanes are 7-9', marked with parking T's.

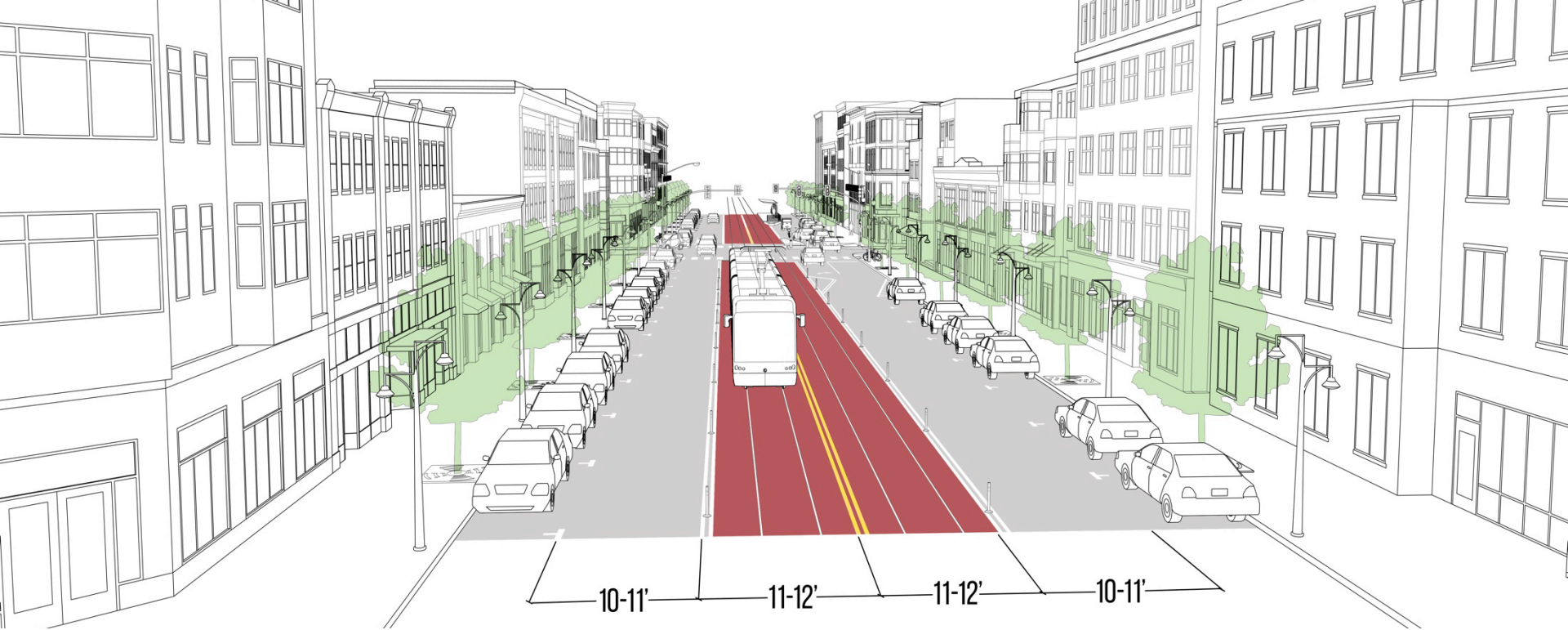
Optional

- Combine with intersection treatments where moderate to heavy turn volumes exist (shared right-turn lane, dropped transit lane, or right-turn pocket)

Curbside Transit Lane

Chicago, IL

Santa Monica, CA



Center Transit Lane

- Applicable to both bus and rail
- Delay caused by congestion
- Can serve very high capacity

Center Transit Lane

Required

- Solid white or double-white line separate from adjacent travel lane
- BUS ONLY, TRANSIT ONLY, or LRT ONLY pavement markings
- Boarding islands must be used to create accessible boarding conditions

Recommended

- Designate with red or terra cotta color to improve compliance
- Should be 11–12' when placed alongside opposing transit lane
- Left turns should be prohibited, and must be phase-separated

