








Implementation Tools








The Transit Effectiveness Project consists of three components: service changes, service-related capital projects, and travel time reduction proposals. The following typology lists the various implementation tools:






Service Changes

-  New Route
-  Route Elimination
-  Route Alignment
-  Headway Change
-  Vehicle Type Change
-  Expanded Hours

Service-Related Capital Projects

-  Terminal & Transfer Point Improvements
-  Overhead Wire Expansion
-  Systemwide Capital Infrastructure

Travel Time Reduction Proposals (TTRP)

-  **TRANSIT STOP CHANGES**
 1. Remove or Consolidate Transit Stops
 2. Optimize Transit Stop Locations at Intersections
 3. Install Transit Bulbs
 4. Install Transit Boarding Islands
 5. Optimize Transit Stop Lengths
 6. Convert Flag Stops to Transit Zones
-  **LANE MODIFICATIONS**
 7. Establish Transit-Only Lanes
 8. Establish Transit Queue Jump/Bypass Lanes
 9. Establish Dedicated Turn Lanes
 10. Widen Travel Lanes through Lane Reductions
-  **PARKING AND TURN RESTRICTIONS**
 11. Implement Turn Restrictions
 12. Widen Travel Lanes through Parking Restrictions
-  **TRAFFIC SIGNAL & STOP SIGN CHANGES**
 13. Install Traffic Signals at Uncontrolled and Two-way Stop-controlled Intersections
 14. Install Traffic Signals at All-way Stop-controlled Intersections
 15. Replace All-way Stop-controls with Traffic Calming Measures at Intersections
-  **PEDESTRIAN IMPROVEMENTS**
 16. Install Pedestrian Refuge Islands
 17. Install Pedestrian Bulbs
 18. Widen Sidewalks

Service Improvements

The TEP proposes service changes for route restructuring, frequency improvements, and vehicle type changes, which will direct resources where they are needed most, reduce crowding, and improve connections to regional transit. The proposed service changes include:

- Increase overall transit service by 12%
- Redesign routes to streamline travel and improve efficiency
- Enhance neighborhood connections
- Increase frequency on popular routes
- Reduce crowding
- Modify or discontinue low-ridership routes/segments
- Expand limited-stop service

These changes will better serve Muni customers, reflect changing travel patterns within San Francisco, provide improved connection to regional transit, streamline routes for improved reliability and reduced delay, and maximize the benefits from public resources.

Service-Related Capital Improvements

Many of the Service changes can be implemented without capital investments. However, some of the proposals are dependent on or would be enhanced by service-related capital projects. These projects fall into three categories:

Terminal and Transfer Point Improvements (TTPI)

Transfer and terminal points are stops that accommodate substantial passenger interchanges and/or transit vehicle layovers. Some of the TEP route changes would require passengers to transfer at new locations and/or additional buses to layover at existing sites. The TEP proposes four TTPI projects. The TTPI projects would include some or all of the following: the installation of new switches, bypass rails, transit bulbs, and overhead wiring and poles and associated underground wiring; the expansion of transit zones for bus layovers; the reconfiguration or elimination of on-street parking; and possible sidewalk modifications.

Overhead Wire Expansion (OWE)

OWE projects would include the installation of additional overhead wires and related infrastructure (e.g., support poles up to 30-feet in height, conduit, and duct banks) for certain electric trolley coach routes. OWE projects would support service route changes by allowing Muni to use electric trolley coaches on additional streets and would make it possible for trolley coaches to pass one another on existing trolley coach routes.

Systemwide Capital Infrastructure (SCI)

The two SCI projects would include the installation of new accessible platforms to improve system accessibility across the light rail network and the extension of an existing “transit- commercial” contraflow lane on Sansome Street to optimize bus routing and reduce transit travel time. Typical dimensions of an accessible surface platform are 60 inches by 90 inches. The heights of the platforms would vary by location, but would not exceed three and one-half feet from the ground surface or six and one-half feet in total height including the height of the three-foot-high open railing.

The Service-related Capital Improvements also include two levels of analysis: program level and project level. Capital projects for which specific designs and locations have not yet been developed are evaluated at a program-level. Capital projects with sufficiently detailed designs are analyzed at a project level.

Travel Time Reduction Proposals (TTRP)

Research conducted by the SFMTA during the initial planning phase of the TEP identified the following as major causes of transit delay: intersection congestion, traffic congestion on roadways, narrow mixed-flow lanes, and closely spaced transit stops. Other sources of transit delay identified in the research were associated with dwell time, traffic signals, and transit zone operational delays (i.e., the time for transit vehicles to pull into a stop or merge back into traffic after a stop).

The SFMTA has identified a set of standard traffic engineering elements that address these issues and can reduce transit travel time when applied to streets along a transit corridor. These elements include adding transit bulbs/boarding islands; transit stop changes including moving, adding, or eliminating stops; the addition of turn lanes, turn restrictions, and transit-only lanes; pedestrian improvements such as curb extensions and other crosswalk treatments; and the removal of stop signs and installation of traffic signals or other traffic calming measures at intersections. Collectively, these tools or elements are called the Transit Preferential Streets Toolkit (TPS Toolkit).

Transit Stop Changes

Transit stop changes adjust the size, location, or type of a transit stop. Transit stop changes reduce travel time by changing the distance between stops, making boarding and alighting easier for passengers, reducing transit dwell time, and/or reducing the time it takes for a transit vehicle to move in and out of traffic.

TOOLS

1. Remove or Consolidate Transit Stops
2. Optimize Transit Stop Locations at Intersections
3. Install Transit Bulbs
4. Install Transit Boarding Islands
5. Optimize Transit Stop Lengths
6. Convert Flag Stops to Transit Zones

Lane Modifications

Lane modifications change the roadway striping. These tools are proposed to separate transit vehicles from vehicle congestion, enhance safety by widening existing travel lanes, or improve transit speed and reliability by improving traffic flow. These changes are generally implemented by modifying an existing travel lane or by removing a parking lane.

Travel Time Reduction Proposals (TTRP)

TOOLS

7. Establish Transit-Only Lanes
8. Establish Transit Queue Jump/Bypass Lanes
9. Establish Dedicated Turn Lanes
10. Widen Travel Lanes through Lane Reductions

Parking and Turn Restrictions

Parking and turn measures are primarily legislative changes and enacted by signage, striping and parking restrictions. In some cases, they could also include roadway striping changes. Turn restrictions and tow-away zones are proposed to reduce travel delay caused by turning vehicles and to increase the number of travel lanes or the width of travel lanes on a street for some or all times of day.

TOOLS

11. Implement Turn Restrictions
12. Widen Travel Lanes through Parking Restrictions

Traffic Signal and Stop Sign Changes

Intersections are typically controlled by yield signs, stop signs and traffic signals. Signalizing an intersection or removing the stop sign(s) on the street with transit would reduce delay from stop signs. Traffic calming measures could be added to intersections with Stop sign removals to help pedestrians cross the street.

TOOLS

13. Install Traffic Signals at Uncontrolled and Two-way Stop-controlled Intersections
14. Install Traffic Signals at All-way Stop-controlled Intersections
15. Replace All-way Stop-controls with Traffic Calming Measures at Intersections

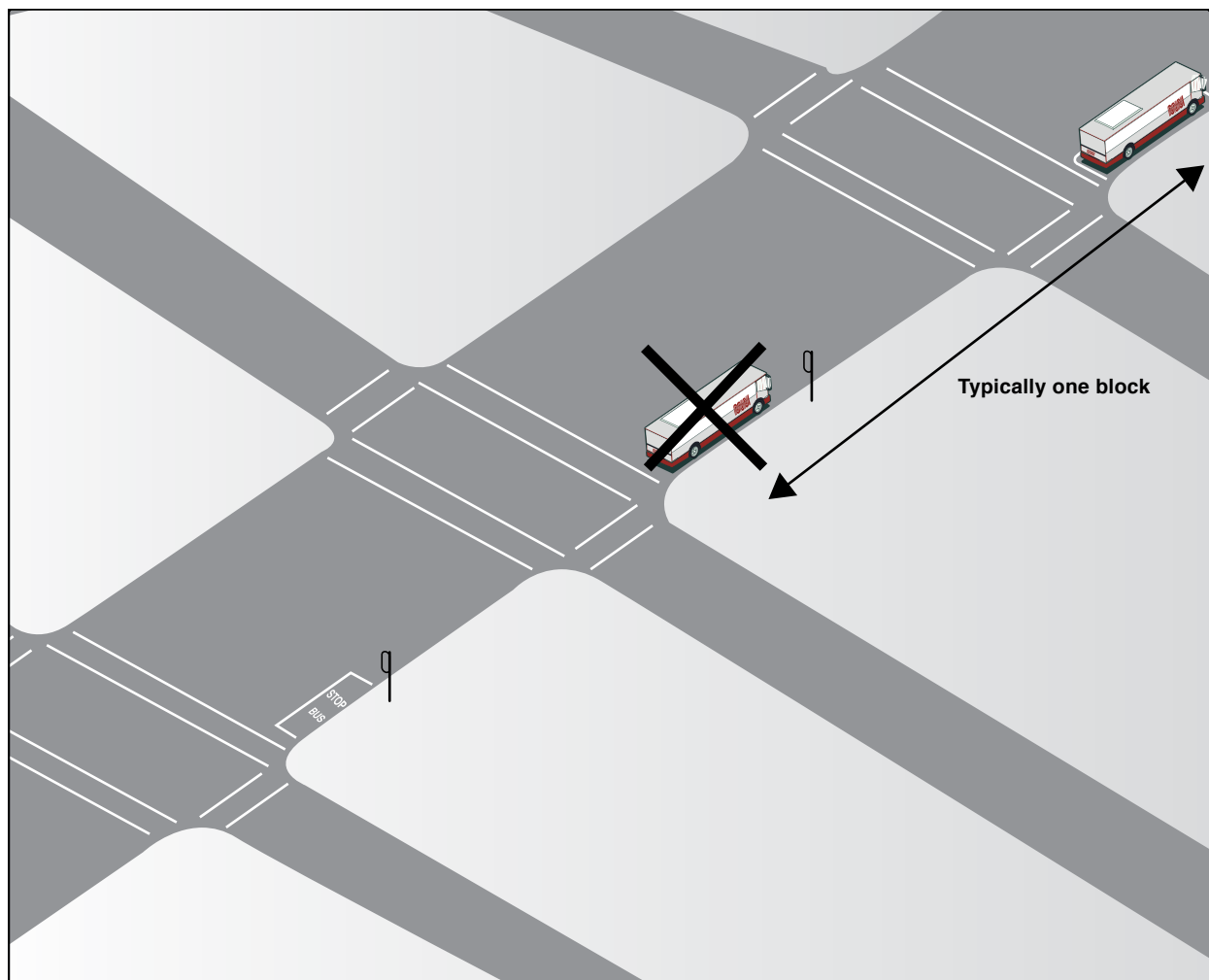
Pedestrian Improvements

Pedestrian improvements enhance access to transit, and enable transit to move with less delay and more reliability through a corridor.

