SIDNEY

SAFETY ACTION PLAN **APPENDICES**

May 2025



SIDNEY SAFE STREETS PLANNING

Together for a Safer Sidney

Solutions Toolbox



The **Solutions Toolbox Appendix** provides a categorized set of treatments, including roadway enhancements, pedestrian crossing solutions, and bicycle and pedestrian facilities. Each treatment is outlined with its benefits, limitations, typical applications, key design considerations, and maintenance cost considerations.

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Roadway Treatments

__Speed feedback signs__ require routine inspections, LED or bulb replacements, wiring maintenance, and occasional software updates. Solar-powered models have lower long-term costs due to reduced energy consumption, while wired versions may need more frequent electrical servicing. __Sight distance improvements__ involve vegetation trimming, signage upkeep, and occasional roadway modifications to maintain visibility. Costs vary based on terrain, traffic volume, and the extent of adjustments needed.

SPEED FEEDBACK SIGN

*Portable, interactive sign that displays the speed of drivers traveling over the threshold speed with the message, "YOUR SPEED **XX**." Sign can also display message, "SLOW" or "SLOW DOWN."*



Benefits

- Reduce average speeds by 5 mph[1] or between 2 and 10 mph[3]

Constraints and Limitations

- **Effectiveness Diminishes**: If used too frequently, the effectiveness is diminished.[2] Over time, drivers become accustomed to them, leading to reduced compliance. [4, 5]
- **Limited Range**: Most effective in specific locations, such as school zones or curves, but their impact may not extend far beyond the immediate area. [4, 5]
- **Dependence on Visibility**: Poor weather conditions, such as fog or heavy rain, can reduce their visibility and effectiveness. [5]
- **No Enforcement Capability**: Unlike speed cameras, these signs cannot issue penalties, so they rely solely on voluntary compliance. [4]
- **Cost and Maintenance**: Permanent installations can be expensive, and portable units require regular maintenance and battery replacements. [6]

Typical Applications

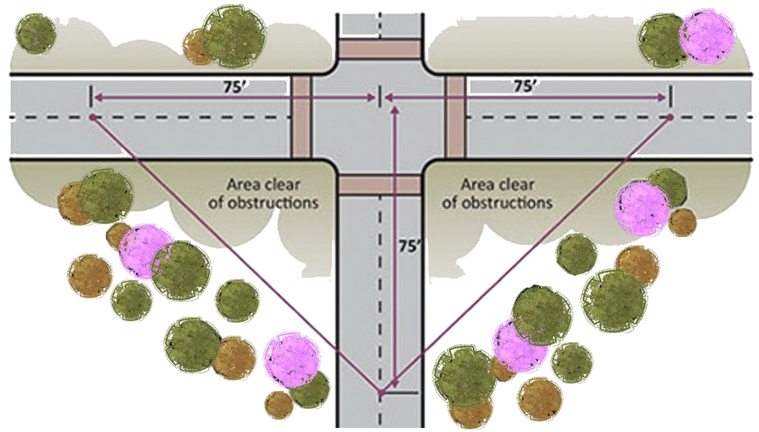
- Effective in speed transition areas (e.g. entering a school zone or other area characterized by high volumes of non-motorized traffic) [2]

Design Considerations

- **Speed Study**: Before deploying a speed feedback sign, speed studies and appropriate modifications to the speed limits should be considered.
- **Observed Speeds**: Consider when observed 85th percentile speeds at a study exceed posted limit by 5 mph or more.
- **Visibility**: Clearly visible from a distance, even in adverse weather.[7]
- **Placement**: Install at optimum heights: typically 5-7 ft in urban[7]; allow drivers time to react.[8]
- **Regulatory Compliance**: Follow MUTCD and local guidelines/regulations[8]; use in conjunction with regulatory speed limit signs[7].
- **Durability and Maintenance**: Use weather resistant materials; check and maintain regularly.
- **Technology Integration**: Incorporate radar to measure/display real-time speeds[8]; consider adding data collection features to analyze traffic patterns and speeds.

1 safety.fhwa.dot.gov/speedmgt/ref_mats/eng_count/2014/reducing_speed.cfm.
2 highways.fhwa.dot.gov/sites/fhwa.dot.gov/files/2022-06/speedmanagementguide.pdf
3 Hallmark, S., et al., Evaluation of Gateway and Low Cost Traffic-Calming Treatments for Major Routes in Small, Rural Communities (2007), http://www.intrans.iastate.edu/reports/traffic-calming-rural.pdf
4 nhtsa.gov/book/countermeasures-that-work/speeding-and-speed-management/countermeasures/other-strategies-behavior-change/dynamic-speed
5 highways.dot.gov/turner-fairbank-public-roads
6 carmanah.com/wp-content/uploads/2019/06/resource-radar-speed-feedback-signs-mutcd-requirements.pdf
7 optraffic.com/blog/height-speed-feedback-signs-urban-highway/
8 iowadot.gov/design/dmanual/09b-11.pdf

SIGHT DISTANCE IMPROVEMENTS



Enhancing a drivers ability to see and react to road conditions, hazards, or traffic. This is achieved by clearing obstructions (signage, vegetation), improving lighting or markings, or modifying road geometry. Boosts safety by allowing drivers to make timely decisions, particularly at intersections, curves, hills, pedestrian crossings.

Benefits

- **Enhanced Safety**: Drivers detect hazards earlier, reducing likelihood of collisions.
- **Improved Traffic Flow**: Drivers make smoother, more confident maneuvers, reduce sudden braking, erratic behavior.
- **Vulnerable Road User Support**: Older drivers with slower reaction times have more time to respond.
- **Compliance with Standards**: Align with AASHTO Green Book, roads meet safety benchmarks.

Constraints and Limitations

- **Physical Limitations**: terrain, structures, vegetation - limited improvement without significant alterations.
- **Cost**: slopes, removing obstacles, widening curves
- **Environmental Impact**: Clearing vegetation, altering landscapes may have ecological consequences.
- **Urban Constraints**: Space limitations, challenging improvements to existing infrastructure
- **Driver Behavior**: Even with improved sight distance, some drivers still engage in risky behavior, limiting overall effectiveness.

Typical Applications

- **Intersections**: Patterns of crashes related to poor sight distance; intersections with restricted sight distance
- **School Zones & Crosswalks**: Improve visibility of pedestrians and cyclists

Design Considerations

- **Obstruction Removal**: Ensure traffic signs and signal heads are not obstructed by street furniture and vegetation. Maintain clear zones regularly to prevent re-growth or accumulation of new obstacles.
- **Costs and Feasibility**: Consider phased implementation to gradually achieve sight distance goals in stages.

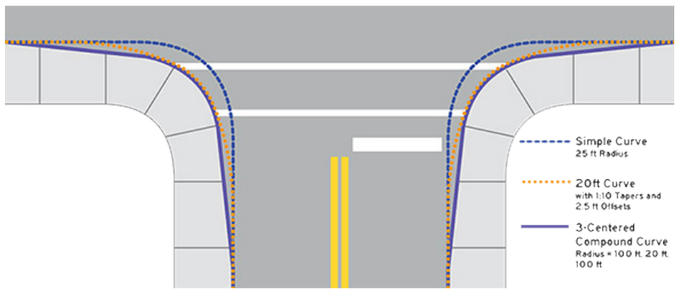
Sight Distance Graphic: mikeontraffic.com/sight-distance-explained/

Roadway Treatments

Reduced curb radii *require surface repairs, drainage maintenance, and occasional signage updates. Costs range from $2,000 to $20,000, depending on utilities and site features.* **Road diets** *have low maintenance costs, as they often involve re-striping rather than major reconstruction. Costs vary based on lane reductions, resurfacing needs, and added features like bike lanes or medians.*

REDUCED CURB RADII

Designing corners with tighter turning radii, which slow vehicle turning speeds and enhance pedestrian safety. This approach shortens pedestrian crossing distances, improves visibility between drivers and pedestrians, and creates more space for sidewalks or landscaping.



Benefits
- Better placement of curb ramps and crosswalks
- Reduced turning speeds for right-turning vehicles
- Shortened pedestrian crossing distances
- Improved visibility between motorists and pedestrians
- Larger area for pedestrian space

Typical Applications
- Urban and pedestrian-focused areas to enhance safety and accessibility
- Pedestrian Crossings: To shorten crossing distances and improve visibility between drivers and pedestrians.
- Traffic Calming: To slow down turning vehicles, especially at intersections with heavy pedestrian activity.
- Dense Urban Areas: Where space is limited, and pedestrian safety takes priority over high-speed vehicular movement.
- School Zones and Parks: To promote a safer environment for vulnerable road users.
- Multi-modal Streets: Where bike lanes, parking, and transit facilities coexist and require careful design.

Constraints and Limitations
- May require motorists to reduce vehicle speed
- May result in longer crossing distances for pedestrians
- Dependence on turning movements and street widths
- Potential pedestrian crashes when right-turning vehicles strike pedestrians

Design Considerations
- Angle of intersection, land uses, street type when designing curb.
- School buses, maintenance vehicles, emergency vehicles, delivery trucks, and other large vehicles
- For areas where accommodating design vehicles makes curb radii challenging, consider compound radii, at-grade pavement treatments, and advance stop lines to balance pedestrian safety with vehicle maneuverability.
- Evaluate vehicle turning capability using the effective turning radius instead of the curb return radius, factoring in elements like on-street parking, bike lanes, and medians to ensure a balanced design.

Reduced Curb Radii Figure: highways.dot.gov/safety/other/older-road-user/handbook-designing-roadways-aging-population/chapter-2-intersections

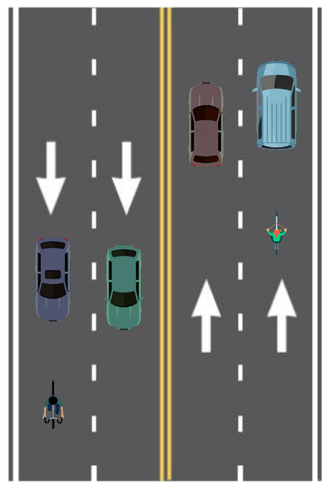
Photos at right: http://guide.saferoutesinfo.org/engineering/reduced_corner_radii.cfm

A large turn radius allows drivers to make higher speed turns and increases the crossing distance.

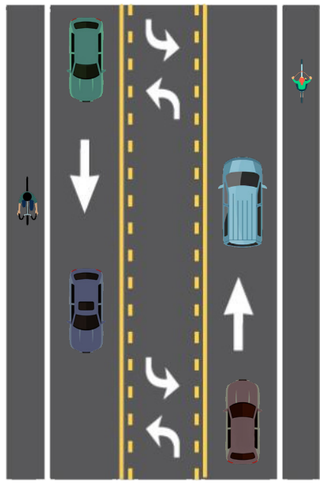




ROAD DIET



BEFORE - 4 Through Lanes



AFTER - 2 Through Lanes
Center Left Turn Lane
2 Bike Lanes

Road diets reduce the number of vehicle lanes, converting travel lane space to bike lanes or sidewalks, to manage speed and reduce risk of crashes for all road users.

Benefits
- Improved safety by reducing vehicle-to-vehicle conflicts that contribute to rear-end, left-turn, sideswipe crashes
- Lower vehicle speeds
- Increased mobility and safety for bicyclists
- Provide vehicular access for turning into/out of commercial drives
- Relocates space for other needs: bike lanes, pedestrian pathways

Constraints and Limitations
- Travel time may increase
- Roadway capacity may decrease
- Traffic may be blocked by transit vehicles/mail trucks when stopped

Typical Applications
- Converting 4-lane undivided roadway into 3-lane with one lane in each direction and a 2-way center turn lane.

Design Considerations
- **Traffic Volume**: Assess average daily traffic (ADT) to determine if road diet is feasible without causing congestion.
- **Safety Improvements**: Focus on reducing crash points, improving sight lines, accommodating left-turn lanes to enhance safety.
- **Multi-modal Integration**: Incorporate bike lanes, pedestrian crossings, transit stops to support diverse transportation modes.
- **Intersection Design**: Optimize intersections with features like turn lanes, signal timing adjustments, pedestrian refuge islands.
- **Community Context**: Align the design with local needs, land use, urban or rural settings.
- **Public Engagement**: Involve stakeholders to address concerns and build support for project.

Roadway Treatments

__Speed bumps__ and __speed humps__ require periodic resurfacing, repainting, and debris removal, with asphalt needing more frequent upkeep than concrete. __Speed tables__ have higher maintenance costs due to their larger surface area, requiring resurfacing, drainage upkeep, and repainting. __Rumble strips__ need occasional re-milling, repainting, and pavement inspections, with costs varying based on installation method and road conditions.

