



U.S. Department of Transportation
Federal Highway Administration

COMPLETE STREETS TRANSFORMATIONS

*Six Scenarios to Transform
Arterials using a Complete Streets
Implementation Strategy*





Complete Streets Transformations

Six Scenarios to Transform Arterials using a Complete Streets Implementation Strategy

A Complete Street is safe, and feels safe, for all users. The majority of States and hundreds of local jurisdictions have adopted Complete Streets policies, and FHWA is focused on supporting these transportation agencies to plan, develop and operate equitable streets and networks that prioritize safety, comfort, and connectivity to destinations for all people who use the street network. Complete Streets serve pedestrians, bicyclists, public transportation users, children, older individuals, individuals with disabilities, motorists, and freight vehicles. Complete Streets transformations are particularly important for arterials in urban and suburban areas and rural main streets where a disproportionately high number of fatal pedestrian crashes occur.

What is a Complete Streets Implementation Strategy?

Complete Streets implementation starts with people, not transportation mode. The elements of a Complete Street vary based on community context and the role that a particular street needs to serve in the multimodal network. Not every street requires bicycle lanes or public transportation stops. Instead, creating a safe, connected, and equitable Complete Streets Network is an iterative strategy that involves:

1. Understanding the community and network **context**;
2. Identifying safety, connectivity, and equity **concerns**;
3. Implementing **improvements** over time; and
4. Evaluating **impacts** by monitoring and measuring success. ¹

Focusing on Arterials

This document provides examples of how to apply a Complete Streets Implementation Strategy to transform arterials that pose significant safety, connectivity, and equity challenges. The scenarios discussed in this document are intended to represent common non-controlled access arterials.

A disproportionate number of pedestrian crash fatalities take place on arterials (63% in 2019), which often lack sufficient sidewalks and pedestrian crossing opportunities as well as safe, convenient, and accessible facilities for all modes.²



- In addition to a lack of facilities, high speeds and dark conditions contribute to fatalities and serious injuries among pedestrians. According to NHTSA, 76% of pedestrian deaths in 2019 occurred in the dark.³
- A recent study found that of the top 30 pedestrian crash hot-spot locations in the US, a majority have multiple lanes, high traffic volumes and speed limits above 30 mph, and 97% have adjacent commercial land uses. Seventy-five percent are also bordered by low-income communities.⁴

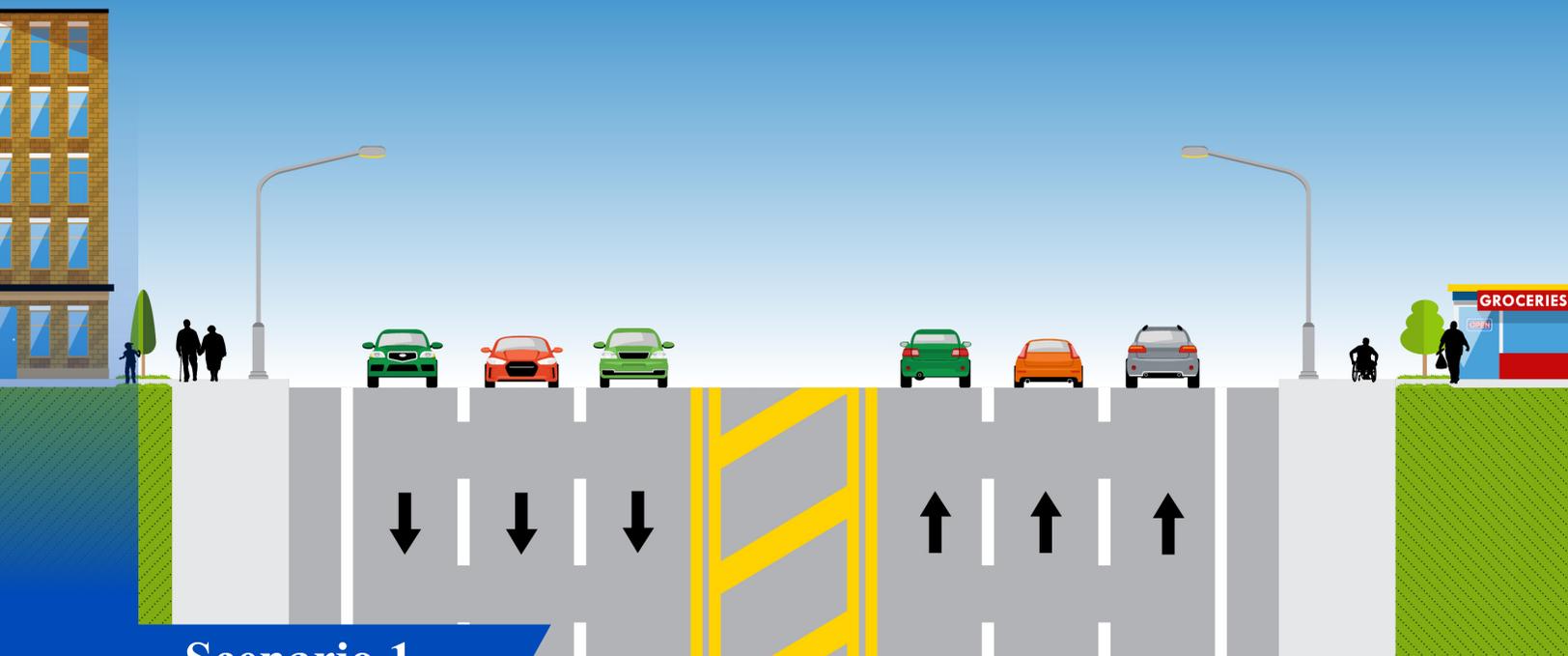
Making arterial roadways safe for all users is necessary to address the large portion of fatalities and serious injuries among vulnerable road users traveling outside of vehicles.

Stimulating Ideas for Complete Streets Transformations

This document provides six hypothetical scenarios of how common arterial corridor configurations can be transformed to accommodate the needs of different users by implementing Complete Streets. The examples focus on (1) urban and suburban arterials with posted speed limits less than 55 mph, and (2) rural arterials that serve as main streets in smaller communities. The purpose of these scenarios is to stimulate ideas for improving existing streets as part of developing a Complete Streets network, with an emphasis on developing safe and complete bicycle and pedestrian networks and access to public transportation.