TOOLS

16. Install Pedestrian Refuge Islands
17. Install Pedestrian Bulbs
18. Widen Sidewalks

TTRP: Transit Stop Changes

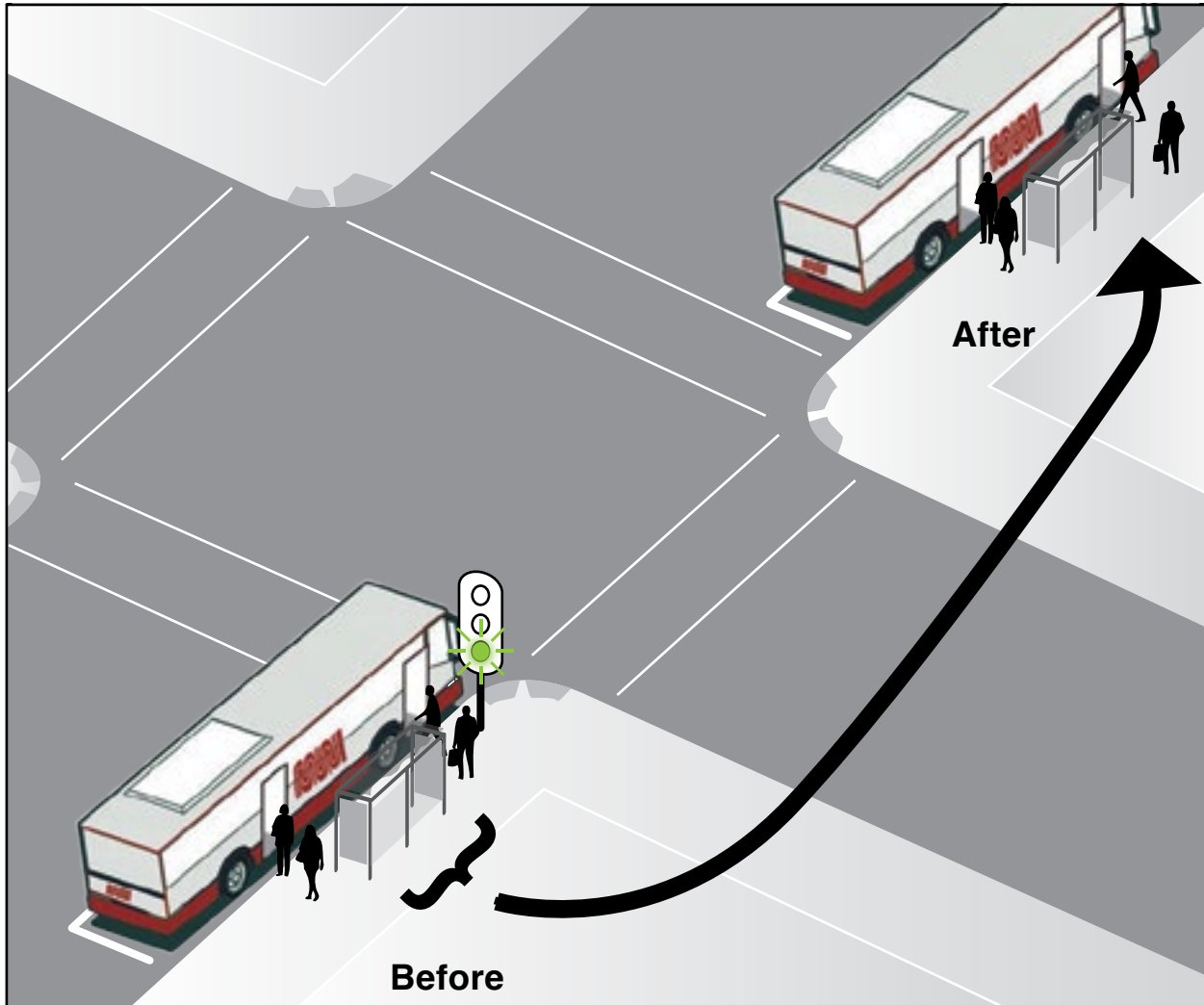


Note: The above conceptual figure is not to scale and is for illustrative purposes only.

1. Remove or Consolidate Transit Stops

Removing closely spaced transit stops can decrease transit travel times by reducing the frequency that transit vehicles must stop to pick up and drop off passengers. Consolidating transit stops involves removing two adjacent transit stops and establishing a new transit stop at an intermediate location. Removing or consolidating stops with existing transit zones may result in the availability of additional curb space that could be used for new on-street parking, bicycle parking, parklets, or parking restrictions at intersection approaches to improve pedestrian visibility and sight distance.

TTRP: Transit Stop Changes

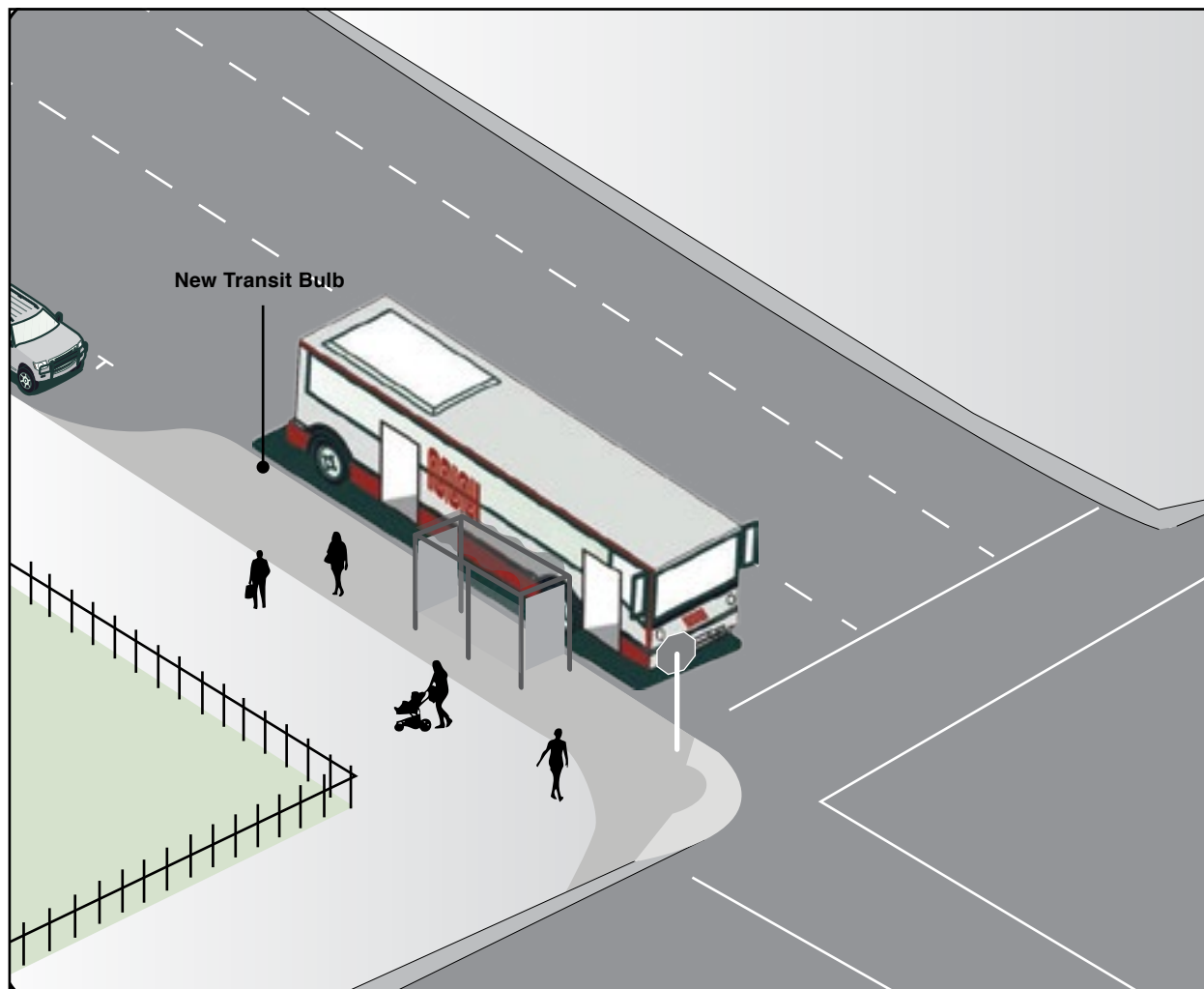


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2. Optimize Transit Stop Locations at Intersections

Optimizing transit stop locations at intersections can decrease transit travel times by reducing the number of times transit vehicles stop at intersections. At stop sign-controlled intersections, it is generally recommended that transit stops be located on the nearside of the intersection to enable transit vehicles to pick-up and drop-off passengers while stopped at the stop sign, rather than needing to stop a second time to conduct passenger pick-up and drop-off on the farside of the intersection. At traffic signal-controlled intersections, it is generally recommended that transit stops be located on the farside of the intersection, as depicted above, to allow transit vehicles to take advantage of existing and planned transit signal priority improvements that could allow traffic signals to hold green signals for approaching transit vehicles.

