CENTRAL INDIANA

VISION ZERO TOOLKIT

IndyMPO.gov/VisionZero

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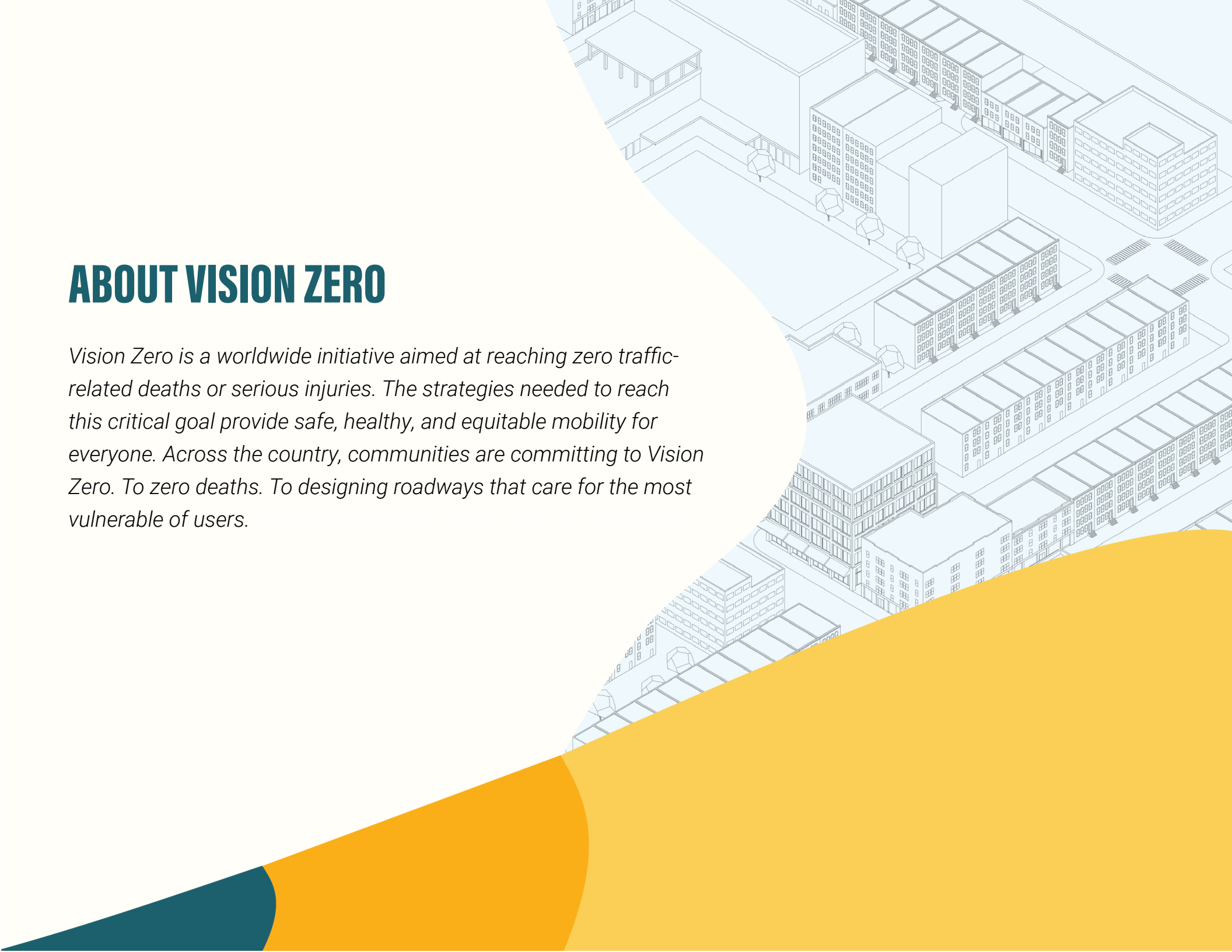
ABOUT VISION ZERO

Vision Zero is a worldwide initiative aimed at reaching zero traffic-related deaths or serious injuries. The strategies needed to reach this critical goal provide safe, healthy, and equitable mobility for everyone. Across the country, communities are committing to Vision Zero. To zero deaths. To designing roadways that care for the most vulnerable of users.



WHAT IS VISION ZERO?

Vision Zero is a strategy to eliminate traffic-related fatalities and injuries. To reach zero deaths.

Every year, tens of thousands of people die in crashes on America's roads. While often referred to as "accidents," the reality is that traffic deaths from crashes are preventable. Vision Zero views traffic deaths as an urgent public health issue with the goal of using a variety of strategies to eliminate all deaths and serious injuries from crashes, not necessarily eliminate all crashes. This approach recognizes that people make mistakes on the road, but streets and transportation systems should be designed so those mistakes don't cost lives. Vision Zero is not simply policy but is a change in approach. Its founders believed that loss of life is an unacceptable price to pay for faster mobility.

By acknowledging that road and vehicle design influence driver behavior, Vision Zero emphasizes the need for infrastructure and strategies that reduce risks, accommodate human error, and promote safe speeds. This toolkit focuses on urban planning, policy, land-use, and engineering interventions that can be implemented at the local level and contribute to a larger program for all modes (whether driving, walking, cycling, or using mobility devices) and in all contexts (from urban to rural).

For Vision Zero to be successful, a system must work together. At the national level, the US Department of Transportation (USDOT) addresses vision zero through what it refers to as the Safe System Approach. The system considers five (5) elements of a safe transportation system that all must work together to create layers of protection.

5 ELEMENTS OF THE USDOT SAFE SYSTEM APPROACH:

Safe Road Users — The safety of all road users is equitably addressed, including those who walk, bike, drive, ride transit, use a mobility device, or travel by other modes.

Safe Vehicles — Vehicles are designed and regulated to minimize the frequency and severity of collisions using safety measures that incorporate the latest technology.

Safe Speeds — Humans are less likely to survive high-speed crashes. Reducing speeds can accommodate human-injury tolerances in three ways: reducing impact forces, providing additional time for drivers to stop, and improving visibility. At lower speeds crashes that may occur are less likely to end in a serious injury or fatality.

Safe Roads — Designing transportation infrastructure to accommodate human mistakes and injury tolerances can greatly reduce the severity of crashes that do occur. Examples include physically separating people traveling at different speeds, providing dedicated times for different users to move through a space, and alerting users to hazards and other road users.

Post-Crash Care — People who are injured in collisions rely on emergency first responders to quickly locate and stabilize their injuries and transport them to medical facilities. Post-crash care also includes forensic analysis at the crash site, traffic incident management, and other activities.

For more information the Safe Systems Approach, **click here**.

WHAT DOES VISION ZERO LOOK LIKE?

Vision Zero envisions communities where everyone can move safely and comfortably, whether they are driving, walking, biking, or using transit. It does not mean eliminating cars. It means designing streets that recognize human limits and create safer conditions for all users. In practice, this includes improvements such as more continuous sidewalks, clearly marked crossings, well-designed roundabouts in rural or suburban areas, and better visibility at intersections. These engineering changes make streets safer and more predictable while maintaining efficient travel for drivers.

Vision Zero also extends beyond roadway design. It connects to how communities grow and use land. A Vision Zero community still looks familiar. Neighborhoods retain their character, could be organized in a way that shortens trips and makes walking or biking a convenient option for some journeys. Better coordination between housing, jobs, and services allow people to reach daily destinations safely and efficiently. This approach reduces the need for long, high-speed trips while supporting local businesses and neighborhood vitality.

Access is another core principle. Vision Zero aims to provide safe and reliable access to jobs, schools, parks, and essential services, regardless of travel mode. Well-connected sidewalks, protected bike lanes, and reliable transit options complement a well-functioning road network. When some trips shift from car to other modes, traffic volumes decrease, congestion eases, and reliability improves for those who continue to drive. Cities such as Hoboken, New Jersey, and Oslo, Norway, have achieved or approached zero traffic fatalities by combining these strategies with careful speed management and consistent community investment. Their success demonstrates that safe, efficient mobility for all users is both practical and achievable. Not every community needs to adopt every strategy to make progress towards Vision Zero but small efforts, from crosswalks to turning lights, can add up to save lives.

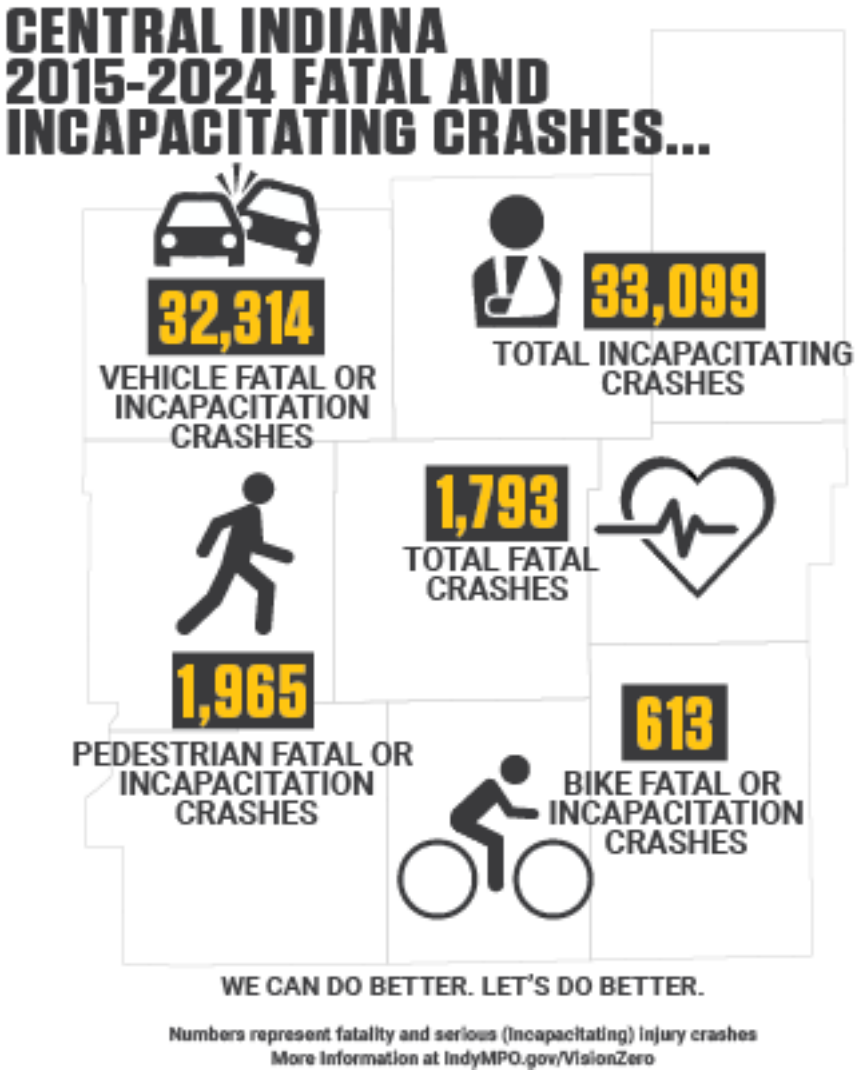
WHY VISION ZERO MATTERS

Safe access to transportation options across a community is critical to a high quality of life.

Every 24 seconds, someone dies on America's roads. Traffic injuries are the 8th leading cause of death globally and the leading cause of death for children aged 5-14 and young adults aged 15-29. In 2022 alone, an estimated 43,000 lives were lost, with millions more injured—each one a preventable tragedy. The road safety crisis demands urgent action, and with Vision Zero, we have the power to eliminate future traffic deaths.

However, traffic fatalities do not impact all communities equally. The most vulnerable road users, children, the elderly, people with disabilities, and those with lower incomes, face the greatest risks. Transportation also comes at a significant cost, both in terms of time spent and cost of travel (car payments, insurance, gas, transit tickets, etc.). Many people, due to time cost or monetary cost, face barriers to safer transportation. Limited transportation options, combined with infrastructure that fails to prioritize their safety, leave them disproportionately exposed. The danger also varies by mode of travel. Those walking, biking, using transit, or relying on mobility devices like wheelchairs pose little risk to others but are far more likely to be killed if struck by a speeding vehicle.

The Vision Zero approach is essential because it works. When meaningfully implemented, it prevents injuries and saves lives, transforming streets from hazardous spaces into places where everyone can move safely. And we know it can be done locally. By prioritizing safe, equitable, and well-designed transportation systems, we can end the devastating toll of traffic deaths on our communities.



WHY VISION ZERO MATTERS

SAFE SPEEDS CREATE STRONGER COMMUNITIES

Designing streets around safe speeds doesn't just prevent crashes, it helps streets function better for everyone who uses them. When travel feels predictable and safe, people walk more, visit local businesses, and spend more time in their neighborhoods. This strengthens community pride, supports local economies, and makes better use of existing infrastructure. Communities that balance safety and mobility tend to attract investment and become places where people and businesses want to stay.

CLEANER AIR AND HEALTHIER LIVING

Smoother, safer traffic flow cuts down on idling and stop-and-go driving. When walking, biking, and transit feel safe, some short car trips shift to other modes, reducing congestion for drivers who need to drive. The result is cleaner air, lower emissions, and better public health, benefits shared by all road users.

IMPROVED MOBILITY AND RELIABILITY

Designing for safe speeds makes the whole transportation system work more efficiently. When streets are designed for steady, context-appropriate speeds, traffic flows more smoothly, and incidents clear faster. A slight reduction in top speeds can actually move more people overall by addressing issues of street volume and crash-related blockages. Safe, predictable streets also give people real options, walking, biking, or transit for short trips, which eases pressure on main corridors. For drivers, that means fewer bottlenecks, less stress, and more consistent travel times across the network.

QUIETER NEIGHBORHOODS

Lowering vehicle speeds contributes to noticeably quieter streets. Reducing average speeds by just 5 to 10 miles per hour can lower noise levels by up to 40 percent, helping residents sleep better, reduce stress, and enjoy their surroundings. Quieter streets are a hallmark of safe, family-friendly neighborhoods where people feel comfortable spending time outdoors.

MORE JOB ACCESS AND LOWER COSTS

A transportation system that works safely for all modes of transportation helps more people reach jobs and services affordably. By making walking, biking, and transit viable, households can own fewer vehicles or drive less often, saving thousands of dollars a year on fuel, insurance, and maintenance. That's money that stays in local economies instead of leaving through fuel and car payments.

STRONGER SOCIAL CONNECTIONS

When traffic moves at safe speeds, people spend more time outside walking, visiting neighbors, and enjoying public spaces. Streets that feel safe encourage casual social contact, which builds trust and community cohesion. This "eyes on the street" effect also strengthens safety, making neighborhoods more resilient and welcoming for all ages.

ENCOURAGING PHYSICAL ACTIVITY

Vision Zero principles work hand in hand with public health goals. Slower, safer streets combined with sidewalks, bike lanes, and safe crossings make it easier for people to choose active transportation. Over time, this contributes to better cardiovascular health, reduced chronic disease, and lower healthcare costs creating a stronger, healthier community overall.

SAFE STREETS FOR CHILDREN AND FAMILIES

Vision Zero design is especially valuable for children and families. Safe speeds near schools, playgrounds, and parks gives kids independence to walk or bike and helps parents feel confident letting them do so. Streets that work for the most vulnerable road users work better for everyone.

RESILIENT INFRASTRUCTURE AND LONG-TERM SAVINGS

Designing for safe speeds reduces wear and tear on roads, vehicles, and infrastructure. Lower impact speeds mean less damage during crashes and less maintenance over time. Cities that implement Vision Zero can also attract new development and investment and associated increases in tax revenue by creating places where people want to live.

Fewer crashes mean lower public spending on emergency response, insurance claims, and infrastructure repair which is savings that can be reinvested in local improvements.

HOW TO USE THIS TOOLKIT

You can make a meaningful difference in reducing traffic deaths and serious injuries that cause irreparable harm to families, communities, and quality of life. This Toolkit provides an abundance of resources to get started including who to connect with, design and policy solutions, communication tools, and resources to advocate. Use this Toolkit to orient yourself and colleagues to Vision Zero and the tools available to work toward a goal of zero fatalities in traffic crashes.

