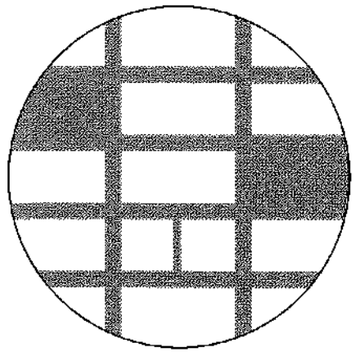
Street Design Principles

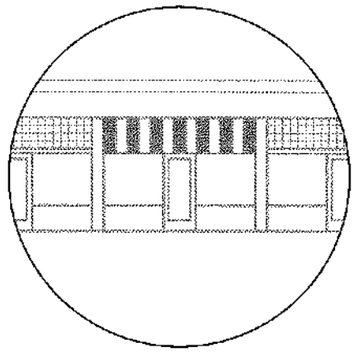
The *Urban Street Design Guide* crystallizes a new approach to street design that meets the demands of today and the challenges of tomorrow. Based on the principle that streets are public spaces for people as well as arteries for traffic and transportation, this guide foregrounds the role of the street as a catalyst for urban transformation. It cements the tactics and techniques being pioneered by the nation's foremost urban engineers and designers.

Key Principles

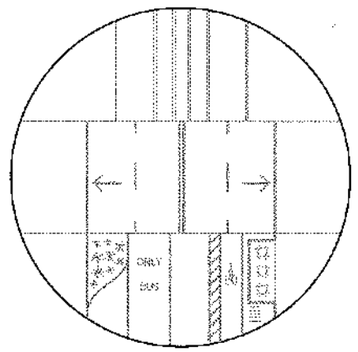
In an urban context, street design must meet the needs of people walking, driving, cycling, and taking transit, all in a constrained space. The best street design also adds to the value of businesses, offices, and schools located along the roadway.



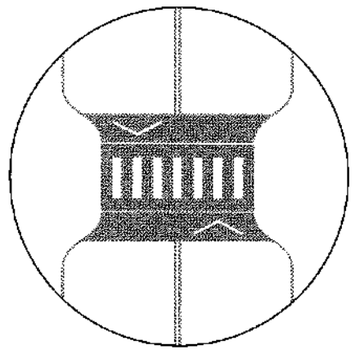
Streets Are Public Spaces
Streets are often the most vital yet underutilized public spaces in cities. In addition to providing space for travel, streets play a big role in the public life of cities and communities and should be designed as public spaces as well as channels for movement.



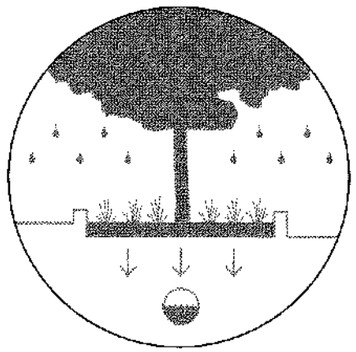
Great Streets are Great for Businesses
Cities have realized that streets are an economic asset as much as a functional element. Well-designed streets generate higher revenues for businesses and higher values for homeowners.[1]



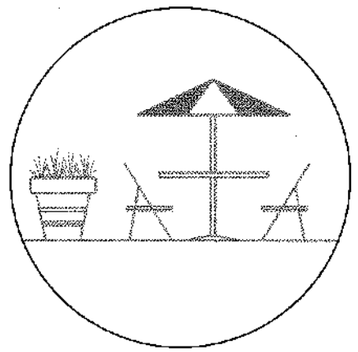
Streets Can Be Changed
Transportation engineers can work flexibly within the building envelope of a street. This includes moving curbs, changing alignments, daylighting corners, and redirecting traffic where necessary. Many city streets were built or altered in a different era and need to be reconfigured to meet new needs. Street space can also be reused for different purposes, such as parklets, bike share, and traffic calming.



Design for Safety
In 2012 in the U.S., over 34,000 people were killed in traffic crashes, which were also the leading cause of death among children aged 5–14. These deaths and hundreds of thousands of injuries are avoidable. Traffic engineers can and should do better, by designing streets where people walking, parking, shopping, bicycling, working, and driving can cross paths safely.



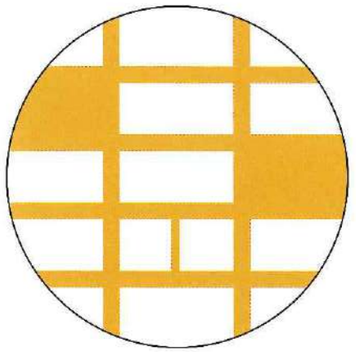
Streets Are Ecosystems
Streets should be designed as ecosystems where man-made systems interface with natural systems. From pervious pavements and bioswales that manage storm-water run-off to street trees that provide shade and are critical to the health of cities, ecology has the potential to act as a driver for long-term, sustainable design.



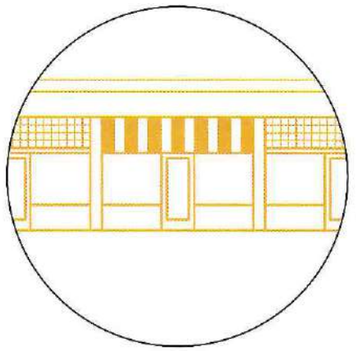
Act Now!
Implementing projects quickly and using low-cost materials helps inform public decision making. Cities across the U.S. have begun using a phased approach to major redesigns, where interim materials are used in the short term and later replaced by permanent materials once funding is available and the public has tested the design thoroughly.

Key Principles

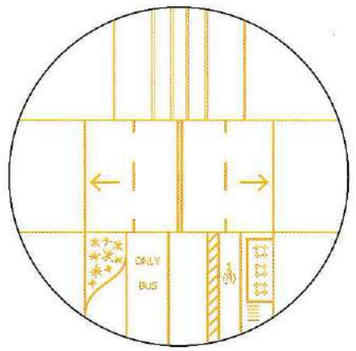
In an urban context, street design must meet the needs of people walking, driving, cycling, and taking transit, all in a constrained space. The best street design also adds to the value of businesses, offices, and schools located along the roadway.



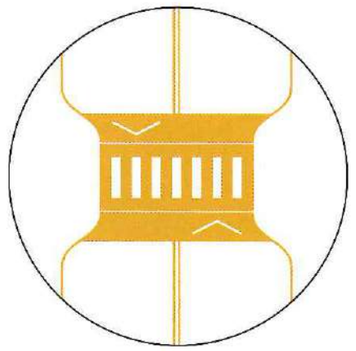
Streets Are Public Spaces
Streets are often the most vital yet underutilized public spaces in cities. In addition to providing space for travel, streets play a big role in the public life of cities and communities and should be designed as public spaces as well as channels for movement.



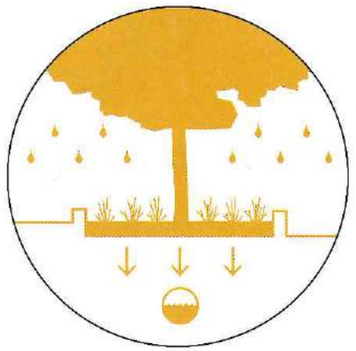
Great Streets are Great for Businesses
Cities have realized that streets are an economic asset as much as a functional element. Well-designed streets generate higher revenues for businesses and higher values for homeowners.[1]



Streets Can Be Changed
Transportation engineers can work flexibly within the building envelope of a street. This includes moving curbs, changing alignments, daylighting corners, and redirecting traffic where necessary. Many city streets were built or altered in a different era and need to be reconfigured to meet new needs. Street space can also be reused for different purposes, such as parklets, bike share, and traffic calming.



Design for Safety
In 2012 in the U.S., over 34,000 people were killed in traffic crashes, which were also the leading cause of death among children aged 5–14. These deaths and hundreds of thousands of injuries are avoidable. Traffic engineers can and should do better, by designing streets where people walking, parking, shopping, bicycling, working, and driving can cross paths safely.



Streets Are Ecosystems
Streets should be designed as ecosystems where man-made systems interface with natural systems. From pervious pavements and bioswales that manage storm-water run-off to street trees that provide shade and are critical to the health of cities, ecology has the potential to act as a driver for long-term, sustainable design.

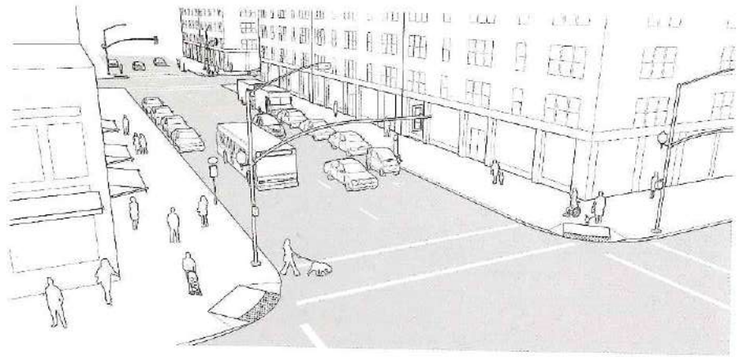
Act Now!
Implementing projects quickly and using low-cost materials helps inform public decision making. Cities across the U.S. have begun using a phased approach to major redesigns, where interim materials are used in the short term and later replaced by permanent materials once funding is available and the public has tested the design thoroughly.