Optional

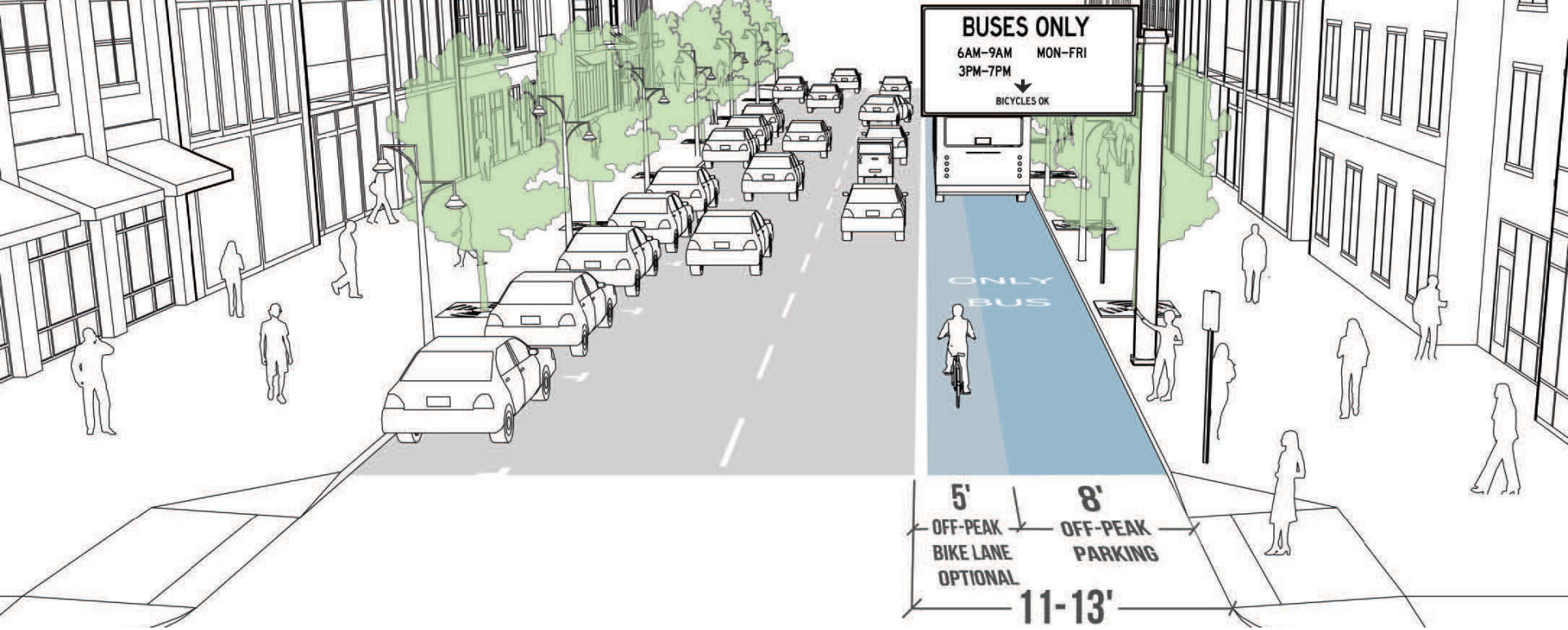
- Vertical barriers can be either "soft" (e.g. rumble strips) or "hard (e.g. conrete curbs, rounded domes)

Center Transit Lane

San Bernardino, CA

Center Transit Lane

San Francisco, CA



Peak-Only Transit Lane

Peak-Only Transit Lane

Required

- Solid white or double-white line separate from adjacent travel lane
- BUS ONLY, TRANSIT ONLY, or LRT ONLY pavement markings
- Boarding islands must be used to create accessible boarding conditions

Recommended

- Designate with red or terra cotta color to improve compliance
- Should be 11–12' when placed alongside opposing transit lane
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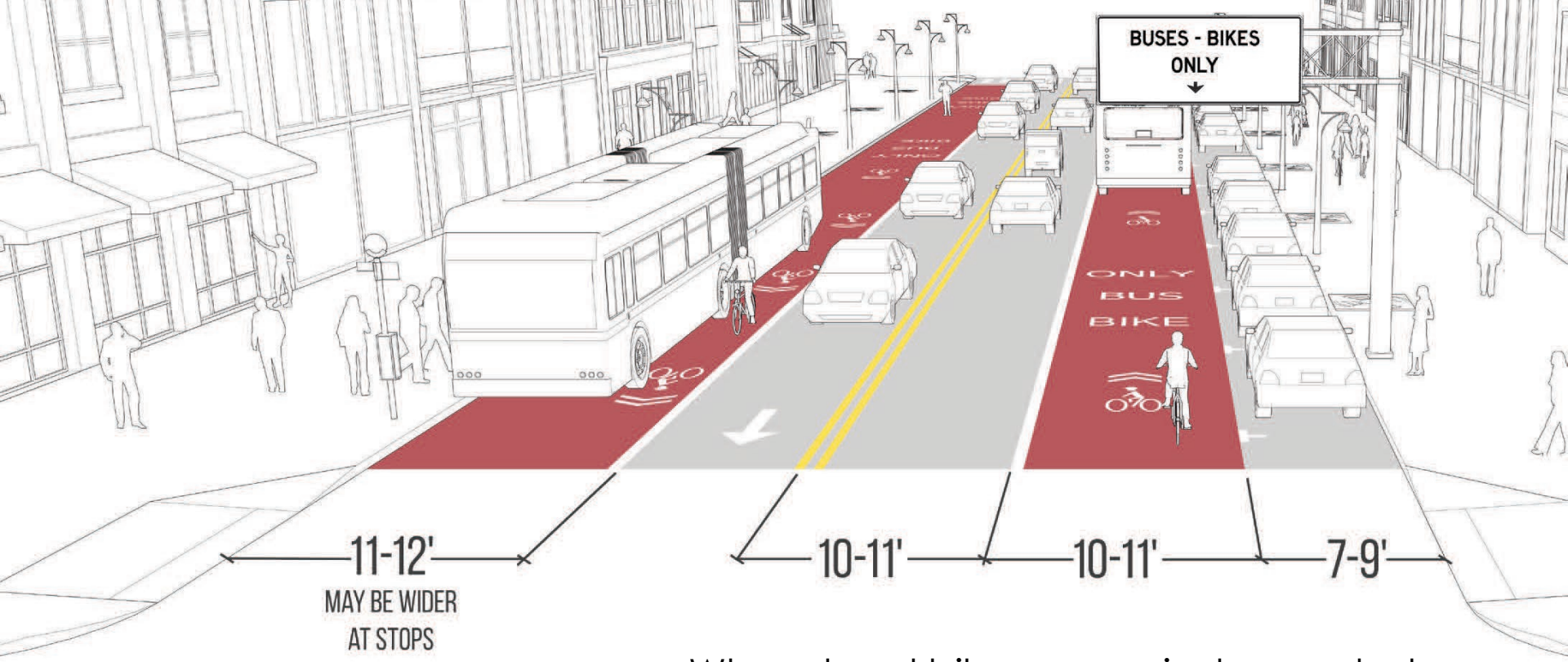
Optional