SPEED BUMPS, SPEED HUMPS, SPEED TABLES

Generally located on residential streets or other low-speed roads, these raised pavement structures force motorists to slow down to a safe speed.

Speed tables are a modified version of the speed hump, with a long flat-top that can raise the wheelbase of a standard vehicle at once, preferred for streets where 8-15 mph reduction is desired.

Speed bumps are typically used to reduce speeds between 5-10 mph; speed hump treatments are used where traffic limit is 10-15 mph. Humps and Bumps can be used in parking lots to increase safety of pedestrians and vehicles as well as in school zones to protect students.

Benefits
- Easily navigated by bicyclists
- Relatively inexpensive
- Slow vehicle speeds effectively, with speed humps and bumps reducing speeds more than speed tables

Design Considerations
- Consider and accommodate drainage needs.
- Use treatments at mid-block locations, not at intersections.
- Not appropriate for roadways with grades over 8%.
- Preferred treatments will not cover a bike lane.

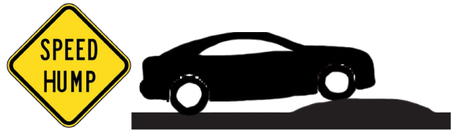
Constraints and Limitations
- Emergency vehicles are forced to slow down
- Inappropriate for streets with bus traffic, reducing speeds and affecting rider comfort

Typical Applications
- Create pedestrian-friendly zones, promoting more relaxed traffic flow in residential areas.
- Speed tables work well with curb extensions or reductions.
- Use when reducing roadway speeds and calming traffic is desired.
- Use humps and bumps on lower order roadways. Speed tables are appropriate on higher order roadways.

Speed Hump vs. Speed Bump - both are used to control traffic speeds



A speed hump is a gradual raised area on low-speed roadways, typically found on residential or local streets.



A speed bump is an abrupt raised area generally located in private driveways or parking lots.

Source: https://highways.dot.gov/safety/speed-management/speed-management-countermeasures-more-just-speed-humps

Studies show speed humps can be effective at reducing speeds by nearly 10 mph.

FHWA, "A Desktop Reference of Potential Effectiveness in Reducing Speed," July 2014. Available at: http://safety.fhwa.dot.gov/speedmgt/ref_mats/eng_count/2014/reducing_speed.cfm.

https://speed-cushion.com/speed-cushions/speed-bumps-humps-tables-cushions-differences/

RUMBLE STRIPS





Rumble strips are an effective countermeasure to keep vehicles on the roadway and reduce the frequency of crashes. They alert drivers through noise and vibration. However, there are concerns related to noise and feasibility.

Benefits
- Speed reduction
- Increase driver awareness
- Low cost

Constraints and Limitations
- **Bicycle traffic**: Impacts comfort and control of bicyclists
- **Unwanted noise**: Vibration noise may not be appropriate for residential areas
- **Pavement maintenance**: Pavement deterioration potentially impacted depending on pavement placement and quality

Typical Applications
- Install on facility types where crash data predicts crashes will occur in the future.
- High speed roadways; where driver attention is an issue
- Place across roadway to alert drivers of the need for speed reduction or for changing roadway condition
- Use on shoulders to alert drivers that they have entered a part of roadway not intended for their use.

Design Considerations
- Consider and accommodate for all road users. Bicyclists require particular attention. Will bicyclists be expected to use roadway or shoulder—some designs provide virtually no shoulder, requiring bicyclists to use the travel lane.
- Rumble strip types vary. Determine the most appropriate rumble strip design for each site application

https://highways.dot.gov/safety/rwd/keep-vehicles-road/rumble-strips/fact-sheet-rumble-strips-and-pavement
https://highways.dot.gov/safety/rwd/keep-vehicles-road/rumble-strips

General Crossing Treatments

Bulb-out curb extensions *need surface repairs, drainage maintenance, and repainting; concrete lasts longer but costs more upfront.* **Raised pedestrian crossings** *require resurfacing, drainage upkeep, and repainting, with concrete costing more initially but needing less maintenance over time.*

BULB OUT (CURB EXTENSIONS)

Narrowing the vehicle path, usually at an intersection, a bulb out is an extension of the curb or sidewalk into the street. Designed to enhance pedestrian safety by shortening pedestrian crossing distance. Improve traffic flow and inhibit fast turns.



MCS, Sidney, NE (2024)

Benefits

- **Improve Pedestrian Safety**: Shorten crossing distances
- **Enhanced Sight-lines**: improve visibility between motorists and pedestrians, particularly near parked vehicles.
- **Traffic Calming**: Narrow roadways reduce motorist turning speeds, especially at intersections.
- **Multi-functional Space**: Use the extended sidewalk area for trees and landscape planting and water runoff treatment, seating, transit stops. Enables permanent parking.
- **Reduced Storm water Runoff**: Provide opportunities for green infrastructure, like rain gardens, to manage storm water.
- **Support for Multi-modal Streets**: Facilitate better integration of walking, cycling, and transit by reallocating space.

Constraints and Limitations

- **Vehicle Maneuverability**: Turning radius problems.
- **Cost and Maintenance**: Consider construction costs and long-term maintenance, especially in areas with fire hydrants or utility access.
- **Limitations**: Use only on streets with unrestricted parking.

Typical Applications

- Streets with on-street parking where ADT ≥ 1,500 vehicles per day, pedestrian volumes are ≥ 20 pedestrians per hour, average right turn speeds are ≥ 15 mph.
- Intersection or mid-block pedestrian crossings where parking is unrestricted.

Design Considerations

- **Drainage**: Address potential drainage issues by incorporating trench drains or edge islands with gaps.
- **Vehicle Maneuverability**: Ensure turning radii accommodate larger vehicles like buses and trucks without encroaching on sidewalks.
- **Sight-lines**: Align pedestrians with the parking lane for better sight-lines.
- **Cyclists**: Prevent conflict with vehicles by including narrow passage for bicyclists.
- **Curb Ramps**: Include accessible curb-ramps and detectable warnings.
- **Cost and Maintenance**: Consider construction costs and long-term maintenance, especially in areas with fire hydrants or utility access.
- **Multi-functional Space**: Differentiate path for pedestrian (including visually impaired) travel using landscaping, seating

RAISED PEDESTRIAN CROSSING



An elevated section of roadway designed to prioritize pedestrian safety by creating a level, continuous walking surface between sidewalks. Used at intersections or mid-block crossings, raised crossings bring the level of the roadway even with the pedestrian walkway, requiring vehicles to slow.

MCS, Golden, CO (2025)

Benefits

- **Accessibility**: Provides a smooth, step-free crossing for strollers, wheelchairs, and bicycles.
- **Traffic Calming**: The raised platform acts as a speed hump, slowing down motorists.
- **Improved Visibility**: Elevation makes pedestrians more visible to drivers, reducing collision risk.

Constraints and Limitations

- **Navigation:** Difficult to navigate for low ground clearance vehicles, large trucks, snow plows. Can contribute to additional wear-and-tear on vehicles if not properly constructed.
- **Emergency Vehicle Delays**: May slow down emergency response vehicles.
- **Drainage Issues**: Improper design can lead to water pooling around the crossing.
- **Expensive**: Construction and maintenance costs can be higher than standard crosswalks, especially with specialized materials.
- **Space Requirements**: Requires adequate roadway width and length for gradual ramps on either side to meet accessibility standards.
- **Winter Maintenance**: Snow and ice removal can be more challenging compared to flat road surfaces.

Typical Applications

Mid-block crossings on two-lane roads where speed control is needed and there are ≥50 pedestrians per hour.

- **Material Differentiation**: Frequently constructed with contrasting materials or markings to alert drivers.
- **Slower Zones**: Enhance walkability, provide safer crossings for children, slow down motorists near schools and neighborhoods.
- **Urban Intersections**: To improve visibility and prioritize pedestrians in busy city areas. Consider when low volume streets intersect high volume streets or roadway changes character (e.g. residential—commercial).
- **Trail Crossings**: Where recreational paths or greenways intersect with roadways, ensuring safe passage for non-motorized users.
- **Do Not Use**: Do not use for transit routes or areas with steep grades or curves.

Design Considerations

- **Drainage Management**: Often includes ramps with gaps or slopes to direct storm water away.

General Crossing Treatments

Pedestrian Hybrid Beacons (PHBs), Rectangular Rapid Flashing Beacons (RRFBs), and traffic signals for Leading Pedestrian Intervals (LPIs) *require routine inspections, bulb or LED replacements, wiring maintenance, and occasional software updates. PHBs and LPIs are integrated into existing signal systems, making upkeep relatively low, while RRFBs, especially solar-powered models*

PEDESTRIAN HYBRID BEACON (*HAWK* or PHB)

Traffic control device designed to improve pedestrian safety at mid-block crossings or locations without traffic signals. Consists of signal lights that remain unlit until activated by a pedestrian. Once activated, it follows a sequence of flashing yellow, solid yellow, and solid red lights, requiring drivers to stop and allowing pedestrians to cross safely. It increases pedestrian visibility and driver compliance at crossings.

Benefits

- **Increased Pedestrian Safety**: Reduce the risk of pedestrian-involved crashes by providing a clear signal for drivers to stop when pedestrians are crossing.
- **Improved Driver Compliance**: Red light phase commands drivers to yield, increasing compliance—nearly 100% rate of motorist yielding behavior at crossing location.
- **Cost-Effective**: Less expensive to install and operate than full traffic signals
- **Versatile Application**: Mid-block crossings, high-speed roads, or intersections without traffic lights
- **Efficient Traffic Flow**: remain inactive until activated by a pedestrian, minimizing unnecessary stops for vehicles



Constraints and Limitations

- **Cost**: Although less expensive than full traffic signals, PHBs can still be costly to install and maintain compared to basic crosswalks.
- **Driver Understanding**: Some drivers may not be familiar with beacon's unique light sequence, potentially leading to confusion or non-compliance.
- **Pedestrian Compliance**: Rely on pedestrians to activate them—pedestrians' safety not maximized if crossing without using beacon.
- **Space Requirements**: Installation may require sufficient space for equipment like poles, signal lights, and signage.
- **Limited Applicability**: Most effective in specific scenarios—mid-block crossings or high-speed roads. Not suitable for all intersections.
- **Impact on Traffic Flow**: On busy roads with frequent pedestrian crossings, can cause delays for drivers, especially at peak times.
- **Power / Maintenance Needs**: Require reliable power source, regular maintenance to ensure proper functioning.

Typical Applications

- **Pedestrian Traffic Volume**: Assess frequency of pedestrian crossings to determine warrant.
- **Vehicle Traffic and Speed**: Particularly effective on high-speed or multi-lane roads.
- **Crash History**: Review the location's history of pedestrian-related accidents to identify safety concerns to address.
- **Location Characteristics**: Mid-block crossing, near transit stops, or areas with limited visibility could benefit from the beacon.
- **Proximity to Signalized Intersections**: Avoid installing too close to traffic signals to prevent driver confusion.
- Regulatory Compliance: Ensure the installation complies with the Manual on Uniform Traffic Control Devices (MUTCD) and local traffic regulations.
- **Cost and Maintenance**: Budget for initial installation, power requirements, ongoing maintenance for continuous operation.

Design Considerations

- **Accessible Button**: Easily accessible button for pedestrians, wheelchair users, and where applicable, bicyclists.

RAPID RECTANGULAR FLASHING BEACON (RRFB)

Positioned below pedestrian crossing signs, RRFBs are designed to alert drivers to the presence of pedestrians. RRFBs increase visibility to reduce crashes. The traffic control device consists of rectangular high-intensity LED lights that flash in a rapid and attention-grabbing pattern when activated.

Benefits

- **Enhanced Visibility**: Bright, rapidly flashing LED lights are highly noticeable, even in adverse weather conditions or at night. At eye level, motorists more aware of pedestrians.
- **Improved Pedestrian Safety**: Draws driver attention to crosswalks—helps slow motorist, increases likelihood of yielding to pedestrians, resulting in 80-100 percent compliance.
- **Cost-Effective**: Compared to traffic signals or pedestrian overpasses, RRFBs are relatively inexpensive to install and maintain.
- **Quick Activation**: Pedestrians can activate RRFBs instantly, ensuring timely alerts for approaching vehicles.
- **Versatility**: Can be used at various types of crossings, including mid-block crosswalks, trail crossings, and school zones, making them adaptable to different environments.



Constraints and Limitations

- **Pedestrians must activate** flashing beacons.
- **Compliance may be lower** than with a traffic signal as motorists may not understand the flashing lights.