Phases of Transformation

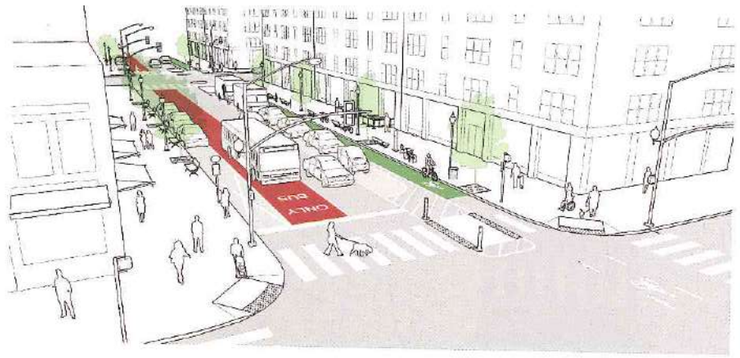
The streets shown in this guide are depicted in three stages of transformation: existing, interim, and reconstruction.

Interim design changes for streets can be carried out using low-cost materials. These interim design strategies realize the benefits of a full reconstruction in the short term, and can help build support for projects or test their consequences. While not all projects should or need to go through these three phases, many projects can benefit from this approach.

Existing
Existing conditions demonstrate how traditional design elements, such as wide travel lanes and undifferentiated street space, have had an adverse impact on how people experience the streetscape.



Interim Redesign
Striping and low-cost materials can realize the benefits of a full reconstruction in the short term, while allowing a city to test and adjust a proposed redesign.



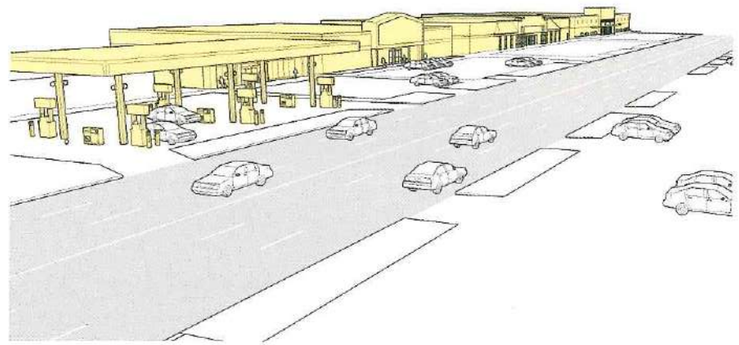
Reconstruction
Full capital reconstructions can take 5–10 years. A complete upgrade might include new drainage and stormwater management provisions, raised bikeways, wider sidewalks, and traffic calming elements.

Street Design in Context

Context is a crucial, yet often overlooked, parameter in designing streets. Street design should both respond to and influence the desired character of the public realm.

Rooted in city goals and policies, designers can work to enhance their surroundings by fulfilling the visions and desires of adjacent communities through street design.

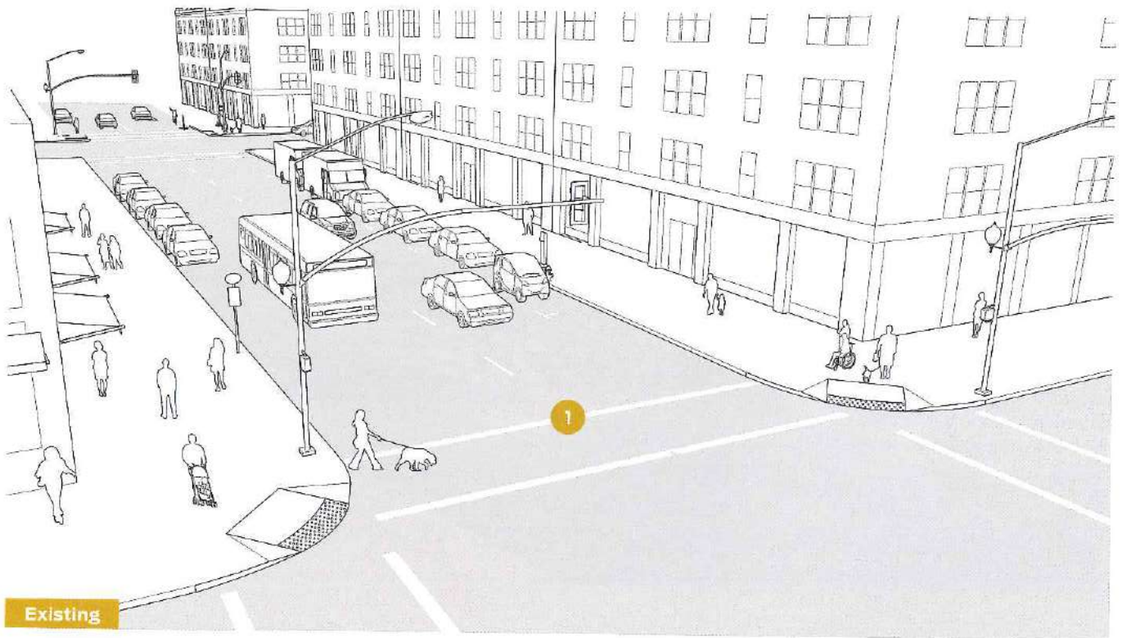
Commercial Strip
A single corridor can pass through multiple environments within the city, each with a different character and usage pattern. At right, a roadway passes through an auto-oriented commercial zone but has the same right-of-way as the two streets below.



Residential Boulevard
The same right-of-way serves a different purpose as it passes through a residential area. In this environment, the street can be used for plantings, on-street parking, and shaded sidewalks.

Downtown Street
In the heart of the commercial district, the right-of-way becomes a busy, downtown space full of buses, bikes, cars, and pedestrians.

Downtown 1-Way Street



Existing

In the mid-20th century, many 2-way downtown streets were converted to 1-way operation to streamline traffic operations, reduce conflicts, and create direct access points to newly built urban freeways. Today, many of these streets operate significantly below capacity and create swaths of empty pavement in downtown areas. While many cities are converting these streets back to 2-way operation, these broad roadways can be narrowed using cycle tracks and transit lanes, which require less cost and analysis, and optimize usage of the street as a public space.

EXISTING CONDITIONS

The existing conditions shown in the illustration above are typical of many city streets in the downtown core. Many of these streets have been designed for a 15-minute peak period and remain well below capacity at other times of day.

1 Undifferentiated street space and wide travel lanes can result in higher speeds and are an ineffective use of valuable street space.

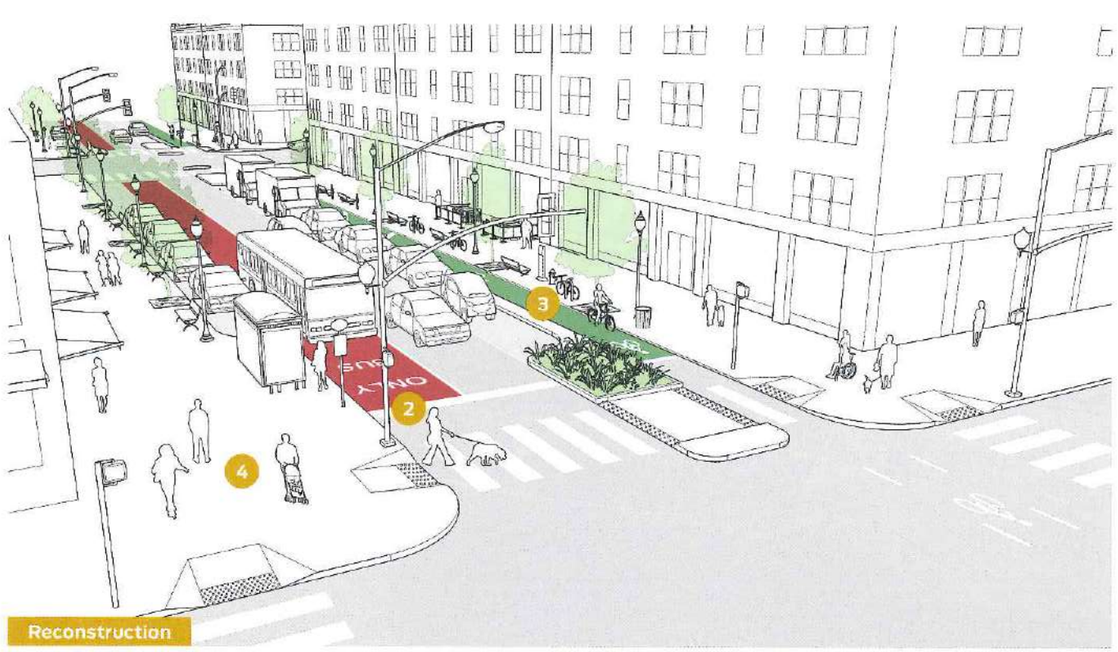
Many downtown 1-way streets have travel lanes with extra capacity or peak-hour restricted parking lanes.

Bicyclists feel uncomfortable riding between fast-moving traffic and the door zone. Double-parked vehicles may cause bicyclists to weave into traffic unpredictably, creating unsafe conditions for both motorists and bicyclists.

RECOMMENDATIONS

2 On downtown streets with heavy bus traffic, a red bus-only lane may be applied at curbside or offset. Bus-only lanes require significant enforcement and may be encroached upon by double parked cars and loading vehicles without proper enforcement. Combine bus-only lanes with bus bulbs, shelters, and transit signal priority to increase their effectiveness.

Analyze existing traffic volumes to determine whether or not peak-hour lanes can be removed and converted to on-street parking, bus or bike lanes, or additional sidewalk space. Converting underutilized travel lanes to other uses can eliminate potential conflicts within the roadway and improve traffic operations.