Complete Streets implementation aligns with the Safe System Approach, which anticipates human mistakes by designing and managing road infrastructure to keep the risk of a mistake low and to reduce injury severity if a crash does occur. The improvements elaborated in this document align with some of FHWA's Proven Safety Countermeasures and highlight three key strategies for improving safety on arterials: (1) managing speeds, (2) improving lighting, and (3) separating users in time and space. Additional resources on these countermeasures and strategies are included at the end of the document, and resources are linked throughout for more information on additional improvements. These transformations may take place in a single project, or over time.⁵

Many States and local agencies are installing innovative facilities and safety countermeasures to transform their streets to achieve safety for all users. To learn more, please browse FHWA's Complete Streets Website for trainings and case studies. To help quantify the potential safety effectiveness of Complete Streets improvements, visit the Crash Modification Factor Clearinghouse.⁶



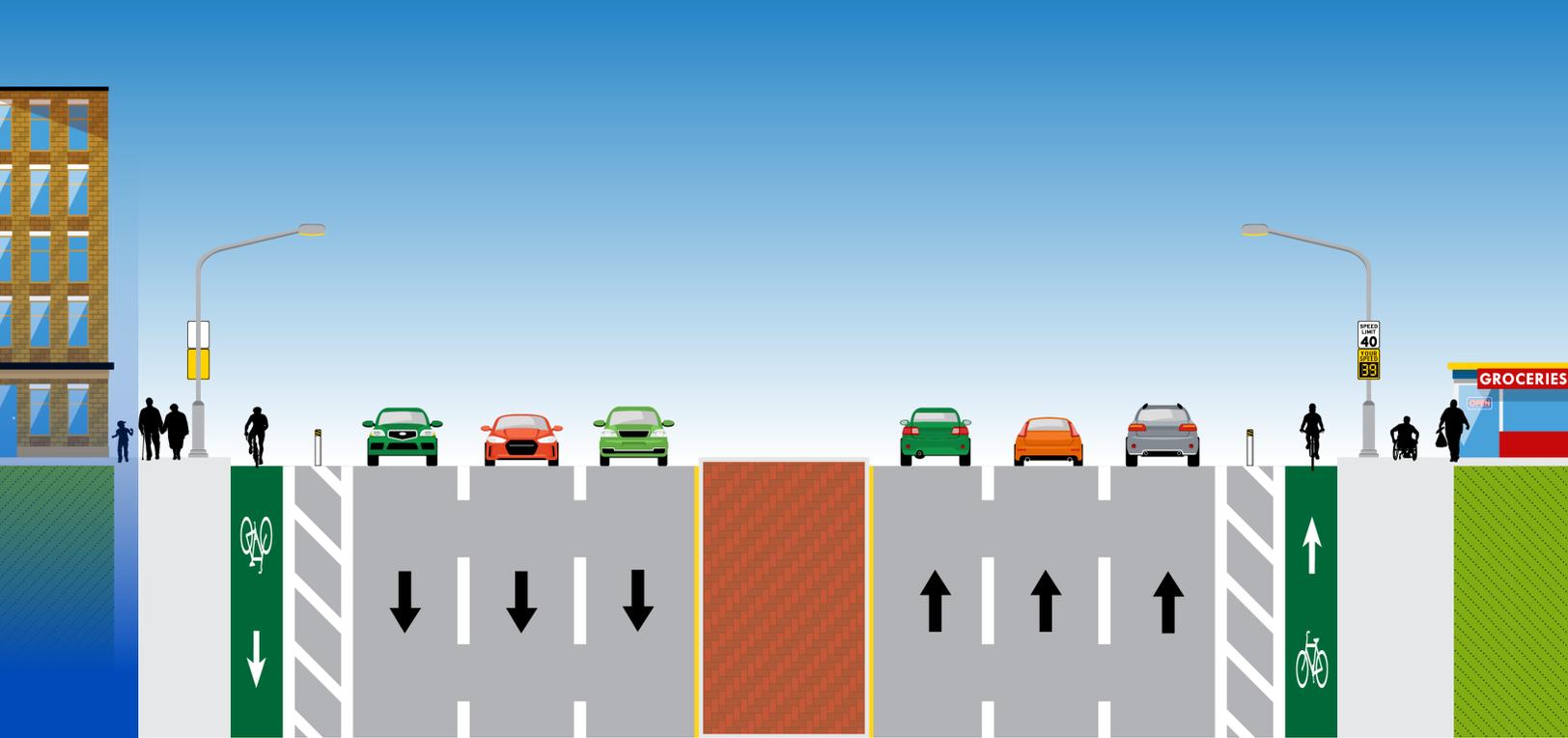
Scenario 1

Suburban 6-lane principal arterial

Understand Context: The cross-section below illustrates a typical arterial street in a suburban context. It has multiple through lanes, with an outside shoulder that is occasionally used by bicyclists. Sidewalks attach to the curb without trees or other separation from motor vehicles. They are frequently punctuated by driveways to allow traffic to enter retail establishment parking lots. Employers, restaurants, shopping centers and grocery stores are located along this corridor, and a university is located nearby, creating demand for short trips that could be made by bicycling or walking. Through public outreach, and a [road safety audit](#), the transportation agency learns that the university population walks and bicycles at high rates, but they find it uncomfortable to access businesses in this corridor. In partnership with the local housing authority, the transportation agency engaged a targeted focus group of residents at an apartment complex. Discussions revealed that many residents rely primarily on walking and public transportation and have concerns about safely crossing the street to access the grocery store. This is due to high-volume, high-speed traffic and the lack of convenient crosswalks and adequate lighting. An analysis of safety data identified the arterial as the location of several of the jurisdiction's pedestrian and bicyclist crash hot spots.

Identify Concerns:

1. With wide lanes and a flush median, many drivers exceed the speed limit. Community members have expressed concerns about walking or bicycling on this route due to **high vehicular speeds and the lack of separation**.
2. Despite standard pedestrian crosswalks and signals at intersections, pedestrians find this street **difficult to cross** due to the many lanes, **distance between crossings, lack of median refuge and poor lighting** at the crosswalks. This includes residents of a low-income apartment complex who must cross the street to catch the bus and to access a grocery store.



Implement Improvements:

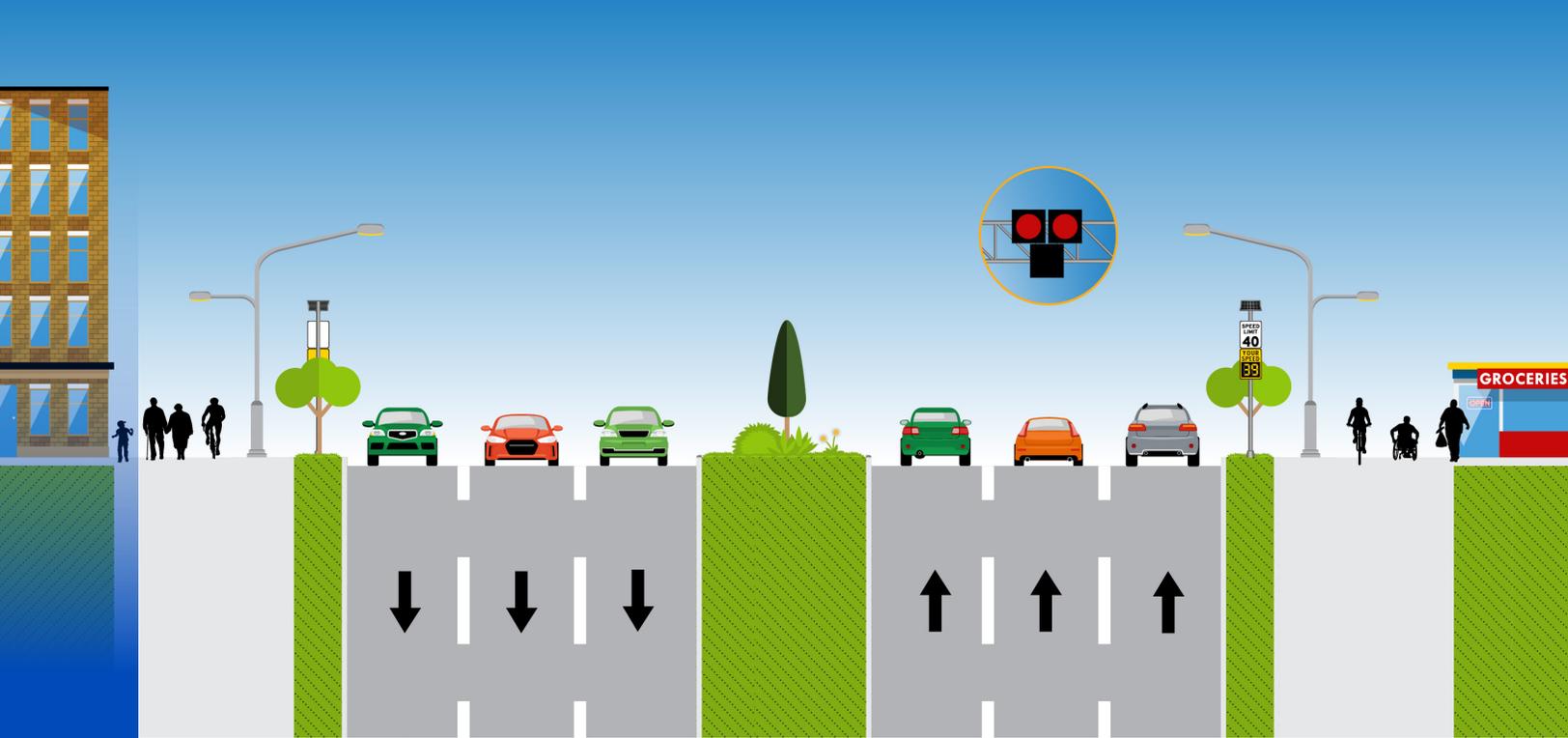
To provide improvements without moving the outside curb, the transportation agency can:

1. Set **appropriate speed limits**. When setting a speed limit, agencies should consider a range of factors that impact safety such as the presence of pedestrians and bicyclists, crash history, land use context, intersection spacing, driveway density, roadway geometry, roadside conditions, roadway functional classification, traffic volume, and observed speeds.
2. Add **speed feedback** signs to remind drivers to slow down and obey posted speed limits.
3. Provide space for a **separated bicycle lane** on each side by eliminating the shoulder and narrowing the travel lanes.
4. Install **green colored pavement** within the bike lanes with [Interim Approval from FHWA](#),⁷ to increase motorist awareness that bicyclists might be present.
5. Install a **wide raised median** so that sufficient space is available to provide median refuge for crossing pedestrians.
6. Ensure **accessible bus stop shelters** enhance visibility and provide protection from the elements.

Evaluate Impacts:

After completing the interim project, the transportation agency evaluated the success of their Complete Streets implementation project and identified additional concerns:

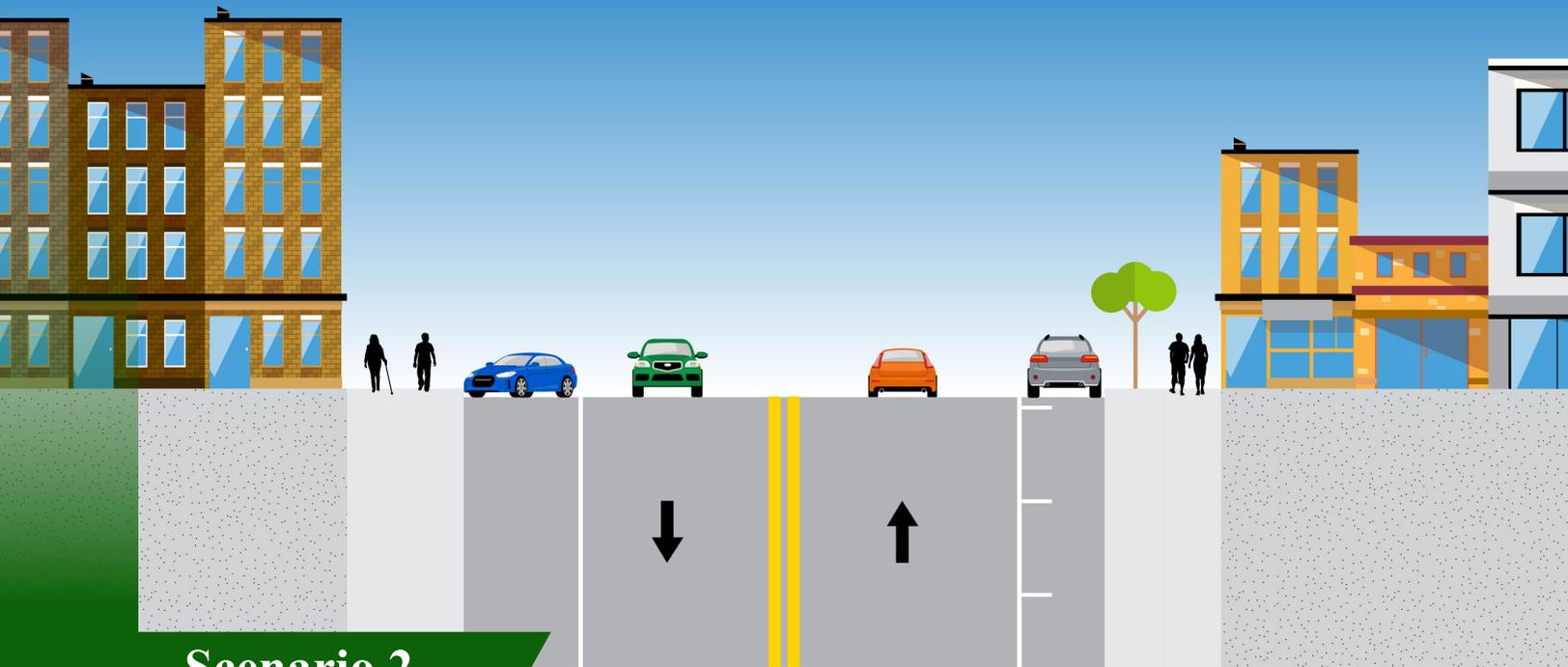
1. Pedestrian **lighting is inadequate** along the roadway and at crosswalks, and pedestrian crossings are still spaced far apart.
2. In-street separated bike lanes improved safety but did not provide a low-stress bicycling facility.
3. Many bicyclists were observed riding **contraflow** in the one-way bike lanes in order to access destinations without having to cross the arterial.