Typical Applications

- **Mid-Block Crosswalks**: Those with medium -high pedestrian or bicycle demand and/or medium-high traffic volumes. Providing visibility at crossings located between intersections, where drivers might not expect pedestrians.
- **School Zones**: Enhancing safety for children and families near schools during peak drop-off and pick-up times.
- **Trail Crossings**: Alerting drivers at road crossings for walking, cycling, or hiking trails.
- **High-Traffic Areas**: Assisting pedestrians in crossing busy multi-lane roads safely.
  Shopping Centers: Improving pedestrian access in commercial areas with high foot traffic.

Design Considerations

- **Median Island** or multi-lane crossings, consider adding a push button in median.
- **Accessible Button**: Easily accessible button for pedestrians, wheelchair users, and where applicable, bicyclists.
- **Pedestrian Demand**: Evaluate pedestrian volume is an RRFB necessary for the crossing.
- **Vehicle Traffic and Speed**: Consider road conditions—traffic volume, speed limits, do drivers have sufficient reaction time to yield.
- **Crosswalk Visibility**: Assess sight-lines for both pedestrians and drivers visibility.
- **Proximity to Intersections**: Determine if the crossing is far enough from a traffic signal to avoid confusion or conflicting signals.
- **Cost and Maintenance**: Consider the budget for installation and the long-term maintenance needs of the beacons.
- **Regulations and Guidelines**: Ensure compliance with local and federal standards, such as the Manual on Uniform Traffic Control Devices (MUTCD).
- **Community Feedback**: Engage with the community to understand their concerns and gain support for the installation.

General Crossing Treatments

Pedestrian crossing islands *need surface repairs, signage upkeep, and periodic inspections, with concrete options lasting longer but costing more upfront.*
Grade-separated crossings (bridges or tunnels) *have higher long-term costs, requiring structural inspections, lighting maintenance, drainage upkeep, and occasional resurfacing.*

CROSSING ISLAND (PEDESTRIAN ISLAND)

Also known as a refuge island or pedestrian safety island, a raised or marked area placed in the center of a roadway at a pedestrian crossing. Provides a safe space for pedestrians to pause while crossing multiple lanes of traffic. Allows them to navigate one direction of traffic at a time. Enhance pedestrian safety and visibility on busy or wide roads, and can be used at intersections or mid-block crossings.


MCS, Golden, CO (2024)


MCS, Sidney, NE (2025)



MCS, Fargo, ND (2025)

Benefits

- **Enhanced Pedestrian Safety**: Allow pedestrians to cross one direction of traffic at a time Reduces at marked and unmarked crosswalks.
- **Improved Visibility**: By guiding pedestrians to a specific crossing point, crossing islands make them more visible to drivers.
- **Traffic Calming**: Narrowing the roadway with a crossing island can help slow motorist speeds.
- **Cross in Two Phases**: Provides a safe pause point for pedestrians who move at different speeds, including older adults, children, or those with mobility challenges.
- **Shorter Gaps**: Less time in traffic to cross street.
- **Cost-Effectiveness**: Compared to other infrastructure solutions like pedestrian overpasses, these are relatively inexpensive to implement.

Constraints and Limitations

- **Space Requirements**: Require sufficient roadway width to accommodate the island. May not be feasible on narrow streets.
- **Design Complexity**: Proper design is essential to ensure the island is accessible to all pedestrians, including those with disabilities, which may increase planning requirements.
- **Drainage Issues**: Installation may interfere with existing drainage systems, potentially requiring additional modifications.
- **Cost of Implementation**: Although cost-effective compared to other safety solutions, can still require funding for construction and ongoing maintenance.

Typical Applications

- **Wide Roads:** Used to help pedestrians safely cross multi-lane roads, providing a midway refuge.
- **High-Traffic Areas**: Placed in busy urban environments to accommodate high volumes of pedestrians and vehicles. Also in areas with pedestrian crash history.
- **Trail Crossings**: Used at intersections where walking or biking trails cross roads, ensuring safer passage.
- **Shopping Districts**: Located in commercial areas to enhance pedestrian access to shops and amenities.

Design Considerations

- **Accessibility**: To accommodate people with wheelchairs/strollers, ensure 6 feet of clear width. Include curb ramps and tactile warning surfaces to comply with accessibility standards, such as the Americans with Disabilities Act (ADA).
- **Bicycles**: To accommodate bicycles with trailers and groups of cyclists, a width of 10 feet or greater is desirable.
- **Traffic Control**: Pair the crossing island with additional traffic calming measures, like signage, pavement markings, or flashing beacons, to enhance safety.
- **Landscaping**: If adding vegetation, ensure it does not obstruct sight-lines for drivers or pedestrians.
- **Drainage**: Account for water flow around the island to prevent pooling or flooding in the roadway.
- **Lighting**: Install adequate lighting to improve visibility during nighttime or low-light conditions.

GRADE SEPARATED CROSSING


MCS, Scottsbluff, NE (2023)

Infrastructure solutions that enable pedestrians to cross busy roads, railways, or other pathways safely and without direct interaction with traffic. Typically built as overpasses (bridges) or underpasses (tunnels), physically separating pedestrians from vehicle flow—they are especially beneficial in high-traffic or high-speed areas where at-grade crossings would pose significant safety risks.

Benefits

- **Enhanced Safety**: Eliminates direct interactions with vehicles. Significantly reduces risk of pedestrian/cyclist related crashes. Pedestrians cross safely without waiting for gaps in traffic or signal changes, improving convenience.
- **Traffic Flow**: Motor vehicle traffic remains uninterrupted, reducing congestion and delays.
- **Accessibility**: Properly designed crossings accommodate people with disabilities, strollers, and cyclists, fostering inclusivity.
- **Suitable for High-Traffic Areas**: These crossings work well in locations with high traffic volumes or speeds, such as highways or railway lines, where at-grade crossings are impractical or dangerous.

Constraints and Limitations

- **High Costs**: Construction and maintenance of overpasses or underpasses can be expensive.
- **Space Requirements**: They require sufficient space to make grade changes, dependent on topography.
- **Accessibility Challenges**: If not designed properly, they may be difficult for people with mobility issues to use.
- **Safety & Security Risks**: Long under-crossings have potential to create security/safety risks.

Typical Applications

- **Railway / Highway Crossings**: Allow pedestrians to safely cross railways and busy, high-speed, limited access, multi-lane roadways. Prevent pedestrian-vehicle collisions by providing overpasses or underpasses.
- **Multi-use Pathways**: Comfortable and safe for users of all levels.
- **School Zones**: Ensure children can cross safely near schools, especially roads with heavy traffic.

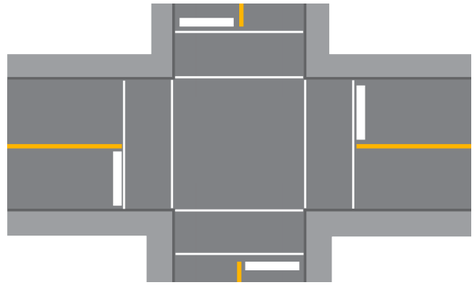
Design Considerations

- **Slope | Travel Direction**: If a crossing involves significant slopes or requires a detour, some bicyclists and pedestrians might choose to bypass it. To encourage usage, such designs should be minimized whenever feasible.
- **Site Assessment**: Consider surrounding floodplain, natural features, topography for crossing site selection. Evaluate terrain, traffic patterns, pedestrian flow, and environmental impact to determine the most appropriate design
- **Signage and Wayfinding**: Provide clear signage and markings to guide pedestrians to and through the crossing.
- **Visibility**: Ensure bicyclists have clear sight-lines to spot others; if not, require bicyclists to dismount.

General Crossing Treatments

High-visibility crosswalks *need regular upkeep to stay effective. Thermoplastic markings last longer but cost more upfront, while paint-based markings are cheaper but need frequent reapplication. Some cities use recessed thermoplastic to protect against snowplows, though installation is pricier. Placing markings outside tire paths and using primer coatings can extend their lifespan and reduce maintenance costs.*

STANDARD CROSSING



A standard crosswalk treatment typically includes pavement markings, such as two parallel white lines or ladder-style designs, to indicate pedestrian crossing areas. It may also include signage, signals, or curb ramps to enhance visibility and accessibility, ensuring safer crossings for pedestrians.

Benefits

- **Improved Safety**: They define designated crossing areas, reducing pedestrian-vehicle conflicts and encouraging safer crossings.
- **Driver Awareness**: With accompanying signage alert drivers to watch for pedestrians.
- **Accessibility**: Standard crosswalks often include curb ramps, making crossings accessible to individuals with disabilities or mobility aids.

Constraints and Limitations

- **Limited Visibility**: On busy or fast roads, markings may be overlooked, lowering effectiveness.
  Weather Impact: Faded/ obscured markings due to weather/wear can diminish visibility over time.
- **Driver Non-Compliance**: Some drivers may not yield to pedestrians, even at marked crosswalks.
- **Accessibility Challenges**: Without proper curb ramps or adjustments, they might not fully accommodate people with disabilities.
- **Traffic Flow Impact**: Frequent pedestrian crossings can disrupt vehicle flow in busy areas.
- **Complementary Safety Features**: May require pairing the crosswalk with features like raised crossings, flashing beacons, or advanced stop lines to further enhance safety.

Typical Applications

- **Traffic Volume and Speed**: Are road's traffic flow and speed suitable for a standard crosswalk or are additional safety measures are required?
- **Pedestrian Demand**: Assess whether location has sufficient foot traffic to justify.
- **Proximity to Intersections**: Avoid placing too close to signalized intersections, where they could cause confusion or reduce their effectiveness.
- **Accessibility**: Include curb ramps and tactile paving to make the crosswalk accessible for all users, including individuals with disabilities.

Design Considerations

- **Visibility**: Use high-contrast markings like ladder or zebra patterns for visibility, especially in low-light or obstructed areas.
- **Durable Materials**: Choose materials like thermoplastic or reflective paint that can withstand heavy traffic and weather conditions, reducing the need for frequent maintenance.
- **Location and Alignment**: Position in areas with natural pedestrian flow and align it with sidewalks and other pathways.
- **Border Lines**: These are suitable for lower-speed roads with minimal traffic, where pedestrian visibility is not a major concern. They work well in quiet residential streets or areas with low pedestrian volume.
- **Ladder-Style Markings**: Provide higher visibility, are ideal for high-traffic, multi-lane roads, higher vehicle speeds. Particularly effective in areas where pedestrian safety is a priority, such as near schools, transit stops, or commercial zones.
- **Width**: Standard crosswalks typically are at least 6 feet wide to accommodate pedestrian traffic safely. To accommodate groups of children, may widen to 10-15 feet or more.

HIGH VISIBILITY CROSSWALK



A high-visibility crossing uses reflective bold roadway markings, such as ladder or zebra patterns, and accompanying signage at intersections and priority pedestrian crossing locations. May include additional safety features like flashing beacons to enhance pedestrian visibility and driver awareness.

Benefits

- **Improved Safety**: Bold markings and added features make pedestrians more noticeable, reducing accident risks.
- **Designates Crossing**: Identifies a preferred crossing point for pedestrians.
- **Encourages Compliance**: Drivers are more likely to yield when crossings are highly visible. Motorists are required to stop for pedestrians in crosswalks.
- **Supports Vulnerable Users**: Improves safety for children, elderly individuals, those with disabilities.
- **Lower Cost**

Constraints and Limitations

- **More Effective**: When paired with flashing beacons, raised markings, advance warning signs, enhanced lighting, signals, stop signs.
- **Uncontrolled Locations**: Mid-block motorist compliance is lower at uncontrolled locations than with other treatments.

Typical Applications

- **High-Pedestrian Demand Areas**: Locations between intersections where pedestrians frequently cross—arterials, collectors, facilities with moderate to high vehicles volumes/speeds.
- **Long Blocks**: Urban areas with long distances between intersections where pedestrians may otherwise cross unsafely. Can apply at mid-block, especially in conjunction with other treatments.
- **Trail or Park Connections**: To facilitate safe crossing where recreational trails or parks intersect with roadways.

Design Considerations

- **Visibility**: Use bold markings, signs, and lighting to alert drivers and pedestrians. Crosswalk striping can vary—zebra striping, ladder striping, continental striping, and more.
- **Materials:** Paint or thermoplastic material.
- **Dimensions**: Minimum width is 6 feet. Wider crossings suit high pedestrian areas.
- **Accessibility**: Include curb ramps and tactile paving for universal access.
  Safety Enhancements: Add flashing beacons or pedestrian-activated signals if needed.
- **Location**: Align with pedestrian demand and ensure clear sight-lines.
- **Traffic Flow**: Minimize disruptions to vehicle flow with proper placement.