There are multiple ways to address the goals of Vision Zero. This Toolkit acknowledges that communities face different challenges and have different opportunities for action. The Toolkit allows users to implement whatever approaches are most feasible in their community at this time.

While the Toolkit encourages users to implement whatever is feasible, Vision Zero is only truly implemented system-wide across the community through policy, design, education, outreach and communication. That is when a community will be able to best move the needle on reducing crashes and injuries, eventually eliminating them altogether.

In addition to the current section outlining the broad overview of the history of Vision Zero across the world, and the importance of implementing Vision Zero in Central Indiana, the toolkit directs you through a series of resources including:

- **Data Collection and Benchmarks:** Organizing, collecting, and evaluating data to inform solutions and ongoing effectiveness is a key component of Vision Zero results. This section includes best practices for collecting and accessing data, interpreting, and effectively using that data.
- **Planning and Policy Strategies:** To be effective, leadership must adopt and execute concrete policy changes. This section focuses on the legislative, educational, policy, land-use, and enforcement strategies a community can deploy as part of their commitment to Vision Zero.
- **Design Strategies:** Roadway design is a critical piece of Vision Zero, and builds long-term solutions for all users. This section identifies several design-based solutions for communities of all sizes and needs.
- **Resources:** Case studies and external sources for more specific information on Vision Zero action plans from across the country are included in this section.
- **Communications:** Committing to Vision Zero is worth celebrating and sharing widely.This section shares tools, templates, techniques, message creation, and branding materials needed to help educate decision makers and the broader public.
- **Decision Matrix:** The decision matrix helps users determine where to go for information in the Vision Zero Resource Toolkit. Depending on the issues or the desired approach, the Decision Matrix acts as a guide to focus the user on the most relevant resources to address that issue.

ABOUT THE IMPO

A Metropolitan Planning Organization (MPO) is a federally mandated and federally funded regional planning organization. Federal regulations require every urbanized area with a population of 50,000 or more (as defined by the US Census) to have a designated MPO. With the collaboration of local governments, MPOs complete a "continuing, cooperative, and comprehensive" planning process for the region they serve.

The Indianapolis Metropolitan Planning Organization (IMPO) is Central Indiana's federally-designated regional planning organization. The IMPO develops short and long range plans to support local governments and advance the region's goals in transportation, housing, safety, sustainability, and other quality-of-life issues. The IMPO also tracks and distributes certain transportation funds to local governments in the region for roads, transit, trails, and other means of moving people and goods around Central Indiana.

Our planning region includes almost 1,500 square miles, 36 member jurisdictions, and approximately 1.78 million residents. The IMPO planning process is a collaborative approach including community members, and is governed by boards and committees made up of elected and appointed officials from across the region as well as partner organizations who plan for and/or provide transportation services within the region. The IMPO's financial operations are governed by the Executive Committee. The IMPO's transportation functions are approved by its Transportation Policy Committee with support from the Transportation Technical Committee.

Our vision is one in which Central Indiana will thrive as we continuously improve our built environment and expand economic opportunities for all residents. The IMPO is built around four core pillars of convene (bring experts and community members together), Inform (provide reliable data to support planning and policymaking), plan (create and adopt infrastructure plans and track their implementation), and fund (fund regionally significant projects).

ABOUT THE VISION ZERO NETWORK

The **Vision Zero Network** provides resources for communities as well as a "Vision Zero Community" recognition program. This resource includes many success stories. For example, Hoboken, New Jersey has seen a significant reduction in traffic fatalities after implementing several Vision Zero design solutions including daylighting and leading pedestrian intervals for traffic signals. **Read more about how Hoboken achieved 0 traffic deaths in 4 years.** Sweden, where Vision Zero was founded, has one of the lowest annual rates of road deaths in the world and fatalities involving pedestrians have fallen nearly 50 percent. Joining the Vision Zero Network provides access to lessons on success from these communities and others.

DATA COLLECTION & SETTING BENCHMARKS

Vision Zero is a data-driven approach that makes data collection vitally important when setting goals and then tracking them over time. Not only is data used to help determine what strategies are beneficial to implement, but it helps to identify common patterns where a community could be proactive in preventing serious injuries or fatalities from occurring.

CRASH DATA COLLECTION

In nearly all cases where change is reactive, data is used to support the changes based on this information and patterns identified by using that data. The same should be done for communities looking to be proactive in their approaches to prevent collisions. For this to be accomplished to the best of a community's ability, data must be recorded frequently and accurately with the help of local government, police, and the public.

Vision Zero initiatives should be conducted with the support of community's elected officials, community departments, and community partnerships. Streamlining data collection and analysis will strengthen the case for proactive implementation. Some techniques include:

- Online incident portals outside of police reporting allow users to submit information in real time without the fear of making an unwarranted 911 call.
- Departments of transportation (DOTs), Metropolitan Planning Organizations (MPOs), and local health partners can work with law enforcement to enhance police crash reports. Currently, misinformation comes from reports with missing information that either has been omitted or is not accurate based on the actual situation.
- The public knows the community best. It is impossible for local officials to know where the least safe intersections or stretches of road are unless there are continual crashes happening. Near-miss incidents are almost never reported to authorities and there is often a significant misrepresentation of what happens in the streets of neighborhoods with high minority or low-income populations. Elected officials, department staff, and public health officials, must build trust within these neighborhoods and communicate openly with the public about the streets, intersections, and crossings that are unsafe. This allows for site-specific changes to be identified and additional funding to be allocated towards infrastructure improvements.

INTERACTIVE MAPPING

A study by the Harvard T.H. Chan School of Public Health found that bike and pedestrian incidents are often underreported, particularly among minority populations. Police data may not capture the full scope of these incidents due to reporting hesitancy, whereas hospital records often provide a more accurate picture by including cases not documented in police reports. These records serve as a valuable resource for understanding where, how, and what types of crashes occur, especially those involving pedestrians and cyclists.

To address these data gaps, many cities have turned to residents for help. They encourage community members to share insights on near-misses, unreported crashes, and other safety concerns through crowdsourced maps. These interactive tools enhance traffic safety data by incorporating local knowledge in an easy, anonymous way. By allowing users to report incidents, these maps help create a more complete and transparent public record.

The IMPO corrected the GPS locations of incapacitating injury and fatal crash records in Indiana's Automated Reporting Information Exchange System (ARIES) for 2015-2024. Several thousand of these records have been corrected, and data from 2012-2024 is available in the IMPO's online Crash Dashboard. Due to a change in the definition of "incapacitating injury," data from 2012–2014 is not displayed in the dashboard, but the information can still be obtained upon request.

To visit the dashboard, which records data from across eight counties, please visit **indympo.gov/crash**.

HIGH INJURY NETWORK DATA

The IMPO developed a High Injury Network (HIN) to identify the local corridors with the highest frequencies of crashes resulting in incapacitating injuries and fatalities within the MPA. The HIN represents the top 10% (234 centerline miles) of regional collector and arterial streets scored by the number of incapacitating injury and fatal crashes per centerline mile. The HIN enables IMPO and local agencies to prioritize safety investments and other strategies on the streets with the highest number of severe crashes to make rapid progress toward regional safety goals.

To view the network data please **indympo.gov/safety**

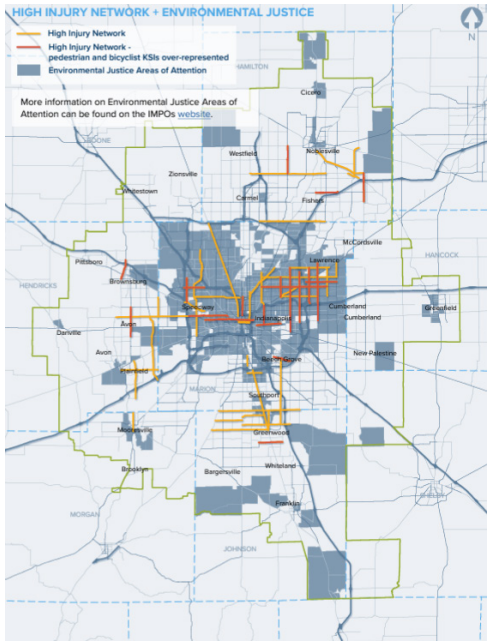
HIGH CRASH INTERSECTION DATA

The IMPO has completed three studies on **high crash intersections** in the region. The first completed in 2016 identifies the top fifty (50) high-crash locations within the region. In 2019 the IMPO updated the intersection study identifying 24 high-crash intersections in the region and again recommending improvements. In 2023 the IMPO completed a new type of intersection safety study to identify 19 high-crash locations within the Indianapolis Metropolitan Planning Area (MPA). This included five high-priority pedestrian and bicycle locations.

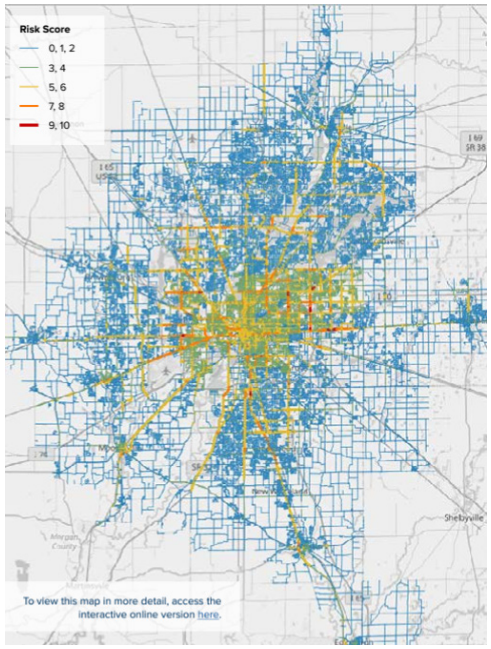
For each location, the team reviewed crash data and existing conditions, created a collision diagram, conducted a field check, met with local engineering and police representatives, and identified specific improvements to remedy existing safety issues. Recommended improvements range from lower-cost maintenance items, such as signage and pavement markings, to higher-cost capital improvements, such as intersection reconstruction or "road diets".

ROAD RISK SCORE MAP

As part of the 2023 Safety Action Plan Update, a risk score analysis was performed on the IMPO's road network. The analysis looked at the following higher-risk roadway attributes to determine the risk score: Equity Area, Area Type, Pedestrian/Bicycle Exposure, Lanes, Left Turn, Speed Limits, and AADT. The Risk Score can be used to evaluate the relative safety of streets and roads in the IMPO region. View the **Risk Score Map** for more information.



High Injury Network



Road Risk Scores

HOW TO COLLECT AND USE DATA

Collected data can be used by communities to identify crash patterns and help communities improve safety conditions before additional crashes occur.

A few ways to collect data are:

- Recording collision locations on a map based on police and hospital reports
- Completing walk audits to evaluate all transportation and infrastructure conditions along a specific corridor or roadway segment
- Analysis of driver, pedestrian, and bicyclist behavior through studies, experiments, and programs
- Use crash data to prioritize locations for investment or further study
- Use the **Crash Modification Factor (CMF) Clearinghouse** to asses solutions to crashes based on data.
- Use data to set benchmarks for implementation

BENCHMARKING

Benchmarking is the act of measuring something before making a change. Then measurements are made after the change at certain time intervals to see if the change has resulted in an improvement or if conditions have been made worse. Monitoring the effect of changes is essential to identify patterns of success, failure, or unanticipated outcomes.

Benchmarking can take place by collecting data at regular intervals, such as during certain seasons or annually, reviewing and analyzing that data, and possibly making changes as needed. Having evidence of success allows a community to replicate a pilot project or strategy in new areas experiencing the same safety concerns, or scaling the strategy up to implement community-wide.

Benchmarking results should be accessible to the public. By collecting, analyzing, and sharing data, communities with similar issues can determine if certain solutions will work in their own context.

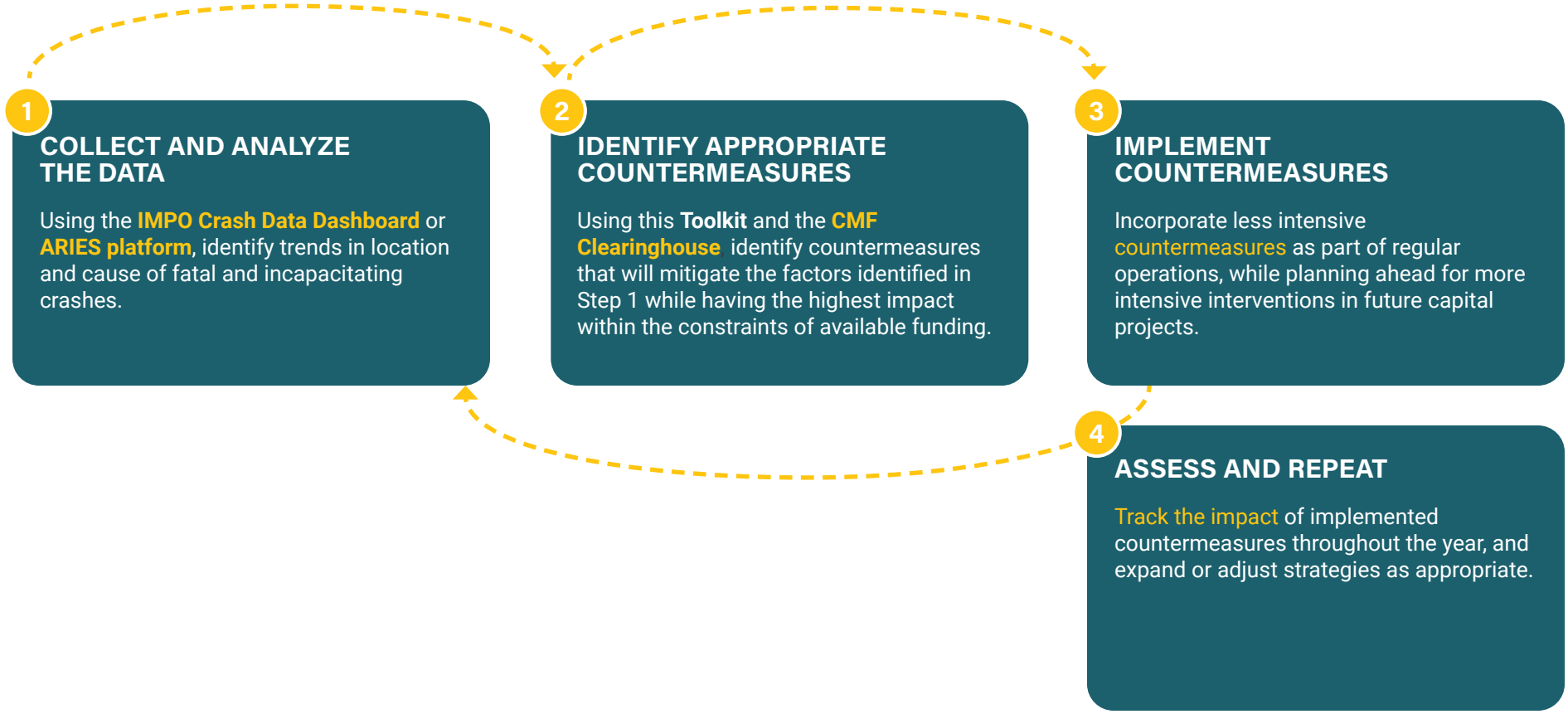
HOW DO YOU MEASURE BENCHMARKS?

Benchmarking can be completed many different ways; using paper, machines, hand held devices, website, etc. The device chosen should be the most accurate and easiest to keep track of the goals. Some communities might choose to analyze data monthly, others on a semi-annual basis, and others might only be once annually. San Francisco uses a **spreadsheet** to record all incidents. A score card was used in this situation and updated as frequently as necessary with data. Other communities may use the overall data to see if they're reaching goals set in their plans. All of this benchmarked data is analyzed and summarized into a progress report.

Scorecards can be tailored based on the community or modal data for vehicles, bicycles, or pedestrians. There is no single method to organize these scorecards and measure a community's goals. As long as a community records data and information accurately, assessing the success of strategies and solutions will be made easier. For example, New York City employed a **before-and-after injury analysis**, comparing the average year of crash data before treatment installation to the average year of crash data after installation. The City used this data to track which investments had the highest returns in safety improvements for people driving, walking, and biking.