TTRP: Transit Stop Changes

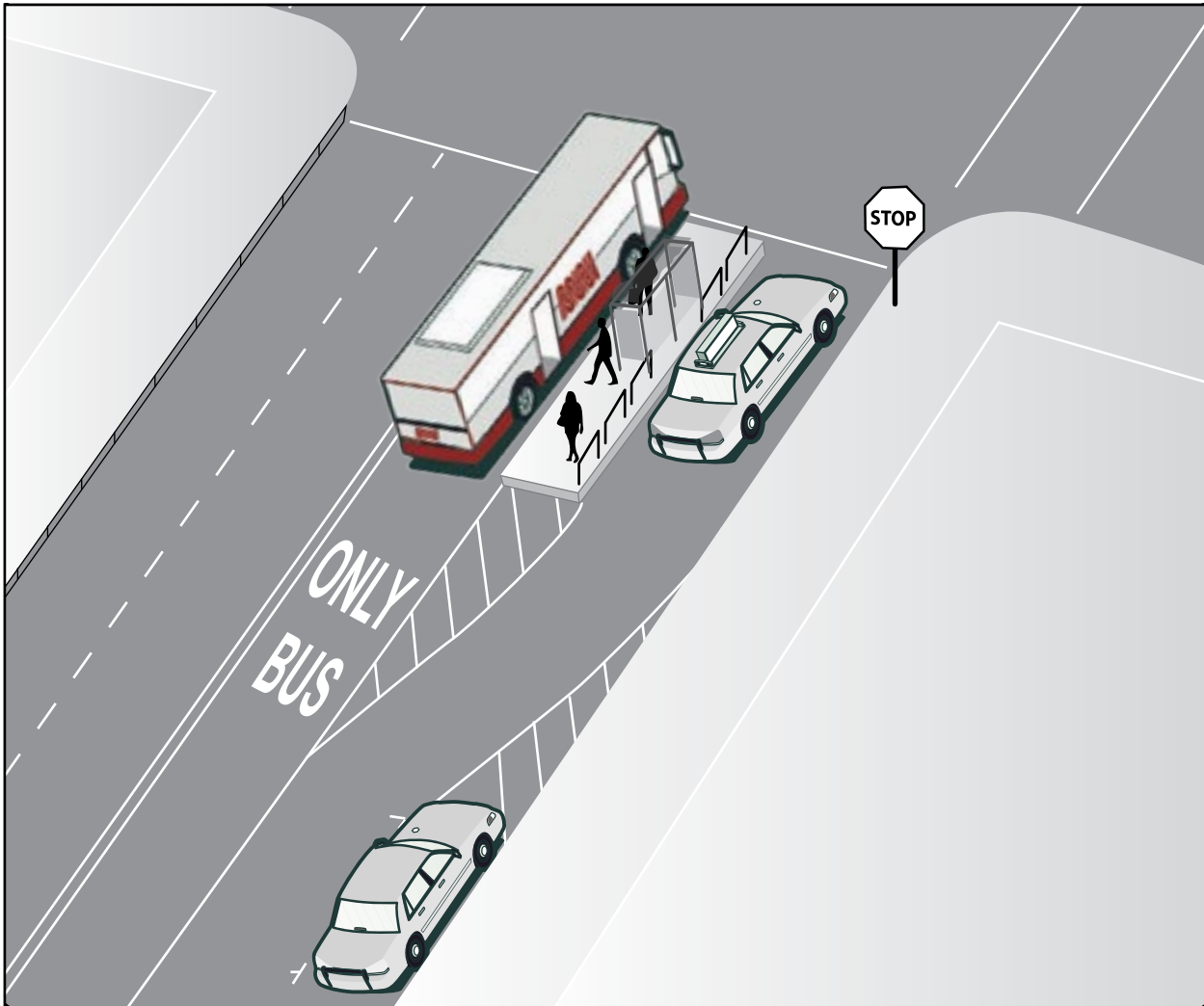


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3. Install Transit Bulbs

Transit bulbs are sidewalk extensions at the location of a transit stop, typically about the same width as the adjoining parking lane. They can reduce transit travel times on bus routes by eliminating the need for buses to exit and re-enter the flow of traffic to access curbside transit stops and on rail lines by providing a place for boarding passengers to wait directly adjacent to a stopped light rail vehicle (LRV), thereby eliminating the time needed for passengers to walk from the curb across a parking lane to the LRV. Transit bulbs also provide added space for customer amenities such as shelters, improve pedestrian safety by shortening the street crossing distance, and reduce the speed of turning traffic, as well as reducing sidewalk crowding at transit stop locations.

TTRP: Transit Stop Changes

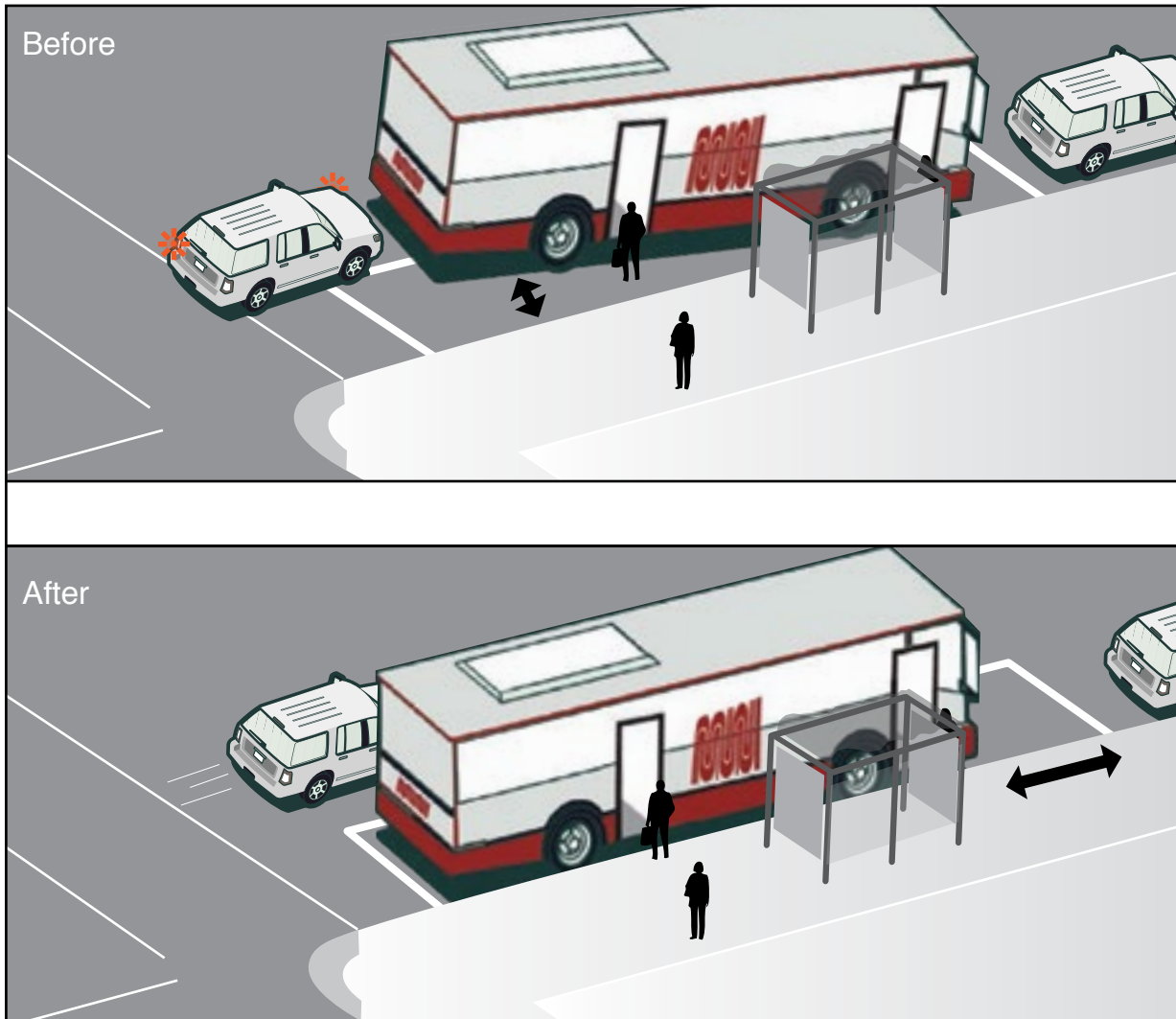


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4. Install Transit Boarding Islands

Transit boarding islands are raised islands within the street that allow transit vehicles to use a center lane within the roadway to pick-up and drop-off passengers at transit stops. They can reduce transit travel times on bus routes by eliminating the need for buses to exit and re-enter the flow of traffic to access curbside transit stops. Transit boarding islands also allow the bus to avoid the curb lane, which is generally slower as a result of parking maneuvers, right turns and illegal double parking. Transit boarding islands can reduce transit travel times on rail lines that operate on fixed guideways in the center of the street by providing a place for boarding passengers to wait directly adjacent to a stopped light rail vehicle (LRV), thereby eliminating the time needed for passengers to walk from the curb to the LRV.

TTRP: Transit Stop Changes

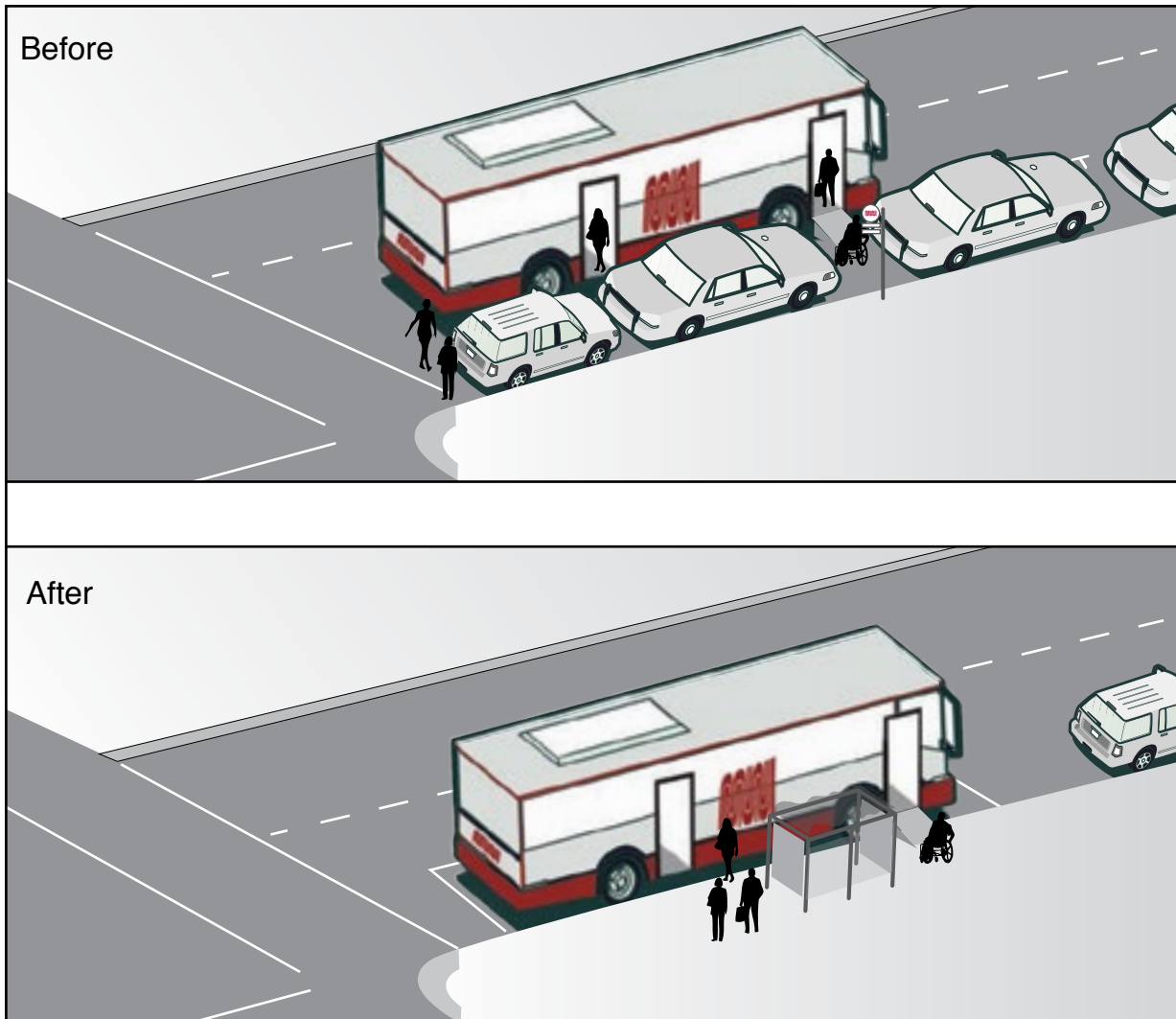


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5. Optimize Transit Stop Lengths

Optimizing transit stop lengths can reduce transit travel times by providing space for all doors of a transit vehicle to align with the curb or boarding island or by providing space for multiple buses to pick up and drop off passengers at a bus stop concurrently. Most transit stops are designed to accommodate the arrival and departure of one bus at a time; however, where transit stops serve multiple bus routes and/or bus routes with frequent service, transit stops would be designed to accommodate multiple buses at the same time, thereby reducing the delay associated with a second bus waiting to access a transit stop to pick-up and drop-off passengers.