Reconstruction

3 A raised cycle track or parking-buffered cycle track applied on the left side of a 1-way street, removes cyclists from potential conflicts with bus traffic and creates a pedestrian safety island that decreases exposure time for pedestrians. Note: 2-way cycle tracks can also function effectively on 1-way streets in some instances. Where 2-way cycle tracks are installed, consider mitigating contra-flow turn conflicts by using bicycle signals, turn restrictions, and other means that improve visibility and slow motorists turning at the intersection.

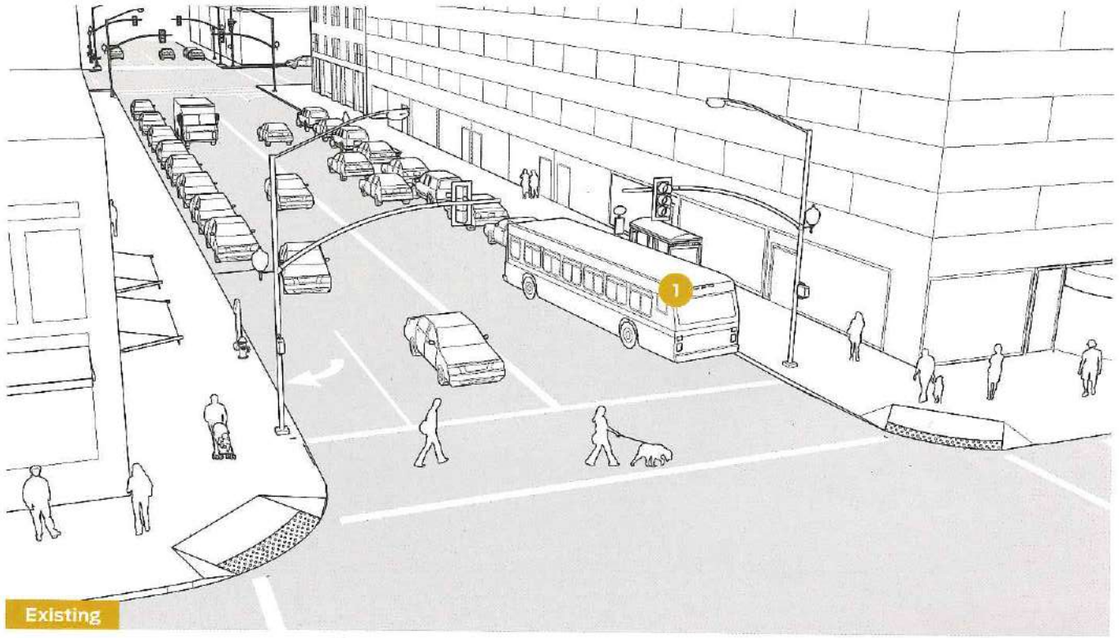
4 As part of a full reconstruction, consider widening sidewalks, especially when they have previously been narrowed in favor of additional travel lanes.

The street illustrated above depicts a 46-foot roadway within an 86-foot right-of-way.

NEW YORK, NY

In 2010, 1st Avenue in New York City was redesigned with a 1-way cycle track, Select Bus Service, and pedestrian safety islands. The redesign not only carved out room for bicyclists, but shortened long, unsafe crossings for pedestrians. The avenue has since become a model for the successful transformation of the city's major avenues.

Downtown 2-Way Street



Existing

Busy downtown 2-way streets are often the most difficult streets for cities to reconfigure and retrofit. Many of these streets suffer from double parking and loading conflicts, have heavy turn volumes, and offer insufficient accommodations for bicyclists and pedestrians. Retrofit constrained 2-way streets using lane diets and conventional bike lanes or add cycle tracks that decrease the overall width and offer a higher quality bicycle facility.

EXISTING CONDITIONS

The above illustration depicts a constrained 2-way street in a central business district. While many downtown streets were converted to 1-way operations, many were not, resulting in streets that are heavily congested by buses, bikes, people, and cars. Especially in older cities, these streets may be a main route for multiple modes.

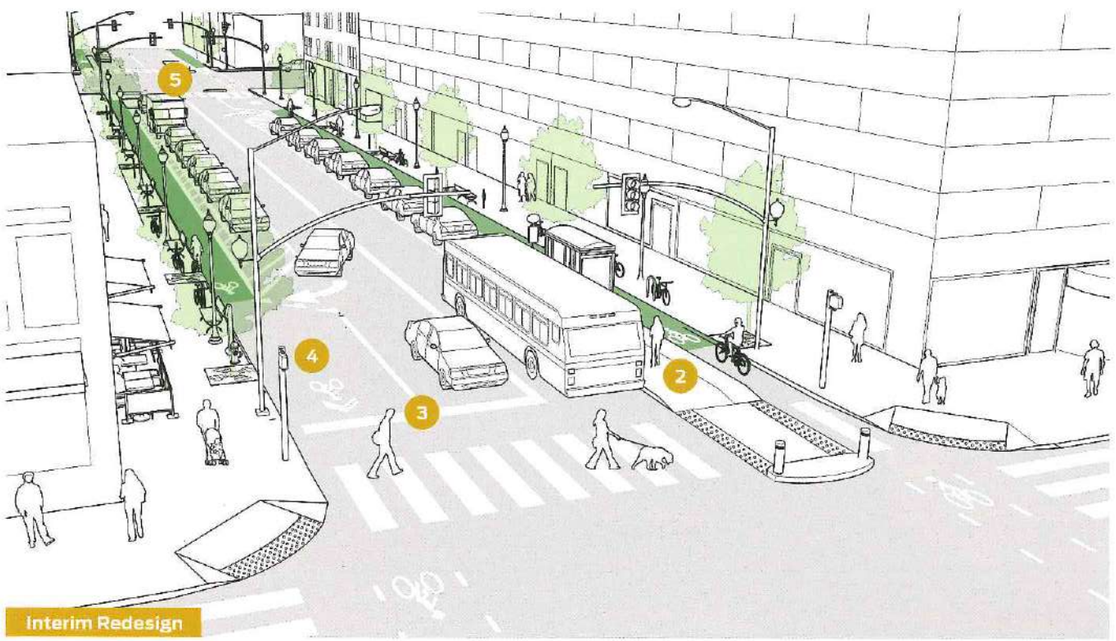
1 On major bus routes, curbside bus stops may be undermined by double-parked vehicles and heavy rush-hour traffic. These obstructions hurt the reliability and on-time performance of transit vehicles.

A lack of organization and striping can invite unintended uses and double-parking.

Freight vehicles double-parking at peak hours create weaving conflicts and safety hazards for motorists and bicyclists.

CHICAGO, IL

SAN FRANCISCO, CA



Interim Redesign

RECOMMENDATIONS

2 Bus bulbs serve as dedicated waiting areas for transit users while decreasing pedestrian exposure during crossings. Far-side placement is preferable to near-side when possible. Apply turn restrictions for near-side bus bulbs where right-turning vehicles are likely to queue in the right lane. Bus bulbs may be created in the near term without affecting drainage if slightly offset from the curb or designed as a bus-boarding island with a bicycle cut-through.

3 Create definition in the roadway using striping, cycle tracks, and narrow travel lanes.

4 Cycle tracks require special attention at intersection crossings. Conflicts should be highlighted using intersection crossing markings with the application of color optional. Bicycle signals may need to be applied for bicycle traffic to operate safely along the corridor, though bikes may use pedestrian signals in an interim design. Turning conflicts may be reduced through the implementation of turn restrictions.

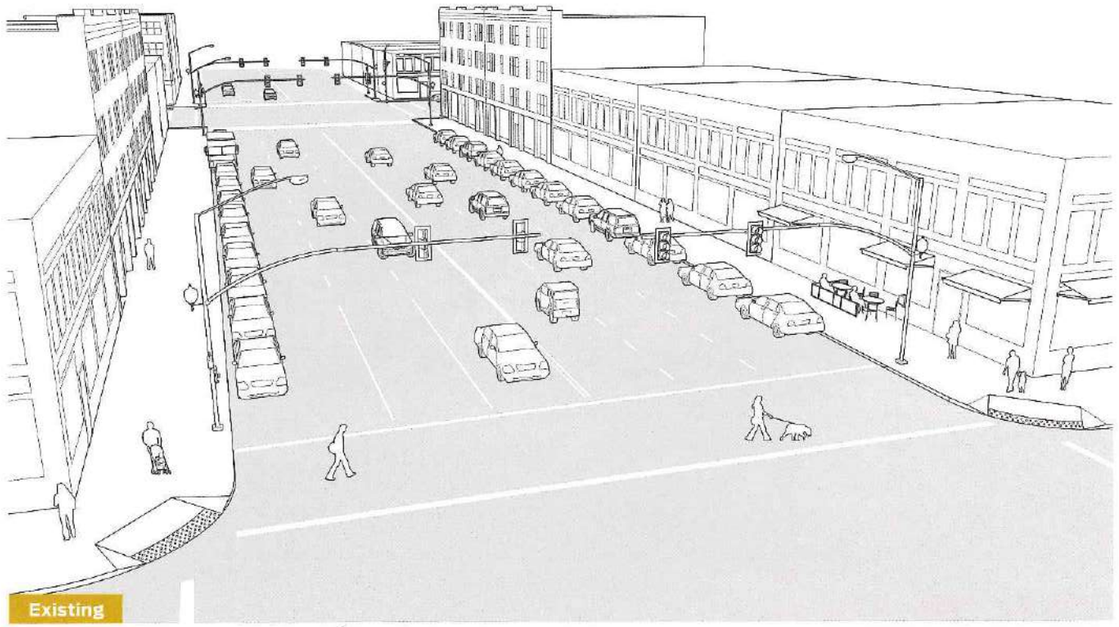
5 Restricting freight delivery or encouraging off-peak freight delivery is critical to eliminating double-parking obstructions. Off-peak deliveries are faster and more cost-efficient and avoid obstruction of the bike lane or delays to buses and local traffic. At peak loading times, dedicated loading zones should be provided to avoid the need for freight vehicles to double-park. Designers may also consider the use of wide parking lanes in these situations.[1]

The street illustrated above depicts a 50-foot roadway within an 80-foot right-of-way.