- Vertical barriers can be either "soft" (e.g. rumble strips) or "hard (e.g. conrete curbs, rounded domes)

Peak-Only Transit Lane

Seattle, WA



Shared Bus-Bike Lane

- Where local bike access is demanded and space is constrained
- Low bus speeds and moderate headways

Shared Bus-Bike Lane

Required

- Bikes must be allowed across entire road surface
- Buses must operate all the way to the right side of the lane
- Pavement markings must allow both users, either "BIKE BUS ONLY" or "BUS ONLY" with bike icon
- Signs must name both users, preferably overhead

Recommended

- 10–11' for an offset and up to 12' for a curbside configuration
- 13–15' lanes should be avoided in most cases; if 15' width is available, the bike facility should be upgraded
- Transit lanes may be narrower (9') at stops; use bicycle sharrow markings to direct bikes to the left at stops.

Optional

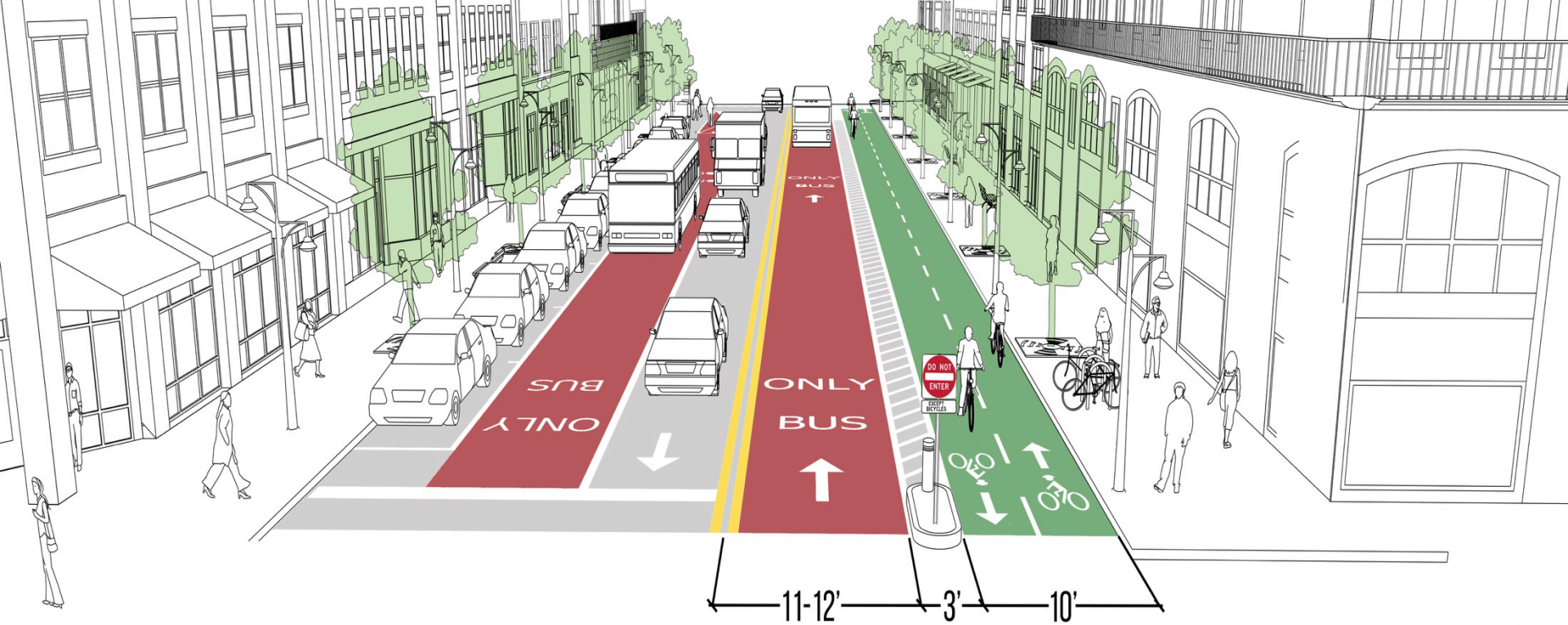
- Channelize passing movements; if space is available at stops, route bikes behind the boarding area to limit conflicts with moving vehicles