General Crossing Treatments

*Maintenance costs for **LPIs** are very low when only signal timing adjustments are needed. Since LPIs are often programmed into existing traffic signals, they require minimal upkeep compared to physical infrastructure changes.*
***Bike signals** generally have low maintenance costs—they are integrated into existing traffic signal systems. Expenses mainly include routine inspections, bulb or LED replacements, software updates, and occasional repairs.*

LEADING PEDESTRIAN INTERVAL

A leading pedestrian interval (LPI) gives pedestrians a 2-5 second head start at traffic signals by allowing them to begin crossing before vehicles receive a green light, enhancing their visibility and safety. Pedestrians can then enter and occupy the crosswalk before turning vehicles get there.



LPI allows pedestrian to establish a presence in the crosswalk before vehicles get green light.



FHWA

Benefits

- **Improved Safety**: Pedestrians are more visible in crosswalk before vehicle starts moving.
- **Reduced Collision Risk**: Provide pedestrians a head start—reduces conflicts with turning vehicles.
- **Increased Compliance**: Encourage pedestrians to use crosswalks properly.

Constraints and Limitations

- **Signal Timing Adjustments**: May reduce green time for vehicle movements. Potentially increases delays for intersections operating near capacity.
- **Driver Confusion**: Some drivers may not anticipate pedestrians starting early, leading to conflicts.
- **Implementation Costs**: Requires updating traffic signal systems, which can be costly.
- **Limited Effectiveness**: Benefits depend on high pedestrian compliance and proper driver awareness.
- **Intersection Complexity**: More challenging to implement at multi-phase or complex intersections.

Typical Applications

- **Right Turn Vehicle Movements**: Use in areas where pedestrian crossing movements are often interfered by right-turning vehicle movements.
- **Documented Crash History**: Intersections with documented history of turning movement related pedestrian-related vehicle crashes.

Design Considerations

- **Require pedestrian signal faces to function:** These signals display the “Walk” indication to pedestrians while holding vehicle traffic with a red light, ensuring the head start for pedestrians.
- **Signal Timing**: Adjust traffic signals to give pedestrians a minimum head start, typically 3-7 seconds depending on crossing distance, before vehicles receive a green light.
- **Visibility**: To improve visibility at high-conflict intersections, may combine with curb extension.
- **Intersection Geometry**: Assess intersection complexity, including turning movements and multi-lane crossings, to ensure LPIs are effective.
- **Signal Coordination**: Maintain proper timing coordination with surrounding traffic signals to minimize disruptions.

Additional Guidance

- **Monitoring and Evaluation**: Regularly assess LPI effectiveness by tracking pedestrian and vehicle behavior, as well as collision data.
- **Context-Specific Design**: Adapt LPI timing and implementation to suit local traffic patterns, intersection geometry, and pedestrian volumes.
- **Technology Integration**: Use smart traffic signal technology to adjust LPI timing dynamically based on pedestrian demand and traffic conditions.

BIKE SIGNAL



A bicycle-only signal is a traffic control device that provides dedicated separate signal phase for bicyclists at intersections.

Benefits

- **Enhanced Safety**: Reduce conflicts by clearly separating bike movements from vehicle or pedestrian traffic. Provides increased protection for bicyclists.
- **Improved Traffic Flow**: Provide organized transitions for all users, minimizing confusion.
- **Increased Cyclist Confidence**: Offer a predictable and dedicated system for safer crossings.
- **Promotes Cycling**: Encourages cycling as a viable mode of transportation with improved infrastructure.
- **Adaptability**: Can be customized to suit various intersection types and traffic conditions.

Constraints and Limitations

- **Increased Complexity**: Adds to signal timing complexity, potentially causing increased delays for other road users.
- **Cost**: Installation and maintenance can be expensive.
- **Driver Compliance**: Drivers may misunderstand or ignore bike signals, leading to conflicts.
- **Space Requirements**: Requires adequate space for placement, which can be challenging in constrained urban areas.
- **Limited Effectiveness**: Benefits may be reduced in areas with low bicycle traffic or poor cyclist compliance.

Typical Applications

- **Multi-Use Trails**: Where shared-use paths cross busy roadways.
- **Bike Lanes**: Intersections with dedicated bike lanes to manage bicycle-vehicle interactions, or at transitions to and from two-way separated bike lanes (cycle tracks).
- **High-Cyclist Areas**: Urban centers or campuses with heavy bicycle traffic. Intersections where many turning vehicles have potential to conflict with through bicycle movements.
- **Complex Intersections**: Locations with turning conflicts or multi-phase traffic signals.

Design Considerations

- **Visibility**: Ensure bike signal heads are clearly visible and distinguishable from pedestrian and vehicle signals.
- **Indicators**: Mark bicycle detectors with painted indicators to show cyclists where to wait.
- **Placement**: Position signals where cyclists can see them clearly, such as near bike lanes or cycle tracks.
- **Prohibit Right-Turn-On-Red**: Consider for motorists if right turns conflict with bicycle movements.
- **Compliance**: Use signage or education campaigns to encourage proper use by cyclists and drivers.

Bicycle | Pedestrian Amenities

__Street furniture__ maintenance costs vary based on materials and exposure to weather. Metal benches and trash bins require occasional repainting and rust prevention, while wooden furniture needs sealing and refinishing. Regular cleaning and minor repairs help extend lifespan. __Pedestrian lighting__ maintenance includes bulb replacements, wiring inspections, and fixture cleaning. LED lights have lower upkeep costs due to their long lifespan and energy efficiency.

STREET FURNITURE

Street furniture at crossings includes items like pedestrian seating, trash cans, bollards, planters, information/ wayfinding structures, lighting and railings designed to guide pedestrians, enhance safety, and improve the crossing environment—encouraging pedestrian activity on a street.





MCS, Alliance, NE (2018)

Benefits

- **Low Investment**: Easy installation and relatively inexpensive.
- **Enhanced Safety**: Guides pedestrian movement and reduces conflicts with vehicles.
- **Accessibility**: Provides support and rest areas for individuals with mobility challenges. Provides sense of comfort and security for pedestrians. Encourages walking.
- **Aesthetics**: Improves the visual appeal of crossings, encourages foot traffic, can make local businesses and attractions inviting.
- **Traffic Calming**: Serves as physical barriers to slow down vehicular traffic near crossings.
- **Wayfinding**: Helps organize spaces and direct pedestrians effectively.

Constraints and Limitations

- **Obstructions**: May restrict pedestrian flow or reduce sidewalk space in potentially busy areas.
- **Durability**: Susceptible to weather damage or vandalism.
- **Clutter**: Overuse may create visual and spatial overcrowding.
- **Placement Challenges**: Poor positioning can hinder accessibility or usability.

Typical Applications

- **Installation Sites**: Typically provided at busy city centers, child safety crossings, retail districts, parks and multi-use trails, cultural sites.
- **Safety, Function, Visual Appeal**: On corridors with commercial activity and anticipated high pedestrian use, utilize street furniture and pedestrian lighting to improve visual appeal, guide pedestrian flow, enhance accessibility and visual harmony in tourist-heavy areas.

Design Considerations

- **Placement**: Street furniture should not block a building entrance. Place furniture to avoid obstructing pedestrian flow or accessibility. Furniture should be accessible to all users.
- **Durability**: Use materials that withstand weather, wear, and potential vandalism. Choose low-maintenance materials and designs to reduce upkeep costs.
- **Aesthetics**: Ensure furniture complements the surrounding environment and urban design.
- **Functionality**: Prioritize multi-use designs, such as benches with integrated lighting or bollards that also serve as barriers.
- **Safety**: Avoid sharp edges or hazards that could harm pedestrians, especially in high-traffic areas.
- **Space Efficiency**: Fit furniture appropriately within the available space without overcrowding. Consider available space and anticipated demand.

PEDESTRIAN LIGHTING





Pedestrian lighting enhances nighttime street visibility and safety for pedestrians by illuminating crossings, especially in low-light areas.

MCS, Alliance, NE (2018)

Benefits

- **Enhanced Safety**: Improves visibility for pedestrians—waiting to cross, and in the crossing. Improves visibility for drivers, reducing pedestrian related crashes, especially at night.
- **Increased Comfort**: Creates a sense of security for pedestrians in dimly lit or isolated areas.
- **Better Navigation**: Clearly illuminates pathways, crosswalks, and obstacles, aiding movement.

Typical Applications

- **Key Locations**: Focus on high-priority areas like crosswalks, intersections, sidewalks, transit stops. Focus areas: ≥ 20 nighttime pedestrians per hour; locations with high frequency of nighttime pedestrian crashes; crossings with low pedestrian volume where crossing conflict is severe or unexpected (e.g. high speed roadway crossing).
- **Visibility Needs**: Ensure proper placement to illuminate pedestrian paths without causing glare for drivers.
- **Energy Efficiency**: Opt for sustainable options like LED or solar-powered lighting to reduce energy consumption and costs.
- **Maintenance Access**: Design for easy upkeep to ensure reliability and longevity.
- **Integration**: Use in conjunction with other crossing treatments.

Constraints and Limitations

- **Cost**: Installation, maintenance, and energy consumption can be expensive.
- **Durability**: Weather conditions or vandalism may damage fixtures.
- **Obstructions**: Trees, signs, or other infrastructure can block light, reducing effectiveness. Potential of limiting or cluttering the sidewalk space near the crosswalk.
- **Maintenance**: Regular upkeep is required to ensure consistent performance.

Design Considerations

- **Aesthetics**: Blend illumination design seamlessly into the surrounding environment for visual harmony, to enhance the area's appeal and unify the streetscape.
- **Light Pollution**: Scale to street and land use concepts to minimize unnecessary light spill and reduce environmental impact while ensuring comfortable illumination quality for users.

General Crossing Treatments

Multi-use path crossing treatments *require periodic maintenance—surface repairs, repainting high-visibility markings, ensuring proper drainage to prevent wear. Costs vary based on materials—raised crossings and textured pavement tend to have higher upkeep than standard painted markings.* **Pavement markings through intersections** *need regular reapplication, especially paint-based markings; thermoplastic and epoxy-based markings last longer with higher initial costs. Snowplow damage and heavy traffic can accelerate wear.*

MULTI-USE PATH CROSSING TREATMENTS

When designing crossings for multi-use paths, there are several general treatments to consider, depending on the context and traffic conditions. Each treatment is chosen based on factors like traffic volume, speed, and the type of users expected on the path.

Benefits & Typical Applications

Unmarked Crossings: Typically used in low-traffic areas where visibility is high, and users can cross safely without additional markings.

- Minimal infrastructure costs.
- Suitable for low-traffic areas with good visibility, allowing natural interactions between path users and vehicles.

Marked Crossings: Include painted crosswalks to alert drivers and guide path users.

- Enhances visibility for both path users and drivers.
- Guides path users to cross at designated, safer locations.
- Reinforces drivers' awareness of shared road use.

Refuge Islands: Provide a safe space for users to pause while crossing multi-lane roads.

- Provides a secure spot for crossing wide or multi-lane roads in stages.
- Reduces the stress and risk for path users, especially children or elderly individuals.

Traffic Control Devices (e.g., stop signs, flashing beacons, or signals): Can include stop signs, yield signs, or even traffic signals to manage interactions between path users and vehicles.

- Regulates interactions at crossings, improving safety.
- Reduces ambiguity by clarifying priority for vehicles and path users.

Grade-Separated Crossings (overpasses/ underpasses): Are used in areas with high traffic volumes or speeds to completely separate path users from vehicles.

- Completely separates vehicles from path users, eliminating conflict points.
- Ideal for high-speed, high-traffic areas, ensuring continuous flow for path users.

Design Considerations

User Needs

- Consider pedestrians, cyclists, wheelchair users, and other path users with varying mobility levels.
- Ensure clear sight-lines for both path users and vehicles.
- Comply with ADA (Americans with Disabilities Act) standards for ramps, surface textures, and signage.

Traffic Conditions

- Higher speeds or traffic volumes may call for grade-separated crossings or traffic signals.
- Minimize potential points of interaction between vehicles and path users.

Environmental Factors

Provide adequate illumination for nighttime visibility.

- Use non-slip surfaces and design for effective drainage.

Infrastructure

- Include clear, consistent markings and signs to direct both path users and drivers.
- If crossing multi-lane roads, consider a median for safe stopping.
- Use overpasses or underpasses for high-risk crossings.

Safety Enhancements

- Ensure adequate crossing time for users of all abilities.
- Incorporate measures like speed bumps or narrowed lanes to reduce vehicle speeds.