Implement Improvements:

Moving the outside curb, the transportation agency can:

1. Add a mid-block crossing using a [Pedestrian Hybrid Beacon \(PHB\)](#) to provide safe crossing opportunities between intersections where blocks are long and conduct public outreach to educate all users about PHBs.
2. Add visibility enhancements, including lighting, to crosswalks and shared use sidepath to increase the safety and comfort of pedestrians and bicyclists.
3. Narrow the roadway to provide **shared use sidepaths** for pedestrians and bicyclists behind the curb, allowing for safe and comfortable bidirectional travel on both sides of the road.
4. Add **trees** along the median and roadside to provide shade and possible traffic-calming effects.



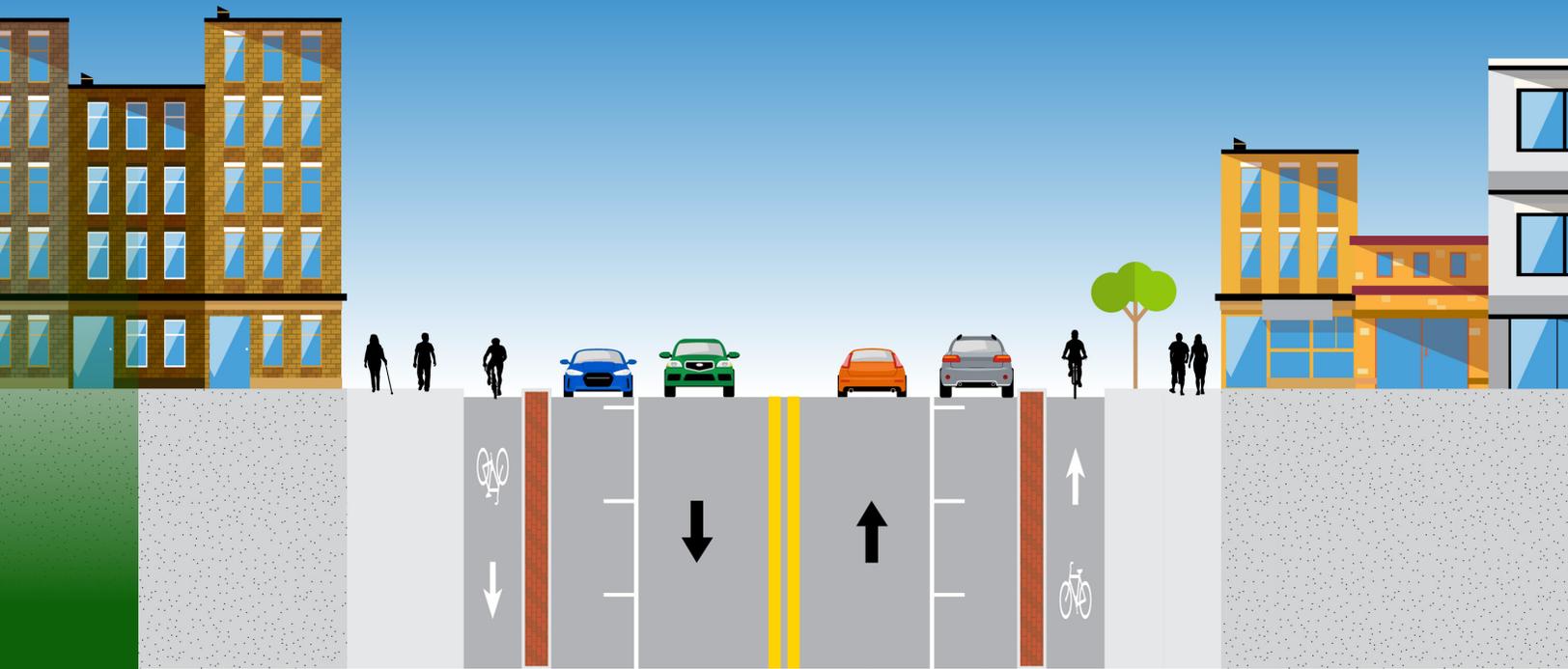
Scenario 2

Urban 2-lane minor arterial

Understand Context: This two-lane minor arterial features wide lanes, sidewalks without separation from the street, head-in angled parking on one side with parallel parking on the other side, and no bicycle facilities. The transportation agency is seeking to increase the number of short trips made by bicycling and walking to reduce congestion, as well as improve safety to meet their Vision Zero goals. During the engagement process, the agency learns that retail businesses want to retain street parking but note that the current parking does not work well for parcel delivery services. Additionally, customer feedback tells them that the street itself lacks any sort of unique character.

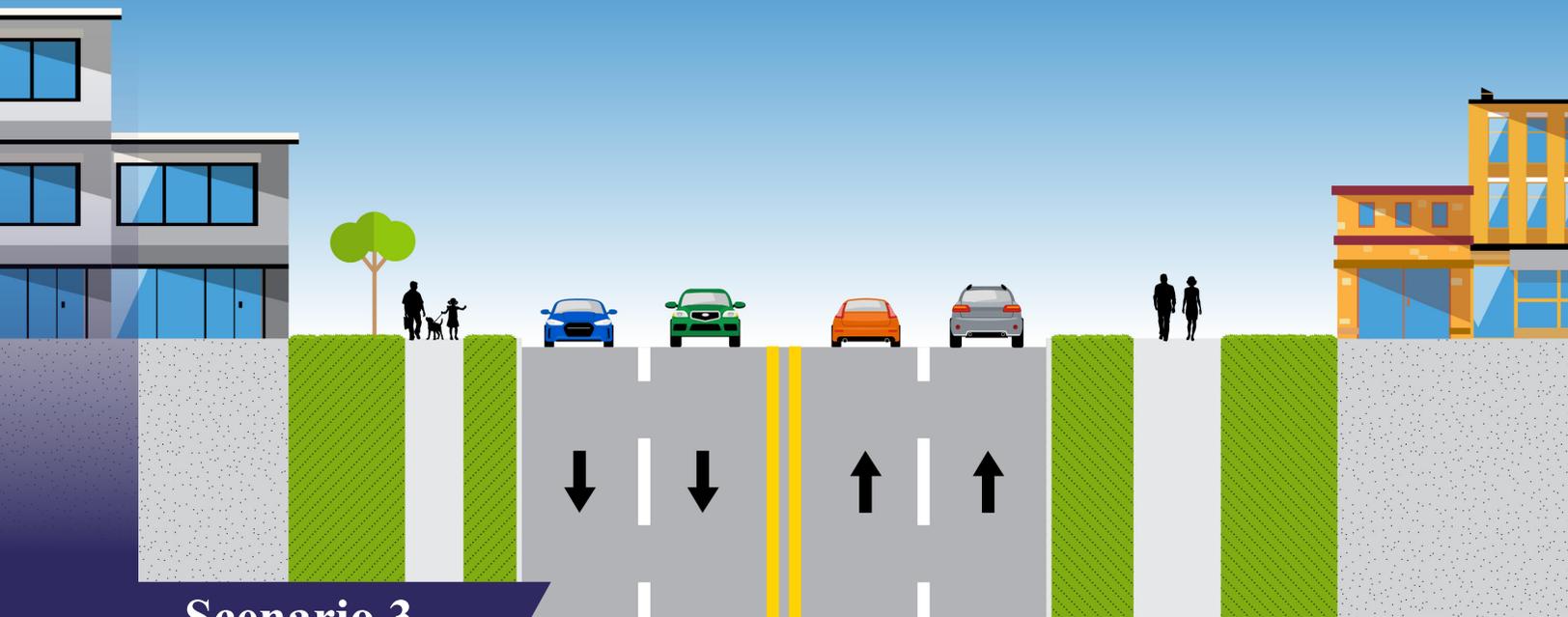
Identify Concerns:

1. Wide lanes may encourage **high vehicular speeds**.
2. Pedestrians do not feel safe being so close to the roadway on the side without more **separation** from motor vehicles.
3. **Head-in angled parking** may pose a safety hazard and complicates freight delivery.
4. **Accessible parking spaces** are not available to individuals with disabilities.
5. Bicyclist safety is compromised by the **lack of dedicated space for bicyclists** to travel.



Implement Improvements:

1. **Narrow driving lanes** to reduce vehicle speed.
2. Replace angled parking with **parallel parking** to allow for designation of freight delivery spaces while eliminating the need to back out of a space into traffic.
3. Add **accessible spaces** at the end of the block or on side streets to improve parking options for individuals with disabilities.
4. Add **dedicated bike lanes** in each direction with a **curb separation** from motor vehicles and parked cars to improve safety and comfort for bicyclists and pedestrians.



Scenario 3

Urban 4-lane minor arterial

Understand Context: This minor arterial includes four through-lanes that are relatively narrow. There is no dedicated space for bicyclists. Sidewalks in need of repair are present on each side. This minor arterial provides a critical link in the urban grid, connecting separate nodes of residential, shopping, dining, and medical facilities. Traffic volumes are too high to make a lane reduction feasible. However, analysis shows that this segment serves as a critical link in connecting the walking and bicycling networks of two adjacent neighborhoods. At one point along the roadway, an apartment complex for low-income older adults is located on one side of the street, with shops, medical facilities, and a park on the other side. Through targeted public engagement with residents at a community event, the agency learned that older adults cross the street daily to spend time outdoors or access the services, but they feel unsafe crossing. Several residents have been seriously injured in crashes. Many more have had near-misses. Indeed, analyzing crash data, the agency notes that several crashes involving bicyclists and seniors have occurred. Upgrading sidewalks and crosswalks, adjusting signal timing, and providing low-stress bicycling facilities and crossing opportunities could result in a significant increase in walking and bicycling trips and improve safety for all users, particularly the older adults who call this corridor home.

Identify Concerns:

1. **Pedestrians with disabilities** are unable to use the sidewalks because they have not been maintained in good condition.
2. The street is sometimes seen as a **barrier** rather than a connector for these neighborhoods. **Older adult residents** do not feel safe crossing the street.
3. Bicyclists do not feel safe using this road since there are **no dedicated bike facilities** and crashes involving bicyclists have occurred.



Implement Improvements:

1. Provide enhanced crossings through installation of a [Rectangular Rapid Flashing Beacon \(RRFB\)](#).
2. Reconstruct the [sidewalk](#) to [eliminate barriers to accessibility](#)
3. Provide a vegetative strip between the sidewalk and the bike lanes to provide **separation** and [help pedestrians with vision disabilities](#) detect the edge of the sidewalk.
4. Add sidewalk-level **bike lanes** on each side to provide dedicated, separated space for bicyclists. By keeping the through-lanes the same width, the agency can avoid the expense of moving the curb and drainage.