TTRP: Transit Stop Changes

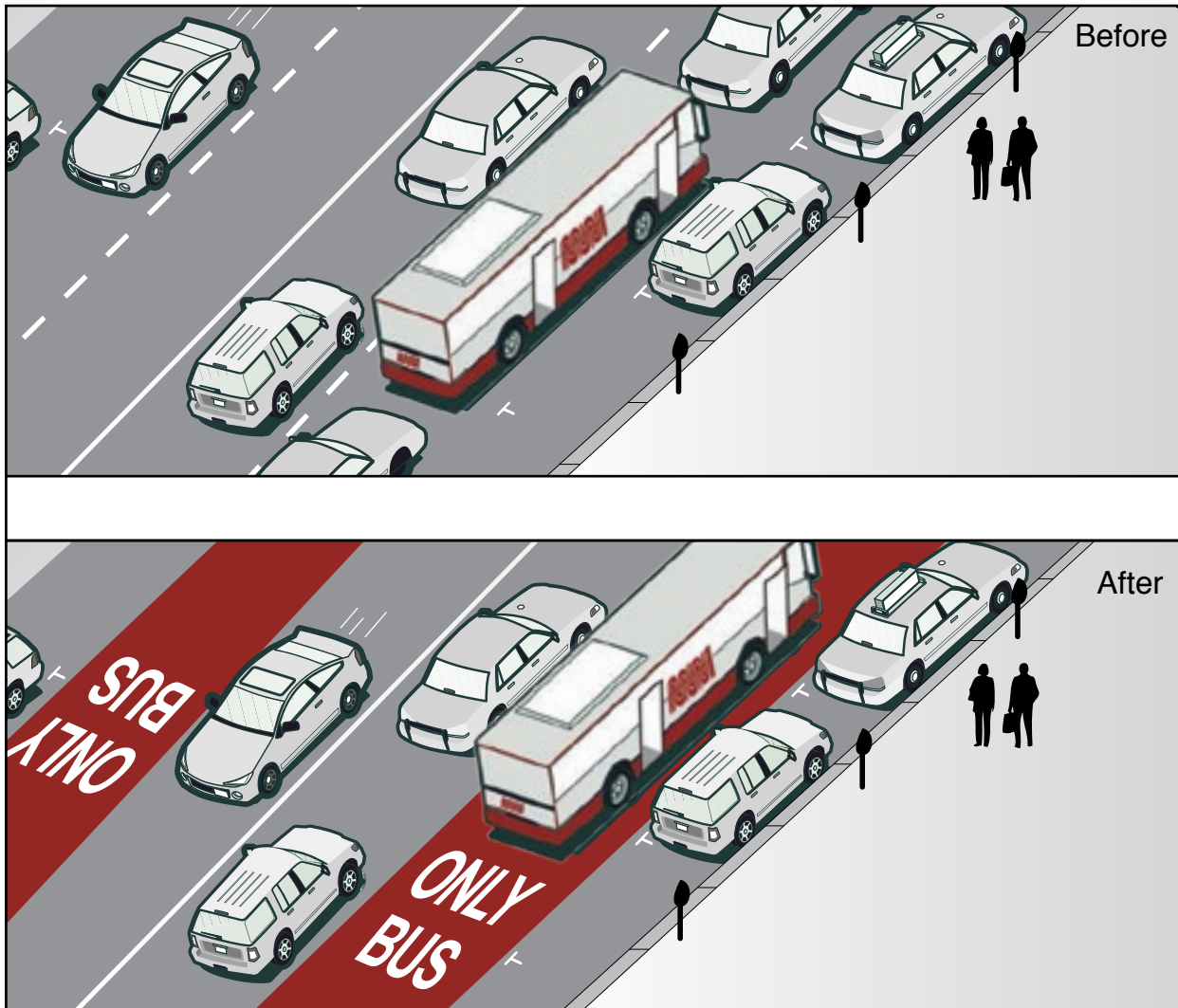


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6. Convert Flag Stops to Transit Zones

A flag stop (also referred to as a pole stop) is a transit stop without a designated curbside zone and where parking is not restricted. Some flag stops are located on streets without parking, in which case the bus can either stop in the mixed-flow lane or pull over to the curb. At flag stops adjacent to on-street parking, all passengers, including wheelchair users, must board and exit buses in the street since the bus cannot pull to the curb. Converting flag stops to transit zones can reduce transit travel times by allowing passengers to be picked up and dropped off at the curb adjacent to the sidewalk instead of in the street.

TTRP: Lane Modifications

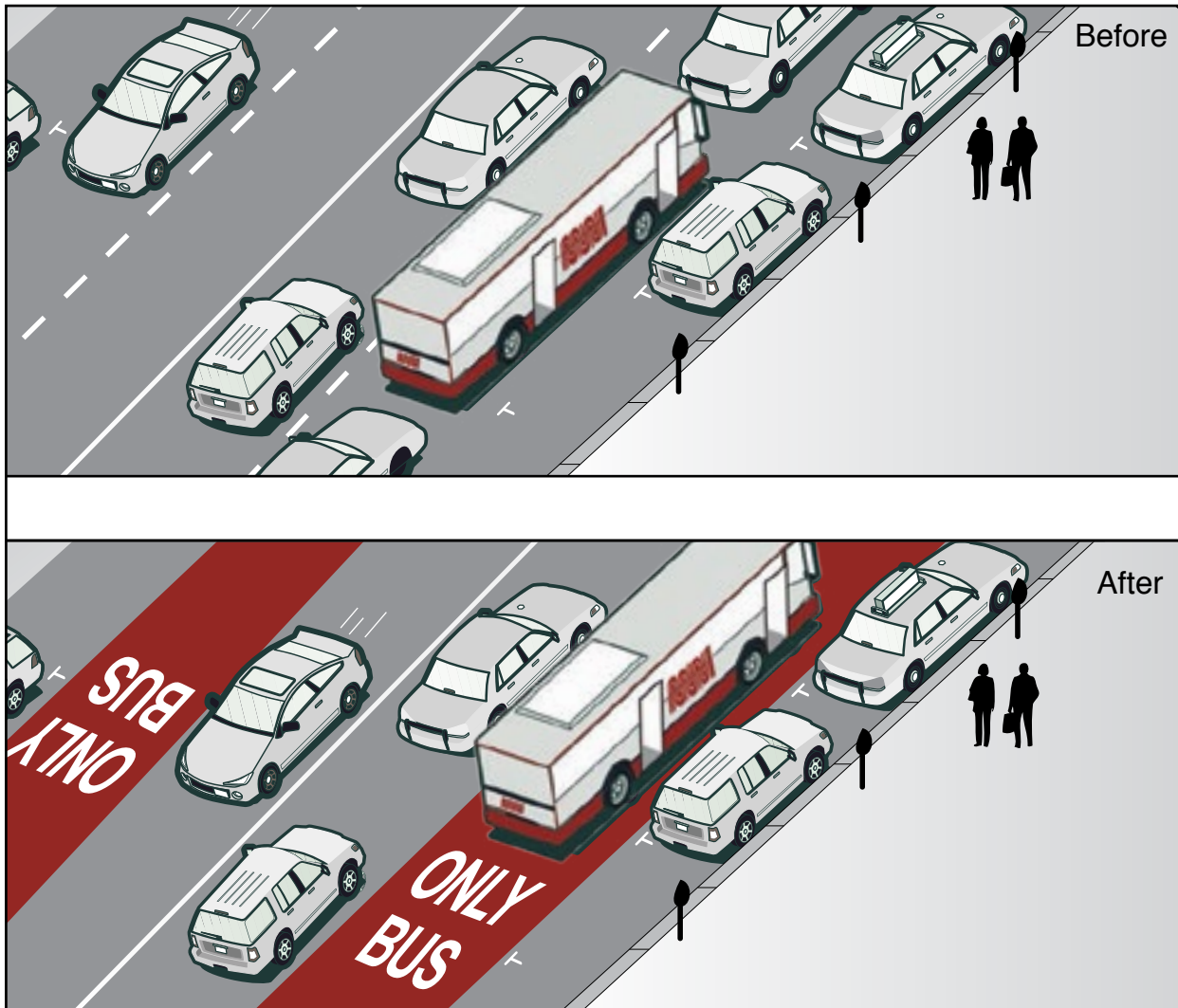


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7. Establish Transit-Only Lanes

A transit-only lane is a travel lane that is dedicated for the exclusive use of transit vehicles. Transit-only lanes are typically identified with signs and pavement markings. Transit-only lanes can reduce transit travel times by allowing transit vehicles to bypass traffic congestion and avoid conflicts with other vehicles in mixed travel lanes. Non-transit vehicles are generally permitted to enter transit-only lanes to access curbside parking or to complete a turn, unless specifically prohibited. Emergency vehicles may use transit-only lanes at all times, and often taxis may also use these lanes. Transit-only lanes can be created by removing an existing travel lane or by removing a parking lane.