DATA-DRIVEN DECISION MAKING

PROCESS DIAGRAM

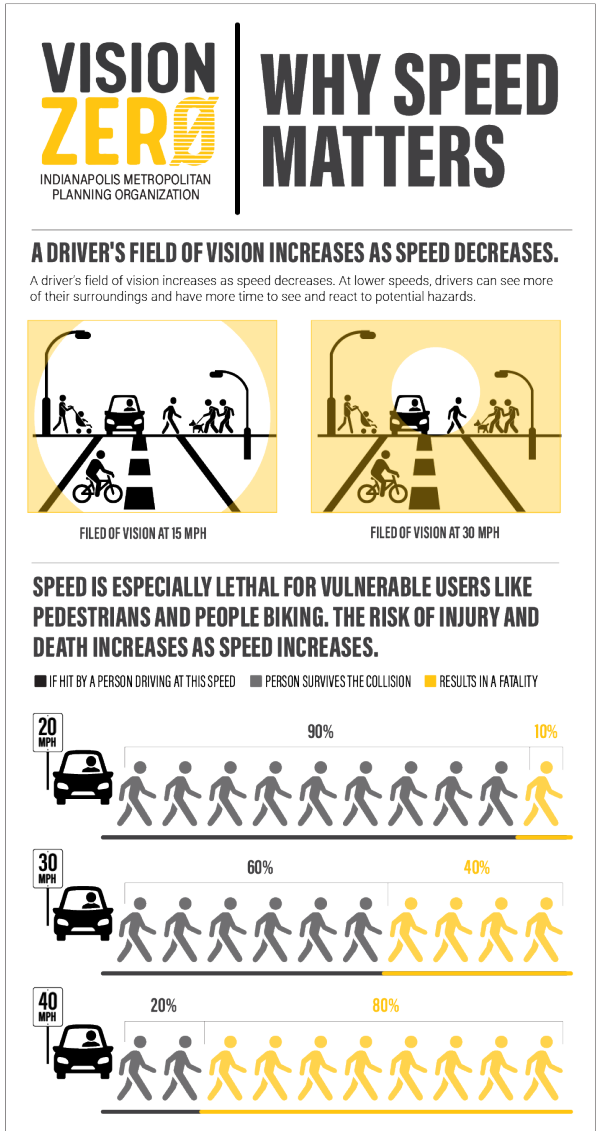


LEVELS OF SERVICE, SPEED, AND DEATHS

In transportation planning, the Level of Service (LOS) of roadways measures factors such as car density per mile per lane, average speed in the area, and the demand-to-capacity ratio. For instance, a LOS of A indicates smooth, free-flowing traffic with no obstructions, allowing for easy maneuvering. In contrast, a LOS of D reflects a situation where traffic is starting to slow down due to increased density, limiting the drivers' ability to maneuver.

The LOS rating is determined by the speed of travel. However, speed is also a key risk factor in road crashes, as it is directly linked to both the likelihood and severity of injuries. As speed increases, so does the distance a vehicle covers during the driver's reaction time, which reduces the chance of avoiding a crash in time to prevent serious injury or death. especially when there are pedestrians or cyclists involved.

Vehicle speed at the moment of impact strongly correlates with the chances of survival. For example, a pedestrian hit by a car traveling at 35 miles per hour is five times more likely to die than someone hit by a car going 20 miles per hour. Research also shows that at higher speeds, drivers have reduced peripheral vision and are less likely to notice or anticipate potential hazards, such as other vehicles approaching, pedestrians crossing the street, or children playing. This has led to **tens of thousands** of preventable deaths.



Resources:

- **Why Safety and Speed are Fundamentally Incompatible—a Visual Guide**
- **Transportation for America Level of Service Analysis**
- **Severe and Fatal Crash Dashboard**
- **Pan American Health Organization Speed and Road Crashes Report**

SPOTLIGHT

DATA-DRIVEN DECISION MAKING IN HANCOCK COUNTY

Hancock County takes a holistic, data-driven approach to crash reduction. The county conducts an annual traffic safety audit using ARIES data - usually in the winter when construction slows - to identify top contributing factors to traffic crashes. After identifying root causes, they utilize the **Crash Modification Factors Clearinghouse** to identify countermeasures to those causes. County Engineer Gary Pool targets countermeasures derived from studies that have at least a four star rating and are peer reviewed. Pool stresses the importance of taking a system-wide approach. While a more expensive countermeasure may result in a greater reduction in crashes at one location, it is often the lower barrier countermeasures, such as striping and signage, that result in the greatest overall reduction in crashes when implemented county-wide. While more intensive design interventions are incorporated into capital projects, Pool says that the greatest impact comes from operational interventions. For example, the county recently saw significant reduction of crashes by installing rumble strips at every four-way intersection in the county. In the period leading up to September of 2022, the County achieved zero traffic fatalities for 14 months.

While this approach can be applied to car crashes, the County's engineering department stated that a more targeted approach needs to be taken for pedestrians. Due to a lower number of crashes involving a pedestrian - Hancock County typically only sees about one per year - there simply isn't enough data to identify county-wide trends. Instead, Pool takes a case-by-case approach to addressing these crashes. He noted a recent fatality involving a truck driver who exited his vehicle on a roadside near an Amazon warehouse. The county worked with Amazon to establish a better understanding of related safety issues and install new lighting at targeted locations.

PLANNING & POLICY STRATEGIES

There are multiple planning and policy strategies that effectively reduce the incidence of crashes within a community. This section will identify planning and policy strategies to reach make Vision Zero.

PLANNING

VISION ZERO RESOLUTIONS + IMPLEMENTATION

A Vision Zero resolution reflects a community's recognition of the problem and its intent to pursue effective strategies to eliminate traffic deaths and serious injuries. It signals that safety is a shared priority.

However, a resolution alone does not create change. It is a statement of intent, not an enforceable policy, and real progress requires action beyond words. True Vision Zero success depends on bold, coordinated steps that turn the commitment into reality.

Early actions can demonstrate momentum, such as adding bike lane striping or flexible posts to a planned roadway project, while leaders work toward adopting a comprehensive policy and implementation plan.

Vision Zero is a long-term commitment. Achieving it requires consistent leadership and sustained effort, through both system-wide changes and site-specific improvements, to move steadily toward the goal of zero traffic-related deaths and serious injuries.

On August 17, 2022 the IMPO Transportation Policy Committee adopted a Vision Zero Policy committing to reduce serious and fatal crashes by 35% by 2040. The IMPO considers this a starting point toward the goal of eliminating traffic deaths fully in the long term. The resolution supported a regional vision to reduce motorist, bicyclist, pedestrian, transit user, and other transportation-related deaths and serious injuries. Unlike other resolutions previously adopted for performance measures, this one does not have a mandate.

Indianapolis IMPO's policy resolution

LONG-TERM PLANS

Planning is at the core of every community and every system. It forms the policy basis for what communities want to do for the next 20 years in their community. There are many different types of plans that can be created to address a range of needs in a community in which elements of Vision Zero could be incorporated into or a community could create a specific Vision Zero Action Plan. This section will summarize the various types of plans and how Vision Zero could be incorporated.

Vision Zero Plans

A Vision Zero Plan is an implementation plan that is concrete and action driven. It is focused on building equitable access to a community-wide multi-modal transportation system by addressing the problems both system-wide and at specific locations.

A Vision Zero Action Plan can take many forms but often includes:

- **Political commitment –** The highest-ranking local officials (mayor, council, city/town manager, etc.) makes an official and public commitment to a Vision Zero goal of eliminating traffic fatalities and severe injuries among all road users (including people walking, biking, using transit, and driving) within a set time frame. This should include passage of a local policy that states clear goals, commits to a timeline, identifies stakeholders, and demonstrates commitment to engagement and outcomes.
- **Action plan –** A Vision Zero Action Plan (or strategy) is created within one year of initial commitment and is implemented with clear strategies, owners of each strategy, interim targets, timelines, and performance measures.
- **Multi-disciplinary leadership –** An official Vision Zero task force is created and charged with leading the effort. The task force should include, at minimum elected officials, community leaders, business owners, and department heads including planning, fire, emergency services, police, public works, District Attorney, senior services, disability groups, and schools.

- **Equity –** Stakeholders commit to both an equitable approach to Vision Zero by establishing inclusive and representative processes, as well as equitable outcomes by setting measurable benchmarks to provide safe transportation options for all road users in all parts of the jurisdiction.
- **Cooperation and collaboration –** A commitment is made to encourage meaningful cooperation and collaboration among relevant governmental agencies and community stakeholders to establish a framework for implementation partners to set shared goals and focus on coordination and accountability.
- **Systems-based approach –** Leaders commit to and prioritize a systems-based approach to Vision Zero by focusing on the built environment and policies that affect the built enviroment.
- **Community engagement –** The Vision Zero task force plans meaningful community engagement, such as public meetings, workshops.
- **Data-driven –** Stakeholders commit to gather, analyze, utilize, and share reliable data to understand traffic safety issues and prioritize resources based on evidence of the greatest needs and impact.
- **Transparency –** The process is transparent to stakeholders and the community, including regular updates on the progress on the Action Plan and performance measures, and a yearly report (at minimum) to the local governing body.

Source: **Vision Zero Network**

Comprehensive/Land Use Plan

A Comprehensive/Land Use Plan is a 20-year policy document that lays out how a community will develop over the next 20 years. It illustrates the quantity, quality, type, and location of various land uses. Indiana has minimum requirements for a plan as permitted by the 500 series of Title 36-7-4 of the Indiana Code. A community's comprehensive plan must include:

- A statement of objectives for the future development of the jurisdiction
- A statement of policy for the land use development of the jurisdiction
- A statement of policy for the development of public ways, public places, public lands, public structures, and public utilities

Transportation is often an integral part of the comprehensive plan because land use and transportation are inherently linked. The land use intensity and location directly affect recommendations and improvements to a multi-modal system. Incorporating Vision Zero elements into a Comprehensive Plan including goals, principles, and analysis of the transportation system is a natural evolution of the transportation element of these plans.

Resources:

- **APA Indiana Citizen Planning Guide: Chapter 7 Comprehensive Plans**
- **Local Comprehensive Plans**

Bike & Pedestrian Plans & Transportation Plans

Bike & Pedestrian Plans focus specifically on bike and pedestrian connections throughout the community, whereas transportation plans address all modes of transportation. While these plans focus on the integration of multi-modal options into the transportation systems, Vision Zero strategies have not historically been included.

Both types of plans use a systems-based approach. A systems-based approach takes into account the needs of community, the existing conditions, the strengths, and the deficiencies, and develops recommendations and strategies based on a set of criteria like costs and safety in order to create the most efficient, safe, and best possible environment for all transportation users.

Updating Bike, Ped, and Transportation Plans to incorporate the principles of Vision Zero will not alter the systems-based approach. As a community's needs change over time,

traffic patterns and development will alter infrastructure needs. Additionally, as roadway improvements occur, additional infrastructure improvements could be done at the same time. Vision Zero's safe systems approach allows communities to move beyond crash data and look ahead to identify what areas are potentially unsafe and try to prevent them before they happen. Design elements such as separated bike lanes incorporated into a road improvement, multi-use trails with an enhanced crosswalk to connect a neighborhood with a school, and adding lighting along a dark corridor are things that should be considered during the planning phase.

Resources:

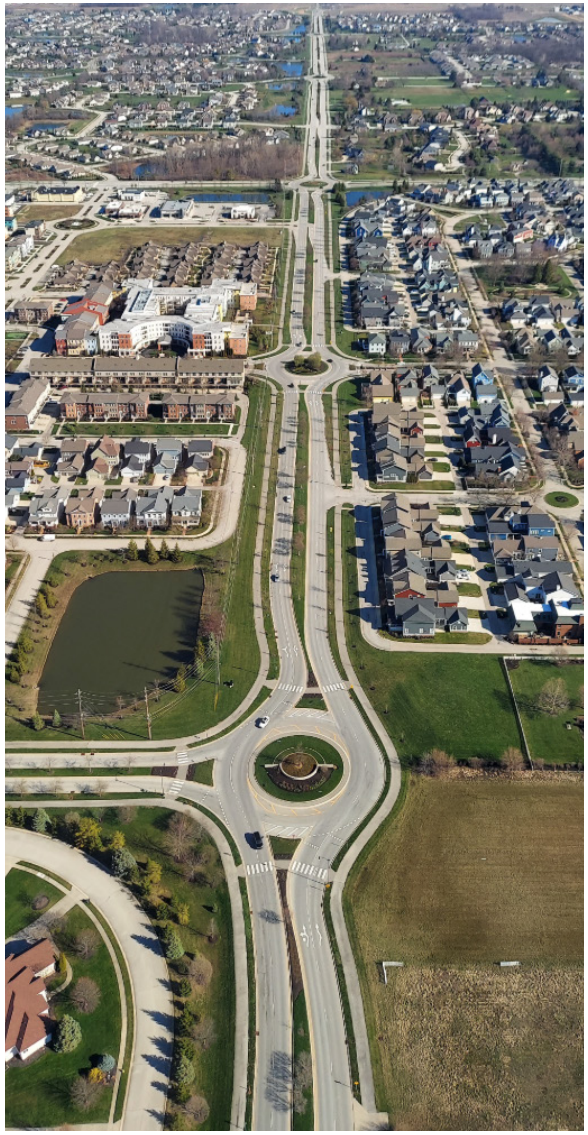
- **Local Bikeways/Walkways/Transit Plans**
- **Regional Bike/Pedestrian Plans**

Highway Safety Improvement Plan (HSIP) / Highway Safety Plan (HSP)

The Highway Safety Improvement Plan helps states plan highway safety improvement projects using a performance-driven process, implement those projects, evaluate the effectiveness, and annually report on the status of the implementation efforts. Many communities have a state-owned highway that runs through or adjacent to their community. Coordination with INDOT becomes critical in planning and addressing safety in the community. Incorporating recommendations for state-owned roadways into a local plan can help build consensus with the state to help make the changes and infrastructure improvements to the portion or stretch of roadway that is in the community.

Resources:

- **INDOT HSIP Plan**



TRANSIT PLANS AND SAFETY

Transit in Central Indiana

In the Central Indiana region, major transit services include IndyGo bus routes, Bus Rapid Transit (BRT) routes, and paratransit services focused on residents with disabilities. It also includes CIRTA services focused on travel demand management such as Commuter Connect to support carpooling and various workforce connector programs to connect residents to job centers.

Transit as a Safety Strategy

Even modest increases in public transit mode share can provide disproportionally large traffic safety benefits. One means of achieving safety benefits is through "mode shift" or shifts from one means of transportation to another (switching from a personal car commute to transit, for example) which can reduce the number of personal vehicles on the road thus **reducing crash risks**. Mode shift also reduces the risk of crashes from those who may be inexperienced, fatigued, or under the influence of drugs or alcohol and would otherwise be driving personal vehicles. The presence of a trained bus driver whose job is to focus on the road makes travel safer and makes travel possible for many populations that might otherwise not have transportation options. Transit can also support more walkable communities which further reduces total vehicle miles traveled and provides additional safety and **public health benefits** such as improved air quality and reduced health disparities. All of these benefits add up, **a 2016 study** found passengers have less than a tenth the per-mile crash rates as car drivers, and transit-oriented communities have less than a fifth the total per capita traffic fatality rates as in automobile-dependent communities. A 2**014 study** found that increased mass transit miles traveled per capita over 29 years for 100 U.S. cities was associated with lower traffic fatality rates in those cities.

Bus Rapid Transit (BRT) and Safety

Bus Rapid Transit (BRT) provides additional safety benefits. Dedicated lanes are a form of "road diet", a proven safety countermeasure that reduces dangerous speeding by physically narrowing roads. Dedicated lanes also separate transit vehicles from other vehicles that may be on the road, reducing the potential for conflict. Dedicated lanes also help implement other parts of the "Safe Systems" approach by providing emergency vehicles the lane to utilize when needed. In Central Indiana, BRT lines have a raised median separating the dedicated lanes. This limits mid-block left turns and confines them with U-turns at signalized intersections. This reduces points of conflict and potential accident locations by limiting movements to right-turn only in some locations (think turning right onto College Avenue in South Broad Ripple instead of crossing College or turning left). Planned bus rapid transit projects in Central Indiana will also advance safety by providing major investments in sidewalks and ADA curb ramps. By providing safe mobility options to residents of all ages, abilities, and incomes transit is essential to any Vision Zero strategy.