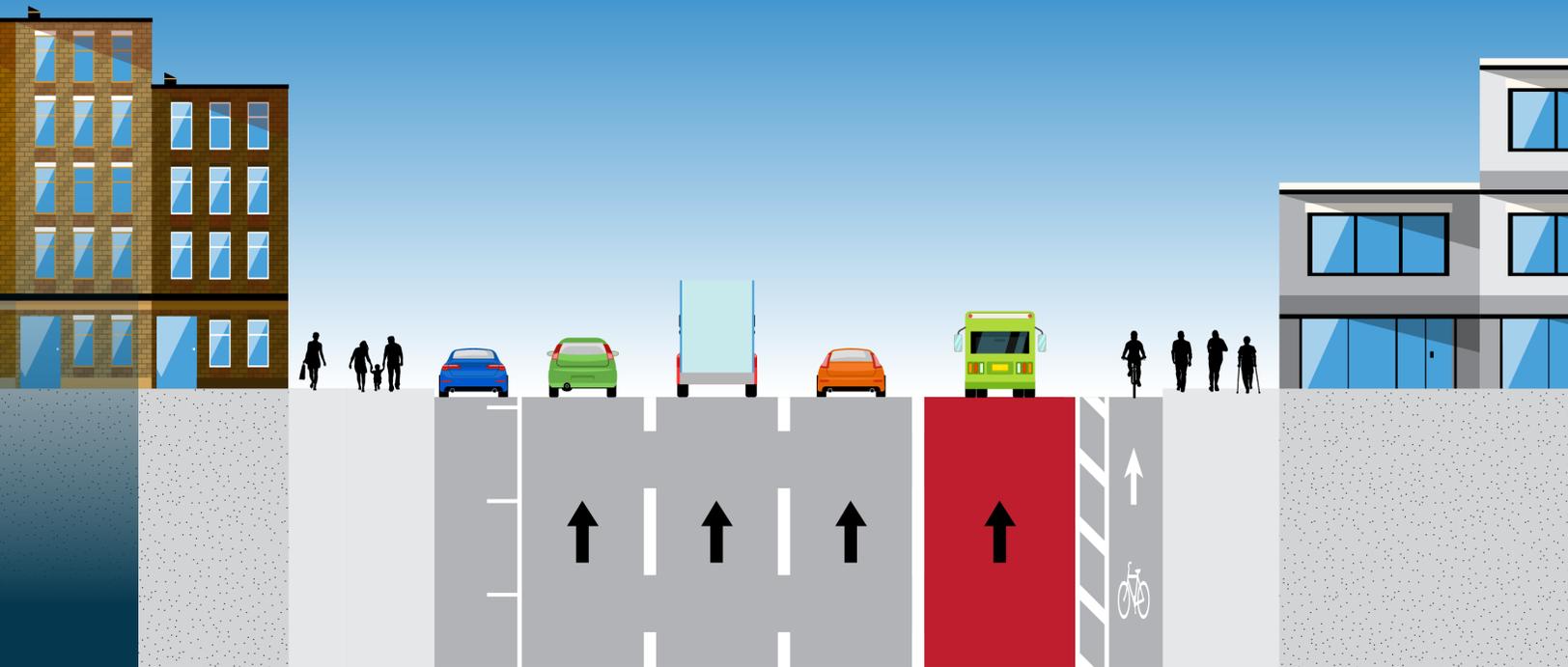
Scenario 4

Urban core one-way principal arterial

Understand Context: This one-way arterial in a downtown urban core has four travel lanes and parking on both sides of the road. The arterial is part of a one-way pair, with a similar arterial carrying parallel traffic in the other direction on the next block. When considered collectively, these paired roads occupy a substantial amount of space. The project's original justification was to prioritize high-speed vehicle throughput serving workers commuting between the suburbs to jobs in the city. Through targeted outreach with community members, the City learned that many downtown residents – particularly those who do not own vehicles – feel isolated from and unsafe finding access to jobs, healthcare, healthy foods, and recreation. The transit agency noted that while the bus route on this roadway is one of the busiest in the City, it has poor on-time performance. To address community needs, the City wants to improve bus service reliability, bus stop access and amenities, and increase transit frequency. The agency also wants to improve conditions for bicycling and walking to make it possible for residents to bicycle and walk more often for short trips and also reduce crowding on buses. The City determined that the community's overall goals for this downtown route are best met by improving bus service reliability and conditions for nonmotorized travel.

Identify Concerns:

1. Sidewalks on both sides are adjacent to the curb and **cluttered** with intermittent utilities that may impede travel for some users; no accessible parking spaces are available.
2. Several bus routes use this heavily congested corridor, and **bus service is unreliable** due to traffic delays, including trucks stopping for deliveries.
3. There are **no dedicated bicycle facilities** in this high-traffic corridor.
4. As with many multilane one-way streets, **speed** in the general-purpose travel lanes often exceed the posted speed limit.



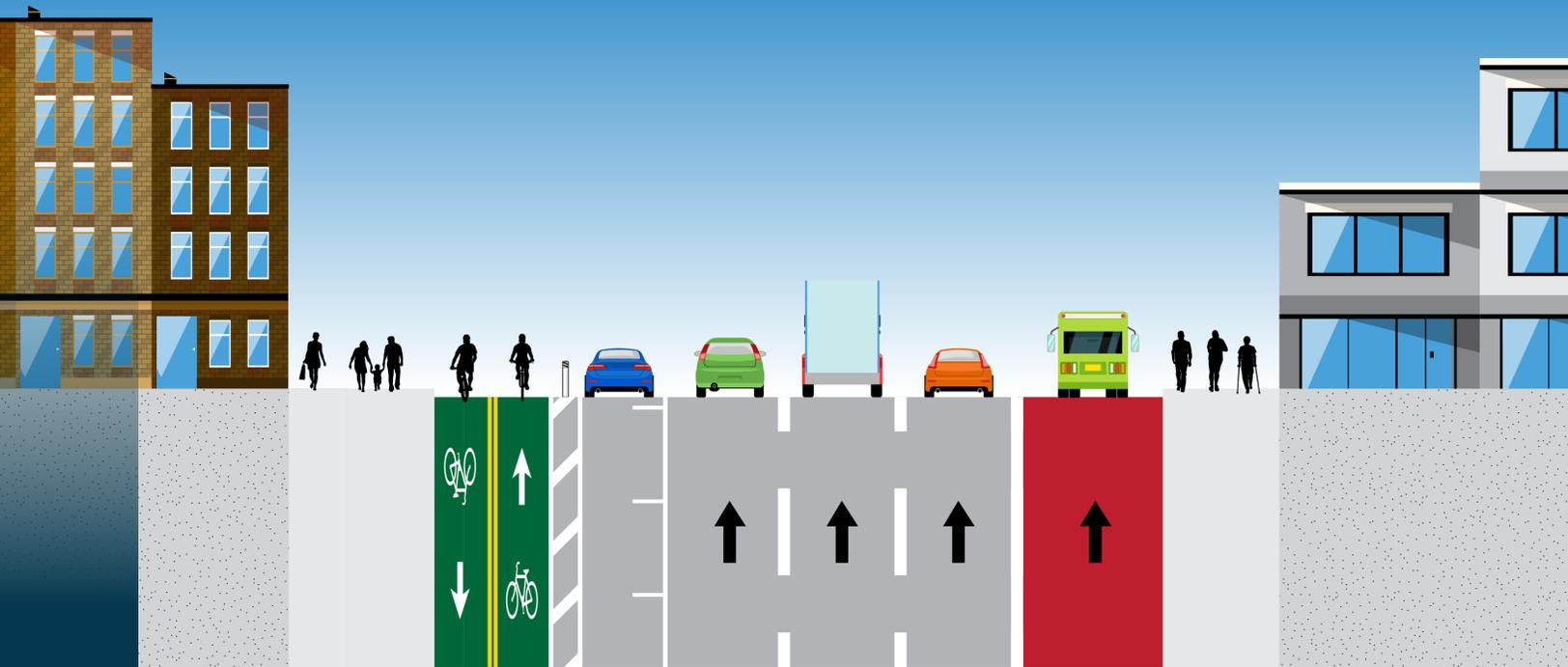
Implement Short-Term Improvements:

Maintaining overall curb-to-curb width, the transportation agency can:

1. Relocate easily movable fixtures to provide a more predictable pedestrian space on both sidewalks, while maintaining utilities.
2. Add **accessible parking spaces** at either the end of the block or on side streets.
3. Re-allocate one travel lane for **exclusive use as a bus lane** to improve the on-time performance of bus routes and increase transit frequency. The transportation agency received **Interim Approval from FHWA** to install red colored pavement within the exclusive bus lanes.
4. Designate some **loading/unloading zones** to meet anticipated demand for freight deliveries in this busy corridor.
5. Repurpose parking on one side of the street as a **buffered bike lane** to encourage residents to bicycle more for short trips and to improve access to transit.

Evaluate Impacts:

1. Vehicular **Speed** continues to exceed the posted speed limit.
2. **Contraflow bicyclists** use the one-way facility to shorten their overall trip length.
3. Buses must **pull into the bike lane** to reach the curb at stops.
4. Bicyclists have to pass the bus using the remainder of the bus lane.