Integration with Surroundings

- Land Use: Align the crossing design with nearby land uses, such as schools, parks, or businesses
- Ensure the crossing links seamlessly with the path and adjacent infrastructure.

PAVEMENT MARKINGS THROUGH INTERSECTIONS



pedbikeimages.org / Laura Sandt



pedbikeimages.org / Greg Griffin, AICP

Pavement markings through intersections for both cycle tracks and bicycle lanes guide and inform cyclists and motorists as they navigate crossings.

Benefits

- **Alert Motorists**: Use of green paint can alert motorists of a conflict zone.
- **Pedestrian Safety**: Crosswalks and stop bars create safer zones for pedestrians to cross and prevent vehicles from stopping in dangerous positions.
- **Bicycle Safety**: Paint through the intersection alerts drivers to look for bicyclists and helps cyclists know where to cross. Bike lanes and symbols ensure cyclists have dedicated space, reducing conflicts with motor vehicles.
- **Visibility at Night/Weather Conditions**: Reflective markings enhance visibility during low-light conditions or adverse weather, helping drivers stay oriented.

Constraints and Limitations

- **Wear and Tear:** Markings fade over time due to traffic, weather, and road maintenance activities, reducing visibility. Use durable materials like thermoplastic or epoxy paint, and schedule regular maintenance and repainting.
- **Poor Visibility**: Markings can be difficult to see in low light, rain, or snow conditions. Incorporate reflective materials or glass beads into the markings to enhance visibility—night / adverse weather.
- **Snow-Covered Roads**: Pavement markings are often obscured by snow in colder climates. Use raised markings, in-road lighting, or other physical markers that remain visible above snow levels.
- **Budget**: Maintaining high-quality markings can be costly. Prioritize critical areas (e.g., intersections, school zones) and explore cost-effective materials and application techniques.
- **Driver Comprehension**: Unfamiliar or inconsistent markings may confuse road users, reducing their effectiveness. Standardize marking designs and educate drivers about their meanings through campaigns or driver's education.

Typical Applications

- **Lane Markings**: Clearly define traffic lanes, including continuation lines to guide vehicles through complex intersections.
- **Bike Lanes**: Highlight designated paths for cyclists through intersections, sometimes with green-colored pavement for extra visibility.
- **Shared Lane Markings (Sharrows)**: Remind motorists and cyclists to share the road where bike lanes aren't available.
- **Advance Warning**s: Markings such as "STOP AHEAD" or chevrons warn of upcoming intersections.

Design Considerations

- **Material Selection**: Choose materials like thermoplastic, epoxy, or paint based on durability, cost, and environmental conditions.
- **Lane Lines**: Standard width is 4 to 6 inches, depending on the road type and jurisdiction.
- **Standard Treatments**: Use white dashed lines through Intersection or across a conflict zone at a minimum to extend the treatment. Dashed green pavement treatments can enhance visibility and awareness.
- **Non-standard Treatments**: Solid green paint or bicycle chevron markings are used throughout U.S.
- **Bike Lanes**: Minimum width of 4 feet, with markings often including symbols or green paint for visibility.

Bicycle Facilities

Maintenance costs for ***two-way separated bike lanes*** *(cycle tracks) depend on materials, climate, and traffic conditions. Regular upkeep includes surface repairs, repainting lane markings, clearing debris, and snow removal in colder regions. Concrete cycle tracks have higher upfront costs but lower maintenance needs, while asphalt tracks require more frequent resurfacing. Protective barriers like bollards or curbs may need occasional replacement due to wear or vehicle impact.*

TWO-WAY SEPARATED BIKE LANE (CYCLE TRACK)

A protected dedicated bike lane on a street that allows bike traffic to travel in both directions. This bi-directional lane on one side of the street is physically separated from motor vehicle traffic by a buffer and a physical barrier (parked cars, flexible posts, planters, mountable curb) providing a continuous, protected path for cyclists.

Benefits

- **Increased Safety**: They provide a physical separation between cyclists and motorists, reducing the risk of crashes and dooring when parked cars are present.
- **Encourages Biking**: The safety and comfort provided attracts users of all levels.
- **Space Efficiency**: By accommodating two-way bicycle traffic in a single protected lane, these tracks make efficient use of right-of-way due to need for only one buffer.
- **Connectivity**: They often connect key destinations like residential areas, schools, workplaces, and recreational sites, making biking more convenient and practical.

Constraints and Limitations

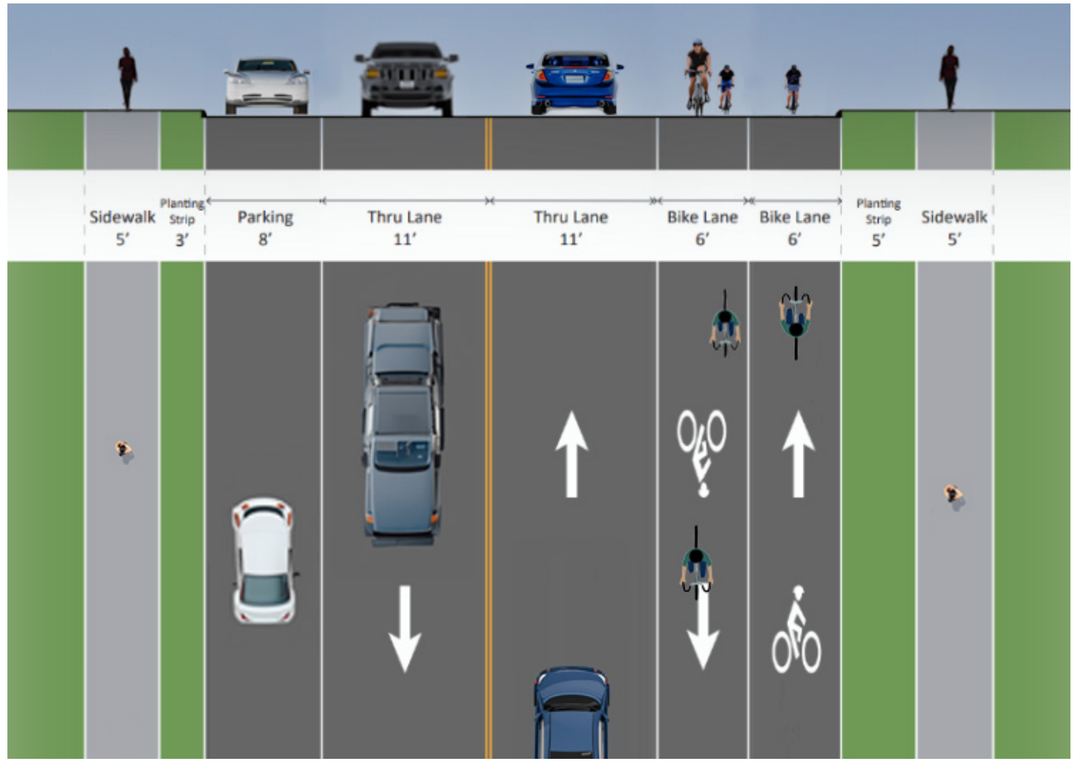
- **Space Requirement**: They require significant road space to accommodate two-way bike traffic and physical barriers, which can be challenging to implement in narrow streets.
- **Costs**: Higher construction and maintenance costs than standard bike lane.
- **Traffic Flow**: Can impact the flow of motor vehicle traffic, potentially leading to congestion or the need for road reconfiguration.
- **Confusion**: May be less intuitive due to apparent wrong way travel on one side of the street.
- **Intersection Complexity**: Managing intersections can be more complex, requiring careful design to ensure safe crossings and minimize conflicts with vehicles and pedestrians.
- **Visibility**: Cyclists traveling in the opposite direction of vehicular traffic may be less visible to drivers, increasing the risk of accidents.
- **Access and Parking**: Requires careful planning to avoid blocking driveways and access points, and to manage the placement of parking spaces. May be unsafe with frequent crossings and driveways.
- **Public Resistance**: Some drivers and residents may resist the reallocation of road space and perceive it as reducing available motorist lanes.
- **Weather Conditions**: Usability of cycle tracks may be affected by snow, ice, or heavy rainfall, requiring frequent maintenance.

Typical Applications

- **One-Way St**: Where desire two-way bike travel.
- **Bicycles Network**: Key segments where more protection is desired—high traffic volumes or speeds, or routes to common destinations.
- **Low Access Roadways**: With infrequent side street accesses and driveways.

Design Considerations

- **Separation Methods**: Buffer type can vary depending on available right-of-way, presence of parking, and context. Physical barriers like curbs, bollards, planters, or parked cars can be used to separate the cycle track from motor vehicle traffic.
- **Intersection Design**: Special attention is needed at intersections to ensure visibility and safe crossings for cyclists. This may include dedicated bike signal phases, high visibility pavement markings, and turning lanes.
- **Markings**: Green pavement markings or striping adds awareness and visibility in intersections and conflict areas—essential to guide both cyclists and motorists when their paths cross, indicating the presence and direction of the cycle track.





MCS, Gunnison, CO (2024)

https://highways.dot.gov/safety/pedestrian-bicyclist/safety-tools/pg-89-101-separated-bike-lane-planning-and-design-guide

Bicycle Facilities

ONE-WAY SEPARATED BIKE LANE (CYCLE TRACK)

A designated lane on the street for bicycles only, running in a single direction. This lane is physically separated from motor vehicle traffic, usually by barriers like curbs, bollards, or planters, which provide increased safety for cyclists by minimizing potential collisions with cars. On two-lane streets, a one-way SBL is like a standard bike lane, found on each side of the street.

Benefits

- **Safety:** Attracts all user levels—provides a physical barrier between cyclists and motor vehicles, significantly reducing the risk of vehicle-bicycle crashes.
- **Encourages Cycling**: Safer and more comfortable cycling infrastructure encourages more people to choose biking as a mode of transportation.
- **Reduces Dooring Risk**: When parked vehicles are present.

Constraints and Limitations

- **Space Requirement**: Requires additional dedicated space over standard bike lane, challenging with limited right-of-way / road width.
- **Costs**: The construction and maintenance of physical barriers and bike lane surfaces may be more expensive than standard bike lane.

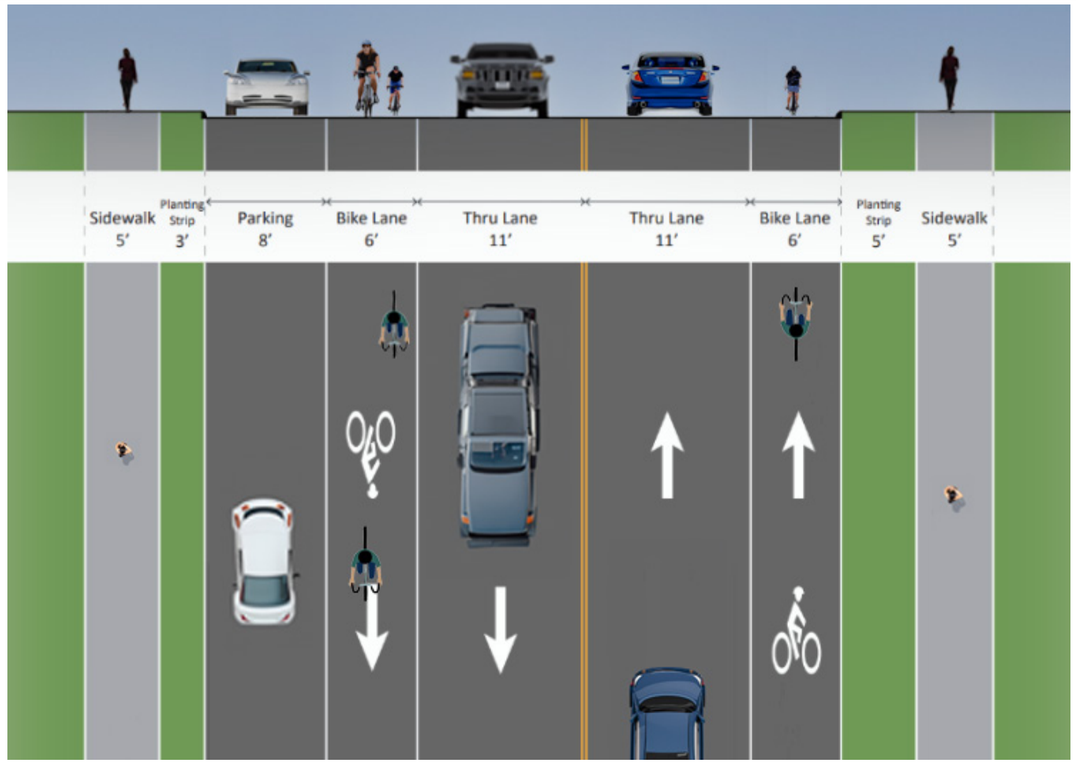
Typical Applications

- **Space**: Where road diet (vehicle lane reduction) can be implemented / sufficient road right-of-way.
- **Few Accesses**: Roadways with infrequent side streets accesses and driveways.
- **Protection**: Locate at key segments of bike network where desire added protection—higher traffic speeds and volumes and routes to schools, common destinations.