Resources:

- **Central Indiana Transit Plan**
- **IndyGo Service**
- **IndyGo Access (Paratransit)**
- **CIRTA Workforce Connectors**

SPOTLIGHT

TRAFFIC DEATHS AREN'T ACCIDENTS

In 2006, Jessie Singer's best friend, Eric Ng, was killed by a drunk driver who veered onto a bike path in New York City. The driver later stated, "*I got into an accident. My car hit this person*." This passive phrasing removed accountability, framing the crash as an unavoidable accident rather than the result of preventable circumstances.

While traffic crash deaths are rarely intentional, they are not accidents. Public policy decisions, such as prioritizing motor vehicle throughput over the safety of all road users, create conditions that make crashes not only possible but likely. Had Eric Ng been riding in a bike lane protected by physical barriers, the drunk driver would likely never have been able to reach him, and his life could have been saved. The decision to use flexible bollards instead of fully protecting the bike lane was a deliberate policy and design choice—not an accident. When government decisions lead to preventable deaths and injuries, calling them accidents obscures responsibility.

A common counterargument to design-based traffic safety solutions is that crashes are caused by "bad drivers." This assumes that driver behavior is the primary issue and that re-educating individuals will reduce crashes. However, this approach fails to address the underlying conditions that encourage speeding and make fatal crashes possible.Drivers in Central Indiana are not uniquely reckless, yet they are significantly more likely to die in traffic crashes than those in Vision Zero communities like Hoboken, which prevented all traffic deaths for four consecutive years. This is not because Hoboken's residents are inherently more careful, less tired, or less distracted but it is because the city has intentionally implemented Vision Zero policies and safer street designs.

All drivers will, at some point, be tired, distracted, or in a hurry. Effective policies recognize these human realities and remove the conditions that turn routine mistakes into tragedies. Traffic errors are inevitable but traffic deaths are a policy choice.

Resources:

- **IMPO Speaker Series: Traffic Safety Talk with Jessie Singer**
- **Book: There Are No Accidents by Jessie Singer**

POLICY SOLUTIONS

EDUCATIONAL PROGRAMS FOR PROBLEM DRIVERS

Most educational and "awareness" campaigns have **no significant lasting impact** on reducing traffic crashes. However, enforced educational programs for problem drivers have **a positive effect** on reducing traffic crashes. For example, New York City passed a law that would require any driver whose vehicle is caught multiple times on camera speeding or running red lights to take a traffic safety course or risk having their car impounded. The three-year program, the first of its kind in the country, attempts to target drivers who repeatedly engage in risky behavior and change their behavior without leveraging fines. Councilors have also **considered requiring** that drivers charged with drunk driving, negligent homicide, or leaving a crash scene have their licenses suspended while awaiting adjudication

ENCOURAGE HELMETS BUT ELIMINATE BIKE HELMET LAWS

Bike helmets make people on bikes safer but legal requirements to use helmets largely do not. Laws or ordinances requiring bike helmets reduce the number of people biking by intimidating more casual cyclists. Fewer people biking results in less visibility and usually less safe bike infrastructure. Furthermore, bike helmet laws have been used to target minority groups. While bike helmets should be encouraged and do provide safety benefit no bike helmet is designed to save the life of a person biking when hit by a vehicle. Focus should instead shift to infrastructure solutions to keep people biking safe.

UPDATE CONSTRUCTION STANDARDS

Require that pedestrian, bicycle, and transit facilities remain open and accessible in local work zones unless extraordinary circumstances make it infeasible. If not possible, provide clear detours marked well in advance of the closure. Also ensure that construction signage does not block sidewalks or bikeways. Signage placed on the sidewalk forces vulnerable users including people using wheelchairs into dangerous situations or stop their mobility altogether.

Restriping is a common maintenance practice. Agencies may adopt policies that require safety reviews before restriping occurs. While the paint is not the same as actual protection, striping may be used to narrow perceived lane width or add bike lanes during otherwise routine maintenance. While not as beneficial as reconstruction, is a relatively low-cost means of reducing risk.

REPORT TRAFFIC CRASHES ACCURATELY AND HONESTLY

If we accept the premise of Vision Zero, we cannot accept the status quo that refers to deadly traffic crashes as isolated “accidents”. Studies show that even subtle editorial choices surrounding traffic crash reporting have major impacts on a reader’s understanding of the crash including if the reader sympathizes with the victim or blames them, and what solutions the reader wants to see.

Traffic crashes are predictable and preventable. Public policy choices like road design and vehicle regulations have resulted in the conditions by which deadly traffic crashes can and often occur. For example, we know wider roads increase the number of drivers speeding whereas narrower lanes slow speeds which reduces crash impacts. When reporting acknowledges the preventable nature of traffic crashes, the ongoing policy choices that lead to crashes, and the disproportionate impacts of those crashes on vulnerable residents we can develop a framework for action.

- **World Health Organization** - Reporting on road safety: a guide for journalists
- **Collaborative Sciences Center for Road Safety** - Shaping the narrative around traffic injury: A media framing guide for transportation and public health professionals
- **Texas A&M University -** Does news coverage of traffic crashes affect perceived blame and preferred solutions?

BAN TURNS ON RED

When drivers approach an intersection and are trying to “turn right on red” they direct their attention to potential oncoming traffic to their left. People walking or biking through crosswalks to the right of the vehicle are unlikely to be seen and are, therefore, at a significantly greater risk of being hit. Several cities around the country have banned “turn right on red” at all or many of their intersections and studies have shown that they reduce crashes and near misses at those intersections. While research on this is growing, this is an easy to implement policy citywide or at high-impact intersections with signage.

Research:

- **The Effect of Right-Turn-On-Red on Pedestrian and Bicyclist Accidents**
- **Right-turn-on-red laws and motor vehicle crashes: A review of the literature**
- **City of Toronto Road Safety Plan Update**
- **Analysis of Expanded No Turn on Red Applications in Washington, DC, USA**
- **How do drivers allocate visual attention to vulnerable road users when turning at urban intersections?**

ALCOHOL CONTROL PROGRAMS IN WORKPLACES

Mandatory alcohol testing programs for motor carrier drivers were implemented in the United States in 1995 and included pre-employment testing, random testing, reasonable suspicion testing, and post-accident testing Later **studies** have confirmed that these policies significantly reduce fatal crashes and they can be implemented for a range of employee types.

ITS SOLUTIONS

Intelligent transportation systems (ITS) are the integrated application of various technologies and management strategies to provide traveler information to increase the safety and efficiency of the surface transportation system. Agencies should budget for ITS improvements to improve safety.

- Assess emergency service routes and equip all signalized intersections to accept input from oncoming emergency vehicles
- Install Automated Pedestrian Detection devices that determine whether a pedestrian needs more **time to cross the roadway**
- **In rural areas, sig**nage may alert drivers to approaching traffic at non-signalized intersections.

For more information see the MPO's **regional ITS Architecture Update** completed in 2024.

TRAVEL DEMAND MANAGEMENT

Methods to reduce the amount of travel demand on roads also help to reduce potential crashes. This is known as **Travel Demand Management (TDM)**. Local agencies can promote this practice at the community level or within the agency itself.

For example, employers may promote work from home, carpool, walking, riding a bicycle, and taking transit among local agency employees to reduce the number of cars on the road.

Employers may change incentives, such as phasing out free parking spaces for employees working in transit-rich locations and instead providing transit passes. Simple amenities such as secure bike storage can also enable employees to commute differently. Employers can also consider “guaranteed ride home” programs.

The **USDOT Climate Strategies That Work** document contains a range of research on TDM strategies that have co-benefits of improving safety and improving transportation options.

CIRTA's Commuter Connect vanpool program is a successful form of TDM

WORK WITH SCHOOLS

Children walking, biking, or exiting vehicles are the most vulnerable road users. Safe Routes to School programs **are effective** but often time-consuming and costly for school districts. While worth pursuing, local agencies and school districts can implement the engineering, enforcement, and educational aspects of the program without using the specific safe routes to school grant, including through IMPO managed funds.

It is the responsibility of drivers and policymakers to ensure children are safe walking or biking to school but education programs for children do **show some benefits**. Knowledge and behaviors of young children may be improved through education and training programs, but that behavior in real-world traffic situations is more likely to be modified if the program incorporates interactive training with opportunities for practice and positive reinforcement.

Agencies may plan and adopt policies to provide short- and long-term solutions at schools. The City of Edmonton, AB did a full multi-year review of safety around all elementary schools and implemented real engineering solutions. While the City completed the review, it offered temporary interventions to schools such as speed feedback signs, signs for the road median, and crosswalk painting.

COMMUNITY MOBILITY RITUALS

Events like community bike rides, neighborhood walks, open street festivals, and public transit excursions bring people together around local mobility, expose people to different forms of mobility, and create shared experiences and values. Agencies should attend, sponsor, or plan **community mobility rituals** to better engage residents and allow staff to experience the mobility options themselves.

CRASH REVIEW GROUPS

Fatal Crash Review groups are multi-disciplinary working groups typically made of police, engineering, and planning experts that review each fatal crash in a community. These groups review the engineering, environmental, vehicle, and behavioral factors for fatal crashes and make design and policy suggestions in an effort to implement countermeasures and prevent future crashes.

SPOTLIGHT

CRASH REVIEW GROUPS

Washington, D.C. has one of the most advanced and accountable post-crash response systems in the U.S., designed to ensure that every traffic fatality results in concrete action rather than mere documentation. The city's Major Crash Review Task Force, led by the District Department of Transportation (DDOT), brings together police investigators, traffic engineers, planners, and public health professionals to examine every fatal crash after criminal proceedings are complete. The group evaluates contributing factors such as roadway design, lighting, signage, and driver behavior, then issues formal recommendations to the Mayor and Council for engineering, enforcement, and policy changes. This multi-agency collaboration ensures that the lessons from each tragedy directly shape the city's transportation design and safety priorities.

A key innovation in Washington's model is its legally mandated Rapid Response Program, created under the Vision Zero Enhancement Omnibus Act. The law requires DDOT to inspect the site of every fatal or likely fatal crash within 30 days, publish a public report, and implement interim safety measures whenever feasible. These quick interventions, such as installing flexible posts, daylighting intersections, modifying turn radii, or adding protected bike infrastructure, can occur within weeks of a crash, while more permanent design changes are planned. The city posts follow-up memos and crash data on its public Vision Zero dashboard, giving residents visibility into what changes have been made and where.

Portland, Oregon takes a similar but more systemic approach through the Portland Bureau of Transportation's Vision Zero program, which compiles annual deadly crash reports and tracks patterns across the city's high-crash network. Rather than focusing on individual sites, Portland uses these reviews to guide corridor-level changes such as speed reductions, new crossings, and quick-build infrastructure. While Portland's process excels at long-term, data-driven prevention, D.C.'s model stands out for its immediate, site-specific response to tragedy turning every crash into an opportunity for near-term safety action and public accountability.

UPDATE BUDGETING PRACTICES

Create dedicated expenditure lines within the transportation operating budget for transportation safety improvements with needs identified in a capital improvement plan. Establish a permanent funding source for a Vision Zero program and align capital improvement programs with specific safety goals.

Agencies make hard decisions on budgets and goals. Agencies should have a policy to prioritize road user safety over speed in operations and design decisions and review this policy during the decision-making process.

ESTABLISH CRASH THRESHOLDS

Develop policy thresholds such as the number of crashes on a road at which point the agency is required to initiate an engineering study for safety with guidance for when to consider specific roadway or intersection modifications.

UPDATE FINE AND FEE STRUCTURES

Fines are a large obstacle for lower-income residents while not a deterrent for higher income residents. Developing equitable fine and fee structures for traffic violations like blocking bike lanes can provide fairer and more effective enforcement.

REQUIRE FUTURE CITY/COUNTY VEHICLES TO BE SAFE

Right-size agency-owned vehicles by updating vehicle purchasing standards to ensure the agency phases in smaller vehicles with the latest crash reduction and safety technology into its fleet where possible.

PERFORM PLACE OF LAST DRINK STUDIES

Implement a "Place of Last Drink Survey" to track where DUI offenders last obtained alcohol and analyze data to promote responsible practices in the sale of alcoholic beverages.

STOP ILLEGAL PARKING IN SIDEWALKS, BIKE LANES AND TRAILS

When bike lanes are blocked by parked cars, delivery trucks, and other obstacles people on bikes are (often quickly and unexpectedly) forced into vehicle lanes. Local agencies should provide a means of reporting obstructions in bike lanes or sidewalks and actively ticket those vehicles (typically using civilian agency staff).

Vulnerable road users including people walking, biking, and using mobility devices are at increased risk at night.

SNOW REMOVAL

Prioritize snow removal on sidewalks, paths, and bike lanes and publish a list of city sidewalks and bicycle lanes that are prioritized for snow removal. This allows residents to plan for their commutes before a snowstorm and ensures that those without access to vehicles (or who cannot safely operate a vehicle in the snow) still have the ability to commute.

TRAIN OFFICIALS, STAFF, AND VENDORS

Elected officials and staff members across departments including engineering, planning, police, finance, and communications can benefit from a better understanding of Vision Zero. Different departments will have different training needs. Police officers may participate in the NHTSA's pedestrian training for law enforcement. Engineers and planners have access to a wide variety of trainings from their professional organizations. Local agency vendors with significant transportation components should be trained on Vision Zero and road safety as part of the selection process.

BIKE HEADLIGHT PROGRAMS

Many people who bike for their commutes must bike in the pre-dawn, evening, or late-night hours. Several cities around the country have implemented bike light programs to provide bike lights to these users.

COMPLETE STREET POLICIES AND CHECKLISTS

A **complete streets policy** is a commitment by a city, county, or state to design and operate streets that are safe, comfortable, and accessible for everyone, regardless of age, ability, or how they travel. This includes people walking, biking, using mobility devices, riding transit, or driving. The policy guides transportation planning and project development to ensure that streets support all users, not just cars. It often includes design standards, performance measures, and procedures to integrate safety and equity into every street project. hese policies help reduce traffic deaths by prioritizing safer speeds, better crossings, and protected bike lanes. A Complete Streets checklist ensures that safety features are considered early in every project. This systematic approach helps embed Vision Zero principles into everyday planning. Together, they create safer, more predictable, and more inclusive transportation networks.

PARTNER WITH HEALTH SYSTEMS FOR CAR-SEAT FITTINGS

Coordinate with health systems to host free car seat fitting stations and parent education during pediatric visits or community events. Distribution plus education programs can increase proper restraint use by **up to 70%,** and hands on demonstrations make correct installation four times more likely than education alone.

ACTIVATE USERS THROUGH CORPORATE, SCHOOL, & COMMUNITY PROGRAMS

Work with employers, schools, and local organizations to host or encourage guided group rides, group bus trips, sponsored bike share memberships, route familiarization workshops, and commute challenges to immerse participants in new street designs and new modes of transportation. These trainings can be combined with travel demand management strategies such as employer-sponsored bus passes, parking cash-out programs, and incentives for using transit, biking, or walking instead of driving.

When people participate in structured programs like guided rides or commute challenges, they begin to shed **windshield bias**, the driver-centered perspective on how streets should function. These hands-on experiences build comfort with navigating infrastructure, encourage behavior change, and increase empathy for others on the road.

PROTECT CONSTRUCTION WORKERS

Local agencies play a vital role in safeguarding construction workers through smart design, targeted enforcement, and coordinated operations—including those outlined in the Intelligent Work Zone Toolkit. Queue warning vehicles and traffic management plans with early alert systems help reduce rear-end crashes. Agencies can support law enforcement by providing training on work zone protocols and deploying tools like radar-based speed feedback signs, smart signage, and Automated Flagger Assistance Devices (AFADs) to reduce worker exposure. Integrating safety early through Prevention through Design (PtD) helps eliminate hazards before projects begin.

