Transportation networks in all land use settings enable people to walk, bike, and/or take transit to and from their destinations. A single trip may consist of using multiple transportation modes, for example walking to a bus stop, riding the bus downtown, and bicycling the last half mile to the office on bike share. Each transportation mode should operate safely and efficiently without negatively impacting others.

Transit conflicts can be a broad topic. This design topic focuses on conflicts between transit vehicles, such as buses and streetcars, and vulnerable road users, such as pedestrians, bicyclists, and pedestrians accessing bus stops. These principles and strategies can be applied to other modes such as bus rapid transit, subways, or heavy railroad stations.

Conflicts between transit vehicles and vulnerable road users can consist of a bus accessing a stop by crossing a standard bike lane, a bicyclist traveling across or along rail tracks, or a pedestrian or bicyclists passing a bus stop with waiting passengers. Conflicts also occur between pedestrians and motor vehicles when accessing or departing from a bus stop.

Transit conflicts may be addressed through designs that clearly delineate the path for each mode and maximize predictability between users.

### COMMON USERS IN CONFLICT AND TYPICAL CRASH TYPES

- Side-swipe
- Road hazard
- Pedestrian Crossing

### GUIDING PRINCIPLES TO REDUCE CONFLICTS

#### SAFETY
Roadways should allow safe operation of transit vehicles and vulnerable road users by minimizing potential crashes.

#### ACCOMMODATION AND COMFORT
The design should provide a sense of comfort to vulnerable road users and transit passengers while accommodating transit operations.

#### COHERENCE
The path of travel for each mode should be clearly delineated through design, pavement markings, and signs.

#### PREDICTABILITY
The design should create predictable behaviors that allow transit vehicles, motorists, bicyclists, and pedestrians to have clear right-of-way assignments.

#### CONTEXT SENSITIVITY
Designs should respond to typical users and conflict types in a manner that complements community character and supports community health, economic, and livability goals.

#### EXPERIMENTATION
Designers should consider innovative solutions to reducing bicycle hazards at streetcar tracks.
DESIGN STRATEGIES

BUS AND BIKE CONFLICTS

A common conflict between buses and bicyclists is referred to as bus-bike leapfrogging. Bus-bike leapfrogging occurs when a bus and bike are traveling on a roadway in the same direction and pass each other at multiple places. The bicyclist is traveling at a constant speed with the bus passing, pulling into a stop, departing the stop, passing the bicyclist, and traveling to the next stop. This crossing of users can create multiple instances where conflicts can occur.

Bus-bike leapfrogging is uncomfortable for bicyclists as well as for bus drivers and passengers as it can impact bus schedules. On one-way streets it may be feasible to avoid transit conflicts entirely by locating bicycle facilities on the other side of the street. Otherwise, implementation of a floating bus stop can eliminate leap-frogging, improving bicyclist’s comfort and bus operation.

CONSIDERATIONS

- Provide clear indication of the purpose and operations of the floating bus stop for pedestrians and bicyclists.
- Provide adequate tapers for bicyclists to transition from bicycle lane to behind the bus stop. 1
- Provide bus stop passengers amenities such as shelters, benches, and trash barrels outside of bicycle travel. 2
- Maintain accessible pedestrian access to stop amenities, sidewalk, and boarding areas.
- Provide continuous separated bicycle facility behind the boarding area. For more information, refer to the design topic on Separated Bike Lanes 3 (FHWA Separated Bike Lane Guide 2015, pp. 92–96).
- Provide clearly marked crosswalks from the island to the adjacent sidewalk 4 (FHWA Separated Bike Lane Guide 2015, pp. 92–96).
- Consider a raised crosswalk across the bicycle facility 5 (FHWA Separated Bike Lane Guide 2015, pp. 92–96).
- Consider yield or stop lines and YIELD [or STOP] HERE FOR PEDESTRIANS (R1-5) signs to alert bicyclists of the passenger crosswalks (MUTCD 2009, Sec. 2B.11).

EDUCATION

Educating transit vehicle drivers to be aware and cautious around vulnerable users can help reduce conflicts. Drivers should receive trainings, ideally through driving simulators, on how to operate when bicyclists and pedestrians are present. Bus drivers should be alert that the exiting passengers may cross in front of the bus. Educating bicyclists to be cautious and courteous at transit stops can help reduce conflicts. Consider installing educational signs at strategic locations such as on buses and shelters.