Shared Bus-Bike Lane

Boston, MA

Shared Bus-Bike Lane

Philadelphia, PA



Contraflow Transit Lane

- Can simplify routing and eliminate difficult turns
- Shorten travel times
- May merit additional safety considerations

Contraflow Transit Lane

Required

- Double-yellow centerline to prohibit encroachment
- Gateway treatments clearly communicate prohibited entry
- At signalized intersections, use transit-specific signal heads facing the contraflow direction

Recommended

- 11–12' width preferred where adjacent to opposing travel lane
- Red or terra cotta color treatment
- Traffic signal coordination to reflect two-way flow
- Intersection turn management

Optional

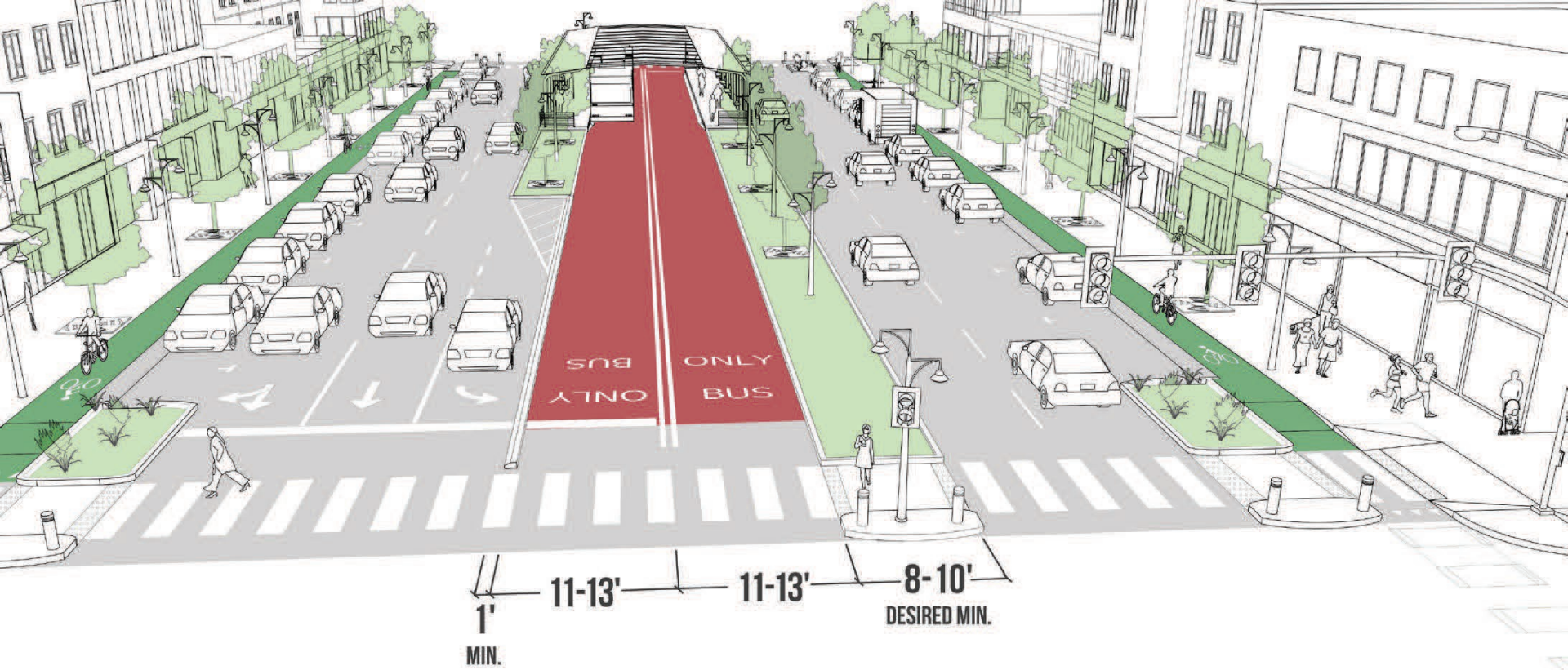
- Restricted turns enable protected bikeways
- "Soft" or "hard" physical separation elements
- Pedestrian refuges with cues to alert pedestrians of opposing travel direction