While currently limited to state use, Indiana's Safe Zones pilot has shown promise. This initiative introduced automated speed enforcement in active work zones and has reduced excessive speeding by 70%, offering a potential model for future local implementation.

ENGAGE, EDUCATE, AND TRAIN RESIDENTS

While urban design may be the driving force in shaping road safety and behavior, education and outreach (rather than just “awareness”) helps residents understand how transportation improvements work, why they are needed, and how to use them safely. When residents know how and why projects are happening, they are more likely to support those efforts and adopt safe travel habits.

Effective communication strategies can reduce confusion and build trust. Residents benefit from simple, clear information about how to walk, bike, drive, and ride transit safely. Well-designed materials such as social media posts, printed handouts, route maps, and short trainings from trusted people within the community can help explain how to use transportation infrastructure. Topics may include how to ride in a bike lane, how to follow bus lane rules, how to read pedestrian signals, or what new street markings mean. These materials work best when they are timely, easy to understand, and tied to real changes in the community.

In areas where new infrastructure is being introduced, in-person support helps residents prepare, adjust, and enjoy new opportunities. Hands-on workshops, pop-up events, and neighborhood visits give residents a chance to ask questions and build confidence. These programs are especially useful when delivered early and consistently. National research shows that education works. In the Washington D.C. region, adding clear education has boosted bus lane compliance by 25%.

For working adults and their employers, simple amenities such as secure bike parking, changing areas, and showers at their workplaces can make biking or walking to work more practical. Employers can also offer support through incentives, such as bike-to-work rewards, parking cash-out programs, transit passes, or discounts on bike gear and equipment. Together with infrastructure changes, these efforts create a culture of road safety.

ZONING AND LAND-USE REFORMS

Land use policies play a fundamental role in shaping transportation systems and determining safety outcomes. Patterns of urban sprawl, marked by low-density development, longer travel distances, and car dependency, typically result in higher crash rates. This is due in part to increased vehicle miles traveled (VMT), higher operating speeds, and the near-total reliance on personal vehicles. In these environments, not only are drivers more exposed to crash risks, but so too are vulnerable road users like pedestrians and cyclists, who must navigate infrastructure built primarily for fast-moving, heavy vehicles.

In contrast, compact, higher-density developments support shorter and slower trips, encourage walking, biking, and transit use, and reduce the need for long car journeys. With decreased VMT and lower average speeds, overall crash exposure diminishes. Dense street grids with frequent intersections also slow down vehicle speeds, making severe crashes less likely. This combination, less driving, slower speeds, and more active travel, not only enhances safety for everyone, including drivers, but also shifts the risk dynamics as a mistake made on a calm, walkable street is far less likely to be fatal than one made on a high-speed arterial. As more people walk or bike, driver awareness of other road users tends to increase, contributing to fewer collisions overall.

Land use decisions also influence the form and function of streets, including the visual and physical cues that guide driver behavior. The livable streets approach integrates design elements that naturally slow traffic, such as orienting buildings toward the street, installing aesthetic lighting, street trees, enhancing pavement quality and signage, and incorporating traffic calming measures or intersection controls. Livable streets emphasize access and safety over vehicle mobility. Compared to conventional arterials, they see significantly fewer crashes per mile and report zero traffic-related fatalities. These features are not merely the result of engineering, they stem directly from urban planning, urban design, and land use policy.

Furthermore, transportation costs extend beyond just dollars and cents. For many households, especially lower-income families increasingly living in car-centric suburbs, transportation is a major financial and time burden, driven by the costs of car ownership and long commutes. These same communities often face greater risks due to limited travel options, long commutes, poor infrastructure for walking and biking, and exposure to dangerous roadways. By reforming land use to bring people closer to jobs, services, and safe travel options, communities can reduce both the economic strain and safety risks tied to transportation. In this way, land use reform becomes essential to achieving Vision Zero's goals of eliminating traffic fatalities and creating safer, more equitable transportation systems.

Research:

- **Literature Review** of relevant research by Nicholas N. Ferenchak, Wesley E. Marshall.
- **Urban Sprawl As A Risk Factor In Motor Vehicle Crashes** - Ewing, Reid; Hamidi, Shima; and Grace, James B
- **The Safe Systems Pyramid: A New Framework For Traffic Safety** - David J. Ederer, Rachael Thompson Panik, Nisha Botchwey, Kari Watkins
- **U.S. Vision Zero Cities: Modal Fatality Trends And Strategy Effectiveness** – Nicholas N. Ferenchak

Vision Zero Land Use Strategies

- Consolidate curb cuts to minimize conflicts between pedestrians and vehicles, thereby reducing sudden turning movements that can lead to rear-end collisions
- Require new cul-de-sac developments to include a pedestrian link at the terminus connecting to adjacent roads, enhancing walkability
- Mandate that commercial developments provide adequate lighting to ensure the visibility of both sidewalk pedestrians and parking lot users
- Locate parking lots at the side or rear of buildings to prevent pedestrians from being

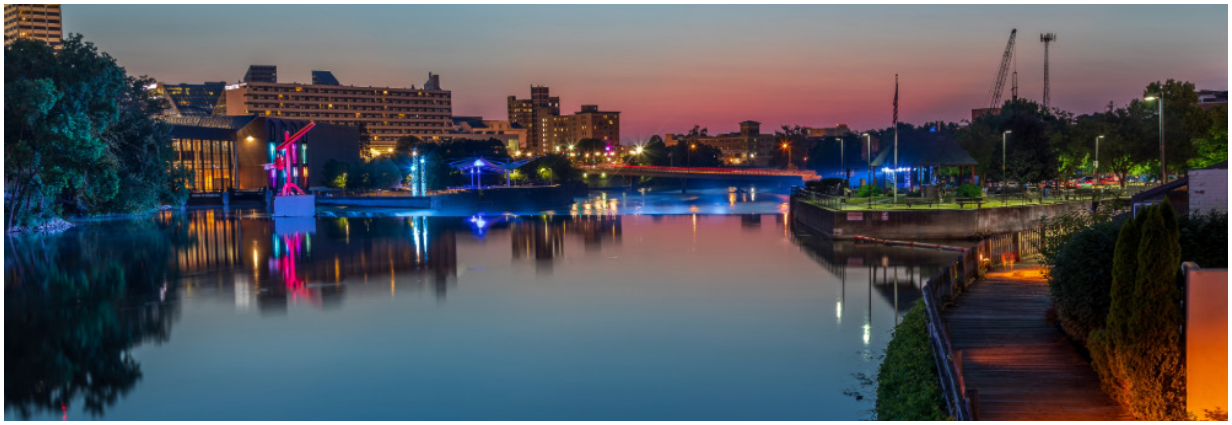
caught between vehicular traffic and parking areas

- Eliminate parking mandates that require a set number of spaces for developments, thereby encouraging construction and reducing housing and business costs
- Remove restrictions on multifamily housing, such as duplex bans, to facilitate closer proximity between residences and workplaces
- Allow accessory dwelling units to support multigenerational living arrangements, reducing transportation burdens for elderly family members
- Permit mixed-use zoning to promote walkability by enabling residents to easily access restaurants, bars, and workplaces
- Expedite zoning reviews and reduce fees for transit- or trail-oriented developments to further encourage such projects.

Resources:

- **Smart Growth & Traffic Safety Studies**
- **Missing Middle Housing**
- **Parking Reform Network**
- **Landscaping Standards**
- **IMPO Housing Study**

NATIONAL SPOTLIGHTS:



South Bend's award winning zoning code, adopted in 2019, is a citywide form-based code. It does not mandate off-street parking spaces for any land use and permits missing middle housing types encouraging safer more walkable neighborhoods.

Minneapolis eliminated bans on multifamily housing citywide. The new zoning does not prohibit the construction of single-family homes, but no neighborhoods in the city are zoned exclusively for single-family zoning. The city also eliminated parking mandates for all uses allowing the market to determine parking needs on a case-by-case basis.

SPOTLIGHT

The Safe Systems Pyramid: A new framework for traffic safety

In **The Safe Systems Pyramid: A New Framework For Traffic Safety** researchers expamine traffic safety from a public health perspecitve. This framework is built on the premise that reducing traffic injuries and fatalities requires a systematic, multi-layered approach. The authors argue that traditional road safety strategies, which often focus narrowly on individual behavior or isolated countermeasures, fall short in addressing the complex interactions that lead to crashes. Instead, the Safe Systems Pyramid offers a holistic model that integrates public health principles with transportation engineering. This model focuses on addressing crashes at the population level and focus on preventing and controlling risk factors while promoting protective factors when possible.

This framework contrasts this comprehensive approach with traditional models that have long dominated American road safety, such as the “E’s” framework. Unlike those earlier models, the Safe Systems Pyramid does not attribute disproportionate effectiveness to any single intervention nor does it solely focus on individual error. Instead, it underscores the importance of population-level strategies and the need to address systemic factors that contribute to road crashes. This shift in perspective is seen as essential for developing more effective, sustainable road safety policies.

Central to this framework is the recognition that kinetic energy is the primary agent of injury, and thus strategies to prevent or control its transfer to human bodies are crucial for reducing traffic injuries. By applying the Safe Systems Pyramid to assess programs like Vision Zero, practitioners can prioritize countermeasures based on their effectiveness in managing kinetic energy transfer, evaluate their impact at the population level, determine when individual actions are necessary, and support broader efforts to address social determinants of health, all within one cohesive framework.

Moreover, the researchers detail a layered approach within the pyramid that organizes interventions from broad socioeconomic policies down to specific educational measures. At its foundation, the pyramid emphasizes socioeconomic factors such as ensuring affordable housing near transit, pursuing zoning reforms, reducing vehicle miles traveled (VMT), and incorporating enhanced safety features on cars. Moving upward, the framework addresses improvements in the built environment through measures like roundabouts, speed humps, and chicanes; it then considers latent safety measures including optimized signal timing and leading pedestrian intervals. The structure further encompasses active safety measures like traffic signals, seat belts, and helmets, and finally concludes with less effective individual behavior focused educational initiatives such as driver training programs and public Slow Down campaigns.

PUBLIC HEALTH APPROACH

PROCESS DIAGRAM

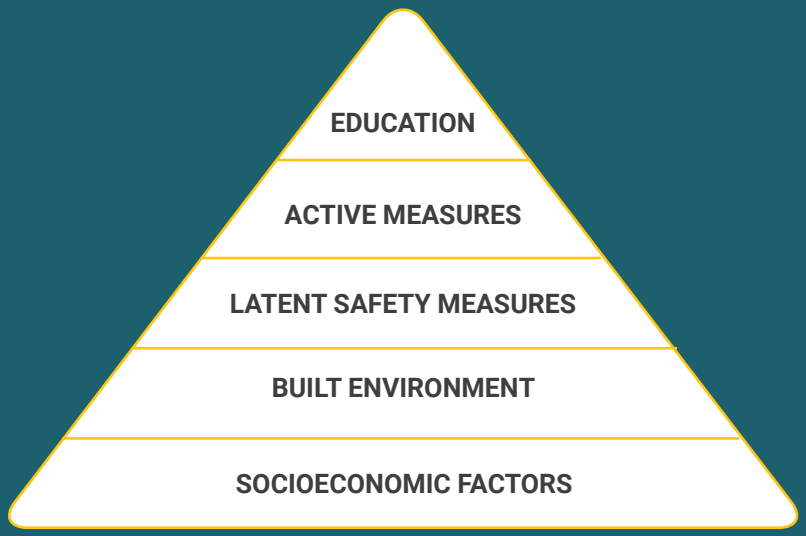
1. Prioritize countermeasures by their effectiveness in controlling or preventing the transfer of kinetic energy. Kinetic energy is the cause of injury or death in traffic crashes.

2. Assess the population-level impact - public health practice is founded on the idea that health problems are preventable when addressed at the population level by preventing and controlling risk factors and promoting protective factors.

3. Determine whether individual effort is needed and support efforts that address the social determinants of health. Public health interventions that require less individual effort should be prioritized.

THE SAFE SYSTEMS PYRAMID

CONCEPT DIAGRAM



USING THE PYRAMID

The pyramid structure is intended to decision makers understand the population health impact of various interventions. No single strategy can be effective alone, and decision makers must make use of interventions at each level of the pyramid given their roles and jurisdictions. **Read the full study**

POLICIES FOR ART IN THE PUBLIC RIGHT-OF-WAY AND TACTICAL URBANISM

In 2022, the Indianapolis Department of Public Works (DPW) adopted policies that give residents more power to enhance the streetscape and in turn, also create safer pathways and crossings for pedestrians, bicyclists, and all those who use the sidewalks.

Art in the Public Right-of-Way

This policy creates a systematic process to evaluate proposals for art to be placed in the public right-of-way, while defining what type of art and messaging will be encouraged.

Public Art is defined within the policy as any two or three dimensional aesthetic enhancement placed in or along public spaces including on pavement, walls, bridge structures, medians and traffic boxes. The public art should 1) enhance the aesthetic appeal of public areas, 2) further a sense of place in the neighborhoods, and 3) showcase the creativity of those living in Indianapolis.

The policy requires applicants provide visuals of the intended location, description of the art, an installation and maintenance plan, and public input from any organization or individual(s) who may be affected by the proposed art.

Proposed art may not convey messages in conflict with that of the City of Indianapolis, nor pose a risk of safety or distraction for motorists. The City of Indianapolis will not allow public art to be installed within crosswalks, create a blind spot, obscure the view from a main travel way, or directly promote a specific business or product.

Examples include painting on the roadway, on bridge supports and on neighborhood electrical boxes.

Tactical Urbanism

This policy, adopted by the City of Indianapolis in 2022, was driven by the potential of tactical urbanism tools to decrease traffic fatalities and increase walkability.

Tactical Urbanism is defined as “small-scale, low-cost and temporary demonstration projects …for the purpose of slowing motorists and testing new measures for enhancement to street safety.” The adopted DPW policy aims to create a process by which the City of Indianapolis controls the strategy, deployment, maintenance and removal of any tactical urbanism efforts within the public ROW.

Persons or organizations may propose the effort with input from the City of Indianapolis. Creative and new ideas are encouraged, and spaces may include but not limited to:

- Protected bike lanes
- Parklets
- Bump-outs
- Public art
- Overhead art

And with materials including but not limited to:

- Water-based paint
- Recycled tires
- Planters
- Wood
- Signage
- Bollards

Applicants should aim for projects that 1) enhance safety and not inhibit movement of emergency vehicles or block private drives; 2) contribute to street corridor sense of community and be in highly visible places; 3) do not conflict with infrastructure facilities or systems, community and cultural resources, or impede traffic flow. Additionally, data collection is a primary tool with tactical urbanism, and all projects require data collection strategy and publication of results to DPW.

Resources:

- **Indianapolis DPW Policies**

LOCAL SPOTLIGHT:

COMMUNITY HEIGHTS NEIGHBORHOOD

Photo Credit: Rebecca Shehorn

Photo Credit: Community Heights Neighborhood Organization

Implementation and Results

In Indianapolis's **Community Heights Neighborhood**, the majority of drivers were speeding which resulted in crashes and deaths. The neighborhood took action under the City's Tactical Urbanism policy installing temporary barriers and trees on high-traffic 10th street. After the installation, the neighborhood saw **significant reductions** in speeding and crashes. This shows that the design-based solution was successful in changing driving behavior. Data showed there were 30 crashes every three months without the barriers. But during the 90 days the barriers were up they only saw eight crashes.

COMPLETE STREETS ORDINANCES

A Complete Streets approach integrates people and place in the planning, design, and operation of the transportation network. Complete streets ordinances require that streets are designed to accommodate all modes of transportation that might reasonably use that road or facility. The goal is to provide safe, convenient, healthy, and equitable mobility options for all users of the road including drivers, people who walk and bike people with disabilities, and people of all ages from children to elderly persons.

The National Complete Streets Coalition promotes policies and practices that ensure street designs are safe for all road users. Complete Streets ordinances are policy components of Vision Zero and require design strategies to be incorporated into practice. Strong complete street ordinances apply to all project phases from preliminary engineering onward. They will require safety elements like sidewalks, walk signals, and transit coordination on a checklist basis. Strong ordinances also incorporate complete streets into zoning and Planned Unit Development (PUD) considerations to ensure private developers are meeting the same expectations for projects. The policy and any associated checklists should be reviewed for each public or private project.