SEATTLE, WA

This street in Seattle uses a planted central median to create a street geared towards slower speeds.

Downtown Thoroughfare



Existing

Major streets that connect neighborhood centers or run through the downtown can be daunting for pedestrians to cross, depressing property values and the quality of the public realm as a result. While many of these streets have significant traffic volumes at peak hours and bustle with activity throughout the day, there are opportunities to improve these corridors for everyone using them. Add a central median and cycle tracks to enhance the experience of the street and to reduce its overall width.

EXISTING CONDITIONS

The illustration above depicts a major 2-way downtown arterial with 6–8 lanes of traffic. This street runs directly through the heart of the city and is a major connector to other neighborhoods. The street has heavy turn volumes and multiple signal phases, making it a barrier for people to cross.

Left turns are a frequent source of conflict between motorists and pedestrians and a common cause of head-on collisions.

Buses experience frequent delay due to the encroachment of parked cars, loading freight vehicles, and through traffic. Bicyclists lack any accommodation on the street whatsoever, forcing many to utilize the sidewalk as an alternative.

RECOMMENDATIONS

1. Assess left-turn volumes and evaluate the overall traffic network to determine whether or not left turns can be restricted or removed at a particular intersection. Where left turns must be retained, consider phasing options that provide a dedicated left-turn phase.

2. A parking-buffered 1-way cycle track, applied on each side of the street, offers a high-quality experience to bicyclists.

3. The cycle track may also be combined with an offset bus-boarding island and other amenities that improve operations for pedestrians and transit users.

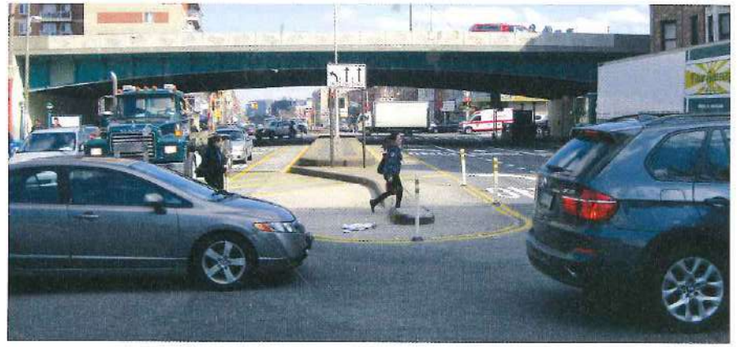
Interim Redesign

4. At intersections, 1-way cycle tracks may either mix with right-turning vehicles in a "mixing zone," or, where turn volumes compromise bicyclist comfort and safety, be given a dedicated bicycle phase.

As an alternative to the treatment shown above, a 6-foot pedestrian safety island and dedicated left-turn bay may be retained at the intersection by tapering the bike lane buffer and shifting the rightmost travel lane.

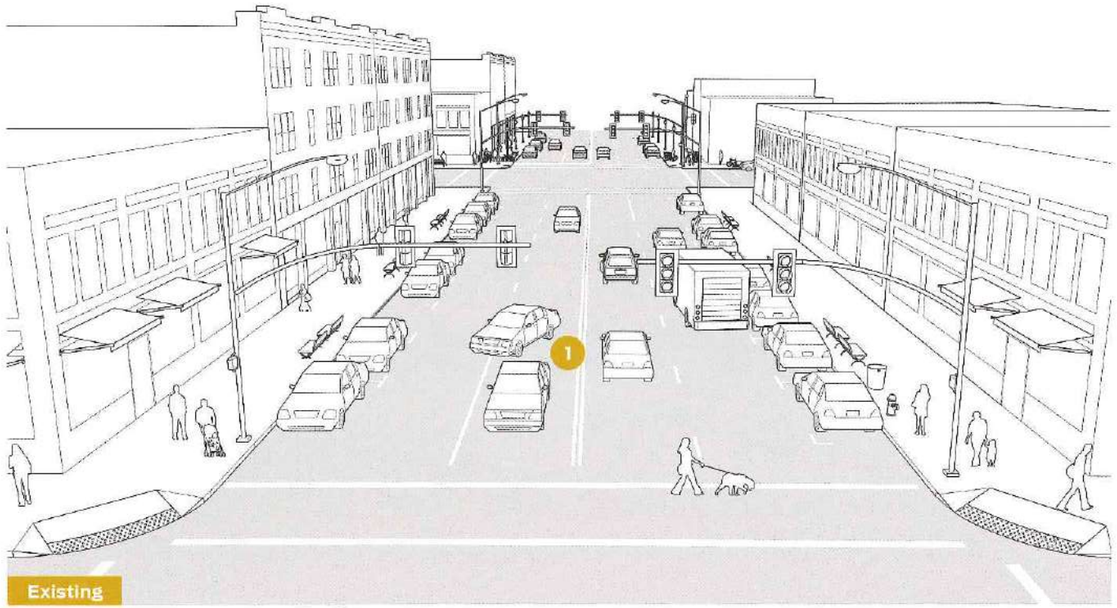
Many major urban arterials with commercial strip development may be reconfigured using the same principles as described above. In such cases, land use changes and access management should be coordinated with the overall vision and redesign of the street.

The street illustrated above depicts an 84-foot roadway within a 114-foot right-of-way.



BROOKLYN, NY
Striping and left-turn pocket closures provide a better pedestrian safety area.

Neighborhood Main Street



Existing

Neighborhood main streets are a nexus of neighborhood life, with high pedestrian volumes, frequent parking turnover, key transit routes, and bicyclists all vying for limited space. Main street design should limit traffic speeds and create a narrower cross-section with frequent, well-designed pedestrian crossings. In recent years, many main streets have been significantly improved through road diets and the conversion from 4 to 3 (or 6 to 5) lanes of travel with bike lanes and a center turning lane or median.

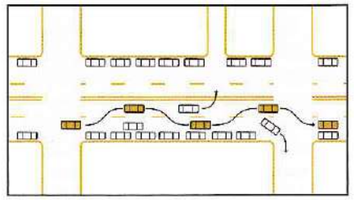
EXISTING CONDITIONS

The illustration above depicts a main street with 4 lanes of traffic. With medium traffic volumes and high pedestrian activity, the street has significant potential for regeneration as a retail district, yet currently underperforms for those who shop, eat, and walk there. Frequent destinations have resulted in multiple turning and weaving conflicts along the street.

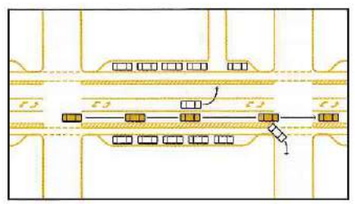
1 4-lane configurations have been shown to increase rear-end and sideswipe vehicle crashes and pose a higher pedestrian crash risk.[1]

RECOMMENDATIONS

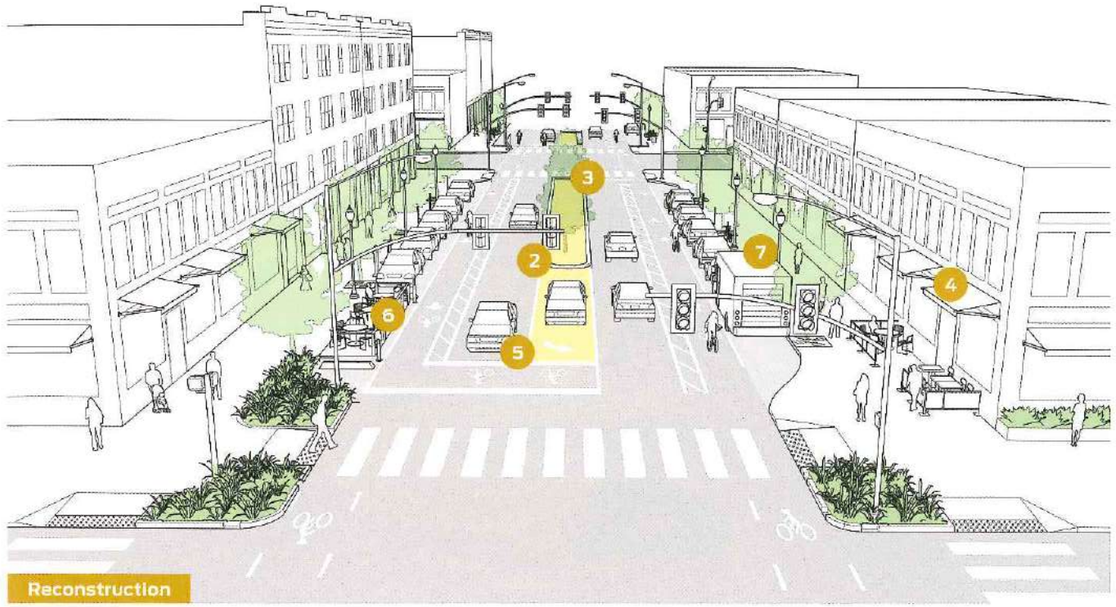
While road diets are not appropriate on all 4-lane cross sections, streets carrying up to 25,000 vehicles per day function effectively with 3 lanes, depending on the traffic volumes of nearby adjacent streets.[2]



The weaving line in the 4-lane configuration shows the pattern of a driver avoiding double-parked vehicles and drivers turning left and right.