Contraflow Transit Lane

San Francisco, CA

Contraflow Transit Lane

Minneapolis, MN



Center Transitway

- Dramatically expand transit capacity, reliability, and priority
- Most applicable with LRT and BRT

Center Transitway

Required

- Median boarding islands are required, and must be compatible with transit vehicles
- Transitway is physically separated from general traffic
- Safe crossings across transitway and to stations are critical
- Transit signal heads reduce confusion

Recommended

- Prohibit or separate turning movements across the transitway
- Implement with rapid transit elements, like off-board fare payment, all-door boarding, level or near-level platforms
- Active TSP or Transit-friendly signal progressions further speed transit

Optional

- Concrete performs better where buses frequently operate and reduces maintenance costs
- Median configurations can include periodic passing opportunities to provide tiered (local & rapid) service

Center Transitway

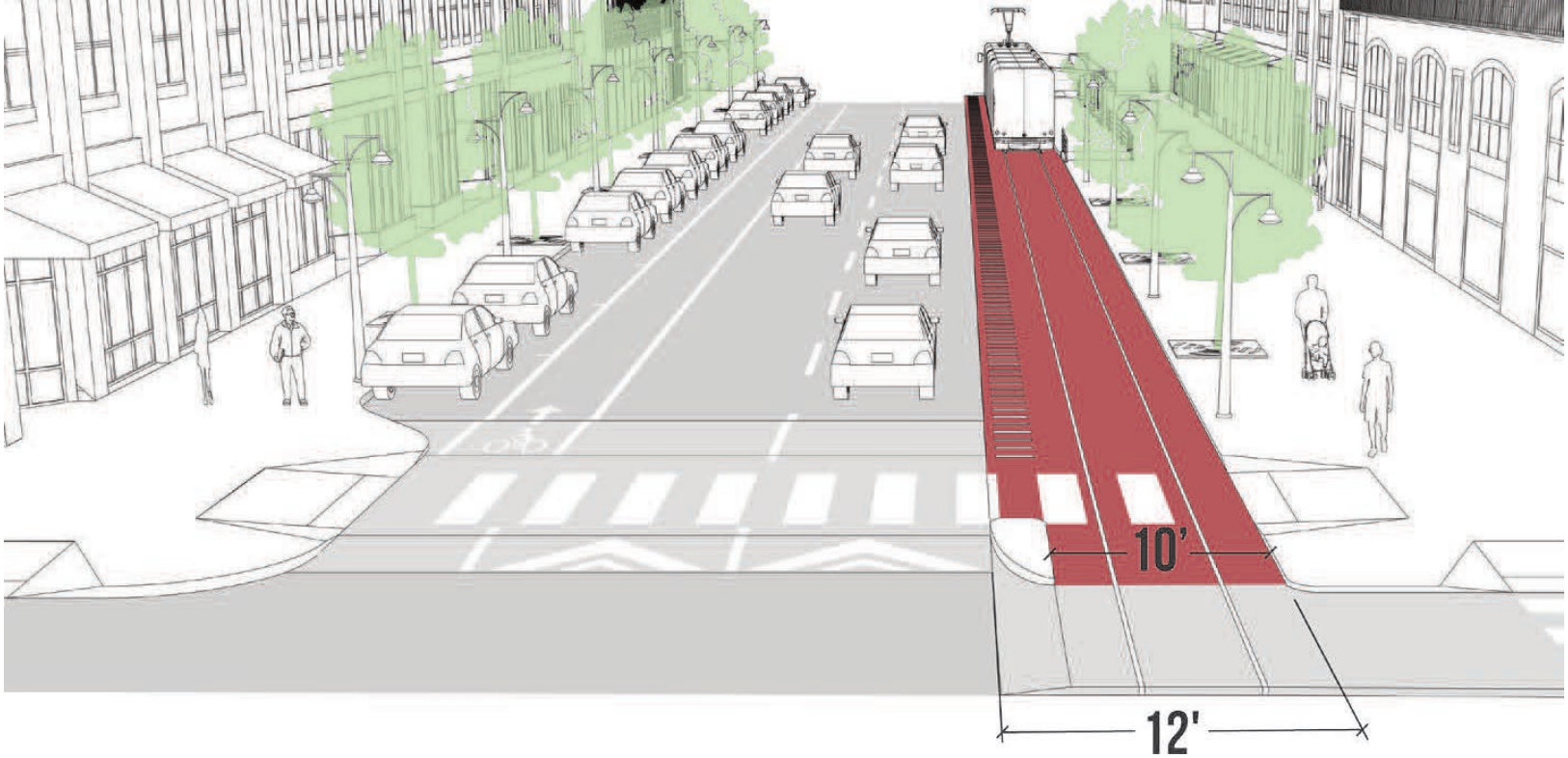
Phoenix, AZ

Center Transitway

Washington, DC

Center Transitway

Minneapolis, MN



Side Transitway

- May be uni- or bi-directional
- Enhanced capacity and priority
- Passengers may board from the sidewalk