There is no singular design prescription for a Complete Street. A Complete Street in a suburban area will be different than a rural community. Strong complete street ordinances should set clear expectations for exemptions from the ordinances (such as very rural areas where there is no demand for sidewalks).

Resource:

- **National Complete Streets Coalition**

UPDATE DESIGN REGULATIONS

Many agencies have been using outdated and dangerous design guidelines. The passage of the federal Infrastructure Investment and Jobs Act now permits local agencies to use design guidelines based on best practices such as the National Association of City Transportation Officials (NACTO) **design guides** proven to save lives.

Other agencies may develop their own guidelines based on best practices. The *Vision Zero Streets Design Standard* was developed by Transportation Alternatives based on solutions available in the New York City Department of Transportation Street Design Manual. It was developed to embody the Vision Zero principles while reducing motor vehicle traffic, increase accessibility, and protect the most vulnerable users of the street. To qualify as a Vision Zero Street, a design must:

- Discourage speeding by design (i.e. "self-enforcing")
- Encourage walking, biking, and/or public transit use;
- Provide accessibility to all, regardless of age or physical ability

Resources:

- **USDOT Complete Streets**
- **Smart Growth America**
- **National Association of City Transportation Officials**
- **Global Street Design Guide**
- **Designing Streets for Kids Guide**
- Fitzpatrick K, Carlson P, Brewer M, Wooldridge M. **Design Factors that Affect Speed on Suburban Streets**. Transportation Research Record: Journal of the Transportation Research Board 2000;1751:18–25.

SPOTLIGHT

THE COST OF CRASHES

In 2019, motor vehicle crashes in the United States resulted in 36,500 deaths, 4.5 million injuries, and damage to 23 million vehicles. The financial burden of these crashes is immense, with costs including wage and productivity losses, medical expenses, administrative fees, vehicle damage, and uninsured costs for employers. According to the National Highway Traffic Safety Administration (NHTSA), motor vehicle crashes cost Americans an estimated $340 billion—equivalent to $1,035 per person and 1.6% of the nation's $21.4 trillion GDP.

When factoring in quality-of-life valuations, the total societal harm from crashes in 2019 reached nearly $1.4 trillion. Lost market and household productivity accounted for $106 billion, while property damage totaled $115 billion. Medical expenses added another $31 billion, and congestion-related costs—including travel delays, excess fuel consumption, and increased emissions—amounted to $36 billion. On average, each traffic fatality resulted in an economic loss of $1.6 million, rising to $11.3 million when considering quality-of-life impacts. Taxpayers shouldered approximately 9% of total crash costs, amounting to $30 billion in public spending, or an additional $230 per household.

These figures come from a range of data sources, including NHTSA's Fatality Analysis Reporting System, Crash Investigation Sampling System, and Crash Report Sampling System. The analysis also incorporates underreported crashes using consumer surveys, in-car observation, and other research methods.

A separate study by the National Safety Council estimates the average economic cost of a fatal crash at $1.78 million and $155,000 for a disabling injury. The crisis is worsening, with over 42,939 traffic fatalities recorded in 2021. The impacts are particularly severe for low-income households, which are more likely to rely on walking, biking, or public transit—often in areas lacking safe infrastructure. These populations not only face a higher risk of injury or death in crashes but also have fewer financial resources to recover from the consequences.

STATE LEGISLATION

Beyond the local level, State policy can support Vision Zero

HANDS FREE

Overview

There has been an increase in distractions since the beginning of the automobile industry. In more recent years, cell phones have become a proven distraction. Many states and communities have enacted some form of "hands free" law where individuals cannot have their phone in their hands at any point during the time they are behind the wheel of a vehicle. Hands free legislation mandates that drivers avoid the use of handheld electronics while operating a motor vehicle, increasing safety and driver alertness. This is especially important as technology becomes an ever-growing part of everyday life.

Indiana has had a no texting while driving law since 2011. The purpose of the law was to address distracted driving but it was challenging for police officers to enforce and it did not reduce crashes due to **distracted driving**. Eventually, the courts found the law to be too narrow in scope to be enforceable. So, on July 1, 2020, Indiana enacted a hands-free law making it illegal for motorists to hold electronic communication devices in their hand while operating a vehicle. This would include devices such as cell phones, tablets, and smart watches. Phone calls, texting, and other activities are not permitted while a device is in a driver's hand. Indiana is now the 25th state to have enacted such laws.

Considerations

Hands free ordinances or legislation should recognize that drivers still might need the use of these devices for navigation and potentially audio content. Hands-free use of the device should be permitted so long as it is mounted to the dash or synced with the vehicle in some manner to reduce the need for the driver to remove their attention from the road.

However, drivers can be lulled into a false sense of security. Hands-free requirements fail to address the underlying problem of diverting a driver's attention from the road. Numerous studies have shown that even with a phone mounted in a vehicle or connected via Bluetooth, the mere act of talking on the phone distracts the driver, making them situationally unaware of what is happening around them.

SEAT BELTS

Overview

The State of Indiana already has a law that requires seat belts for every occupant of a vehicle. Seat belts are a safety measure for everyone within a vehicle to prevent death and serious injury in a crash. However, even in 2020 there are motorists who still do not wear a seatbelt. Enforcement is the key to safety. **Seat belts can reduce the likelihood of adults dying in a crash by up to 45 percent and cut the risk of serious injury by 50 percent**. Children especially should be restrained, and fines are assessed depending on the situation if a motorist is pulled over. It has been repeatedly proven that seat belts save thousands of lives every year by restraining drivers and passengers within a vehicle, preventing them from being ejected during a crash.

Indiana has a "primary" seat belt law that requires any occupant of a vehicle who is 16 years or older to be properly restrained in a seat belt. Additionally persons under 16 must be properly restrained in a seat belt, child safety seat, or "child restraint system". The law applies to all passengers of a vehicle.

Considerations

Since Indiana has a primary law, that means law enforcement can pull a motorist over if the officer suspects a driver or passenger is not

wearing a seat belt. Enhanced enforcement operations like “Click It or Ticket” have been successful in reminding drivers and their passengers to wear their seat belts. However, the most successful methods to implement the requirement of seat belts is technology.

Many car manufacturers have installed audible warnings inside a car to indicate to the front seat driver and passenger that their seat belt is not buckled. While technology has advanced and provides a good reminder to put a seatbelt on, new generations still should be educated to the safety reasons of wearing a seatbelt.

HELMETS FOR MOTORCYCLISTS

Overview

There are still many motorcycle drivers and riders who do not wear helmets. The risk of injury and death from a crash is far greater if a motorcyclist is not wearing a helmet. When a motorcycle crashes, the rider lacks the protections of an enclosed vehicle. In 2017, the number of deaths on motorcycles was 27 times the number of deaths in cars, however **there was a 3 percent decrease in the number of motorcycle deaths from 2016.** In 2017, the number of motorcyclists killed from states that did not have universal helmet laws (57 percent) was approximately 7 times greater than those states than did have universal helmet laws.

Considerations

Currently, Indiana state law requires all motorcycle riders under the age of 18 to wear helmets when driving or riding on a motorcycle. Indiana’s universal helmet law was repealed in 1977. Statistics show that Indiana motorcyclists are more likely to die as result of a crash than motorcyclists in states with universal helmet laws. Advocating and educating for improvements in the quality and value of helmets, protective clothing, and safe driving techniques can all result in positive outcomes for motorcyclist safety.

REDUCING DRUNK DRIVING

Interventions to reduce drunk driving that **are proven** in terms of quantity and quality of evidence are raising alcohol taxes, reducing permissible alcohol blood levels in drivers, blocking automatic car ignition with a blood-alcohol level sensor in previously penalized drivers, restricting alcohol sales to under-age persons, police enforcement with inhaled alcohol tests, and a set of laws called “zero tolerance” that consist of a series of regulations to restrict alcohol consumption in drivers and to increase penalties for driving under the influence.

AUTOMATED ENFORCEMENT

A speed camera is a form of automated enforcement of traffic safety laws. Speed cameras photograph a vehicle’s license plate if the driver is speeding, and the vehicle owner or driver is sent a ticket. **Research shows** that slowing down traffic can reduce crashes. As of January 2022, 171 communities in 18 states and the District of Columbia use automated speed camera enforcement but they are not permitted by State Law in Indiana.

LEGISLATIVE REVIEW

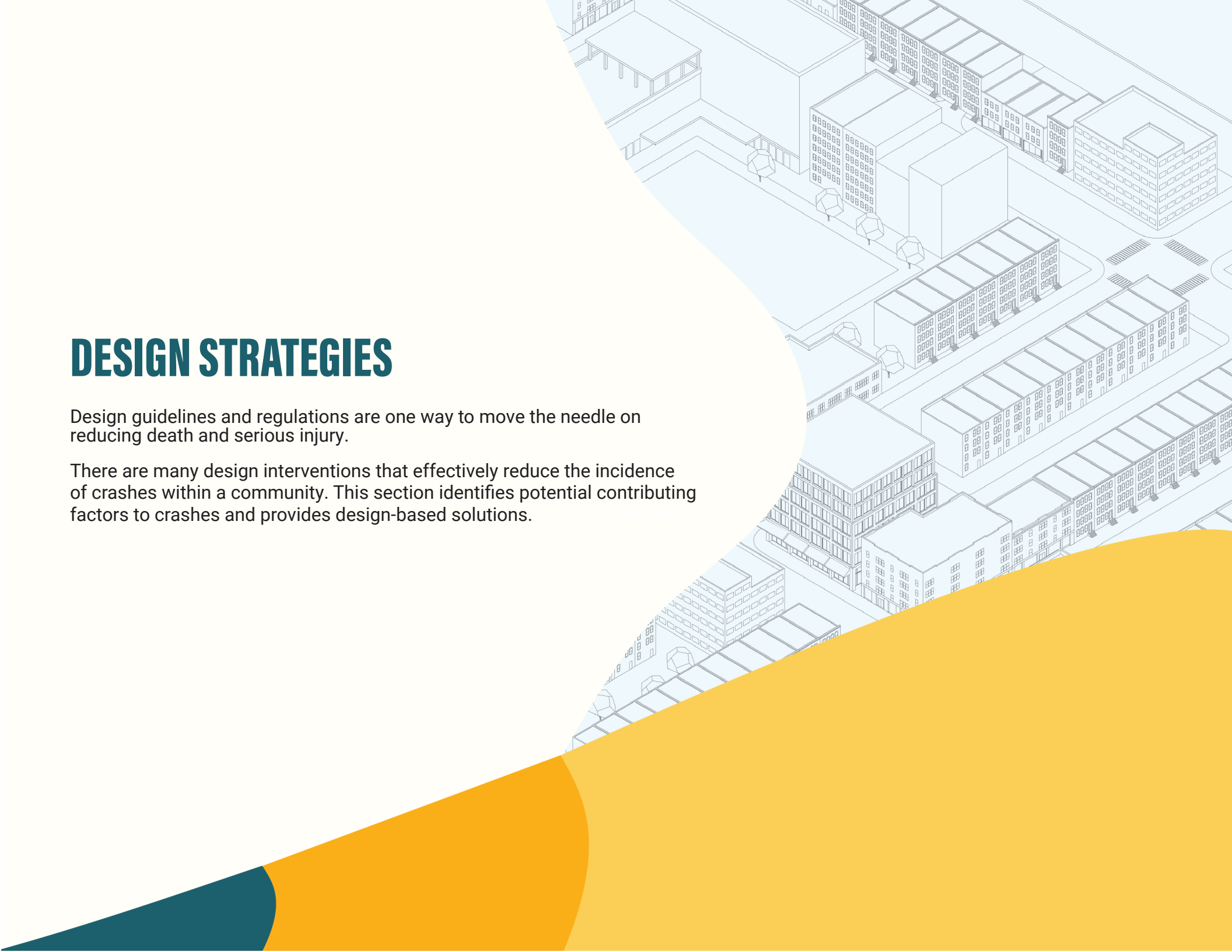
Advocates for Highway and Auto Safety **note several** outstanding laws needed for Indiana.

- All-Rider Motorcycle Helmet Law
- Rear Facing Through Age 2 or Older Law
- Booster Seat Law
- Rear Seat Through Age 12 Law
- Minimum Ages for Learner’s Permit and Licensing
- 70 Hours of Supervised Driving Provision
- Nighttime Driving Restriction Provision
- All-Offender Ignition Interlocks
- Permiting Automated Enforcement by Law

DESIGN STRATEGIES

Design guidelines and regulations are one way to move the needle on reducing death and serious injury.

There are many design interventions that effectively reduce the incidence of crashes within a community. This section identifies potential contributing factors to crashes and provides design-based solutions.



A NOTE ON FUNDING PROGRAMS

MPO INFRASTRUCTURE FUNDING

The IMPO receives an annual allocation of funding from the federal government to support transportation projects within our Metropolitan Planning Area (MPA). Each year the IMPO goes through a process to determine what projects receive this funding. To select projects to receive the IMPO's funding, the IMPO issues an annual "call-for-projects". During the call-for-projects local public agencies (typically cities, towns, counties, and transit organizations) choose projects to submit for consideration by completing a data-driven application and committing to locally fund a portion of the project cost. The IMPO then selects projects for funding based on the funding goals of the Metropolitan Transportation Plan (MTP) as adopted by the IMPO's Transportation Policy Committee, federal eligibility requirements, and on their rank after the scoring process.

When local government agencies apply for funding, they apply under one of the federal programs authorized by the Infrastructure Investment and Jobs Act. Each program has limits on what type of projects can be funded using those funds and on what type of road or facility those funds can be used.

- **Surface Transportation Block Grant (STBG)** funds are the largest source of federal funding for the IMPO and are also the most flexible. These funds may be used for road, transit, bike and pedestrian projects, carpool, planning, among other projects.
- **Highway Safety Improvement Program (HSIP)** funds may be used to implement proven safety projects including intersection changes like roundabouts, traffic calming to reduce vehicle speeds, pedestrian infrastructure, guardrails, signage, or safe routes to school.
- **Congestion Mitigation and Air Quality (CMAQ)** is a program meant to improve air and reduce congestion including projects that support a shift in modes from personal vehicles to more sustainable options like transit, carpool, and bike projects. It may also fund projects that reduce congestion without adding capacity (and thus avoiding induced demand) such as roundabouts or projects that improve overall air quality like dust reduction programs.
- **Transportation Alternatives (TA)** program supports active modes of transportation including most bike and pedestrian projects like trails, sidewalks, and safe routes to school.

While this funding supports many safety projects, there are still costs for local agencies. Typically, the IMPO only funds 80% of construction and construction engineering and does not fund other phases or right-of-way needs. Furthermore, applications for funding and required environmental documentation do cost the local agency time and resources. While many of the smaller projects listed in this section are eligible for IMPO managed funding, it would only be cost-efficient for agencies to apply for them if they were being applied on a large scale or as part of a larger project.

To learn more read the full **Transportation Improvement Program** (TIP) and check out the **call-for-projects page** to learn more about applications, project scoring and selection, and what projects we are already funding.

PLANNING AND POLICY FUNDING

The IMPO also funds planning projects through its **local planning grant**. The overall goal of the program is to support the implementation of the IMPO's Metropolitan Transportation Plan (MTP) and improve the region's performance on federal performance measures. A wide range of safety plans are eligible for funding including Safe Routes to School or Safe Routes to Transit, safety studies, bike and pedestrian plans, and design guideline updates.

COUNTERMEASURES

Design-based crash factors require mitigation through design-based solutions. These countermeasures exist on a broad spectrum of cost and intensity of intervention, and may be implemented through either capital improvements or operational streams. Regardless of scale, implemented solutions should be the result of data analysis and community assessment.

Countermeasures can be tested through temporary installations or decided through data interpretation. While not all countermeasures can be temporary depending on scale, location, and the overall strategy, design elements can be implemented at various levels. Local officials must determine the best countermeasure(s) for either one specific site, a few sites, or sites across a whole community.