In a 3-lane configuration, the weaving and conflicts are eliminated.



Reconstruction

Road diets can improve traffic flow and reduce conflicts with turning vehicles, while increasing a road's efficiency by channeling turning vehicles out of the through lanes. Streets designed with either 2 lanes or a 2-way left-turn lane can cut crash risk by nearly half.[3]

Implementation of a road diet should consider the availability of parallel routes, the potential for mode shift, and reconfiguring signal timing and displays to improve signal operation for all users.

2 Turn lanes can help to eliminate weaving conflicts on 4-lane roads. As an alternative to the illustration above, a 6-foot pedestrian safety island can be retained in the above configuration by tapering the bike lane buffer near the intersection and shifting the through lanes to the right.

3 The application of a road diet may be carried out in two phases, the first consisting solely of striping and a center turn lane, and the second, of medians and plantings to complement the center lane.

4 From an economic standpoint, road diets often rank favorably with business owners and have a positive impact on local business activity.[4]

5 Bike boxes help cyclists make left or right turns by placing them in front of traffic at a red light. On streets with higher traffic volumes, cyclists may choose to make a two-stage turn.

6 Parklets are ideal for neighborhood main streets with active storefronts, heavy foot traffic, and lots of retail activity.

7 Streets with both heavy freight and parking demand, as well as on-street bike lanes, benefit from dedicated loading zones near the intersection. Loading zones help reduce obstruction of the bike lane and make deliveries easier for businesses. Loading zones can be striped and signed, or managed for off-peak deliveries.

The street illustrated above depicts a 64-foot roadway within a 94-foot right-of-way.

BROOKLYN, NY

Neighborhood Street

Local streets in residential neighborhoods are often underutilized as spaces for play and leisure. These streets should provide safe and inviting places to walk with direct access to local stores and schools. Design for local streets can combine stormwater management features, curb extensions, vertical speed control elements, and bicycle facilities that encourage safe speeds and meter through traffic.

RECOMMENDATIONS

1 On 1-way neighborhood streets, travel lanes may be striped to narrow the percieved width of the roadway. An undifferentiated traveled way encourages higher speeds. Crash rates have been shown to increase as lane width increases.

2 Left-side bike lanes reduce the risk of dooring conflicts and are an effective treatment for most neighborhood streets.

3 Raised crosswalks or curb extensions maintain safe travel speeds and reinforce the residential nature of the street.[1]

The street illustrated above depicts a 30-foot roadway within a 50-foot right-of-way.

CAMBRIDGE, MA
Bike lanes narrow this residential street and serve as a valuable low-volume route for commuters.

Yield Street

2-way yield streets are appropriate in residential environments where drivers are expected to travel at low speeds. Many yield streets have significant off-street parking provisions and on-street parking utilization of 40–60% or less. Create a "checkered" parking scheme to improve the functionality of a yield street.

RECOMMENDATIONS

For a yield street to function effectively, motorists should be able to use the street intuitively without risk of head-on collision. Depending on whether the yield street has high or low parking utilization, flush curbs, or other features, its configuration may vary. A yield street with parking on both sides functions most effectively at 24–28 feet, while yield streets with parking on only one side can be as narow as 16 feet.[1]

1 All residential streets should provide safe and inviting places to walk and good access to local stores and schools. Design should mitigate the effects of driveway conflicts, reduce cut-through traffic, and maintain slow speeds conducive to traffic safety.

2 Driveways should be constructed to minimize intrusion upon the sidewalk. Maintain sidewalk materials and grade across driveways.

3 The planted furniture zone of the sidewalk creates opportunities for street trees, bioswales, pervious strips, and rain gardens.

4 While most yield streets should have a minimum of signage and striping, signage should be used to indicate bidirectional traffic at transition points or where 2-way operation has recently been introduced.

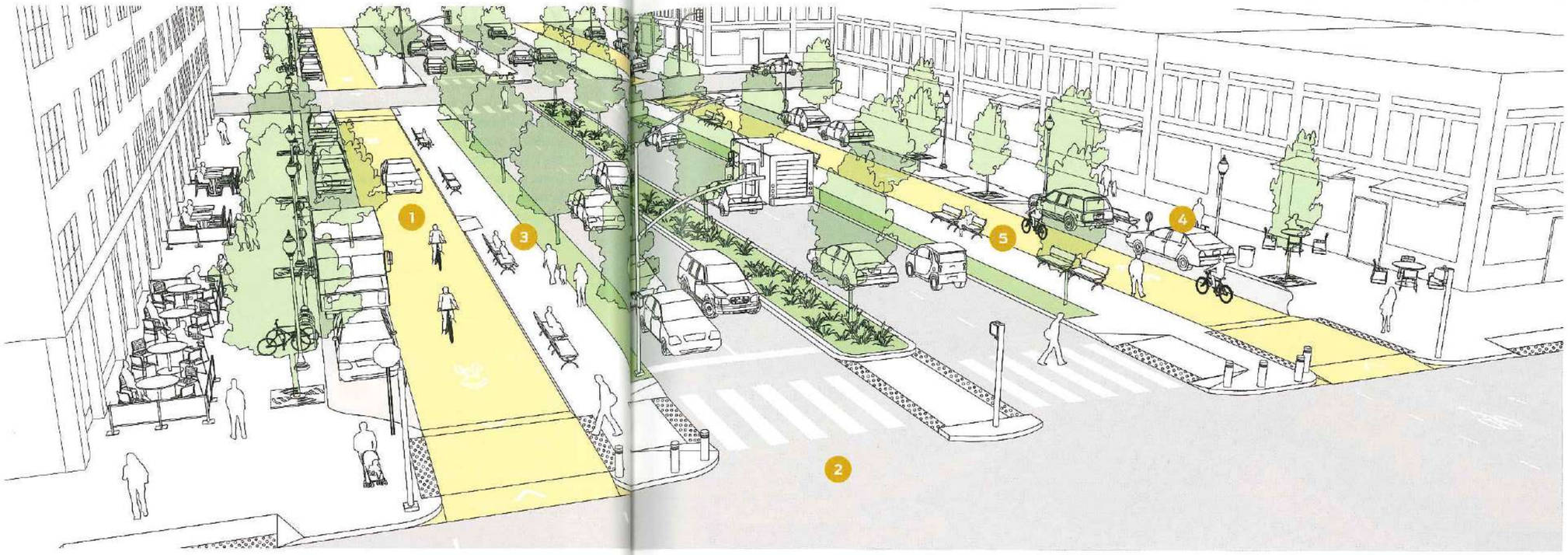
Parking utilization on yield streets should be monitored closely. Before and after conversion, cities should consult with local residents to see whether or not a "checkered" parking scheme should be striped or remain unofficial.

The street illustrated above depicts a 30-foot roadway within a 45-foot right-of-way.

PORTLAND, OR
A curb extension narrows the entry and slows turning vehicles at the mouth of this yield street.

Boulevard

Boulevards separate very large streets into parallel urban realms, buffering the commercial or residential street edge from the high-speed throughway by means of multiway operations and frontage roads. Many boulevards were built at the turn of the 20th century, but fell into disrepair or were redesigned to highway standards over the course of the century. Today, many cities are restoring these boulevards to their former grandeur or applying updated boulevard design standards to overbuilt urban arterials.



RECOMMENDATIONS

1 The frontage road, especially in a residential context, benefits from traffic calming at intersections and midblock as well as pedestrian-scale lighting and street trees. These enhancements preserve safe speeds for bicyclists and pedestrians, and encourage recreational and commercial activity.

2 Boulevards require careful attention at intersections with cross traffic. Poor design can result in intersections that are confusing or unsafe for all street users. In general, frontage roads should be stop-controlled, except in cases where volumes of cross traffic fail to provide sufficient gaps to pass. In such cases, require vehicles on the frontage road to turn or install a signal in conjunction with the through lanes.[1]

BERKELEY, CA
Frontage roads create a parallel low-speed urban environment ideal for retail activity.

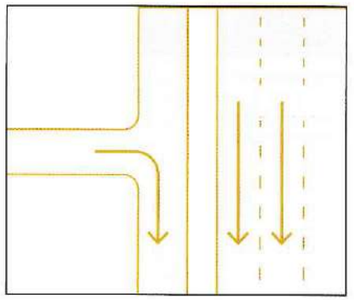
3 Boulevard medians are often under-designed or inhospitable as public space. Intersection conflicts and delays undermine their use. Medians can be activated through the addition of shared use paths, seating, and recreational amenities. Consider the installation of curb extensions or midblock crossings to facilitate median use and access, or design the frontage road with a flush curb to create a seamless transition between the sidewalk, street, and median.

SAN FRANCISCO, CA
Low-speed, low-volume frontage roads are shared by multiple users.

Transit providers may prefer to use the frontage road over the throughway to reduce risks of rear-end collisions and provide more direct access to adjacent homes and businesses. When used as a transit route, the frontage road should be designed with curb extensions and/or speed cushions and should be signalized to ensure the effectiveness of transit service.

4 Frontage roads provide additional parking to local businesses and residents. Back-in angled parking may be an option if space is available.

