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

1. Transit Streets are Active Streets
2. Design Changes Demand
3. 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

- 2.4 minutes faster
- 3.7 minutes faster
- 44 seconds slower
- 34 seconds slower

Brattle St. to Coolidge Ave. (AM Peak)

- Vehicles: MBTA 3%, Other 37%
- People: Riding, 985, 56%
Access to the City

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

How traffic conditions have been communicated

What travelers experience...

Travel times vary greatly day-to-day

Jan    July    Dec

Annual average

Jan    July    Dec

...and what they remember

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

- 10–15 MPH
  - Driver’s peripheral vision
  - Stopping distance
  - Crash risk

- 20–25 MPH
  - Driver’s peripheral vision
  - Stopping distance
  - Crash risk

- 30–35 MPH
  - Driver’s peripheral vision
  - Stopping distance
  - Crash risk

- 40+ MPH
  - Driver’s peripheral vision
  - Stopping distance
  - Crash risk
Minimize Conflicts

- Design for desired speed
- 95\textsuperscript{th} Percentile Speeds
- Percent of vehicles exceeding desired speed

**Reactive:**
Operating (85%) → Design → Posted

**Proactive:**
Target → Design → Posted
Minimize Conflicts

- Control speeds
- Identify conflicts
Public Space & Social Life

• Stationary Activities
• Sidewalk Comfort
Quality of Public Space

Measure social, civic, and market activities
- Number of people engaging in stationary activities
- Quality of space observations/surveys

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

KENDALL SQUARE DAILY MOTOR VEHICLE TRAFFIC

- Broadway
- Binney St.
- Third St.

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
Cost Savings and Transit Productivity

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

Pedestrian Scale

Near-Level Boarding

In-Lane Stops

Safe, Frequent Crossings
Corridor Streets

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

- High-density, congestion, destination access
- Reliability, frequency
- Supporting great public spaces
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
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)
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 terracotta 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. concrete curbs, rounded domes)
Center Transit Lane

San Bernardino, 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
- 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. concrete 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
Shared Bus-Bike Lane
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
Contraflow Transit Lane
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
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
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
- 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**
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.