These are broken down into various approaches:

- **Site Specific Approach** countermeasure at one problematic location
- **Risk-Reduction Approach** countermeasures at locations with the greatest risk
- **System-Wide Approach** countermeasures throughout

Each approach is completely dependent on the community and situation.

The design strategies matrix included in this chapter will help you determine various approaches depending on conditions, cost, degree of permanence, and approach.

HOW TO DETERMINE BEST SOLUTIONS

With hundreds of design solutions presented, how can a city or community best decide the Design or Policy Solution that fits an area, intersection, or system?

Data analysis of crash data is specifically important as crashes may be specific to current road conditions. For example, crashes due to wet pavement might call for additional measures to increase road traction, or even evaluate how water is draining in the area to know how to best approach the problem.

A best practice is an Annual Crash Review with the critical decision makers to rank the most frequent crash locations and/or types. Using this Toolkit and the Crash Modification Factors Clearinghouse, you are able to decide and implement solutions that work.

The **Crash Modification Factors Clearinghouse** is an excellent online tool for narrowing in on solutions for your trouble spots.

Design countermeasures work best when they work in combination with other measures and policies. The goal of Vision Zero is to combine safer streets, safer speeds, safer vehicles, and post-crash care not to fully eliminate all traffic crashes but rather to reduce their severity so that there are no serious injuries or deaths. Better street design is a countermeasure in each community's control that is crucial in lowering dangerous speeds and promoting safer modes of transportation.

SELF-ENFORCING ROADWAYS

A self-enforcing roadway is designed to naturally encourage drivers to adopt safe speeds through its geometric and operational features, reducing reliance on enforcement. This concept integrates elements like lane width, curvature, signage, and visual cues to subconsciously guide drivers toward appropriate speeds.

A study from the Illinois Center for Transportation titled **Advancing Self-Enforcing Streets Phase 1:The Relationship between Roadway Environment and Crash Severity** highlighted the effects of visual guiding facilities, road layouts, and design elements on speed perception, reaction time, and general driving behavior. Overall, the findings underscore the need for a systematic approach to road design to reduce traffic crashes.

HOW TO USE THE MATRIX

The matrix has been organized by type of physical design strategies and problems they most effectively combat. Many strategies overlap with one another, reflecting the need to layer design interventions in order to improve safety, as well as to provide alternatives that are flexible to the unique environment a site is situated in. Most strategies will work towards creating a safer environment for all types of transportation.

Along the top axis, you can find the contributing factors to crashes. Each of the conditions will try to best align with the design strategies that are countermeasures to reduce the chances of crashes happening again.

Additional information involving the design strategies, including cost and how to best administer them within a community are addressed. The matrix focuses on where the countermeasures are most applicable — whether they are best used in a rural or urban setting, or as a highway strategy.

It is critical to acknowledge that no community is the same. Infrastructure investment has historically been lower in communities of color and low-income. Practitioners and decision-makers should consider inequities when balancing investment priorities.

For more information regarding pedestrian and bicyclist safety countermeasures, **click here**.

STRATEGIES KEY

For ease of navigation, strategies are organized into four categories:

General Strategies

Pedestrian Strategies

Bicycle Strategies

Automotive Strategies

Refer to these icons at the top of each page to identify the main road user the strategy is designed to protect.

DEFINITIONS

- **Temporary Approach:** countermeasures that can be "tested" to determine success before finalizing the change (with various exceptions)
- **System-Wide Approach:** countermeasures are implemented at all locations (across the community)
- **Risk-Reduction Approach:** countermeasures are implemented at locations with the greatest risk (specific locations within the community)
- **Site-Specific Approach:** countermeasures are implemented based on crash data that supports continual crashes at one specific site that needs to be addressed (one location within the community)

COST EXPLANATION

Cost is determined based on one installation (i.e. one round-a-bout, one shared-use path, one crosswalk, etc.) and is further explained in each countermeasure section.

- Low-cost ($0-$99,999)
- Medium cost ($100,000 - $499,999)
- High cost ($500,000 and up)
- Range of costs (depending on level of implementation)

VISION ZERO MATRIX

GENERAL STRATEGIES	Cost	Temporary*	Risk-Reduction*	System-Wide*	Site-Specific*	Intersection	Roadway Segment	Urban (U) / Rural (R) / Both (B)	No Pedestrian Infrastructure	Jaywalking	No Crosswalks or Pedestrian Ramps	No Pedestrian/Bicycle Signal at Intersection	Limited or No Signage	No Bicycle Infrastructure	Bicycle Crash (Midblock)	Bicycle Crash (Intersection)	Pedestrian Crash (Midblock)	Pedestrian Crash (Intersection)	Running Red Lights or Stop Signs	Speeding (Residential)	Speeding (Commercial)	Speeding (Intersection)	Auto-Oriented Collision	Auto-Bicycle Collision	Auto-Pedestrian Collision	Bicycle-Pedestrian Collision	Bicycle-Oriented Collision	Low Visibility Signage	Low Visibility Road Users	Low Visibility in the Day / Afternoon	Low Visibility at Night	Running off Road
Adding Sidewalks			X	X	X	X	X	B	X																							
Adding Speed Bumps & Humps		X		X	X			U												X	X	X										
Different Construction Materials			X	X	X	X	X	U	X		X			X	X	X	X	X							X	X	X					
Feedback (Speed) Monitors		X		X	X		X	B												X	X	X										
Improve Lighting			X	X	X	X	X	U															X	X	X	X	X		X		X	X
Increase Sight Distance			X	X	X	X	X	B											X				X	X	X	X	X	X	X	X	X	X
Intersection Delineation			X	X	X	X		U																X	X				X	X	X	
Lateral Shifts				X			X	U												X	X											
Left Turn Calming		X		X	X	X		U									X		X					X							
Mini-Roundabouts				X		X		U										X	X			X	X	X	X							X
Narrowed Lane and Streets				X			X	U												X	X	X										
Pinch Points and Chicanes				X	X		X	U									X			X	X		X	X	X							
Railroad Crossing Improvements				X	X			B																						X	X	
Reducing Speed Limits			X	X	X			U												X	X	X	X	X	X							
Road Diet		X		X	X		X	U	X		X										X	X	X									
Speed Tables		X		X	X			U												X	X											
Upgraded Traffic Signals			X	X	X	X		B								X		X				X	X	X	X	X						X

BICYCLE STRATEGIES	Cost	Temporary*	Systematic*	Systemic*	Site Specific*	Intersection	Roadway Segment	Urban (U) / Rural (R) / Both (B)	No Pedestrian Infrastructure	Jaywalking	No Crosswalks or Pedestrian Ramps	No Pedestrian/Bicycle Signal at Intersection	Limited or No Signage	No Bicycle Infrastructure	Bicycle Crash (Midblock)	Bicycle Crash (Intersection)	Pedestrian Crash (Midblock)	Pedestrian Crash (Intersection)	Running Red Lights or Stop Signs	Speeding (Residential)	Speeding (Commercial)	Speeding (Intersection)	Auto-Oriented Collision	Auto-Bicycle Collision	Auto-Pedestrian Collision	Bicycle-Pedestrian Collision	Bicycle-Oriented Collision	Low Visibility Signage	Low Visibility Road Users	Low Visibility in the Day / Afternoon	Low Visibility at Night	Running off Road
Bike Box		X		X	X	X		U						X		X								X		X			X	X	X	
Bollards & Delineators		X		X	X	X	X	U									X	X		X	X	X	X	X	X	X	X			X	X
Parallel (Conventional) Bike Lanes		X	X	X	X	X	X	U						X										X		X	X		X	X	X	
Protected Bike Lanes		X	X	X	X	X	X	U						X										X		X	X	X	X	X	X	
Shared-Use Paths				X	X		X	U	X					X										X	X	X	X	X	X	X	X	
Two-Stage Turn Queue Box		X		X	X	X		U						X		X								X		X			X	X	X	
Two-Way Separated Bike Lanes				X	X		X	U						X										X		X	X	X	X	X	X	
Modal Filtering																																

VISION ZERO MATRIX

	Cost	Temporary*	Risk-Reduction*	System-Wide*	Site-Specific*	Intersection	Roadway Segment	Urban (U) / Rural (R) / Both (B)	No Pedestrian Infrastructure	Jaywalking	No Crosswalks or Pedestrian Ramps	No Pedestrian/Bicycle Signal at Intersection	Limited or No Signage	No Bicycle Infrastructure	Bicycle Crash (Midblock)	Bicycle Crash (Intersection)	Pedestrian Crash (Midblock)	Pedestrian Crash (Intersection)	Running Red Lights or Stop Signs	Speeding (Residential)	Speeding (Commercial)	Speeding (Intersection)	Auto-Oriented Collision	Auto-Bicycle Collision	Auto-Pedestrian Collision	Bicycle-Pedestrian Collision	Bicycle-Oriented Collision	Low Visibility Signage	Low Visibility Road Users	Low Visibility in the Day / Afternoon	Low Visibility at Night	Running off Road
PEDESTRIAN STRATEGIES																																
Crosswalks			X	X	X	X	X	U	X	X	X	X		X	X	X	X	X						X	X				X	X	X	
Curb Extensions		X		X	X	X		U									X	X				X		X	X							
Daylighting				X	X	X		U								X		X	X					X	X	X			X	X	X	
Flashing Signage		X		X	X	X	X	B					X						X				X	X	X	X	X	X			X	X
Leading Pedestrian/Bicycle Intervals			X	X	X	X	X	U	X	X	X	X				X		X						X	X							
Pedestrian Hybrid Beacon				X	X		X	U	X	X	X				X		X							X	X				X	X	X	
Pedestrian Push Button Countdown			X	X	X	X		U	X	X	X	X				X		X														
Pedestrian Safety Island		X		X	X	X	X	U	X	X				X	X	X	X	X			X	X	X	X	X	X						
Reducing Curb Returns		X		X	X	X		U	X					X								X		X	X				X	X		
Roadway Medians				X	X		X	U		X					X		X			X	X	X	X									
Street Trees & Landscaping				X	X	X	X	U												X	X	X										

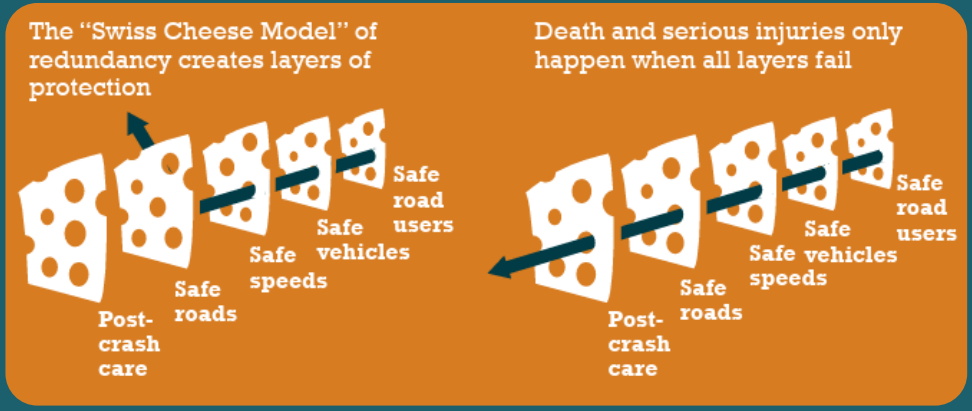
	Cost	Temporary*	Systematic*	Systemic*	Site Specific*	Intersection	Roadway Segment	Urban (U) / Rural (R) / Both (B)	No Pedestrian Infrastructure	Jaywalking	No Crosswalks or Pedestrian Ramps	No Pedestrian/Bicycle Signal at Intersection	Limited or No Signage	No Bicycle Infrastructure	Bicycle Crash (Midblock)	Bicycle Crash (Intersection)	Pedestrian Crash (Midblock)	Pedestrian Crash (Intersection)	Running Red Lights or Stop Signs	Speeding (Residential)	Speeding (Commercial)	Speeding (Intersection)	Auto-Oriented Collision	Auto-Bicycle Collision	Auto-Pedestrian Collision	Bicycle-Pedestrian Collision	Bicycle-Oriented Collision	Low Visibility Signage	Low Visibility Road Users	Low Visibility in the Day / Afternoon	Low Visibility at Night	Running off Road
AUTOMOTIVE STRATEGIES																																
High Friction Surface (HFST)			X	X	X	X	X	R																								X
Improve Signage			X		X			B					X						X				X	X	X	X	X	X		X	X	X
Restriping, Reflectors, Rumble Strips			X	X	X	X	X	B																							X	X
Retroreflective Backplates			X		X	X		B											X									X			X	
Roundabouts				X	X	X		B											X			X	X									
One-to-Two-Way Conversions						X	X	U												X	X	X	X									
Creating Feelings of Enclosure							X	B												X	X	X	X									

SPOTLIGHT

SAFE AND REDUNDANT SYSTEMS

Past road safety initiatives attempted to modify human behavior and prevent all crashes but a new paradigm is needed to address traffic crashes. Implementing this new paradigm involves a **multifaceted transportation approach** in transportation planning, from addressing deadly arterial road design to addressing car bloat. But the **new traffic safety paradigm** also recognizes that the total amount of vehicle travel, measured as vehicle-miles traveled (VMT), is a significant risk factor. This perspective acknowledges that increased driving exposure inherently raises the likelihood of crashes, regardless of individual driver behavior or vehicle safety features. Consequently, strategies that reduce VMT, such as promoting public transit, biking, walking, and compact urban development, enhance overall traffic safety.

This paradigm shift is also reflected in parts of the Federal Safe Systems approach. The Safe System Approach is focused on taking a holistic view of the roadway system and those who use it to anticipate human mistakes and keeping the crash-related kinetic energy impacts on all road users at tolerable levels.



Washington Traffic Safety Commission

- **Humans Make Mistakes** - People will inevitably make mistakes and decisions that can lead or contribute to crashes, but the transportation system can be designed and operated to accommodate certain types and levels of human mistakes, and avoid death and serious injuries when a crash occurs.
- **Humans Are Vulnerable** - Human bodies have physical limits for tolerating crash forces before death or serious injury occurs; therefore, it is critical to design and operate a transportation system that is human-centric and accommodates physical human vulnerabilities.
- **Responsibility is Shared** - All stakeholders, including government at all levels, industry, non-profit/advocacy, researchers, and the general public, are vital to preventing fatalities and serious injuries on our roadways.
- **Safety is Proactive** - Proactive tools should be used to identify and address safety issues in the transportation system, rather than waiting for crashes to occur and reacting afterwards.
- **Redundancy is Crucial** - Reducing risks requires that all parts of the transportation system be strengthened, so that if one part fails, the other parts still protect people.

COUNTERMEASURE:

ADDING SIDEWALKS

GOAL

Adding sidewalks throughout a neighborhood, downtown, or community provides a safe and equitable way to get from place to place without being in the direct line of traffic.

HOW DOES IT WORK?

Sidewalks help to create a safe path for people to walk along that keeps them separated from motorized traffic. Around 6,000 pedestrians are killed in traffic crashes with motor vehicles a year in the United States. Sidewalks are an equity of access tool for all vulnerable users including those ages 50+ and Black pedestrians. According to a report from Smart Growth America, from 2010-2019, Black pedestrians were 82% more likely to be hit by drivers.

Sidewalks or walkways that are separated from the travel lanes, reduce fatalities by 88 percent. Roadways without sidewalks are more than 2x as likely to have pedestrian crashes than places with sidewalks on both sides of the street.

Sidewalks can also increase the health of a community. Pedestrians will start to feel like their needs are being met along a roadway, and potentially begin to encourage more people to get out and walk from place to place. People often will begin to use sidewalks when they are provided, and it serves as a source of exercise which helps aid in increased physical and mental wellbeing.

CONSIDERATIONS

As much as sidewalks increase safety and accessibility, it is common to see neighborhoods without these simple assets.

Statistically it has been proven that **pedestrian-driver crashes are more than twice as likely to occur in places without sidewalks**; this includes neighborhood roads. Additional separation via a median or tree lawn between sidewalk and street enhances safety even more.