Side Transitway

Required

- Physically separated by vertical barrier or grade difference
- All crossings must be signalized, and turns must be separated.
- Place signs, markings, and design elements like curb radii to prevent turning vehicles entering the transitway

Recommended

- Highlight transitway path at intersections
- Apply color, especially at intersections
- Use audible or visual warnings to alert users when approaching
- Complementary treatments (e.g. all-door boarding, TSP, level boarding) magnify service improvements

Optional

- Crossings may be raised to the transitway grade

Side Transitway

Toronto, ON

Side Transitway

Side Transitway

Phoenix, AZ

Pavement Materials

Asphalt

Concrete

Pavers

Color Treatments

Asphalt

Thermoplastic

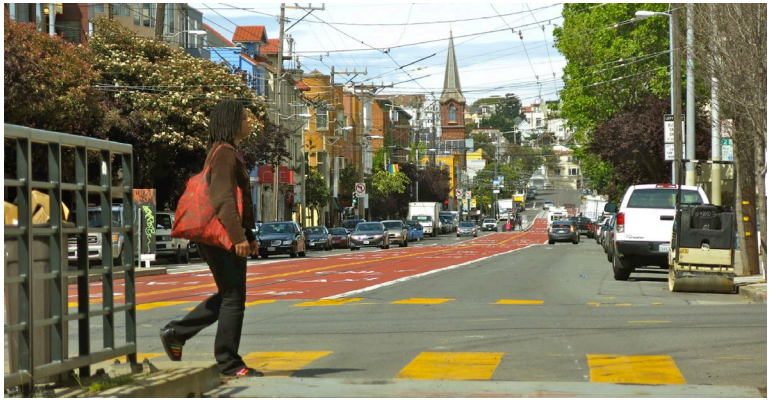
Methyl Methacrylate

Embedded Color

Color Treatments

Red Lanes pilot, **Church Street, SF**

- Reduced corridor travel times 14%, and decreased variability 27%
- Negligible impact of general travel times



Life Cycle Evaluations, New York

- Thermoplastic typically lasts longer than red paint
- Longest lifetime when applied to new pavement
- Shot-blasting/pre-cleaning can extend lifetime

Green Transitways

- Integrate with stormwater management
- Increase permeable surface
- Improve waiting experience
- Dampen noise
- Can incorporate climate-appropriate plantings and xeriscape