TTRP: Lane Modifications

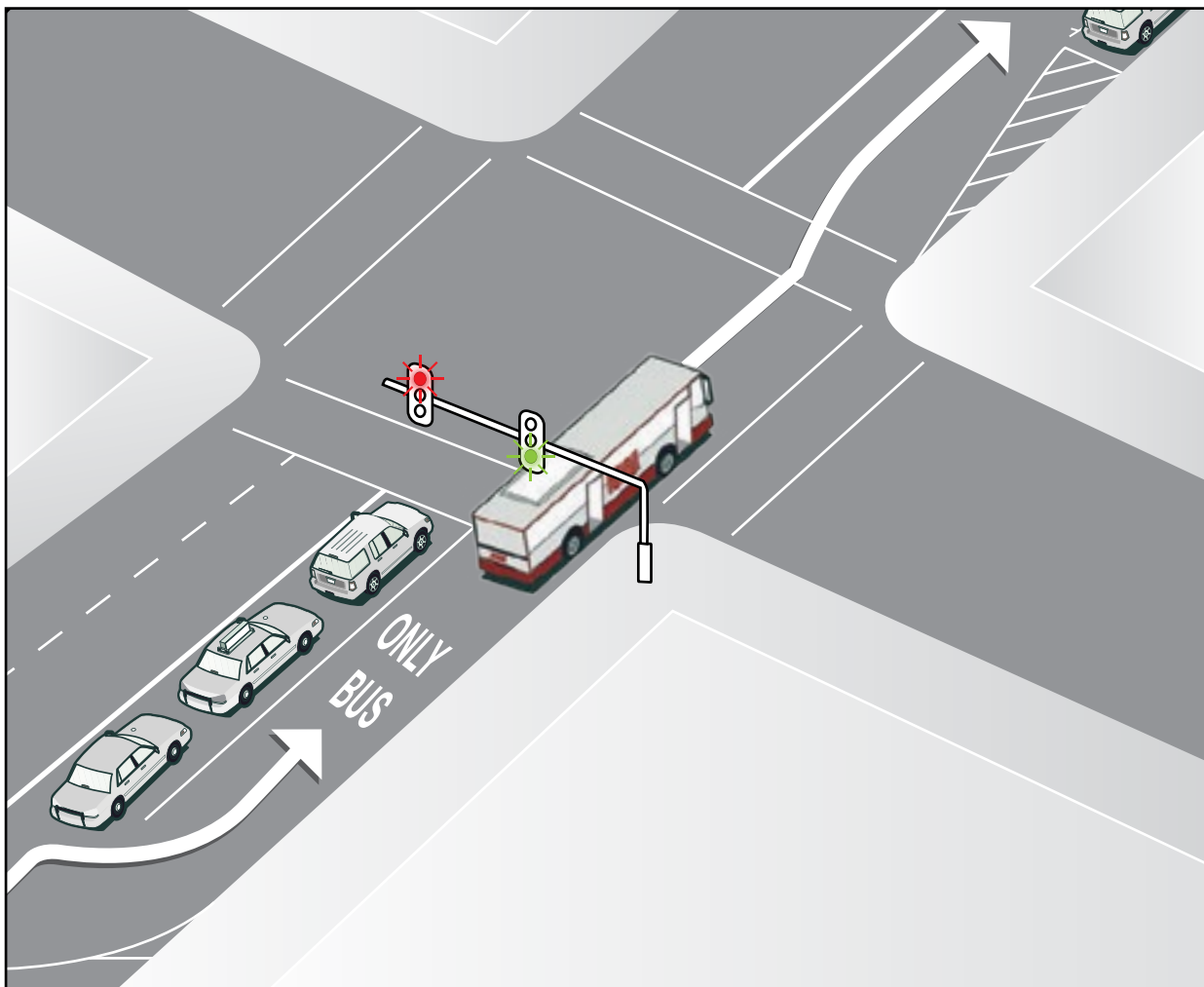


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TTRP: Lane Modifications

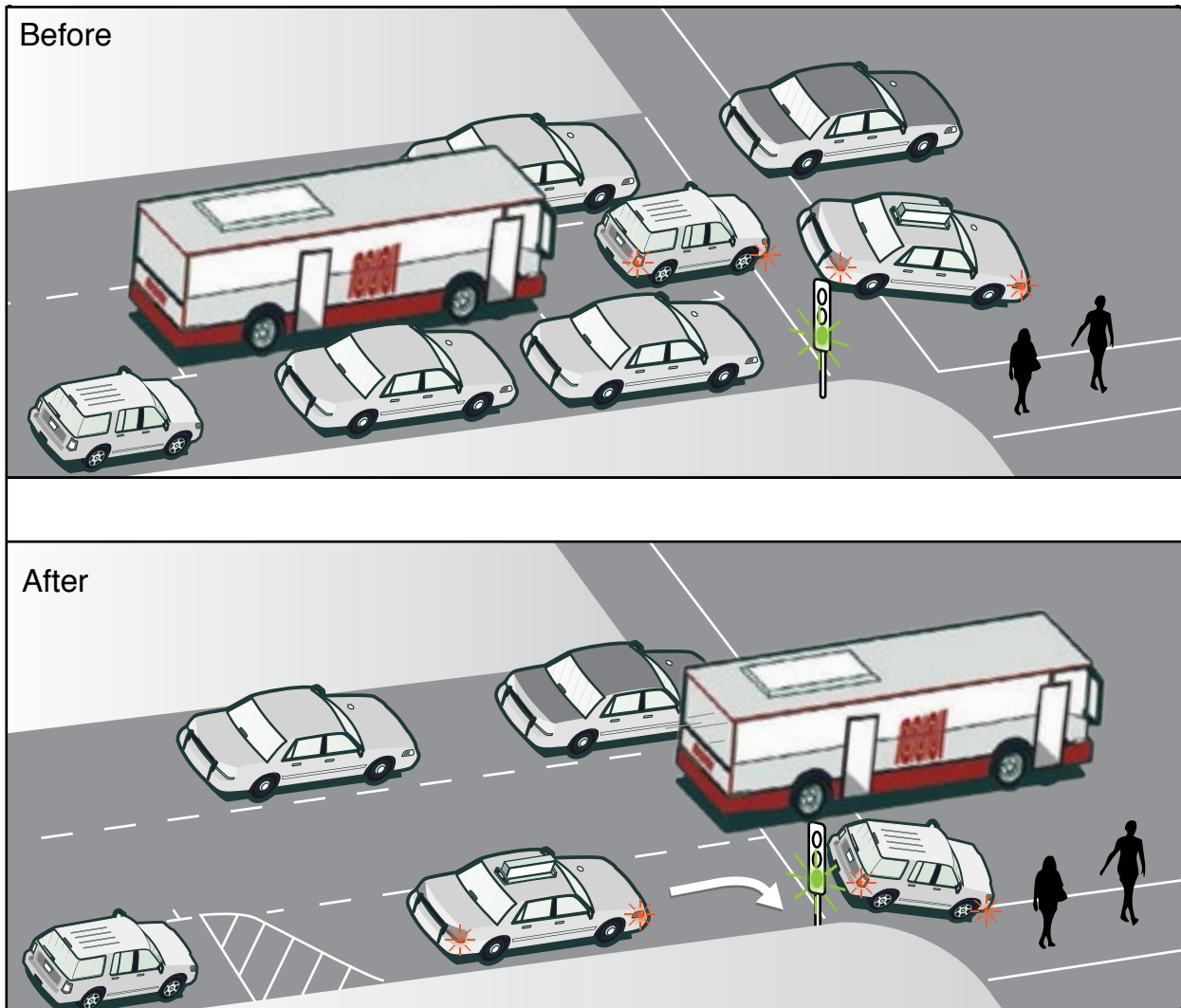


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8. Establish Transit Queue Jump/Bypass Lanes

Transit queue jump/bypass lanes can reduce transit travel times by providing priority to transit vehicles at signalized intersections. A transit queue jump/bypass lane allows transit vehicles to bypass traffic stopped at a signalized intersection and move through the intersection ahead of general traffic by using an exclusive traffic signal phase for the transit vehicles. A transit queue jump/bypass lane may be created by restricting parking at an intersection approach or by allocating a mixed-flow lane to transit vehicles only near the intersection where more than one mixed-flow lane is available.

TTRP: Lane Modifications

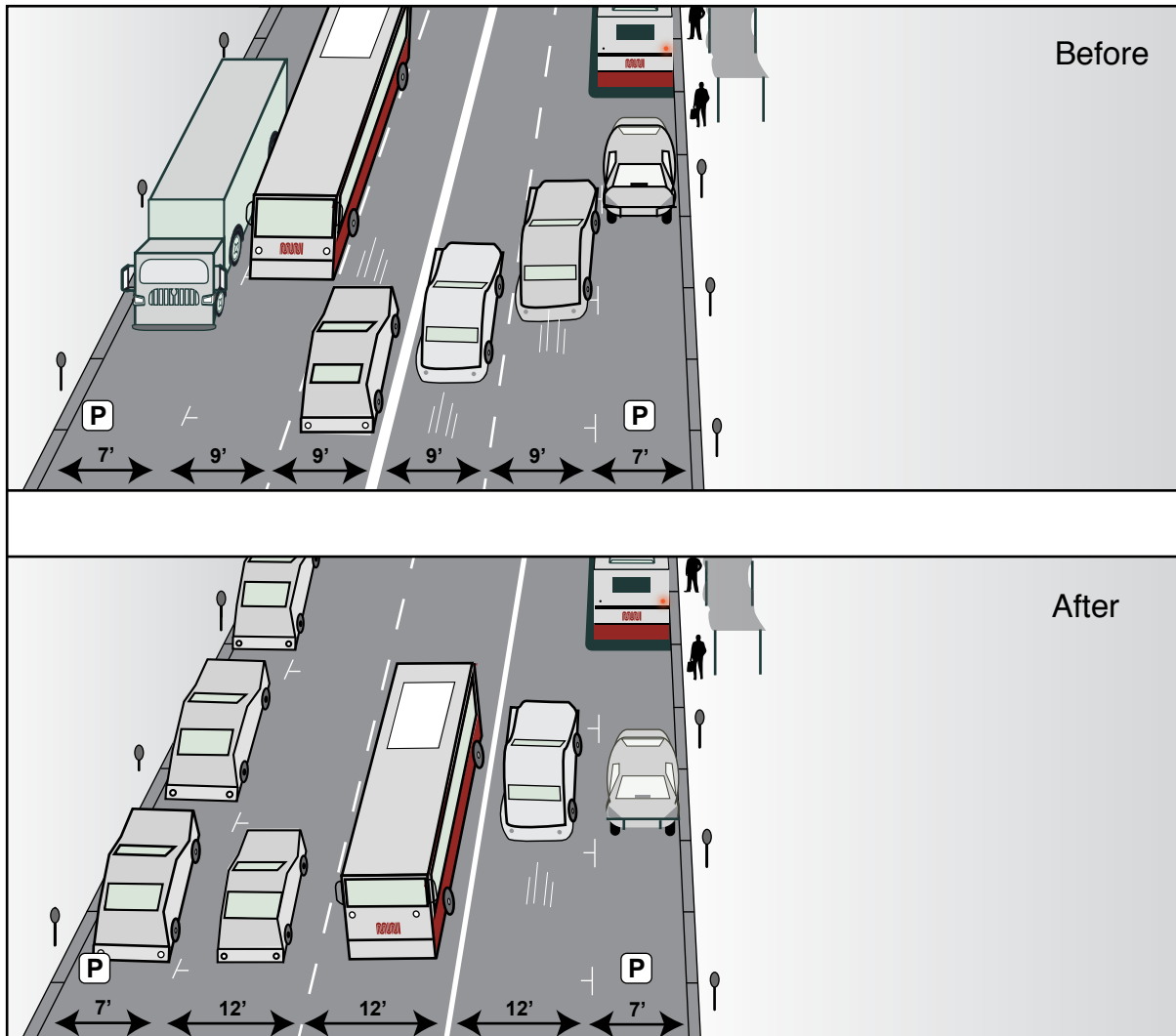


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9. Establish Dedicated Turn Lanes

Dedicated turn lanes can reduce transit travel times by providing a dedicated space for turning vehicles to queue at an intersection approach without blocking the through-movement of transit vehicles and other traffic. At some signalized intersections with a dedicated left-turn lane, the traffic signal may be modified to provide a protected signal phase for left-turning vehicles while opposing traffic is held with a red light. Dedicated turn lanes may require the removal of parking at intersection approaches.