NETWORK

Connected networks for pedestrians and bicyclists allow convenient access to and from transit facilities including stations and bus stops. Factor in desire lines when installing new transit facilities. For more information, refer to the design topic on Network Connectivity.
**TRANSIT CONFLICTS**

Bus stop placement is a key component of reducing conflicts between bus passengers, pedestrians, bicyclists, and motorists. Bus stops should be located at appropriate distances based on the context of the area. For example, bus stop spacing in central business districts is less than 400 feet. Bus stops should complement the sidewalk and bicycle facilities to connect passengers with the surrounding pedestrian and bicycle networks. At intersections, bus stops can be provided on the near- or far-side of the intersection. Far-side bus stops are preferred when feasible as near-side bus stops can block visibility between turning vehicles and pedestrians. At midblock bus stop locations, depending on the proximity of other crosswalks, a midblock crossing may be necessary and may require enhanced crossing treatments. For more information, refer to the design topics on Enhanced Crossing Treatments, Bus Stops, and Midblock Path Intersections.  

(AASHTO Transit Guide 2014, p. 5-11–5-13)

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**TRACK AND BIKE CONFLICTS**

Cities are competing to provide multimodal transportation networks that focus on complete streets and public transportation options. Some have reintroduced light rail and streetcar vehicles to their transit systems. Light rail transit or streetcars, also known as trolley cars, are short public transit vehicles that run on rails on a regular schedule. Light rail transit typically operates within its own exclusive space and streetcars operate in a travel lane along a roadway. Boston, Portland, Seattle, and San Francisco are a few examples of cities that operate light rail and streetcars as part of their transportation systems.

Between the resurgence of light rail and streetcars and increases in bicycling, conflicts between bicyclists and tracks may become more common. Tracks typically contain a gap, called the flangeway, which can be a hazard for bicycle tires. In wet conditions, tracks may be slippery, causing bicyclists to lose control.

**CONSIDERATIONS**

- Consider using the best track surface material for safe bicycle travel especially when the surface may be regularly wet.
- Consider reducing the flangeway or using a flangeway filler product.
- Provide pavement markings such as bike lane lines, bike symbols, and green colored pavement surfaces to direct bicyclists to cross the tracks between 60 and 90 degrees to reduce the risk of getting bicycle tires caught in the tracks.  
  (AASHTO Bike Guide 2012, p. 4-38)
- Consider a median to force deflection of bicyclist to cross the tracks at the appropriate angle and prevent illegal parking by motorists.
- Provide advance track warning signs to alert bicyclists of the tracks ahead.
CASE STUDIES

DIRECTING BIKES ACROSS STREETCAR TRACKS
BOSTON, MA

With the number of bicyclists increasing in Boston, the City has seen an increase in bicycle crashes resulting from the presence of in-street rail lines. The City decided to address the issue of bicyclist interaction with in-street rail through pavement markings and green colored pavement.

At intersections where track angles were creating challenges for bicyclists, dashed white lane lines with green colored pavement were added to help bicyclists position themselves to cross the tracks at near 90-degree angles.

Boston also has streetcars that run along the center of streets that are too narrow for exclusive bike lanes. To encourage bicyclists to stay in the right lane, the City installed shared lane markings and left-turn queue boxes to assist bicyclists in making left turns.

FLOATING BUS STOP
SEATTLE, WA

The City of Seattle has installed bus stop floating islands at a majority of bus stops along Dexter Avenue, a major bicycle commuting corridor that has peak bicycle volumes of over 300 bicyclists per hour. This 1.5-mile corridor carries buses at 10 minute headways during peak periods. The bus stop floating islands allow buses to stop in-lane, decreasing bus delay and allowing buses to easily re-enter traffic without waiting for a gap in passing motorists. The buffered bike lane is routed behind the bus stop, which prevents conflicts between bicyclists and stopped buses. The bus stop floating islands are accessible, with curb ramps and detectable warning surfaces. Some of the bus stops include railings across the back of the bus islands to encourage pedestrians to cross the bike lane at a designated point.

FOR MORE INFORMATION


Federal Highway Administration. Separated Bike Lane Planning and Design Guide. 2015.