Separation Elements

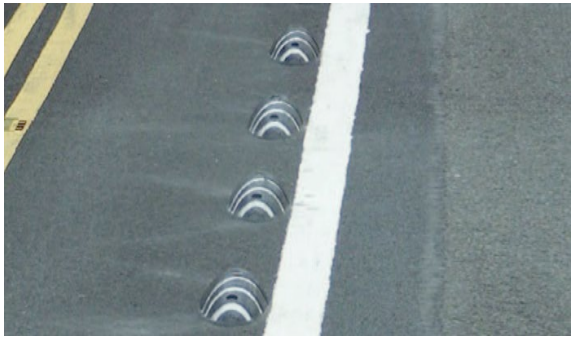
Hard Curb

Mountable Curb

Rumble Strip

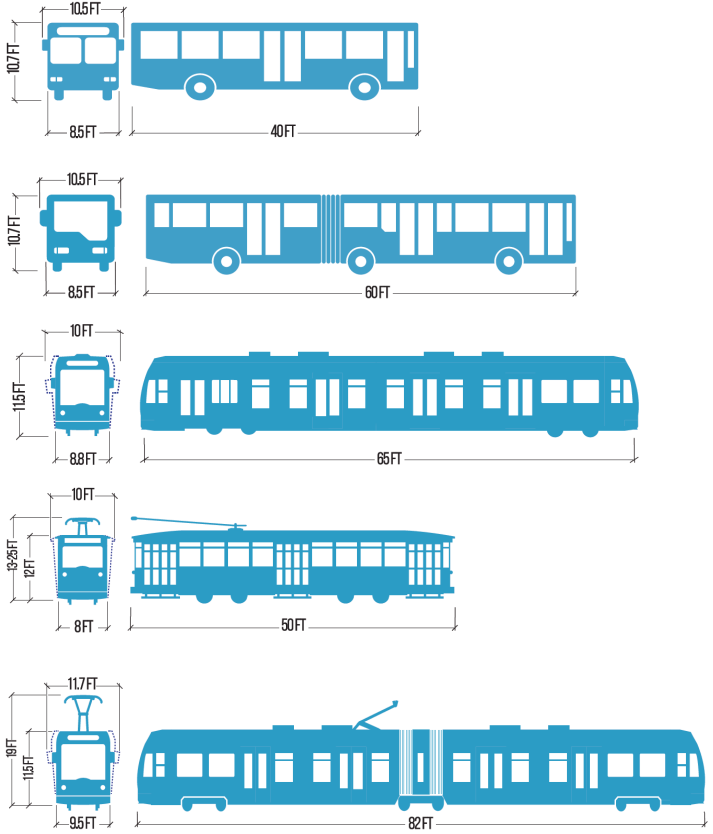
Separation Elements

Bollards



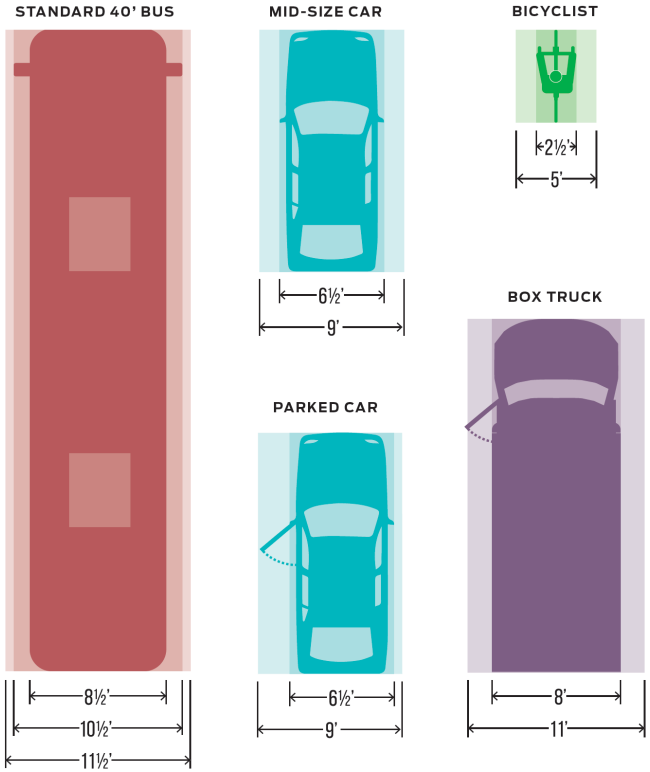
Low Vertical Elements

Full Lane Treatments



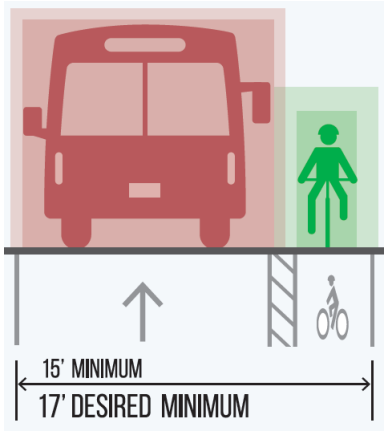
Design Vehicles

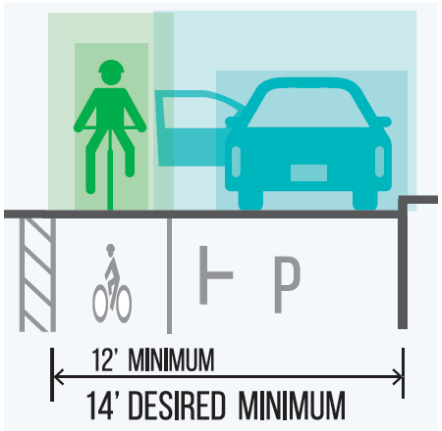
- Select vehicles for capacity and context (speed, throughput, right-of-way width, and block length)
- Transit vehicles should not exceed 25mph in urban contexts; curve radii may assume 10-15mph vehicle speed
- Design for dynamic vehicle envelopes
- Design with the most compact possible geometry without degrading transit's ability to operate

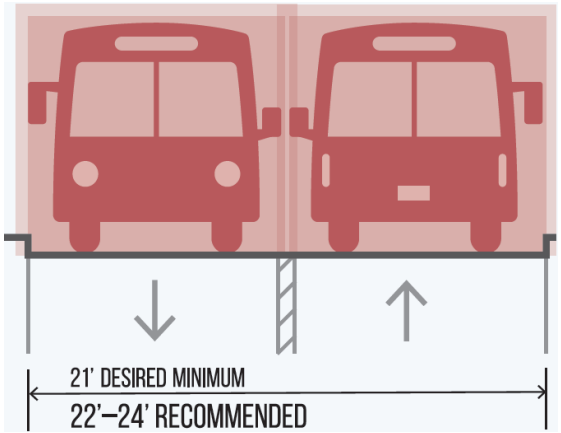


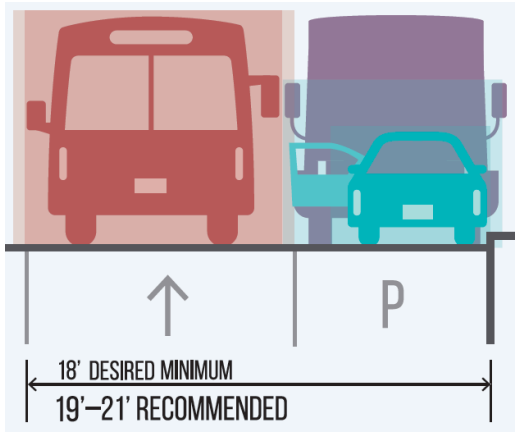
Design Vehicles

- 10–11' can be a comfortable for a bus adjacent to parking or a bike lane
- As speeds increase, operating envelope increases
- Mirror clearance may be more important for rail vehicles than buses.