Boulevards may benefit from access management strategies. At local or low-volume intersections, consider creating a T-intersection by extending the median and forcing turns. Through traffic and recreational median users both benefit from this configuration. Midblock pedestrian crossings should still be provided to preserve crossing opportunities.

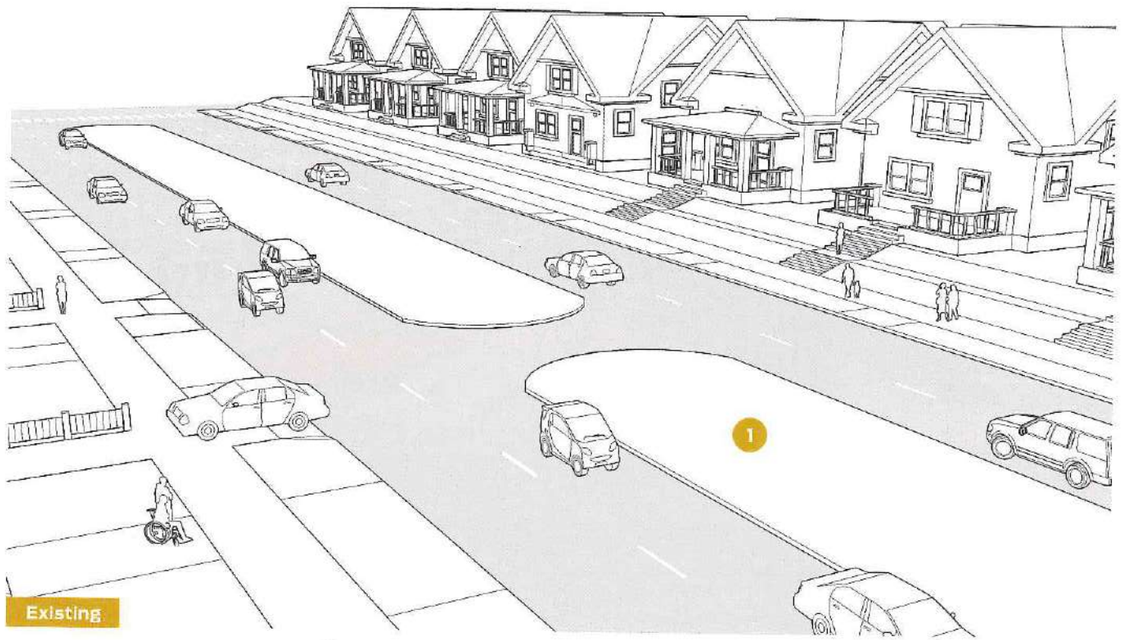


5 A boulevard median with a shared use path should be designed with careful attention to intersection crossings and turning conflicts. Use access management strategies and turn requirements to eliminate these conflicts and ensure that potential intersection conflicts are well marked and highly visible to motorists turning off the throughway as well as to cross traffic.

The street illustrated above depicts a 116-foot roadway within a 164-foot right-of-way.

PHILADELPHIA, PA
Rows of trees make walking pleasant and provide shade in summer.

Residential Boulevard



Existing

Broad historic boulevards and parkways often function as high-speed thoroughfares, even though their adjacent land uses may be primarily residential in nature. In many cases, these streets have excess width, underutilized on-street parking, and too many travel lanes. Retrofit residential boulevards by expanding or activating the median, adding curbside or left-side bike lanes, and curb extensions that provide direct access from homes to the center median.

EXISTING CONDITIONS

The illustration above depicts a broad residential thoroughfare in an older neighborhood. The central median is underutilized. While traffic volumes may not be high, speeds are, creating highway-like conditions in a predominantly residential area.

1 Many historic central medians are underused and lack recreational space. High speed crossings make it difficult for residents and children to safely access the median.

While parkways and boulevards provide natural links in an active transportation network, many lack safe and adequate paths for recreational use.

Parking demand and utilization may vary depending on the amount of off-street parking available to residents.

BOSTON, MA
Commonwealth Avenue has a linear park in its median.

NEW YORK, NY
A cycle track takes advantage of the central median and insulates cyclists from double parking.

Reconstruction

RECOMMENDATIONS

2 Activate the central median with plantings, street trees, walkways, and seating. Broad central medians can become a community focal point as well as an active space for recreation, exercise, and leisure. Provide curb extensions and/or midblock crossings to make it safer and easier for residents to access the median.

3 A raised cycle track takes advantage of the central right-of-way, avoids frequent conflicts with driveways and double-parked cars, and effectively expands the amount of recreational space along the corridor.[1]

4 Provide curbside parking for residents. Curbside parking provides access to the recreational median for visitors, space for residents' guests to park, and narrows the overall cross-section of the road, reinforcing its residential character. Where on-street parking remains underutilized, consider adding curb extensions, bicycle corrals, or expanding the sidewalk to take advantage of the excess pavement.

The street illustrated above depicts an 80-foot roadway within a 110-foot right-of-way.

ST. LOUIS, MO
Many historic neighborhoods have medians with untapped civic potential.

Transit Corridor

Transit corridors, including light rail (LRT), streetcar, and bus rapid transit (BRT), promote economic development around high-quality transit service while fostering a pedestrian scale in which walking and biking actively complement public transit. As major generators of pedestrian traffic, heavy surface transit routes should be prioritized for pedestrian safety improvements in both the immediate surrounding area and major access routes within the transit access shed. When redesigning streets for high-quality transit service, designers should assess how transit service is impacted not only by the geometry of the corridor, but also its existing signal timing, signal phasing, turns, and other operations that may jeopardize the quality of service.

RECOMMENDATIONS

1 Transit corridor retrofits should be coordinated with land use changes to maximize a corridor's potential for economic growth and physical transformation. Setback guidelines and other land use regulations should be tailored to create a pedestrian-scale environment.[1]

2 A raised cycle track on both sides of the corridor promotes the combination of bicycle and transit usage. A center-running 1-way or 2-way cycle track may be preferable in some cases to reduce the dangers of turning conflicts in combination with transit.

Enforcement measures should be put in place to discourage encroaching vehicles from using the dedicated bus lanes. In some cases, median transit lanes may serve as a route for emergency vehicles.

3 Corridors with high transit traffic, where double-parking and local traffic pose obstacles to effective transit, should be considered for BRT, LRT, or streetcar. High-quality transit service and median transit lanes decrease conflicts between buses and through traffic on heavy transit routes, can speed travel times, and reinforce the desirability of transit as an option.[2]

Wide transit corridors are challenging to cross in a single cycle. Consider the tradeoffs between shortening signal cycle lengths and providing sufficient time for all pedestrians to cross the street.

4 Off-board fare collection speeds up transit vehicles and reduces wait time for passengers.

Transit signal priority gives buses and light rail more green time and should always be used as part of BRT or LRT operations.[3]

PHOENIX, AZ
Light rail expansions should be coordinated with land use changes to promote development of the corridor.

A side-running bus, streetcar, or light rail system may be preferable when adjacent land uses are heavily weighted toward one side of the corridor.

5 The design of a transit stop is an opportunity to reinforce the speed and desirability of the system. Shelters and stations should be built to accommodate the typical number of waiting passengers at the peak hour.

Loading zones should be provided near the intersection in the floating parking lane to discourage double parking.

The street illustrated above depicts a 120-foot roadway within a 150-foot right-of-way.

Green Alley

The majority of residential alleys have low traffic and infrequent repaving cycles, resulting in back roads with potholes and puddling that are uninviting or unattractive. Green alleys use sustainable materials, pervious pavements, and effective drainage to create an inviting public space for people to walk, play, and interact.[1]

RECOMMENDATIONS

1 Construct green alleys with low-impact pavement materials, such as pervious pavements with high reflectivity to reduce heat island effects.

DETROIT, MI
This alley in Detroit was transformed to manage stormwater using pervious pavement and native plants along the walkway.

2 Alleys may be operated as pedestrian-only environments or as shared streets. Use bollards, signs, and design features that make clear the intended alley users.

Alley greening and maintenance may be initiated and carried out by local residents or neighborhood associations.[2]

3 To avoid puddling, stormwater run-off should be infiltrated in-place using permeable paving or rain gardens at the edge of the pedestrian path.[3]

4 To maintain a safe environment, green alleys should have adequate lighting. Pedestrian-scale light fixtures that focus their illumination toward the ground and minimize light pollution are recommended. Public safety is of paramount consideration for all new and existing alleys. Good lighting is an essential prerequisite to a feeling of public safety in alleys.

5 Green alleys often run parallel to the larger street network, making them ideal low-speed, low-volume links for cyclists.