TTRP: Lane Modifications

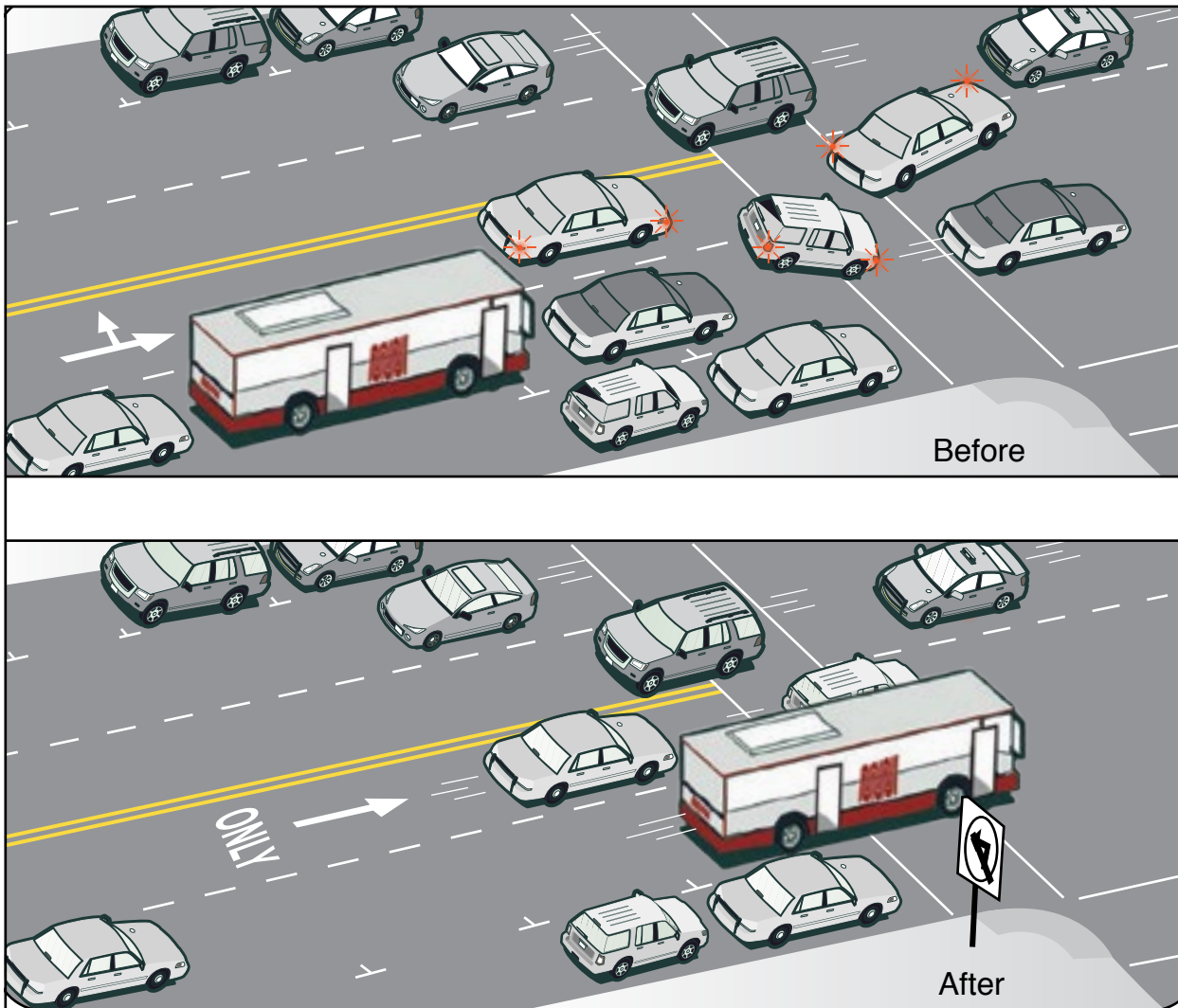


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10. Widen Travel Lanes through Parking Restrictions

Widening mixed-flow lanes can decrease transit travel times and improve safety and reliability by reducing friction with other vehicles and eliminating the need for buses and other large vehicles to straddle two travel lanes. On streets with two or more mixed-flow lanes in the same direction, removing one mixed-flow lane would allow for widening of the remaining lanes. Removing mixed-flow lanes to provide wider lanes can result in an overall decrease in vehicle capacity on a street. This may result in diversion of vehicular traffic to other streets, depending on the existing traffic volumes relative to the available roadway capacity.

TTRP: Parking and Turn Restrictions

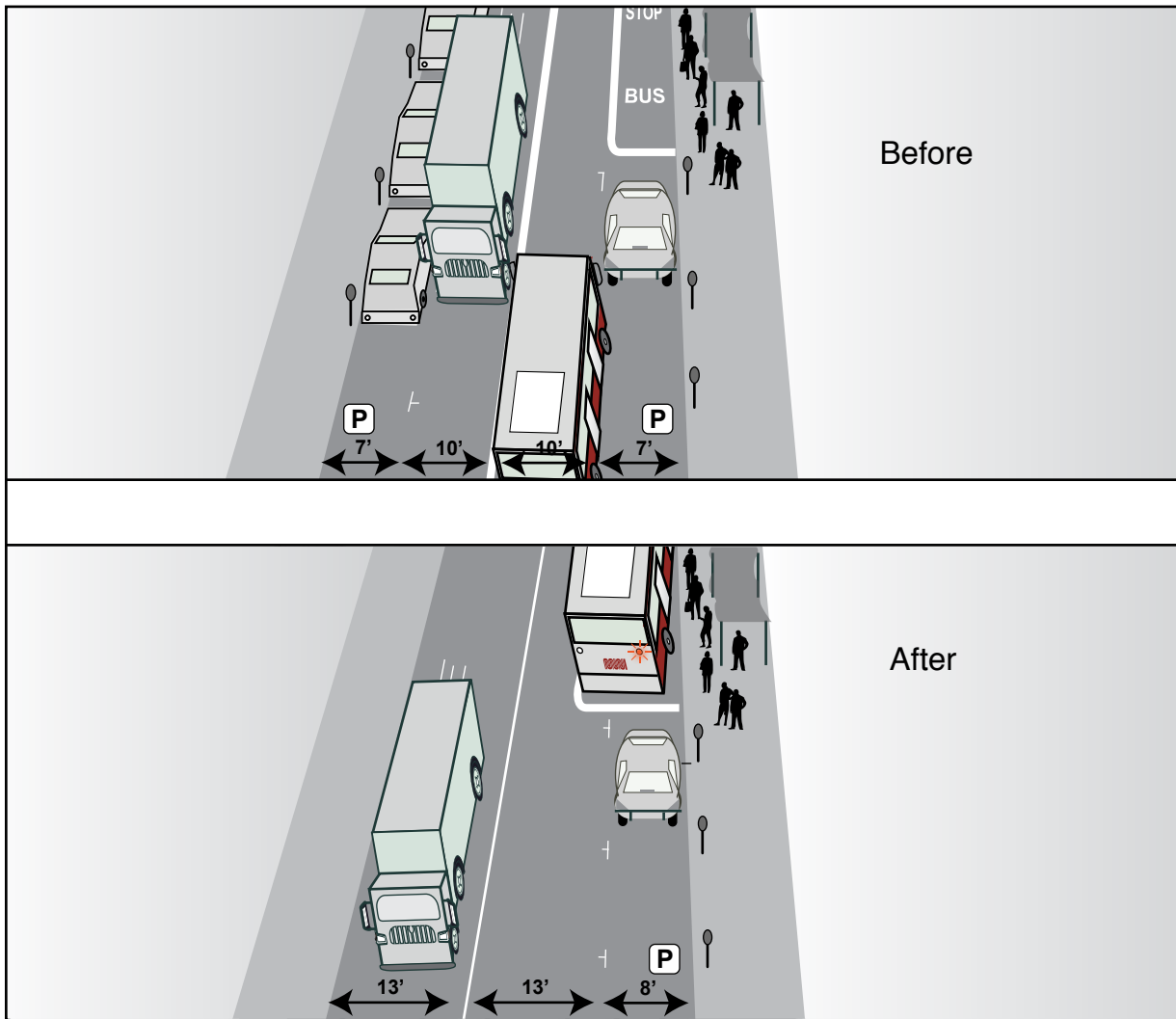


Note: The above conceptual figure is not to scale and is for illustrative purposes only.

11. Implement Turn Restrictions

Turn restrictions can reduce transit travel times by preventing turning vehicles from blocking the through-movement of transit vehicles and other traffic. For example, left-turn restrictions would generally be applied on two-way streets where right-of-way is not available to provide dedicated left-turn lanes, or where left-turning vehicles are required to cross or enter a transit-only lane to complete a turn. Turn restrictions can be part-time or full-time. In locations where part-time turn restrictions are already in place, consistent hours would be considered at multiple intersections along a corridor to improve compliance and clarity.

TTRP: Parking and Turn Restrictions

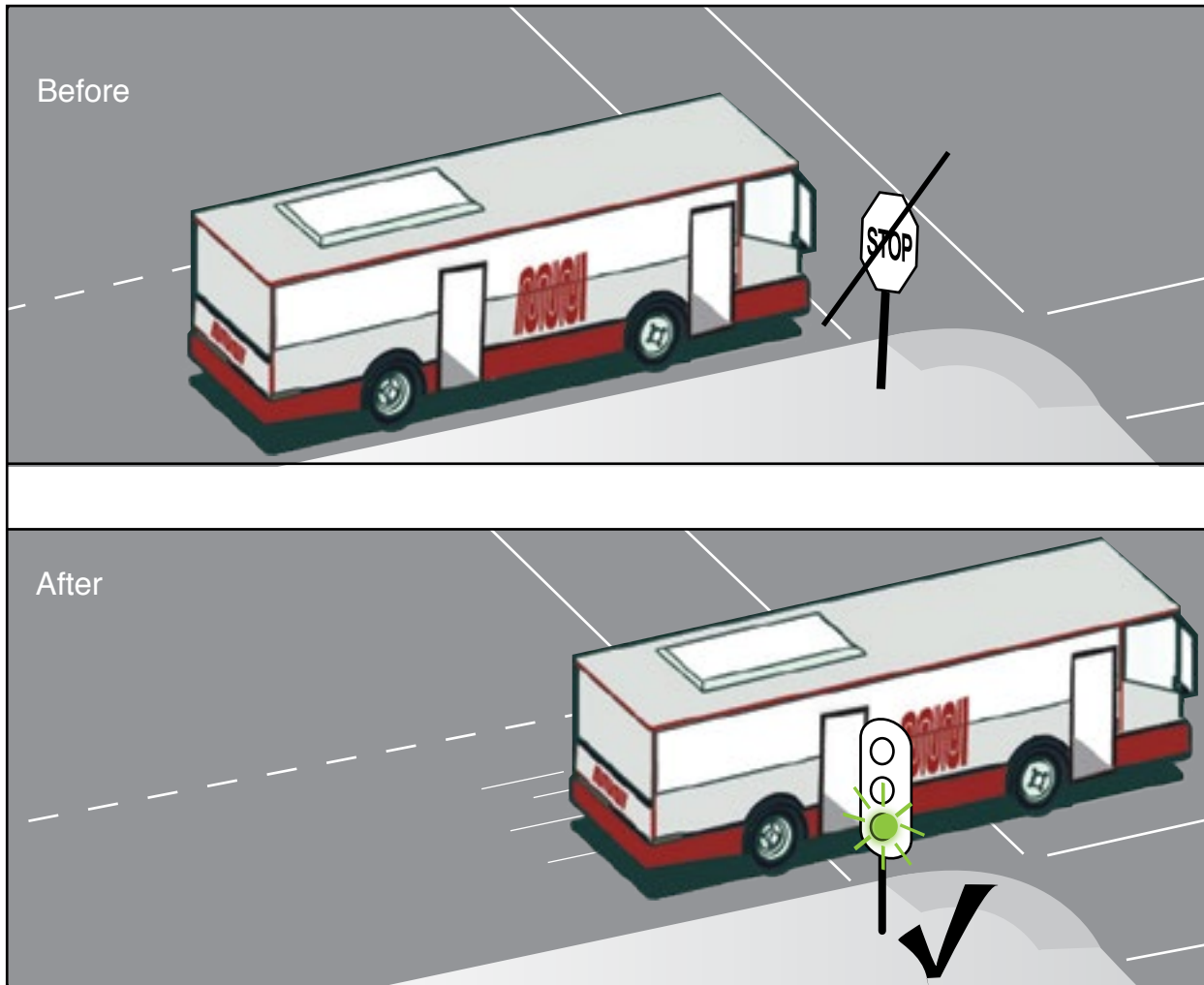


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12. Widen Travel Lanes through Parking Restrictions

At locations with narrow mixed-flow lanes, traffic lanes can be widened by restricting parking and reallocating street space. This can reduce transit travel times by eliminating the need for buses and other large vehicles to straddle two mixed-flow lanes, by reducing delays associated with parking maneuvers, and by providing additional space for through-moving transit vehicles. Parking restrictions could be implemented either during peak periods, such as 7 to 9 a.m. or 4 to 6 p.m., or full-time to facilitate bus travel on streets with narrow mixed-flow lanes.