Design Considerations

- **Separation Methods**: Buffer type can vary depending on context, available right-of-way, presence of parking. Physical barriers—curbs, bollards, planters, or parked cars can be used to separate the bike lane from motorists.
- **Intersection Design**: Special attention is needed at intersections to ensure visibility, safe crossings for cyclists. Treatments include separate signal phases for cyclists—dedicated bike signals, high visibility pavement markings, and turning lanes.
- **Driveways**: Design should accommodate driveways and transit stops, ensuring that cyclists can safely navigate these areas without conflicts with vehicles or pedestrians.
- **Markings**: Green pavement markings or striping in intersections and conflict areas are essential to guide both cyclists and motorists, indicating the presence and direction of the bike lane.
- **Lane Width**: Typical width for one-way separated bike lane ranges from (5’ to 6.5’), providing enough space for cyclists to ride comfortably.
- **Buffer Zone**: A buffer zone (1.5’ to 3’) is often included between the bike lane and motor vehicle traffic to enhance safety.
- **Vertical Separation**: The height of physical barriers can vary, but they should be tall enough to provide a clear separation while not obstructing visibility. Common barriers include curbs (4-6” high) and bollards (3 to 4’ high).
- **Surface Quality**: The bike lane surface should be smooth, durable, and well-maintained to ensure a comfortable ride for cyclists.
- **Grade Separation**: Bike lanes can be at the same level as the roadway, at sidewalk level, or at an intermediate level, depending on the specific design and context.

*Maintenance costs for **one-way separated bike lanes** depend on materials, climate, and traffic conditions. Regular upkeep includes surface repairs, repainting lane markings, debris removal, and snow clearing in colder regions. Concrete lanes have higher upfront costs but lower maintenance needs, while asphalt lanes require more frequent resurfacing. Protective elements like bollards or curbs may need occasional replacement due to wear or vehicle impact.*





MCS, Gunnison, CO (2024)

Photo actually shows a 2-way cycle track, but a single separated cycle track often has a similar separation or buffer from motorists.

https://highways.dot.gov/safety/pedestrian-bicyclist/safety-tools/pg-89-101-separated-bike-lane-planning-and-design-guide

Bicycle Facilities

Standard bike lanes *require routine repainting, surface repairs, and debris removal. Paint-based markings need frequent reapplication, while thermoplastic markings last longer but cost more upfront. Snowplow damage and heavy traffic can increase maintenance needs.* **Buffered bike lanes** *have similar upkeep but may include additional striping or physical barriers like flexible posts, which require occasional replacement. Maintenance costs depend on climate, traffic volume, and material durability.*

STANDARD BIKE LANE

A designated portion of the roadway for exclusive use by cyclists. These lanes are marked by painted lines and symbols on the pavement and are usually situated adjacent to the traffic lanes. Standard bike lanes provide a safer and more predictable route for cyclists and help to organize traffic flow.



MCS, Golden, CO (2025)

Benefits

- **Safety**: They provide a designated space for cyclists, reducing the risk of collisions with motor vehicles.
- **Predictability**: Clear markings and symbols help organize traffic flow, making it easier for both cyclists and motorists to understand where each should be.
- **Encourages Cycling**: Dedicated lanes encourage more people to choose biking as a mode of transportation, promoting a healthier and more active lifestyle.
- **Reduced Congestion**: By accommodating more cyclists, standard bike lanes can help reduce traffic congestion on the roads.
- **Accessibility**: They provide a reliable and efficient route for cyclists, making biking a more practical and appealing option for commuting and leisure.
- **Economic Benefits**: Improved cycling infrastructure can boost local economies by attracting more customers to businesses and reducing transportation costs for individuals.

Constraints and Limitations

- **Safety**: Less protection from motor vehicles, increasing the risk of collisions and dooring incidents.
- **Comfort**: Cyclists may feel less secure due to close proximity to moving traffic.
- **Maintenance**: Painted lines and symbols can wear out over time, requiring regular upkeep.

Typical Applications

- **Urban Roads**: Commonly used on urban roads with moderate traffic to provide a designated space for cyclists.
- **Residential Streets**: Implemented in residential neighborhoods to create safer routes for local cyclists and encourage recreational biking.
- **Arterial Roads**: Added to arterial roads with sufficient width to enhance connectivity and offer a continuous route for cyclists.
- **School Zones**: Installed near schools to ensure the safety of students who bike to and from school.
- **Commercial Districts**: Used in commercial areas to provide convenient access for customers and employees who choose to bike.
- **Connectors**: Applied to streets that connect bike trails, parks, or other cycling infrastructure to create a comprehensive network.

Design Considerations

- **Lane Markings**: Painted lines and symbols on the pavement to clearly define the bike lane.
- **Road Width**: Requires sufficient road width to accommodate the bike lane without disrupting traffic flow.
- **Intersection Safety**: Proper markings and signals at intersections to ensure safe crossings for cyclists.
- **Signage**: Clear and visible signs to guide both cyclists and motorists.
- **Maintenance**: Regular upkeep to keep markings visible and the surface smooth.

BUFFERED BIKE LANE



Bike lanes that have additional space, called a buffer, separating the bike lane from the adjacent motor vehicle or parking lane. This painted buffer provides extra distance, typically marked with diagonal or chevron lines. Buffered bike lanes offer more protection and comfort for cyclists compared to standard bike lanes.

Benefits

- **Enhanced Cyclist Safety**: The extra buffer space reduces the risk of collisions with moving traffic and "dooring" accidents from parked cars.
- **Increased Comfort**: Cyclists feel more secure with additional separation from vehicles, encouraging more people to ride.
- **Better Traffic Flow**: Clear markings help drivers and cyclists stay in their designated areas, reducing confusion and potential conflicts.
- **Adaptable Design**: Easy to implement with paint and signage, making them a cost-effective option for improving road infrastructure.

Constraints and Limitations

- **Space Requirements**: They need additional road width, which may be challenging to allocate on narrower streets.
- **Cost of Implementation**: Though cost-effective compared to physical barriers, painting and maintaining buffer zones still require funding.
- **Limited Protection**: Painted buffers don't provide physical separation from traffic, leaving cyclists vulnerable to vehicles that cross the lane.
- **Driver Awareness**: Some drivers may disregard the buffer or encroach into the bike lane, especially in high-traffic areas.
- **Snow and Debris Accumulation**: In some areas, bike lanes, including the buffers, may not be regularly cleared, reducing their usability.

https://betterbike.org/wp-content/uploads/2013/12/Bike-Lanes-section-from-NACTO-Urban-Bikeway-Design-Guide.pdf

2 https://natcap.com/buffered-bike-lane/

Typical Applications

- **Locations**: On busy city roads, streets with higher speed limits, near schools to encourage cycling among students and ensure their safety, and commercial shopping districts to promote cycling as a mode of transport and reduce vehicle congestion.

Design Considerations

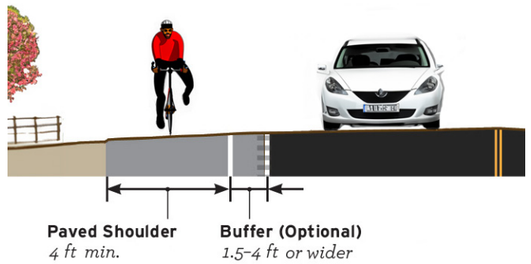
- **Buffer Width**: The buffer zone should be at least 1.5 feet wide, with wider buffers (up to 4 feet) providing additional separation. Buffers wider than 2 feet often include cross-hatching for visibility.
- **Lane Width**: The bike lane itself should be a minimum of 5 feet wide, but wider lanes (7 feet or more) are preferred for added comfort.
- **Markings**: Clear pavement markings and signage are essential to delineate the bike lane and buffer zone.
- **Intersection Design**: Special treatments, such as bike boxes or intersection crossing markings, improve cyclist safety at intersections.
- **Maintenance**: Regular clearing of debris, snow, and ice is crucial to ensure usability.
- **Buffer Placement**: The buffer can be located between the bike lane and moving traffic or between the bike lane and parked cars to prevent "dooring" incidents.
- **Cross-Hatching**: Buffers wider than 2 feet often include cross-hatching at intervals of 20 to 60 feet.
- **Physical Separation**: While most buffered bike lanes use painted markings, some may include flexible posts or other physical barriers for added protection. [2]

Bicycle Facilities

Paved shoulders *require periodic resurfacing, debris removal, and drainage maintenance to prevent deterioration. Costs depend on materials—asphalt shoulders need more frequent upkeep than concrete shoulders, which last longer but cost more upfront.* **Advisory bike lanes** *need regular repainting, surface repairs, and signage upkeep to remain effective. Paint-based markings require frequent reapplication, while thermoplastic markings last longer but have higher initial costs.*

PAVED SHOULDER

A designated portion of the roadway, adjacent to the travel lanes, that is surfaced with durable material like asphalt or concrete. It provides a safe area for non-motorized users, such as cyclists and pedestrians, while also serving other purposes like drainage, vehicle breakdowns, or emergency stops. These shoulders enhance safety by separating vulnerable road users from motorized traffic and offering a stable, flat surface for travel.



Benefits

- **Enhanced Safety**: They provide a designated space away from vehicular traffic, reducing risk of crashes.
- **Improved Accessibility**: Offer a stable and smooth surface for travel, accommodating pedestrians, cyclists, and individuals with mobility aids.
- **Better Visibility**: Increase visibility for cyclists and pedestrians—more noticeable to drivers.
- **Improved Road Longevity**: Paved shoulders also prevent pavement edge cracking, which makes roads safer and more durable for all users.
- **Emergency Pull-Offs**: They provide a safe space for vehicles to pull over in emergencies, indirectly benefiting non-motorized users by improving overall road safety.

Constraints and Limitations

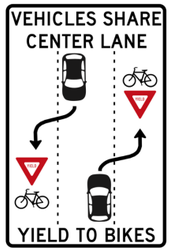
- **Cost**: Construction, maintenance, and resurfacing can be expensive, especially with limited budgets.
- **Space Availability**: Limited right-of-way space can make it challenging to accommodate a paved shoulder without significant roadway alterations.
- **Local Acceptance**: Resistance from communities or property owners near the road may arise due to construction disruptions or perceived changes in property value.

Typical Applications

- **Cyclist and Pedestrian Safety**: Paved shoulders create a dedicated space for non-motorized traffic, reducing conflicts with motor vehicles. They are especially important on rural or suburban roads where separate sidewalks or bike lanes may not be available.
- **Connectivity**: They serve as connectors in areas where there are gaps in dedicated bike lanes or sidewalks, ensuring uninterrupted routes for cyclists and pedestrians.

Design Considerations

- **Minimum Width:** A minimum of 4 feet is recommended for paved shoulders adjacent to road edges.
- **Optimal Width**: For added comfort and functionality, widths of 6 to 8 feet are ideal, especially on roads with higher speeds or traffic volumes.
- **Surface Quality**: Smooth and even surfaces are critical for cyclist safety and comfort.
- **Enforce regulations** to prevent illegal parking or misuse by motorists.
- **Educate drivers** about respecting paved shoulder areas.
- Optimize roadway design by **narrowing vehicle lanes** or using road diets to create space for paved shoulders.
- Explore **flexible designs** that adapt to the available right-of-way without compromising safety.



ADVISORY BIKE LANE

Bike infrastructure that provide dedicated space for bicyclists on the roadway, but allow cars to use the bike lane when there are no cyclists present. They are typically used on roads that are too narrow to accommodate separate bike lanes and car lanes. The lanes are marked with dashed lines, indicating that cars can merge into the bike lane if necessary, but must yield to cyclists. This design encourages safer sharing of the road between cars and bicycles.