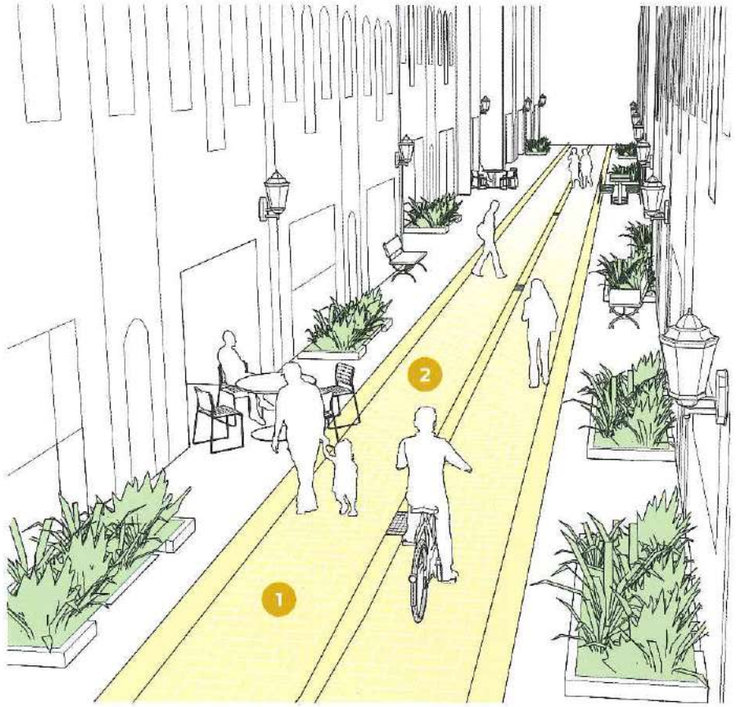
Alleys provide direct property access and eliminate the need for driveways along main roads where people are walking and biking. Consider the use of alleys in all new developments and renovations to existing properties.[4]

Green alleys may present certain unconventional maintenance responsibilities. Use of textured pavements and other materials may be challenging to existing street sweepers and snowplows. Similar to shared streets, alleys may benefit from the application of snowplow compatible materials and provisions for maintenance equipment access.

The alley shown above depicts a 14-foot path within a 28-foot right-of-way.

Commercial Alley

Commercial alleys, though often thought of as dirty or unsafe, can be designed to play an integral role in a downtown street network and improve the pedestrian realm in and around commercial areas. The design of commercial alleys should strive to balance their necessary utilitarian features with their place-making potential.



RECOMMENDATIONS

Intersections between alleys and sidewalks have the potential to obstruct visibility for vehicles (if permitted) and passing pedestrians. Raise the intersection to the sidewalk grade and add rumble strips to mitigate these visibility issues. Warning signs should be provided to warn pedestrians of encroaching traffic.[1]

Freight may use green alleys for loading and unloading, which reduces double-parking on neighborhood streets.

1 Where access for vehicles is prohibited or minimal, commercial alleys may be constructed using low-impact pavement materials, such as pervious or modular paving.

2 Bicycle traffic may use commercial alleys. Similar regulations to those of shared space should apply.

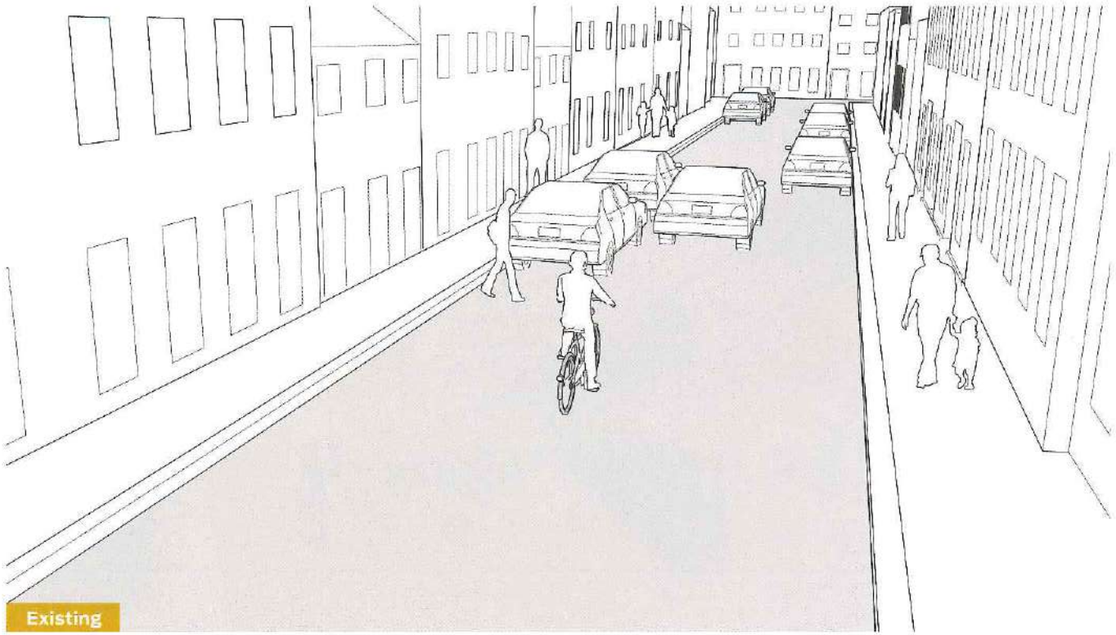
Commercial alleys can be restricted for traffic during non-delivery hours for outdoor seating or other uses.

Where vehicle access is permitted, alleys should be maintained to allow easy access by trucks and other freight vehicles. Bollards and other street furniture should be designed to minimize conflicts with freight movements. In some cases, freight may be conveyed using hand trucks or small vehicles. In these cases, careful attention should be paid to the location of curbs and the access from loading zones to entrances to ensure smooth deliveries.

The alley shown above depicts a 10-foot wide path within a 20-foot right-of-way.

SAN FRANCISCO, CA
Alley redesign can feature pavers for the traveled way, parking restrictions, and additional public space.

Residential Shared Street



Existing

Low-volume residential streets, especially in older cities, often have narrow or crumbling sidewalks. Many of these streets operate as de facto shared spaces in which children play and people walk, sharing the roadway with drivers. Depending on their volume and role in the traffic network, these streets have the potential to be redesigned and enhanced as shared streets. Shared streets can meet the desires of adjacent residents and function foremost as a public space for recreation, socializing, and leisure. It is important to note that while many low-volume residential streets were designed without sidewalks and may function as shared streets, shared street conversions necessitate a deliberate redesign rather than the addition of regulatory signage alone. Sidewalks should be added when upgrading substandard neighborhood streets.

EXISTING CONDITIONS

The residential street in the illustration above is common in neighborhoods with low traffic volumes. Here the configuration of the street network has formed a street segment that functions naturally as a space for children to play and for residents as a gathering place.

Many low-volume residential streets in the United States were designed without sidewalks. Most of these streets have limited access and low volumes, allowing them to operate informally as shared spaces. Cities should aim to maintain low speeds and volumes on these streets, reinforcing their shared nature through materials and targeted design enhancements.

RECOMMENDATIONS

1 Textured or pervious pavements that are flush with the curb reinforce the pedestrian-priority nature of the street. Special pavements, especially unit pavers, may be subject to additional maintenance costs and should be selected based on regional climate and long-term durability. Selection of snowplow-compatible materials is recommended for colder climates. Drainage channels should be provided either at the center of the street or along the flush curb, depending on underground utilities and other existing conditions.

2 Street furniture, including bollards, benches, planters, and bicycle parking, can help define a shared space, subtly delineating the traveled way from the pedestrian-only space.[1]

3 A shared street sign should be used at the entrance to a shared street. In some cases, a modified YIELD TO PEDESTRIANS sign (MUTCD 2B-2) may be added to reinforce the conversion in early stages.

Provide tactile warning strips at the entrance to all shared spaces. Warning strips should alert drivers and pedestrians.[2]

Reconstruction

4 Shared streets generally permit motorists and bicyclists to operate in a 2-way fashion. Narrower shared streets may be made 1-way for motorists, though 2-way bicycle traffic should still be permitted. Certain restrictions and regulations may apply to vehicles on a shared street. Designers should strive to make these behaviors implicit through the design details of the street itself.

5 On wider shared streets, staggered blocks of landscaping, head-in parking, back-in angled parking, or perpendicular parking can be used to create a chicane effect.[3] In some cases, parking may be permitted directly adjacent to properties in a residential environment. Bollards, paving materials, and street furniture help to define parking spaces and to delineate private from public space.

Where necessary, traffic volumes can be decreased through network design and traffic calming as part of a conversion.

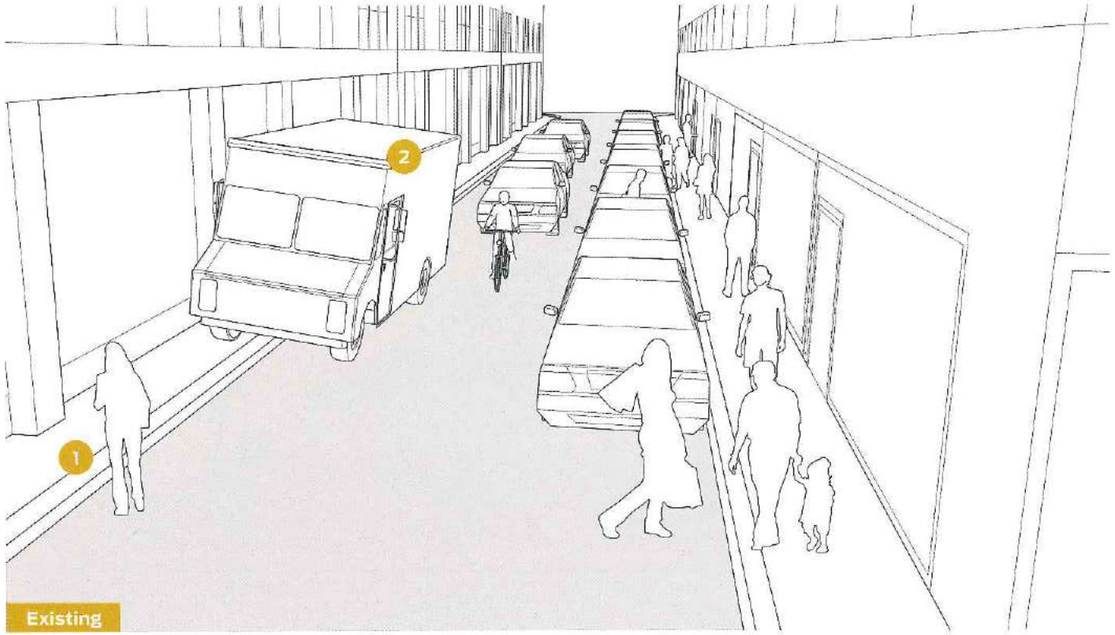
SANTA MONICA, CA
Signage reinforces the transition to a shared street.