TTRP: Traffic Signal & Stop Sign Changes

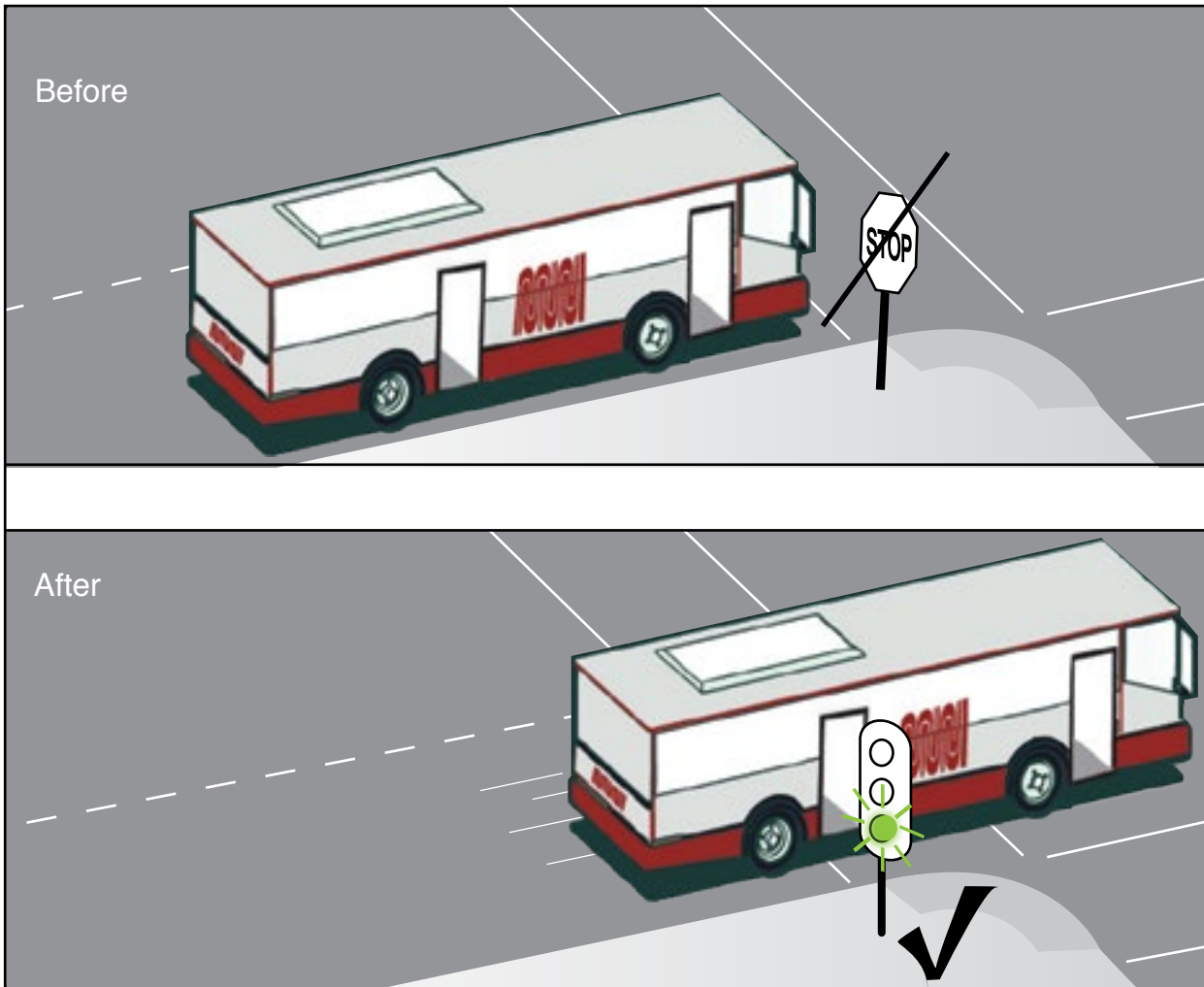


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13. Install Traffic Signals at Uncontrolled and Two-way Stop-controlled Intersections

At some intersections that are uncontrolled or have stop signs requiring only vehicles on the cross street without transit to stop, intersection safety and/or pedestrian access to transit stops may be improved with added right-of-way controls. At these intersections, particularly on Rapid Network corridors, installing a traffic signal could improve vehicular and pedestrian safety by clarifying the right-of-way for crossing the street while minimizing travel time delays for transit vehicles. New traffic signals would include pedestrian countdown signals and marked crosswalks, and could take advantage of planned transit signal priority improvements that reduce signal delay for approaching transit vehicles. Traffic signal poles are typically up to 30 feet in height. The installation of traffic signals at uncontrolled and two-way stop-controlled intersections may require that a curb ramp be rebuilt, or, in places where none exists, that a curb ramp be added.

TTRP: Traffic Signal & Stop Sign Changes

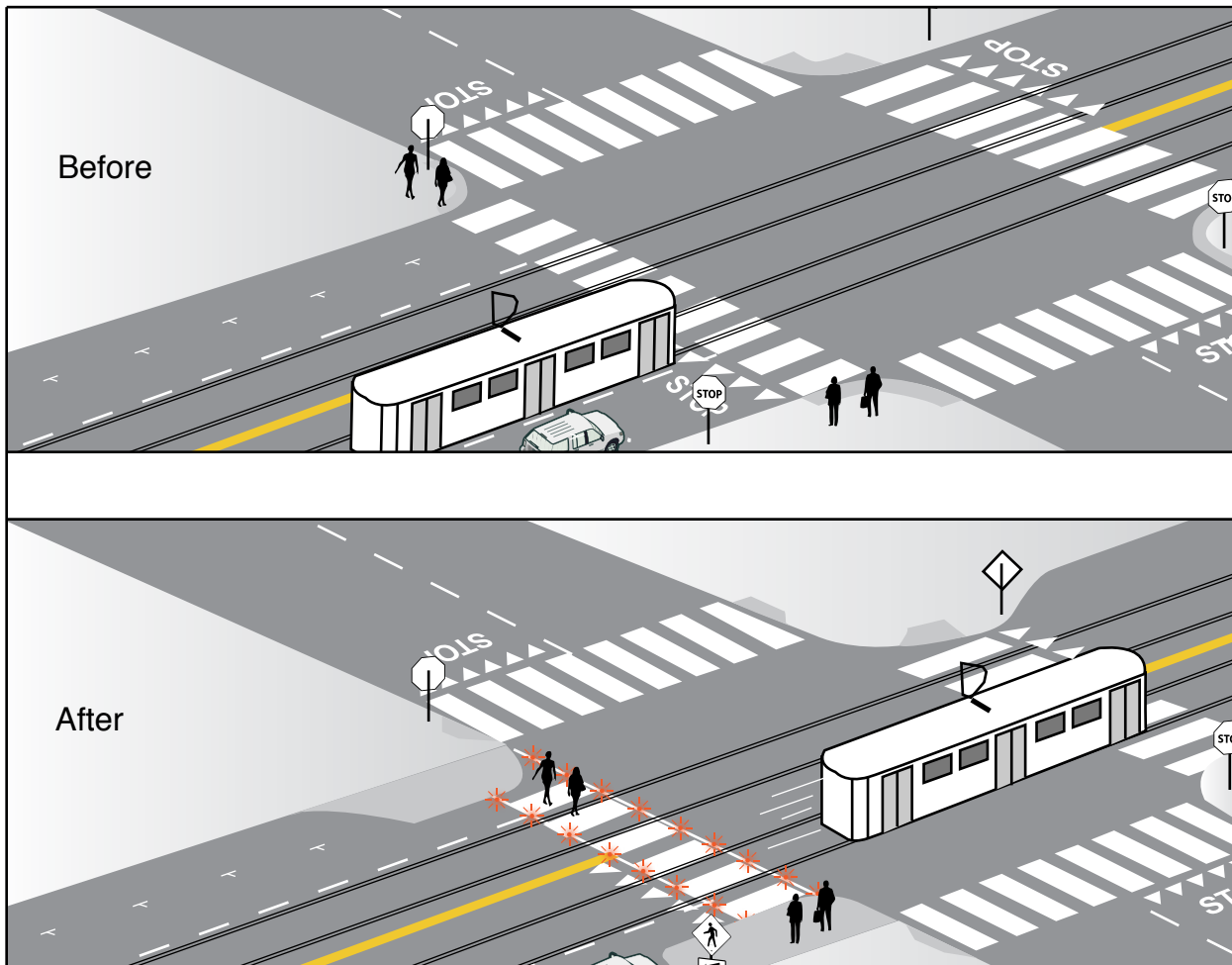


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14. Install Traffic Signals at All-way Stop-controlled Intersections

Installing traffic signals at all-way stop-controlled intersections can reduce transit travel times by allowing transit vehicles to take advantage of planned transit signal priority improvements that reduce signal delay for approaching transit vehicles. This treatment also reduces delays associated with long vehicle queues at busy intersections which are stop-controlled with stop signs. New traffic signals would include pedestrian countdown signals and marked crosswalks. The installation of traffic signals at all-way stop-controlled intersections may require that a curb ramp be rebuilt, or, in places where none exists, that a curb ramp be added. The above is an illustration of stop signs replaced by traffic signals. Installation of traffic signals and related traffic control utility boxes and signage is anticipated to require a maximum nine-foot bgs excavation depth (signal mast arm foundation).