Benefits

- **Improved Safety**: They provide a designated space for cyclists, reducing risk of collisions with motorists.
- **Flexibility**: The dashed lines allow cars to merge into the bike lane when no cyclists are present, making it adaptable to varying traffic volumes.
- **Encourage Cycling**: By clearly marking space for cyclists, they can encourage more people to choose biking as a mode of transportation.
- **Cost-Effective**: They are generally less expensive to implement than separate, dedicated bike lanes.
- **Traffic Calming**: Presence of bike lanes can help reduce vehicle speeds, make road safer for all users

Constraints and Limitations

- **Driver Familiarity**: Advisory bike lanes are not as common, drivers may be unfamiliar with use, leading to confusion and potential safety issues.
- **Enforcement**: Consistent enforcement ensures that drivers yield to cyclists and use the lanes properly.
- **Community Acceptance**: Gaining community support can be challenging, especially for concerns about traffic congestion or loss of parking spaces.
- **Space**: The road must have enough width to accommodate the advisory bike lanes without compromising the flow of traffic.

Typical Applications

- **Location**: On narrow residential streets where space is limited; roads with low to moderate traffic volumes; around schools; connect gaps in existing bike networks; tourist areas to improve safety for visitors; streets with businesses and shops, advisory bike lanes can make cycling more attractive.

Design Considerations

- **Traffic Volume / Speed:** Best suited for roads with lower motorist volumes and speeds.
- **Maintenance**: Plan for regular maintenance—keep the lane markings / signage clear and visible, especially in low-light conditions, adverse weather.
- **Lane Width**: The advisory bike lane itself should typically be 4 to 5 feet wide. This allows enough space for cyclists to ride safely while still being narrow enough to leave room for vehicles.
- **Travel Lane Width**: The remaining travel lane for motor vehicles should be wide enough to accommodate vehicles when cyclists are present in the advisory bike lane. Often around 9 to 11 feet.
- **Road Width**: The combined width of the advisory bike lane and the travel lane needs to fit within the available road width. For example, a road with two travel lanes and two advisory bike lanes might require a total width of around 29 to 32 feet.
- **Buffer Zones**: If space allows, consider adding buffer zones between the bike lanes and travel lanes. Buffers can be around 1 to 2 feet wide.
- **Intersection Design**: At intersections, ensure that the lane widths and markings guide both cyclists and drivers safely through crossing. Might include colored pavement to highlight bike lanes.
- **Parking Areas**: If there are on-street parking spaces, ensure bike lanes are designed to prevent conflicts between parked cars and cyclists. Might involve a buffer zone to separate parked cars from bike lanes.
- **Signage and Markings**: Use consistent, clear signage to accompany road markings, e.g. dashed lines to delineate advisory bike lanes and guide users. Should be visible and maintained regularly.

Bicycle Facilities

BICYCLE BOULEVARD

A low-speed, low volume street designed to prioritize bicycle travel while still allowing access for motorists. These streets prioritize and optimize bicycle movements by using traffic calming elements and intersection crossing treatments—signage, and pavement markings to create a safe and convenient environment for cyclists.



pedbikeimages.org / Adam Fukushima

Benefits

- **Space**: Additional right-of-way is typically not required
- **Safety**: They reduce traffic speeds and volumes, creating a safer environment for both cyclists and pedestrians.
- **Comfort**: Cyclists of all levels experience less stress as they can ride without competing with heavy traffic.
- **Improved Connectivity**: They provide dedicated, safe routes for cyclists, making it easier to navigate urban areas.
- **Community Building**: Bicycle boulevards foster a sense of community, encouraging social interactions, making neighborhoods more livable.

Constraints and Limitations

- **Budget**: Some treatments such as chicanes or traffic circles may be expensive.
- **Traffic Diversion**: May reduce through routes for motorized vehicles. Reducing car traffic on a boulevard might increase traffic on surrounding streets, which can face opposition from local residents.
- **Space Availability**: Limited street width can make it difficult to incorporate necessary design elements like bike lanes, signage, or traffic calming measures.

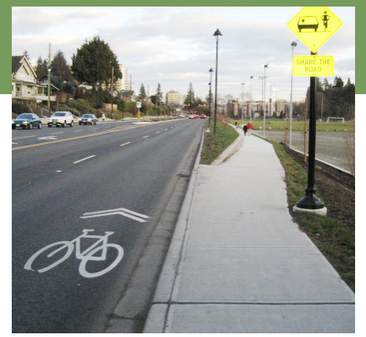
Typical Applications

- **Residential Areas**: Ideal for neighborhoods with low traffic volumes, providing a safe and quiet route for cyclists. Local routes parallel to arterials and collectors.
- **Enhance Bicycle Network Connectivity Between Major Routes**: Acts as a linking path between high-traffic streets or dedicated bike lanes to ensure continuous cycling infrastructure.

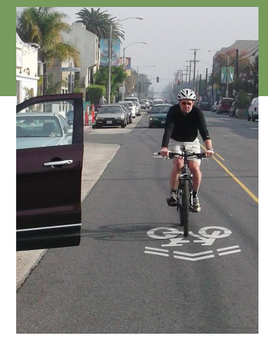
Design Considerations

- **Traffic Calming Features**: These include speed humps, curb extensions, chicanes, median barriers, traffic diverters, and traffic circles to prioritize bicycles and keep traffic volumes low and minimize through-traffic.
- **Intersection Treatments**: When motorists are expected to turn off the bicycle boulevard at intersections, consider providing bicycle-only through movements. Enhanced crossings, such as bike boxes, median refuges, or signal adjustments, improve safety at intersections.
- **Signage and Markings**: Include clear wayfinding signage and shared lane markings—guide cyclists and alert drivers to the boulevard's purpose.
- **Dimensions**: While specific dimensions can vary, bike lanes or shared lanes should provide adequate space for cyclists, typically 4-6 feet wide for bike lanes or wider shared lanes.
- **Accessibility**: Considerations for emergency vehicles, delivery trucks, and local residents are integrated into the design.
- **Connectivity**: Routes are designed to connect key destinations like schools, parks, and commercial areas, ensuring logical and continuous paths.
- **Speed Limits**: Posted speed limits are usually 25 mph or lower to minimize speed differences between cyclists and vehicles.

SHARED LANE ROADWAYS



pedbikeimages.org / Margaret Gibbs



pedbikeimages.org / Dan Gutierrez

A type of street where bicyclists and motorists share the same travel lanes. These lanes are marked with "sharrows" (shared lane markings) or signage to indicate that cyclists are allowed to use the full lane, and drivers should be aware of their presence. Shared lane roadways are typically used on lower-traffic streets where dedicated bike lanes are not feasible. They aim to improve safety and awareness for both cyclists and motorists while promoting cycling as a mode of transportation.

Benefits

- **Low to No Cost:** Utilize existing infrastructure—more affordable compared to dedicated bike lanes.
- **Space Efficiency**: Ideal for streets with limited width where separate bike lanes are not feasible.
- **Increased Awareness**: Sharrows remind drivers to share the road and encourage safer interactions with cyclists.
- **Connectivity**: They help create continuous routes for cyclists, linking various parts of the bike network.
- **Encouraging Cycling**: By visibly integrating bicycles into the street design, they promote cycling as a viable mode of transportation.
- **Flexibility**: Shared lane roadways accommodate both cyclists and vehicles without major redesigns.

Constraints and Limitations

- **Limited Cyclist Separation**: Unlike dedicated bike lanes, shared lanes do not provide physical separation between bicycles and vehicles. Likely to attract only fearless cyclists without additional traffic-calming treatments.
- **Safety Concerns**: Cyclists may feel less secure sharing lanes with vehicles, especially on streets with higher speeds or volumes.
- **Driver Behavior**: Not all drivers are familiar with sharrows, potentially leading to unsafe interactions between vehicles and cyclists.
- **Traffic Conditions:** Shared lanes are less effective on busy roads with heavy or fast-moving traffic.
- **Visibility of Markings**: Sharrows can fade over time, reducing effectiveness—requiring frequent maintenance.

Typical Applications

- **Low-Traffic Streets:** Ideal for streets with low vehicle volumes and speeds, creating a safe shared space for both cyclists and drivers.
- **Urban Connectivity**: Used to link gaps in cycling networks where adding separate bike lanes is not feasible due to space or budget constraints.
- **Neighborhood Route**s: Applied in residential areas to provide safe, accessible routes for local trips and recreational cycling.
- **Downtown Areas**: Implemented in urban centers to integrate cycling into mixed-traffic streets, supporting multi-modal transportation.
- **Historic or Constrained Areas**: Suitable for areas where space is limited—historic districts, where significant infrastructure changes are not possible.
- **Short Distances:** Useful for connecting cyclists to major bike paths, transit stations, or key destinations like parks, schools, and shops.

Design Considerations

- **Traffic Speeds**: Best suited for streets with speeds of 25 mph or lower to ensure cyclist safety.
- **Traffic Volumes**: Appropriate for streets with low to moderate vehicle traffic, typically under 3,000 vehicles per day.
- **Lane Width**: Shared lanes should be wide enough (typically 14-16 feet) to allow safe
- **Sharrow Width**: Place at least 4 feet from edge of curb or on-street parking.

Pedestrian Facilities

Shared lane roadways *require periodic resurfacing, repainting of markings, and debris removal. Costs depend on traffic volume and climate, with paint-based markings needing frequent reapplication while thermoplastic lasts longer.* **Bicycle boulevards** *need routine signage upkeep, pavement maintenance, and intersection treatments. Costs vary based on materials and traffic conditions, with speed humps and diverters requiring occasional repairs.* **Multi-use paths** *require surface repairs, repainting markings, debris removal, and drainage maintenance to prevent wear. Costs vary based on materials—asphalt paths need more frequent resurfacing, while concrete paths last longer but cost more upfront.* **Sidewalks** *need crack sealing, slab leveling, and occasional full replacements depending on damage.*

MULTI-USE PATH

A multi-use path is a paved, bi-directional shared, away from roadways facility designed to accommodate various non-motorized users, such as pedestrians, cyclists, and skaters, safely and efficiently. Multi-use paths facilitate long-distance connections within and between communities, enhance regional accessibility, and serve as vital routes for recreation, commuting, and mobility, appealing to users of all ages and abilities.



Scottsbluff, NE, MCS (2022)

Benefits

- **Accessibility for All Users**: Hard surface designed for universal accessibility—pedestrians, cyclists, and non-motorized users, promoting inclusivity.
- **Enhanced Safety**: Separate paths reduce conflicts between motorists and vulnerable road users.
- **Encourages Active Transportation**: Promotes walking and cycling, fostering healthier lifestyles.
- **Recreational Opportunities**: Provides scenic routes for leisure activities—improve quality of life.
- **Economic Benefits**: Boosts local businesses by increasing foot and bike traffic.
- **Connection to Communities**: Link workplaces, neighborhoods, parks, and schools, fostering community engagement.

Constraints and Limitations

- **Space Requirements**: May require significant land area, which can be challenging in urban settings.
- **User Conflicts**: Shared use can lead to collisions or disputes between pedestrians and cyclists in shared space.
- **Maintenance Costs**: Requires regular upkeep to ensure safety and usability. Winter trail clearance.
- **Accessibility Challenges**: Steep grades or poor surface conditions may limit usability for certain individuals. Adverse weather conditions can affect usability and safety.
- **Connectivity Gaps**: May not always align with existing transportation networks or reach key destinations.

Typical Applications

- **Trail Networks**: Provides long- to medium- links within community, serving as recreational facilities. Provides a safe space for walking, cycling—links neighborhoods, schools, and business districts.
- **Transportation Corridors**: Serves as an alternative route parallel to roads or railways. Provide safe passage where sidewalks and on-street facilities are not present.
- **Tourist and Cultural Sites**: Enhances accessibility for visitors exploring key attractions. Integrate trees/greenery thoughtfully for aesthetics/shade.

Design Considerations

- **Width**: Ensure adequate width (10-14 feet) to accommodate various users safely. Minimum of 10 feet recommended for low pedestrian/bicycle traffic contexts; for moderate to high levels of bike/pedestrian traffic, 12-20 feet should be considered.
- **Gradients**: Maintain gentle slopes to improve accessibility and comply with ADA (Americans with Disabilities Act) standards.
- **Intersections**: Design safe crossings with clear markings, signage, and possibly signalization to manage interactions with vehicles.
  Lighting: Add appropriate lighting for visibility and security, particularly in urban or high-use areas.
  Signage and Wayfinding: Clear, consistent signs to guide users and encourage proper path use.

SIDEWALK

A sidewalk is a paved, pedestrian-exclusive pathway running alongside a roadway, designed to ensure safe and accessible walking spaces separated from vehicular traffic by a curb.



Sidney, NE, MCS (2024)



pedbikeimages.org / Dan Burden

Benefits

- **Enhanced Safety**: Provides a dedicated space for pedestrians, physically separated from motorists, reducing the risk of motorist-pedestrian crashes.
- **Accessibility**: Offers an even, stable surface for individuals with mobility aids, strollers, or wheelchairs—unable to travel unpaved surface.
- **Improved Connectivity**: Links neighborhoods, schools, parks, and other destinations.
- **Community Appeal**: Enhances the aesthetic and functionality of urban and suburban environments.