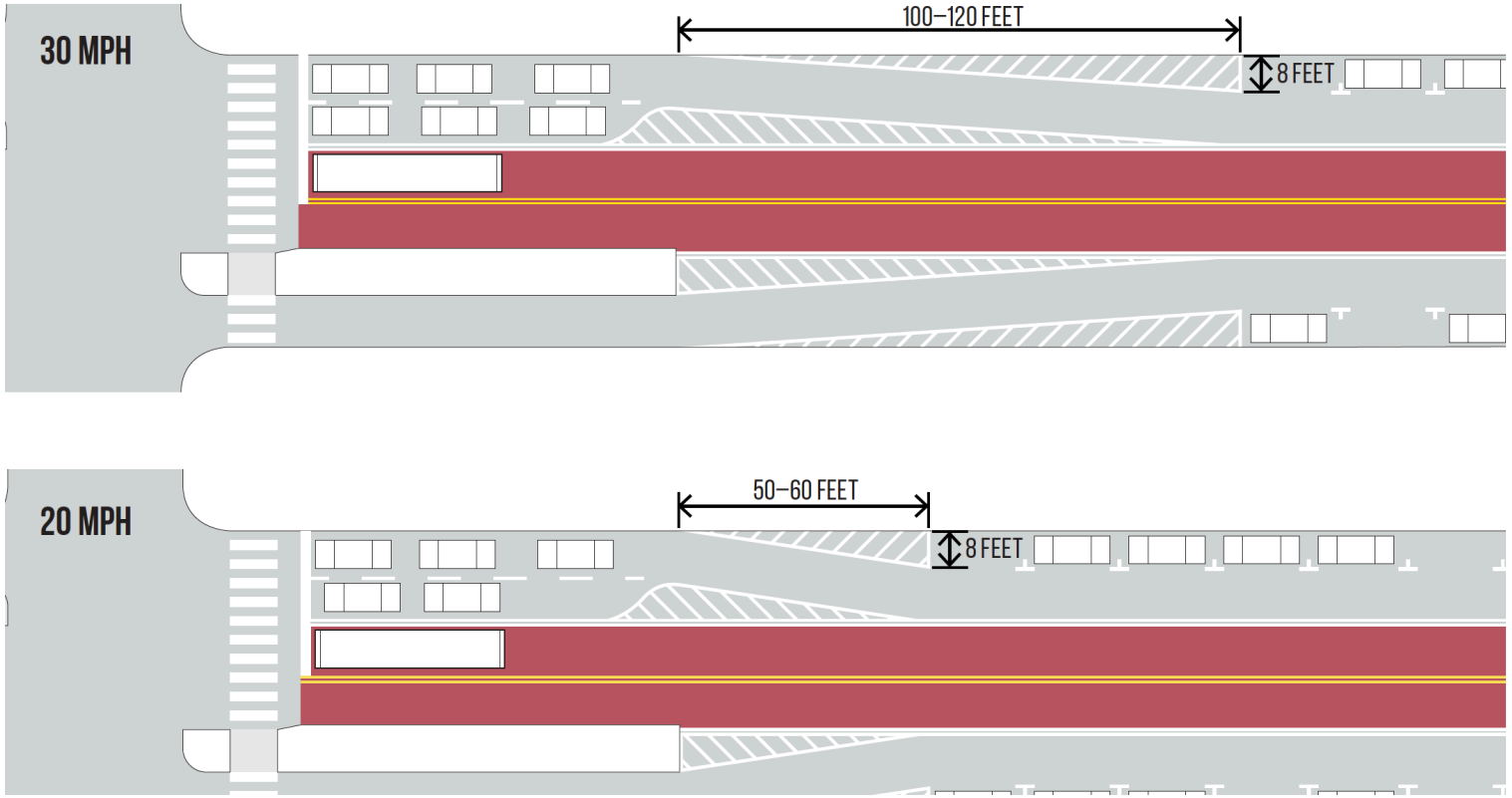






- Design adjacent lane widths in context, accounting for friction and user comfort
- Buffer envelopes may overlap infrequently or at very low speeds

Adjacent User Envelopes



Design Speed

- As speed increases, additional space is consumed for lateral movements
- Reducing speed dispersion makes transit and traffic flow more predictable