Implement Option A for Long-Term Improvements:

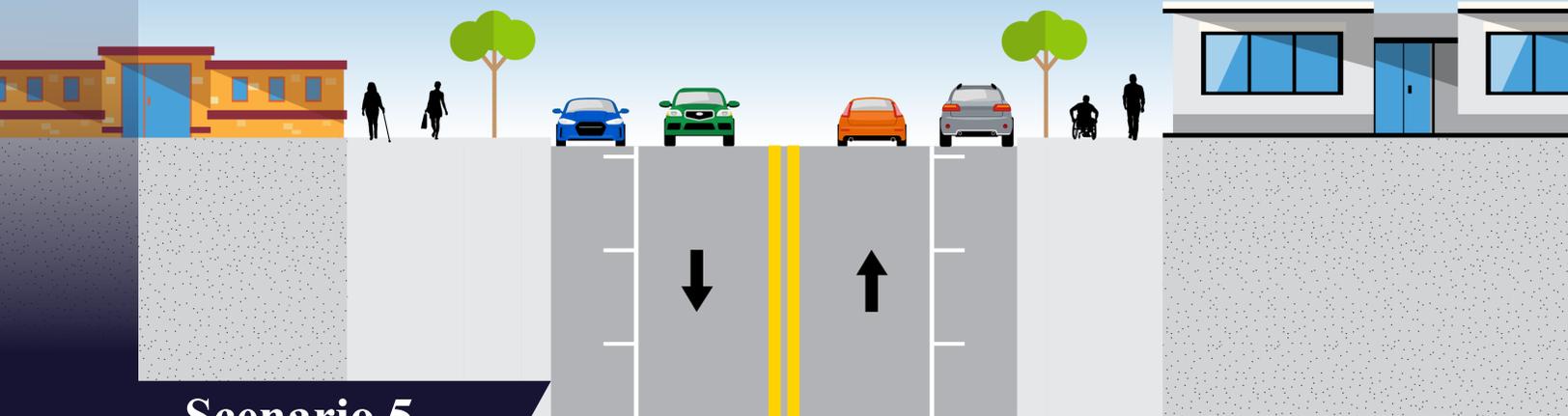
1. Install [Speed Safety Cameras](#) to decrease speeds and improve safety for all users.
2. Provide a **2-way separated bike lane** on the left side of the street to avoid conflicts with transit operations. Install green colored pavement within the bike lanes, with [Interim Approval from FHWA](#).
3. Modify **traffic signals** to accommodate the 2-way separated bike lane.
4. Provide special attention to **operations and sight distance** at intersection, alley and driveway crossings for contraflow movements.
5. Install **bike signal faces and signs**, with [Interim Approval from FHWA](#), and include street name signs to serve contraflow bicyclists.



Implement Option B for Long-Term Improvements:

1. Remove an additional through lane to further **prioritize bicycling** and gain space for improved transit facilities needed to support increased ridership.
2. Build a **floating bus island** in the vicinity of bus stops by narrowing the bike lane.
3. Raise the bike lane where pedestrians cross to access the bus stop to reinforce that bicyclists must **yield to pedestrians**.
4. **Provide a contraflow bike lane** on the left side of the roadway, so that bicyclists can easily access businesses, employers and transit stops located on this route.

Note: Some cities have returned one-way pairs to bi-directional travel, which can help reduce speeds and improve access.



Scenario 5

Rural 2-lane minor arterial Main Street

Understand Context: This two-lane arterial has one lane in each direction with parking on both sides of the street. It functions as the Main Street in a rural town. This highway is a numbered U.S. Route on the National Highway System that passes through several small rural towns located about 30 miles from a major metropolitan area. There are several local businesses along the route, and residential properties are located within a few blocks on either side of this Main Street. The business community wants changes that support their business district. And residents want traffic calming measures implemented to make the street easier to cross and to reduce travel speeds.

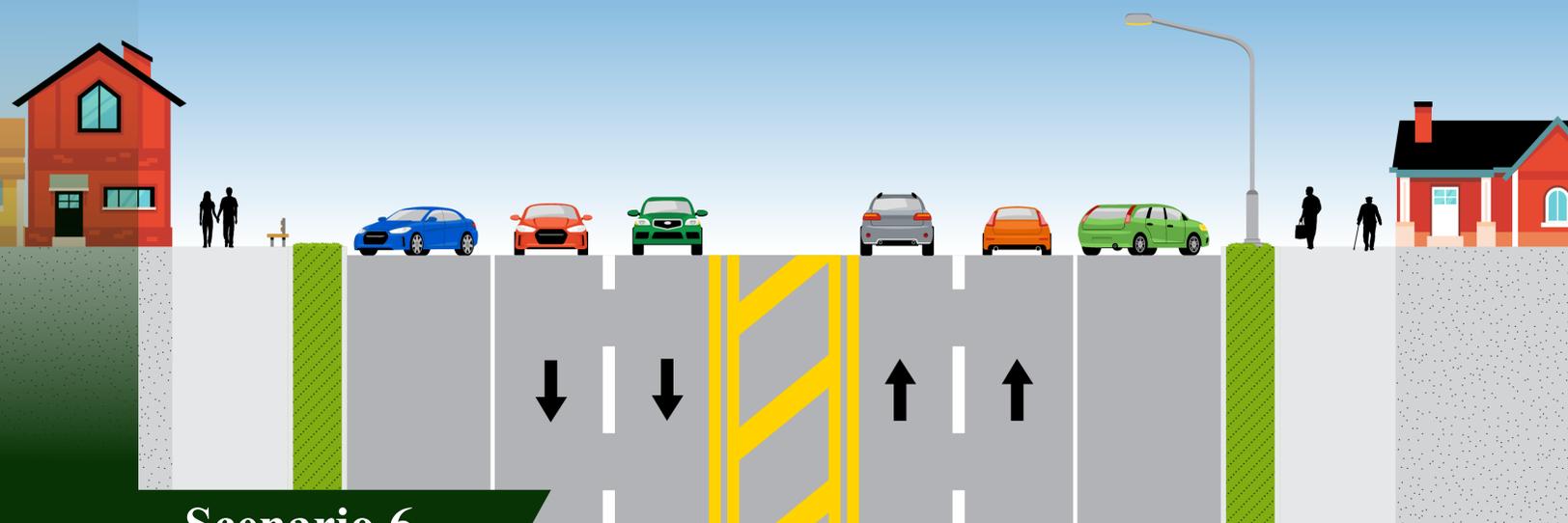
Identify Concerns:

1. Pedestrians find it difficult to cross the street because of **high speed** vehicular traffic.
2. Sidewalks exist but there are **no facilities for bicyclists**.
3. Lack of accessible spaces.