Constraints and Limitations

- **Cost**: Construction and maintenance of concrete curb and sidewalk is a substantial expense.
- **Space Limitations**: Insufficient right-of-way can restrict sidewalk width or placement.
- **Obstructions**: Utilities, signage, or trees may block pathways, reducing accessibility.
- **Connectivity Gaps**: Sidewalks may not always connect seamlessly to other pedestrian facilities.
- **Shared Use Conflicts**: In some cases, sidewalks may need to accommodate non-pedestrian users, such as cyclists.

Typical Applications

- **Locations**: Typically provided on urban and residential streets—connects homes within neighborhoods and to nearby amenities; ensures safe pedestrian access to shops, offices, and restaurants; provides safe walking routes for students near schools; links green spaces and recreational facilities; ensures safe and accessible routes to hospitals and clinics.

Design Considerations

- **Width**: Ensure sidewalks are wide enough to accommodate pedestrians comfortably, at least 5 feet wide, with a minimum of 4 feet of clear width, and typically 6-8 feet wide or more in high-traffic areas. This excludes a 1.5 feet lateral clearance (shy distance) from the curb and any adjacent obstructions—walls, poles, street furniture to ensure comfort and accessibility.
- **Wider Sidewalks**: Beneficial in town center and commercial areas, 12 to 20 feet can be beneficial to accommodate higher pedestrian volumes, street furniture, pedestrian scale lighting, bike parking, business signage, and other amenities.
- **Landscape Buffer**: Preferred in residential areas, and along roadways with higher traffic speeds and volumes.

Pedestrian Facilities

Shoulder pedestrian facilities *require surface repairs, debris removal, and drainage maintenance to ensure safe walking conditions. Costs vary based on materials—paved shoulders need occasional resurfacing, while gravel shoulders require more frequent grading and upkeep.* **Pedestrian sidepaths** *need routine pavement maintenance, crack sealing, and vegetation control to prevent obstructions. Concrete sidepaths last longer but cost more upfront, while asphalt sidepaths require more frequent resurfacing.*

SHOULDER PEDESTRIAN FACILITY

A paved shoulder pedestrian facility provides a designated walking area on a hard surface, typically marked or paved, for pedestrian use in areas without sidewalks, typically rural.



pedbikeimages.org / Dan Burden

Benefits

- **Improved Safety**: Provides a hard surface space for pedestrians, separated from and reducing conflicts with vehicles.
- **Cost-Effective**: A practical alternative to sidewalks in areas with lower pedestrian traffic or limited space. Requires less right-of-way than a separated multi-use path.
- **Enhanced Accessibility**: Offers a stable and smooth surface, accommodating strollers, wheelchairs, and those with mobility challenges.
- **Durability**: Resistant to erosion and weather damage compared to unpaved surfaces.
- **Increased Visibility**: Clearly delineates pedestrian areas for both walkers and drivers.

Constraints and Limitations

- **Space Limitations**: Insufficient shoulder width may restrict pedestrian use.
- **Shared Use**: Often shared with cyclists or vehicles, increasing potential conflicts. Broken down vehicles may force pedestrians into travel lane.
- **Lack of Separation**: Minimal physical barriers from vehicle lanes can compromise pedestrian safety. Does not provide physical protection as with a curb. May not be comfortable for all users.
- **Weather Impact**: Snow, ice, or debris accumulation can make the surface less usable.
- **Driver Awareness**: May rely on drivers' attentiveness for pedestrian safety in the absence of clear markings.
- **Maintenance Needs**: Requires regular upkeep to ensure smooth and accessible conditions.

Typical Applications

- **Interim Treatment**: Used as an interim treatment in urbanizing areas—enhances connectivity along low-density residential or mixed-use streets.
- **Locations**: Connects recreational paths and serves as a walking route near natural spaces; an alternative pedestrian route where sidewalks are not practical; applied on rural roadways.

Design Considerations

- **Width**: Ensure shoulders are wide enough, 6-foot is preferred, to accommodate pedestrians safely without interfering with vehicular traffic. Use 4-foot minimum in constrained areas. In higher speed locations, use greater widths.
- **Separation**: Consider adding rumble strips, profiled striping, or barriers to improve separation from vehicle lanes, and minimize motorists encroaching on shoulder.
- **Markings**: Clearly delineate pedestrian areas with paint or symbols to enhance visibility.
- **Continuity**: Maintain a consistent facility design along the roadway for uninterrupted pedestrian access.
- **Drainage**: Ensure proper water drainage to prevent puddles or erosion that could compromise safety and usability.
- **Lighting**: Install adequate lighting for visibility during low-light conditions, especially rural areas.

PEDESTRIAN SIDEPATH

A pedestrian sidepath is a hard-surface shared-use path, typically adjacent to a roadway, used in lieu of a sidewalk in areas where bicycle facilities exist, designed to accommodate pedestrians (and cyclists) safely. Similar to a multi-use path, these generally do not invite bicycle travel as they are narrower in width.



pedbikeimages.org / Ryan Snyder

Benefits

- **Safety**: Separates pedestrians from vehicular traffic, reducing collision risks.
- **Accessibility**: Provides a comfortable hard surface, buffered from the roadway, a dedicated space for non-motorized users.
- **Space Saving**: Less right-of-way is required than for a multi-use path.
- **Cost Saving**: Lower construction cost than for a full sidewalk with curb and gutter.

Constraints and Limitations

- **User Conflicts**: May attract bicyclists if separate bicycle facility is not provided. Shared paths may lead to conflicts between pedestrians and cyclists, especially with high traffic volumes.
- **Crossing Safety**: Intersection crossings can be hazardous without proper design and signage.
- **Maintenance**: Requires regular upkeep to ensure a safe and debris-free surface.
- **Limited Usage**: Effectiveness depends on sufficient pedestrian and cyclist demand.
- **Connectivity Gaps**: May not always align seamlessly with existing pedestrian or cycling networks.

Typical Applications

- **Interim Treatment**: Used as an interim treatment in urbanizing areas—for connectivity between sidewalk facilities.
- **Locations**: When multi-use paths cannot be accommodated and where sidewalks are not present. Can use where right-of-way allows for a shared path adjacent to the road.

Design Considerations

- **Width**: Typically, a 5- to 8-foot wide asphalt surface. Ensure the sidepath is wide enough to safely if accommodating both pedestrians and cyclists, typically 10–12 feet for shared use.
- **Separation**: Provide physical separation from the adjacent roadway. Typically using gravel or vegetated buffers like grass strips, barriers, instead of curb and gutter.
- **Intersections**: Design safe crossings with clear markings, signalization, and priority for sidepath users.
- **Accessibility**: Allow for universal access by following ADA standards.
- **Signage**: Install clear, consistent signage to guide users and indicate shared use.
- **Drainage**: Incorporate proper drainage solutions to prevent water accumulation and maintain usability.
- **Lighting**: Add adequate lighting for visibility and safety, especially in urban or high-use areas.
- **Landscaping**: Consider incorporating greenery for aesthetics and comfort, ensuring it doesn't obstruct visibility or space.

Pedestrian Facilities

*Maintenance costs for **enhanced pedestrian networks** depend on infrastructure type, materials, and local climate. Regular upkeep includes pavement repairs, repainting crosswalks, maintaining lighting, and ensuring accessibility features remain functional. Costs vary widely—concrete sidewalks last longer but cost more upfront, while asphalt paths require more frequent resurfacing. Features like pedestrian signals, benches, and landscaping add to long-term expenses.*

ENHANCED PEDESTRIAN NETWORK

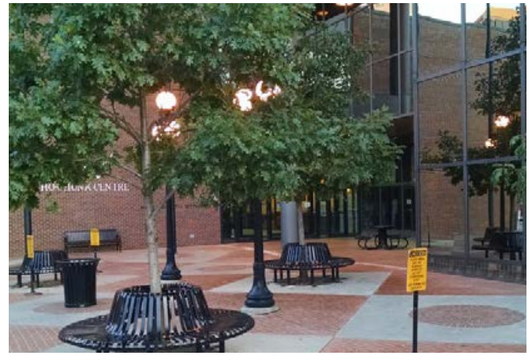
Enhanced pedestrian networks improve safety, accessibility, and connectivity by transforming joint-use alleys, sidewalk segments, and walkways to support high foot traffic areas. By implementing these countermeasures, urban spaces can increase safety, encourage foot traffic, and revitalize unused areas for a more connected, walkable downtown environment.



Sidney Downtown Master Plan, 2020, RDG



Sidney Downtown Master Plan, 2020, RDG



Sidney Downtown Master Plan, 2020, RDG

Benefits

- **Safety & Connectivity**: Reduces pedestrian-vehicle conflicts and links sidewalks, alleys, and public spaces into a secondary pedestrian network.
- **Economic & Community Impact:** Supports local businesses, fosters foot traffic, and creates inviting spaces for social interaction, public art, and events.
- **Efficient Space Utilization**: Converts underused alleys into vibrant pedestrian-friendly areas, optimizing traffic flow and walkability.
- **Sustainability & Accessibility**: Encourages eco-friendly transportation modes like walking and biking, while ensuring ADA compliance and multi-modal access.

Constraints and Limitations

- **Mixed-Use Conflicts**: Balancing pedestrian pathways with vehicular access, parking zones, and delivery areas.
- **Safety & Visibility**: Enhancing lighting, signage, and traffic calming to reduce blind spots and improve security.
- **Infrastructure & Drainage**: Managing storm water runoff and upgrading surfaces for durability.
- **Zoning & Ownership**: Addressing regulations and property rights affecting alley conversions.

Typical Applications

- **Joint-Use Alleys & Urban Revitalization**: Transforming alleys serving parking and rear entrances into pedestrian-friendly corridors.
- **Traffic Calming & Strategic Alley Use**: Implementing speed bumps, raised crossings, and signage to improve pedestrian safety in shared spaces.
- **Safe Routes & Connectivity**: Strengthening links to schools, transit hubs, and commercial areas to enhance accessibility.

Design Considerations

- **Pedestrian Priority & Multi-Modal Access**: Establishing dedicated walkways, bike lanes, and clear traffic separation.
- **Lighting & Wayfinding Enhancements**: Installing pedestrian-scale lighting, directional signage, and navigation aids.
- **Traffic Control & Crosswalk Treatments**: Implementing speed tables, high-visibility crosswalks, and pedestrian refuge zones.
- **Structural & Material Upgrades**: Using durable, slip-resistant surfaces and integrating drainage solutions.
- **Smart Infrastructure & Transit Integration**: Motion-sensitive lighting, real-time pedestrian counters, and seamless connections to public transportation.

Pedestrian Walkways

- **Width**: Minimum 5–6 feet for standard sidewalks; 8–12 feet for high-traffic pedestrian paths or shared-use trails.
- **Clearance**: Maintain at least 2 feet of buffer space from adjacent walls, fences, or landscaping.

Joint-Use Alleyway Design

- **Pedestrian Path Width**: 6–8 feet minimum if pedestrians and vehicles share space; 10–12 feet recommended for high-volume pedestrian areas.
- **Vehicle Lane Clearance**: Minimum 12–16 feet for one-way alley traffic; 20–24 feet for two-way access.
- **Buffer Zones**: 2–4 feet between pedestrian areas and vehicle lanes using bollards, planters, or raised curbs.

Crosswalks & Intersection Treatments

- **Crosswalk Width**: 6–10 feet standard; 10–15 feet for major pedestrian crossings.
- **Raised Crosswalk Height**: 3–6 inches elevation to improve visibility and slow vehicle speeds.
- **Curb Extension Depth**: 5–7 feet protrusion from the sidewalk to reduce pedestrian crossing distance.

Traffic Calming & Speed Control

- **Speed Limits**: 10–15 mph in shared pedestrian alleyways; 20–25 mph in mixed-use downtown areas.
- **Speed Table Length**: 10–14 feet for gradual vehicle slowdown.
- **Bollard Spacing**: 3–4 feet apart to prevent vehicle intrusion while allowing pedestrian access.

Lighting & Visibility

- **Pedestrian-Scale Lighting**: Mounted at 10–14 feet height for optimal illumination.
- **Spacing**: 30–50 feet between lighting fixtures depending on brightness and coverage needs.

Wayfinding & Signage

- Sign Height: Mounted at 5–7 feet for pedestrian visibility.
- **Text Size**: Minimum 4-inch lettering for directional signs and 6-inch lettering for regulatory signage.