TTRP: Traffic Signal & Stop Sign Changes

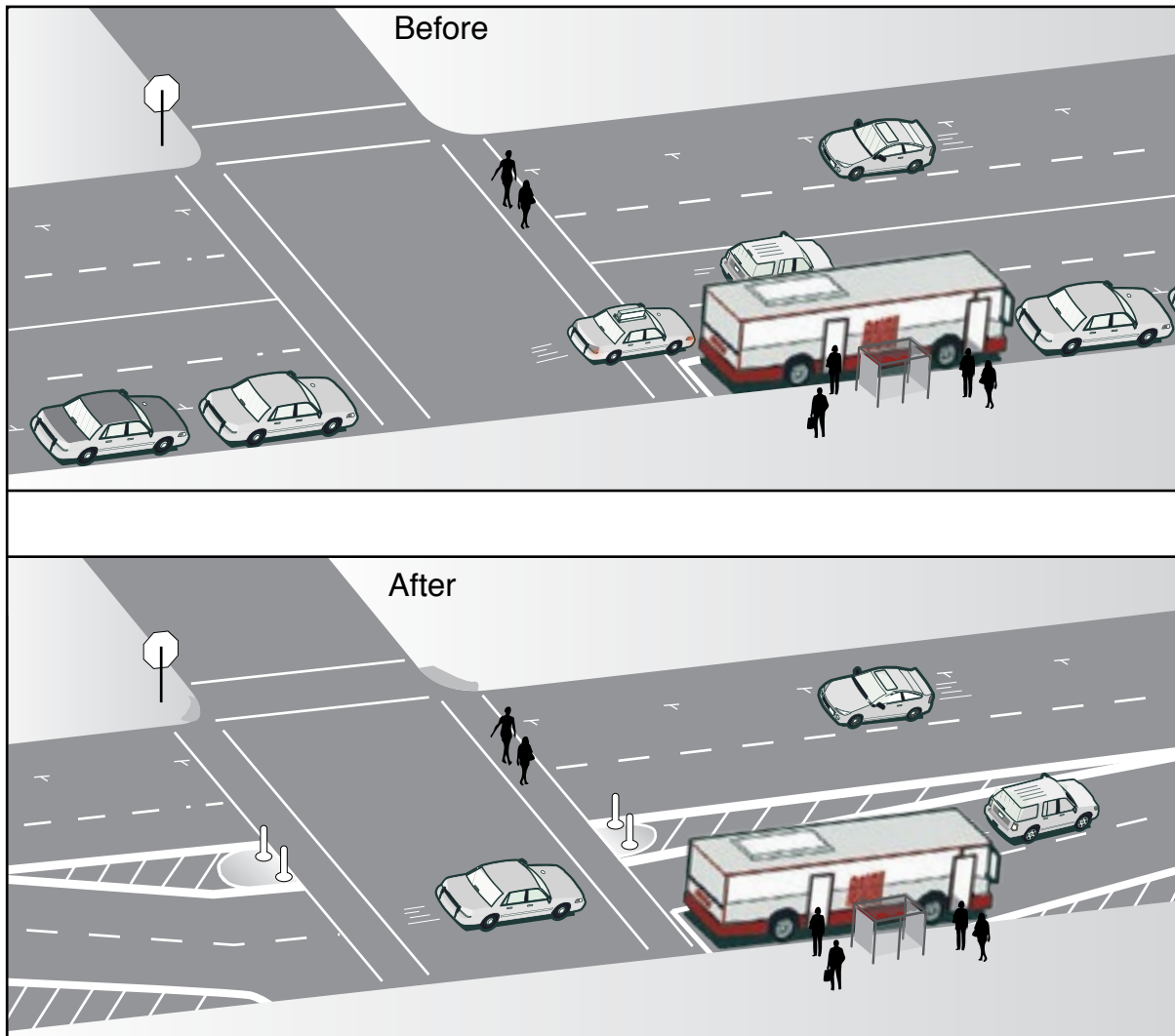


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15. Replace All-way Stop-controls with Traffic Calming Measures at Intersections

At some intersections with all-way stop signs, the stop signs on the street with transit can be removed to reduce transit travel time by allowing transit vehicles to proceed without coming to a complete stop. This treatment also reduces delays associated with long vehicle queues at busy intersections with stop signs. Stop signs would typically be retained on the street without transit. In conjunction with removing the stop signs, other traffic calming measures, which would generally involve improving crossing conditions for pedestrians, slowing traffic, and reducing-right-of way conflicts between pedestrians and other traffic, could be installed.

TTRP: Pedestrian Improvements

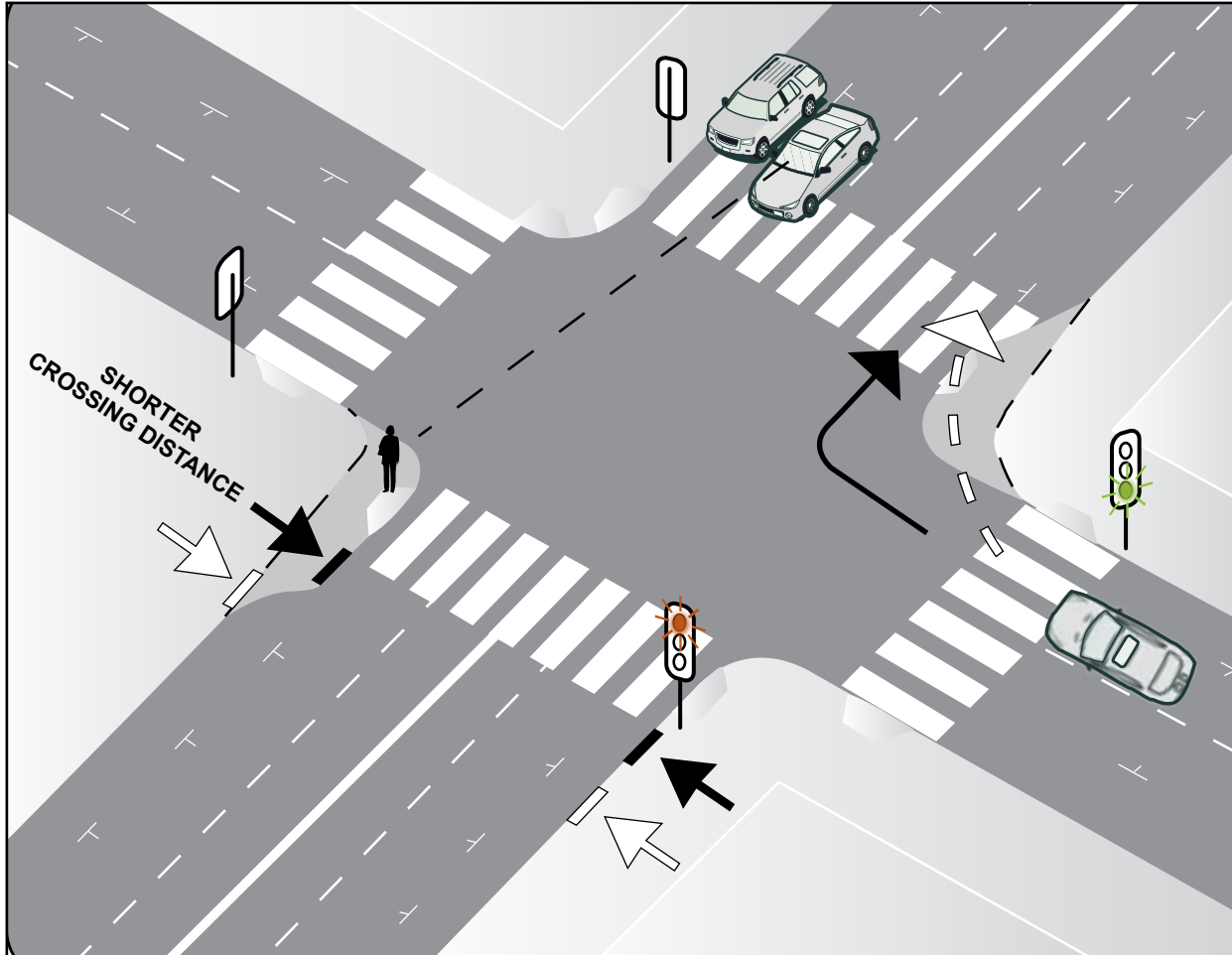


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16. Install Pedestrian Refuge Islands

Pedestrian refuge islands are raised islands in the center of the crosswalk at an intersection that provide space for pedestrians to wait while crossing a street. Pedestrian refuge islands can reduce transit travel time by shifting mixed-flow lanes toward the curb and eliminating the need for buses to exit and re-enter the flow of traffic to access curbside transit stops. Pedestrian refuge islands can also improve pedestrian safety by increasing pedestrian visibility and minimizing pedestrian exposure to vehicular traffic.

TTRP: Pedestrian Improvements

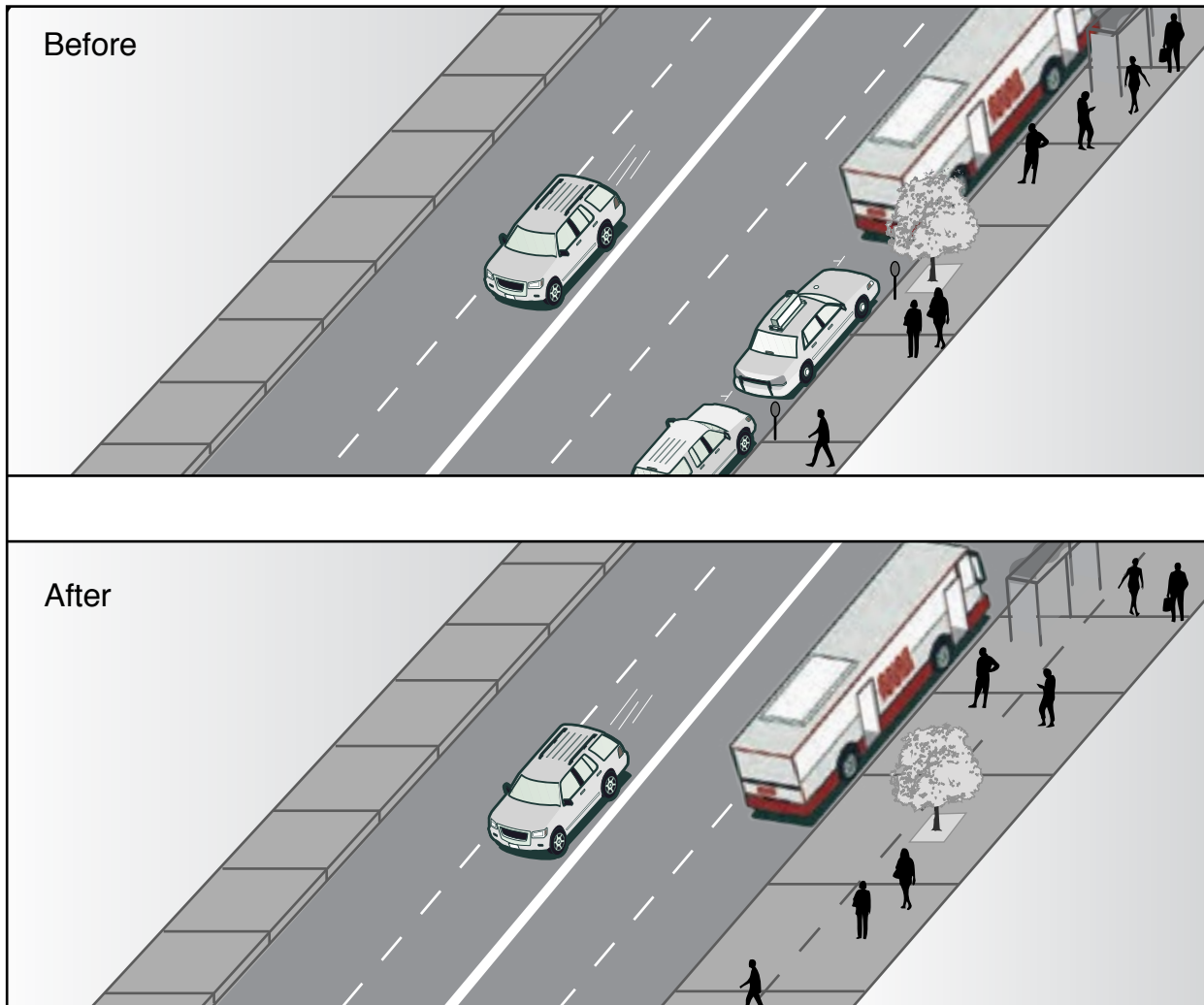


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17. Install Pedestrian Bulbs

Pedestrian bulbs are sidewalk extensions at non-transit stop intersection corners that widen the sidewalk by a distance equal to or less than the width of the parking lane for the width of the crosswalk. Pedestrian bulbs at signalized intersections can reduce transit travel time by reducing the roadway crossing distance, which can provide flexibility in traffic signal timing and reduce the likelihood of transit vehicles arriving on a red signal indication. Pedestrian bulbs improve pedestrian safety by shortening the street crossing distance, improving pedestrian visibility, and reducing the speed of turning traffic.

TTRP: Pedestrian Improvements



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18. Widen Sidewalks

Sidewalk widening can improve pedestrian conditions by providing additional space for pedestrians, transit shelters, landscaping and other amenities. Sidewalk widening can also improve pedestrian safety by shortening the street crossing distance. Existing sidewalk widths and conditions vary throughout the City; therefore, the extent of sidewalk widening would also vary. If the widened sidewalk were proposed on a street with one lane plus parking in each direction, parking would need to be eliminated.