Implement Improvements:

1. Re-evaluate and set **appropriate speed limits**.
2. Add **curb extensions** at each intersection, and at some midblock crossing locations, to shorten pedestrian crossing distances to just two lanes. These measures also help reduce travel speeds in the corridor.
3. Add a mid-block **raised crosswalk** to calm traffic speeds and allow pedestrians to cross at-grade with the sidewalk.
4. Add **accessible spaces** at either the end of the block or on side streets.
5. Add signage to indicate entry to business district and to indicate bicycles will share the road.
6. Dedicated facilities for bicyclists are not added but riding in a shared lane with traffic is more comfortable due to the resulting **reduced travel speeds**.



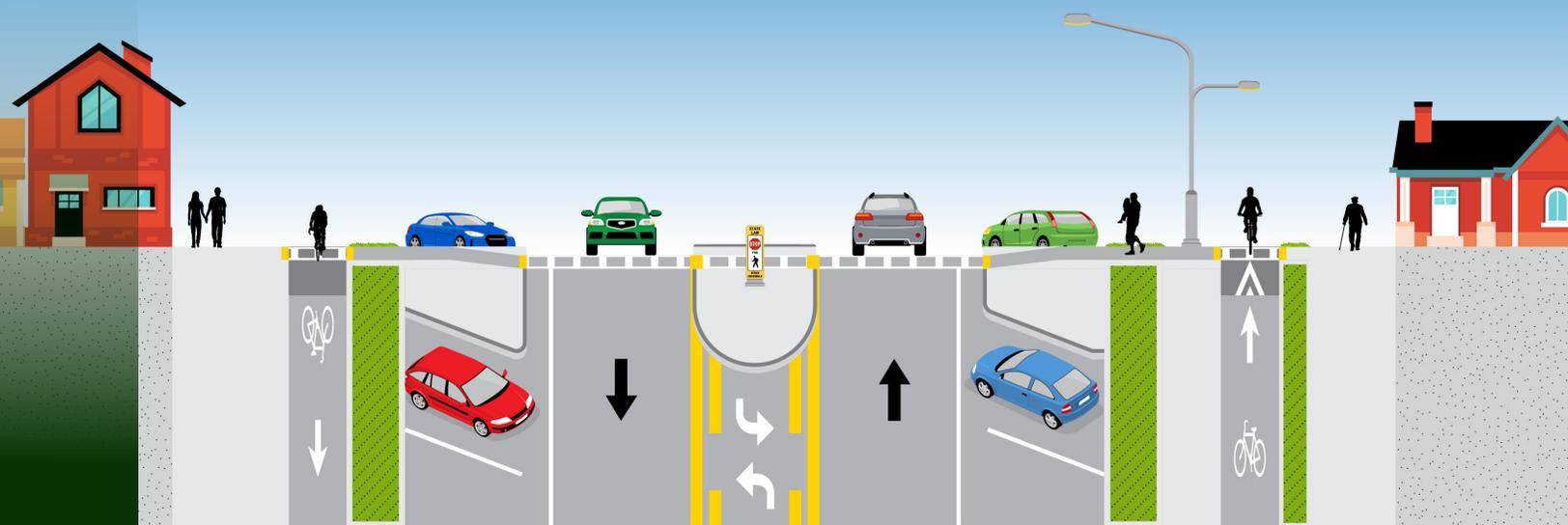
Scenario 6

Rural 4-lane principal arterial Main Street

Understand Context: This four-lane highway is the main street in a thriving rural town with a population of 11,000 people. A tourist location, the street is lined with restaurants, shops and other destinations. Community leaders have reached out to the State Department of Transportation (SDOT), who owns this highway, to request improvements that better support the needs of the community. After extensive outreach, the SDOT has agreed to reconstruct the highway to better serve the needs of local businesses and residents and implement a “road diet.”

Identify Concerns:

1. The flush median is too narrow for a turn lane, and not marked for that purpose, so traffic waiting to make a **left turn** blocks the left through lane.
2. Bicyclists do not feel safe using this route due to the **lack of bike facilities**.
3. The wide lanes and flush median induce **high travel speeds** exceeding the 30-mph speed limit.
4. Pedestrians find it **difficult to cross** this wide roadway, even at intersections.
5. Drivers have difficulty **safely backing out** of head-in angled parking spaces due to the lack of visibility to the travel lanes.
6. People with disabilities have difficulty reaching the streets' attractions.



Implement Improvements:

1. Implement a **road diet**, repurposing two through lanes to:
 - a. Add a **two-way center left turn lane** to facilitate turning traffic with **raised median refuge islands** at intersections and other crosswalks.
 - b. **Add a bike lane** in each direction, with ample separation from the parking lane to allow shoppers to load their vehicles without interfering with bicyclist travel. Raise the bike lane at midblock crossings to improve yielding to pedestrians. These changes will help reduce crossing distance for pedestrians and reduce speeds.
2. Build **bulbouts** (or curb extensions) at intersections and mid-block crossings to shorten the crossing distance for pedestrians.
3. Retain angled parking but convert to **back-in parking** to improve safety and visibility.
4. Provide accessible parking spaces with wide access aisles to accommodate vans with wheelchair lifts.
5. Make accessibility improvements to sidewalks and crossings.
6. Improve **lighting** for pedestrians and drivers.
7. Provide loading/unloading zones to accommodate freight deliveries



Additional Resources

Managing Speed

[Road Diets](#)

[Pedestrian Hybrid Beacon](#)

[Speed Safety Cameras](#)

[Raised Crosswalks](#)

[Appropriate Speed Limits⁸](#)

Separating Users in Time and Space

[Road Diets](#)

[Bike Lanes](#)

[Pedestrian Medians](#)

[Rectangular Rapid Flashing Beacon](#)

Improving Lighting

[Lighting](#)

Intersections

[Safe System Intersections](#)

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1 See Measures of Success resources on the FHWA Complete Streets website for more information.

2 <https://www.ghsa.org/resources/Pedestrians21>

3 <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813079>

4 Schneider, Sanders, and Proulx. 2020. United States Fatal Pedestrian Crash Hot Spot Locations and Characteristics. Transportation Research Board Annual Meeting, 2020. Manuscript Number: 20-02402

5 <https://ops.fhwa.dot.gov/publications/fhwahop12004/index.htm>

6 A crash modification factor (CMF) is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site. A CMF reflects the safety effect of a countermeasure, whether it is a decrease in crashes (CMF below 1.0), increase in crashes (CMF over 1.0), or no change in crashes (CMF of 1.0). A CMF can also be expressed as a crash reduction factor or CRF. A CRF provides an estimate of the percentage reduction in crashes. For example, a CMF of 0.75 is equivalent to a 25% reduction in crashes (i.e. CRF = 25).

7 The transportation agency requested and received Interim Approval from FHWA in accordance with the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD).

8 [Appropriate Speed Limits for All Road Users - Safety | Federal Highway Administration \(dot.gov\)](#)