VICTORIA, BC, CANADA
Angled parking in alternating swaths curves the path of travel.

Depending on right-of-way, designers may consider providing a 3–5-foot clear path, protected from traffic. The clear path may be defined using planters, bollards, and street furniture, as well as detectable warning strips or textured pavers. For narrower shared streets and alleys, use of a clear path is discouraged.

The street illustrated above depicts a 20-foot shared way within a 30-foot right-of-way.

Commercial Shared Street



Many narrow or crowded downtown streets operate informally as shared streets during rush hour or at lunchtime, but are not regulated as such. A commercial shared street environment should be considered in places where pedestrian activity is high and vehicle volumes are either low or discouraged. Commercial shared streets can be designed for narrow or wide cross sections, but become increasingly complex and difficult to maintain as a shared space as width increases.

From 1960–80, many neighborhood main streets and downtown retail corridors were converted to pedestrian-only usage. These conversions were often called "pedestrian malls." In an era of declining downtown retail revenues due to competition from shopping center developments outside of historic cores, many of these conversions were unsuccessful or suffered from poor maintenance and a lack of programming or policing.[1]

Commercial shared streets differ from this earlier generation of pedestrian malls in both their regulation and implementation. Shared streets maintain access for vehicles operating at low speeds and are designed to permit easy loading and unloading for trucks at designated hours. They are designed to implicitly slow traffic speeds using pedestrian volumes, design, and other cues to slow or divert traffic.

EXISTING CONDITIONS

The street in the rendering above is a common sight in many older cities where downtown commercial streets may predate wider grid streets. In newer cities, a retail district with heavy parking utilization and narrow, congested sidewalks may have similar conditions or opportunities.

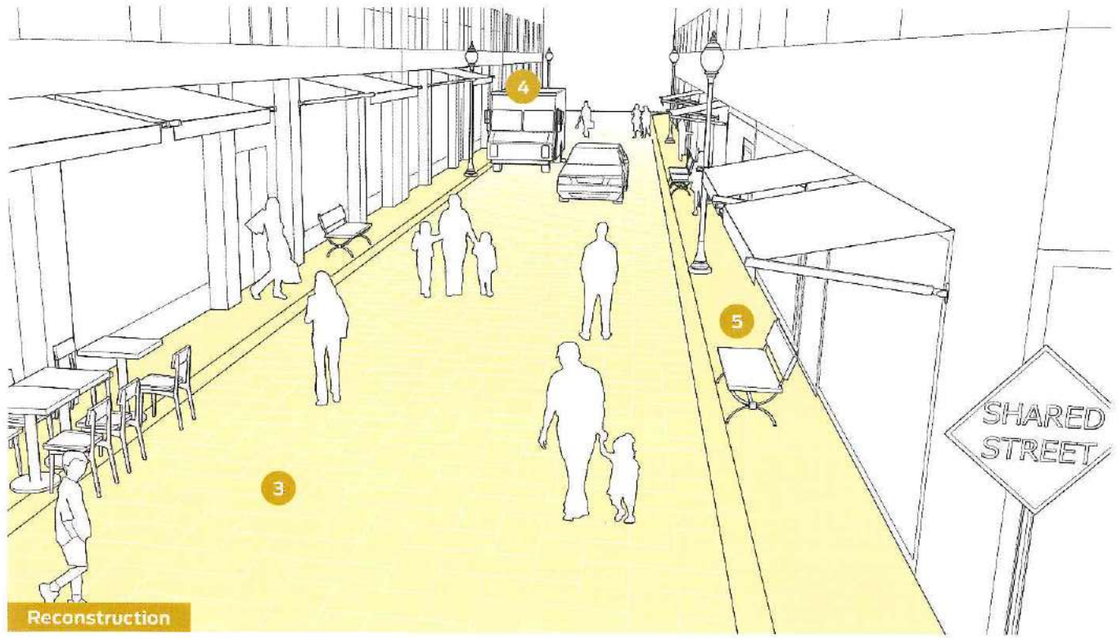
1 Sidewalk congestion creates unsafe conditions, as crowding forces some pedestrians to walk in the street to avoid crowds.

Vehicles in search of on-street parking create traffic congestion.

2 Loading and unloading trucks obstruct pedestrian and vehicle traffic. Truck drivers park on the sidewalk to preserve vehicle flow while unloading, forcing pedestrians to mix with motorists.

RECOMMENDATIONS

3 Textured or pervious pavements that are flush with the curb reinforce the pedestrian-priority operation of the street and delineate a non-linear path of travel or narrow carriageway. Special pavements, especially unit pavers, may be subject to additional maintenance costs and should be selected based on regional climate and long-term durability. Selection of snowplow-compatible materials is recommended for colder climates. Drainage channels should be provided either at the center of the street or along the flush curb, depending on existing conditions and



the overall street width. Drainage channels are often used to define the traveled way from the clear path.[2]

MONTREAL, CANADA
Shared streets should be designed so that people walk comfortably and naturally within the roadway.

4 Commercial shared streets should be accessible by single-unit trucks making deliveries. Where commercial alleys are non-existent, it may be advantageous to design a shared street to accommodate large trucks, though significant changes to the design should be avoided. Designated loading and unloading zones may be defined through differences in pavement pattern or use of striping and signage.

5 Street furniture, including bollards, benches, planters, street lights, sculptures, trees, and bicycle parking, may be sited to provide definition for a shared space, subtly delineating the traveled way from the pedestrian-exclusive area.

Shared streets may be closed to through traffic for specific portions of the day. Use movable planters and time-of-day restrictions to regulate the shared space.

Provide tactile warning strips at the entrance to all shared spaces. Warning strips should span the entire intersection crossing.

Prior to the application of a shared street, cities are encouraged to experiment with car-free hours or to test a conversion using temporary materials to evaluate the potential impact on traffic operations.

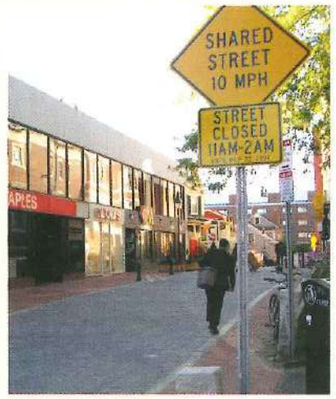
Commercial shared streets restrict transit access. For pedestrian streets that provide direct transit access, consider the application of a transit mall.[3]

CAMBRIDGE, MA
Street furniture helps define the shared space.

Depending on the overall street width, designers may consider providing a 3–5-foot-clear path protected from traffic. The clear path should be defined using planters, bollards, and street furniture, as well as detectable warning strips or textured pavers. For narrower shared streets and alleys, use of a clear path is discouraged.

The street illustrated above depicts a 22-foot shared way within a 30-foot right-of-way.

CAMBRIDGE SHARED STREETS



The City of Cambridge converted Harvard Square's Winthrop Street into a shared street in 2007. This conversion was followed by the conversion of an alley, Palmer Street, into another shared corridor. Prior to their conversion, both streets were cramped and poorly maintained. Winthrop Street had narrow sidewalks and uneven pavers that created an inhospitable environment for pedestrians. Both streets failed to meet accessibility standards of the Americans with Disabilities Act. With vehicle volumes under 1,000 ADT and high pedestrian traffic, the street already implicitly functioned as a shared street.

The city's project formalized the shared operation of the corridor, while the reconstruction allowed for more efficient use of space on a small street and enabled the city to accommodate pedestrians, bicyclists, outdoor diners, and motorists using a flush curb. Shared streets in Cambridge have transformed the public space, integrating and balancing commercial uses, streetperformers, restaurant activity, and transportation using an aesthetically pleasing design.

Interagency Coordination
Multiple government departments worked collaboratively to realize Cambridge's shared streets. The Community Development Department managed the design process and community involvement through a citizen advisory committee. Public Works reviewed the project design regarding long-term maintenance and accessibility issues. The Traffic, Parking, and Transportation Department oversaw traffic and parking regulations, ensuring that deliveries were still feasible. Champions at the Harvard Square Business Association, the Harvard Square Design Committee, and the Historic Commission have also contributed to the success of the shared streets. As part of these efforts, the city also created a new categorization for shared streets within their city code.

Maintenance
Both Winthrop and Palmer Street use standard color and interlocking concrete pavers, which facilitate easy maintenance. On Palmer Street, the use of in-ground lighting has proven more challenging to maintain. Similarly, bollards installed to protect buildings on Palmer Street have suffered wear and tear from truck traffic.

Snow Removal and Stormwater Management
In Cambridge, property owners are responsible for removing snow from sidewalks, while the vity removes snow from the street. After conversion to a shared street, these delineations proved less stark. In Harvard Square, property owners have proactively shouldered additional snow removal responsibilities. Stormwater management has also been a consideration, because removing a curb changes runoff flows. To prevent puddling near buildings, shared streets in Cambridge grade toward a small gully in the center of the road.

Street Design Elements

The elements that make up city streets, from sidewalks to travel lanes to transit stops, all vie for space within a limited right-of-way. Transportation planners and engineers can use this toolbox to optimize the benefits the community receives from its streets.