COST

Moderate- to high-cost

It should be noted that cost-savings will occur when sidewalks are included with a road construction project larger in scale. Projects can be combined into one large one too which can work in conjunction with other jurisdictions or localities and prices will decrease.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)** - As part of larger project or to comply with the ADA and the Safe Routes to School Program
- **FFE-Highway Safety Improvement Program (HSIP)** - As part of a larger safety project
- **FFE-Congestion Mitigation and Air Quality (CMAQ)** - If providing measurable air quality benefits such as reducing vehicle trips
- **FFE-Transportation Alternatives (TA)**

COUNTERMEASURE:

ADDING SPEED BUMPS AND SPEED HUMPS

GOAL

The introduction of speed bumps or humps signify and cause driver speed reduction because of the upcoming obstacle.

HOW DOES IT WORK?

Speed bumps are a form of traffic slowing infrastructure intended for slower speed limit areas. They are more aggressive than speed humps causing a higher decrease in traffic speeds. They are suited more for parking lots and driveways. They can be anywhere from 2 to 4 inches high and have a much shorter travel distance than speed humps, making them more abrupt and resulting in more of a "bounce" when the vehicle drivers over it. Taking speed bumps too fast can cause damage to a vehicle which makes it critical that people slow down. These bumps can reduce speeds from 2 to 10 miles per hour. Signage should accompany speed bumps to alert drivers to the upcoming obstacle.

Speed humps are similar to speed bumps, varying only slightly. They are used in pedestrian zones on local or collector roads and usually found around playgrounds and in school zones (neighborhoods as well) where excessive speeds will harm pedestrians. Unlike speed bumps, speed humps are less abrupt and usually placed in a series along a corridor to maintain slower speeds. They are anywhere from 3-4 inches high (at the pinnacle point) and 12-14 feet wide, with a ramp length of 3-6 feet (circular top). These humps can reduce driver speeds from 15-20 mph. Signage should accompany a speed bump when constructed to warn drivers of the obstacle that they are approaching.

CONSIDERATIONS

Location must be considered for implementation. Speed bumps/humps may make things difficult for street cleaners, and plows during the winter though temporary speed humps are available and may be removed in the winter. hey may also slow emergency vehicles (fire trucks and ambulances) and their response times, so they should not be placed on major emergency routes.The introduction of speed bumps/humps could divert traffic to another street, causing the existing problem to move instead of being solved. While these issues are worth considering, speed bumps and humps do have a place in traffic safety, especially where there are many vulnerable people such as near schools.

COST

Low- to moderate-cost

Speed bumps and speed tables cost on average $2,500 (ranging from $1,000 to $6,900 depending on size, materials, design, and drainage conditions).

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Highway Safety Improvement Program (HSIP)** - Generally as part of larger safety project

Speed bumps could also be funded as part of larger projects in the other funding categories such as TA funded safe routes to school projects or STBG funded intersection projects.

COUNTERMEASURE:

USING DIFFERENT CONSTRUCTION MATERIALS & DESIGNS FOR ROADS, CROSSWALKS, AND BIKE LANES

Image Source: IndyStar

GOAL

To create separation and delineation of space in roadways for multiple uses.

HOW DOES IT WORK?

Distinguishing uses of roads through different colors and materials is an effective way of increasing driver awareness. A common use of this method is using brick pavers in crosswalks, which creates contrast between the pavement and crosswalk. This designates not only a setback for cars to stay behind but signifies the total space pedestrians and bicyclists are allotted on the street.

Asphalt offers flexibility in construction, maintenance and rehabilitation. It's easy to work with and is long lasting for creating smooth roadways for travel.

- Asphalt is the most prevalent, least expensive and easiest to install. The drawback to this material is the higher need for maintenance and its potential for deforming under the weight of large vehicles.
- Concrete is a durable and low maintenance material. It often holds up against heavy trafficking and large vehicle traffic. This material is more expensive but generally outlives asphalt.
- Pavers are a unique and noticeable change in the roadway often indicating to drivers to slow down and expect pedestrian traffic. The most commonly used paver types are made of concrete, brick and stone (granite also known as cobblestone). This change in material also brings a difference in color, texture, and comfort of ride. Creating a rougher drive can decrease vehicle speeds and cause drivers to use these zones more cautiously. The downside is over time these pavers could become loose and require maintenance, uneven surfaces could create difficulties for pedestrians, cyclists, and differently abled persons.

To learn more about street design, **click here**.

Some cities are painting their streets to guide people to safety as well. This can be a temporary/interim test to see if the strategy works for your community, this can be used to beautify a corridor or part of the community as well. Colors can help direct a driver where to go or which lanes they are allowed to be. A couple examples would be like marking out a red lane for bus transportation only or using stencils to mark what major roadway you are traveling on.

CONSIDERATIONS

There are a few drawbacks between material differentiation. One of the most common is the increase in maintenance for materials, like brick and cobblestone, which can be damaged over time and require small components to be reset. The other drawback is the additional cost for installation and maintenance. These materials require more time and expertise to install properly.

Paint is cheap but depending on the extent a city or community is using it,it can be costly to keep up depending on the overall wear and tear of the road. It can be a great alternative to beautifying a space and creating a unique place. Despite this, it can be cost effective and used only temporarily to distinguish right-of-way.

COST

Low- to high-cost depending on the extent of which a community is implementing this strategy.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)** -
- **FFE-Highway Safety Improvement Program (HSIP)**
- **FFE-Transportation Alternatives (TA)**

CONSIDERATIONS

Speed monitors usually are not mobile, which makes installation of them permanent in an area. Radar signs/speed monitors are a proven traffic calming measure which raises awareness of the speed a driver is going. Studies have repeatedly shown that when a radar sign is present, speeders will slow down up to 80% of the time. Typical average speed reductions are seen from anywhere to 10-20%, and compliance with the posted speed limit will increase anywhere from 30-60%. To learn more, **click here.**

COST

Low-cost

Cost between $2,500-$7,000 depending on the type/style. On average for roadside installation, each monitor costs between $2,500-$3,500.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

/ **FFE-Highway Safety Improvement Program (HSIP)**

Speed feedback signs could also be funded as part of larger projects in the other funding catagories such as TA funded safe routes to school projects or STBG funded intersection projects.

CASE STUDY / NATIONAL

Bellevue, Washington installed 31 stationary radar signs as of January 2009. They had a budget of $50,000 to devote to traffic safety technologies and decided that the use of stationary radar signs would be a good opportunity for investment. The City relied on police enforcement to address speeding issues and concerns on streets that did not qualify for other traffic calming measures. These streets were primarily arterial with a posted speed of 30 mph or saw traffic volumes of greater than 3,000 vehicles per day. Speed radars were installed in these areas and began to expand to other streets that did not meet either of these criteria and could accommodate for other traffic calming techniques.

Three studies were done to determine the effectiveness over time. The first study was done for all 31 existing radar signs after having been installed from 1 – 3 years. Several locations showed little speed reductions during the first installation, and one even showed an increase in speeds. The second study focused on 22 locations where signs had been in place for two or more years. These studies showed an increase in the effectiveness of the signs. It should be noted that some of the speed radars were replaced or repaired if they were not working well. The third study was done for ten locations where the radar signs had been there for six or more years. During this study, the radars showed an increase in effectiveness and have not lost effectiveness over time.

This study shows that motorists are starting to correct their driving habits and speeds when necessary. The public perception also remains positive with growing requests for new installations of these radar signs. The City has put funding aside in anticipation for repairs and replacements or upgrades for each sign every seven years.

COUNTERMEASURE:

IMPROVE LIGHTING

GOAL

Improve pedestrian and bicycle safety by providing adequate lighting which improves visibility of all parties. By raising visibility, drivers are more likely to see the pedestrians and cyclists reducing the likelihood of a collision.

HOW DOES IT WORK?

Improving lighting means increasing the quality and quantity of lighting along pedestrian and bicycle corridors; and at intersections to improve visibility and reduce potential collisions. In addition to reducing collisions with vehicles, it can also improve the perception pedestrians have for the corridor's comfort. Lighting is an important factor in improving pedestrian perception of safety. Dim lighting is not sufficient and limits the perceived and real safety; and visibility along roadways and trails discourages walking at night.

About two-thirds of pedestrian fatalities happen at night under low-light conditions. By increasing lighting, these statistics can change dramatically. Roughly 50 percent of these fatalities can be reduced just by increasing lighting. Various analyses of multiple studies have concluded that improved street lighting reduces crime by drawing public attention to the location.

Lighting can be unique to a place; it does not have to be specific to LED bulbs and overhead lighting. Incorporating lighting into safety and design features such as bollards not only helps create a safer space for pedestrians, but brings attention to a driver for where people could be; this is useful and practical when done near crosswalks or large event or gathering spaces.

Lighting can be used to define a specific area within the community. Light features in a downtown, along a corridor, and within neighborhoods create an identity that can be used to increase the sense of place within that area. Specifically, programmable lighting enhances the identity and nighttime interest of locations (downtowns and other popular spots around the community). Lighting can be used as an attraction, used on building exteriors for special occasions, and used for public art displays.

For more information, **click here**.

CONSIDERATIONS

Light pollution is an issue in urban areas but can be managed by following **dark-skies best practices** such as using shielded light fixtures and warm spectrum lights.

COST

Moderate- to high-cost depending on the level of implementation.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Highway Safety Improvement Program (HSIP)**
- **FFE-Transportation Alternatives (TA)**

Lighting could also be funded as part of larger projects in the other funding catagories such as TA funded safe routes to school projects or STBG funded intersection projects.

CASE STUDY / NATIONAL

Seattle, Washington has a unique situation when it comes to addressing lighting in their city. No single department or entity owns and operates street lighting. The main implementer is the Seattle City Light and Seattle Department of Transportation. The City however, recognized its importance and is striving to fund lighting through the general fund in the future. Seattle also sets the light levels and quality requirements that are to be upheld in the right-of-way. The City prioritized lighting placement based on the following criteria

- Pedestrian demand (based on land uses as generators or attractors of pedestrians);
- Socio-economic status (with traditionally under-served areas prioritized); and
- Street segment classification (importance in pedestrian network)

Seattle also decided to engage with their residents and hoped to gather data and information through other processes and plans to get residents and organizations to identify priority areas to focus attention on and so the City can update the Pedestrian Lighting Plan. The plan also recommends a number of design guidelines for the actual lighting design to reduce light pollution; appropriate placement; design of the fixture and its appropriateness in its specific context.

To read the Seattle Department of Transportation's Pedestrian Lighting Citywide Plan (2012), **click here**.

COUNTERMEASURE:

INCREASE SIGHT DISTANCES


Image Source: NACTO

GOAL

Increase awareness and visibility of other vehicles, pedestrians, and bicyclists by clearing the sight line of obstructions near intersections and crosswalks.

HOW DOES IT WORK?

Obstructed sight lines can cause many problems for drivers, bicyclists, and pedestrians. Specifically for drivers, reaction times and stopping distances can be greatly reduced and cause more serious or fatal crashes. By reducing the obstructions and creating a clear line of sight, a driver will be more aware of the surroundings. Additional signage to warn the driver of upcoming intersections or crosswalks will also help prepare a driver for an approaching stop and increase awareness.

Sight distances are particularly important for areas that see high pedestrian and bicyclist traffic crossing roads. In some cases, road construction (realignment) might need to be done where it would be otherwise impossible to create more visibility. This could be more costly but ultimately safer.

COST

Low- to high-cost depending on the level of construction required.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. Specifically funding sightline improvements in larger intersection, safety, or active transportation projects in the following categories could include sightline improvements:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**
- **FFE-Transportation Alternatives (TA)**

COUNTERMEASURE:

FEEDBACK (SPEED) MONITORS & RADAR SIGNS

GOAL

To call attention to the driver's speed in comparison to the posted speed limit.

HOW DOES IT WORK?

Speed monitors are useful in areas where it is important to direct a driver's attention to the speed they are driving. These are more likely to be found near schools where drivers should be more cautious of children and teenagers crossing the street. Other areas might include construction sites and zones, college campuses, and busy residential roads. Some speed monitors are solar powered which means less electrical use.

While speed monitors are a proven method for slowing traffic speeds, they might not always have the desired speed reduction that a physical traffic calming measure would result in.

COUNTERMEASURE:

INTERSECTION DELINEATION

GOAL

Improve intersection linemarkings and establish a clear stopping point for vehicles safely at intersections to permit safe movements of other vehicles, cyclists, and pedestrians whether it be at a signalized or signed intersection.

HOW DOES IT WORK?

The improvement of intersection visibility is important to improve the safety of all roadway users. Motorists can miss signage if it has low visibility especially when there are no or faded lane markings. When stop bars, lane markings and even parking linemarkings are delineated it can greatly improve motorist driving patterns and awareness of intersections to reduce crashes and speeds.

To view the "Toolbox on Intersection Safety and Design" by the Institute of Transportation Engineers and U.S. Department of Transportation Federal Highway Administration, **click here**.

COST

Low-cost

CASE STUDY / NATIONAL

A case study performed in Winston-Salem, NC was performed to test the effectiveness of low cost intersection improvement strategies. The goal was to improve safety at stop sign controlled intersections through the use of stop ahead signs and improved intersection linemarkings. The linemarkings added were double yellow centerlines (up to 50 feet) and stop bars (12 inches wide) to the existing intersections. These strategies were shown to reduce the average crashes per year by roughly 48 percent.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**
- **FFE-Transportation Alternatives (TA)**

COUNTERMEASURE:

PINCH POINTS AND CHICANES

GOAL

Reduce speeds on residential and low-traffic streets

HOW DOES IT WORK?

Pinch points and chicanes are traffic-calming measures that enhance road safety by slowing vehicles and increasing driver awareness or promote modal filtering. Chicanes consist of alternating curves or lane shifts that require reduced speeds and careful navigation. Pinch points, or road narrowings, restrict roadway width at specific locations, naturally encouraging slower driving and improving safety for pedestrians and cyclists. Gateways are pinch points at street entrances that reduce speeds as vehicles enter.

Temporary chicanes can be created with tactical urbanism materials like temporary bollards. Permanent chicanes can be created using curb extensions or landscape islands. A chicane-like effect can also be achieved by alternating on-street parking from one side to the other. This method works if parking demand is high enough to keep most spaces occupied during times when pedestrian safety is a concern. Chicanes typically separate opposing traffic with double solid yellow lines and recessed pavement markers, though some drivers may still cut across the centerline. To prevent this, a raised median—either narrow and mountable or wider with landscaping—can be installed if space allows.

Pinch points and chicanes can be used for modal filtering. Typically implemented on low-traffic streets, modal filters use bollards, planters, or curbs to limit access to a roadway. Some modal filters completely block cars (often used near schools), while others simply slow traffic by allowing a single car lane for local access or emergency vehicles to pass through a narrowed point. Alternatively, some neighborhoods may fully block vehicle access at certain entrances while allowing it at others, creating controlled access points. By managing how and where vehicles move, modal filters reduce traffic volumes and speeds, helping to prevent crashes or reduce their severity. Even partial filters promote “filtered permeability".

According to the **Federal Highway Administration** (FHWA), chicanes and pinch points help reduce vehicle speeds and crash risks, especially in areas with high pedestrian activity. By requiring drivers to slow down and stay more attentive, these measures improve safety for all road users.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project could be funded under the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**

COUNTERMEASURE:

LATERAL SHIFT

GOAL

Mid-block intervention to reduce speeding

HOW DOES IT WORK?

A lateral shift refers to a realignment of an otherwise straight street that causes the travel lanes to move in one direction, typically occurring midblock. The main goal of a lateral shift is to reduce vehicle speeds on the road. Usually, opposing traffic is separated by a median island, which helps maintain the intended lane realignment. Without the island, drivers might cross the centerline to follow a straight path, reducing the speed-reducing effect of the shift. Additionally, the median island lowers the chances of a motorist accidentally drifting into oncoming traffic, enhancing road safety.

In general, a lateral shift uses the median island to separate opposing traffic. If the island is absent, drivers may disregard the shift and maintain a higher speed. The shift slows traffic by encouraging drivers to adjust their speed due to the horizontal deflection, with the amount of speed reduction depending on the length of the shift and the traffic volume and distribution. It is less effective in reducing speeds when one direction has much higher traffic volumes than the other or when traffic is so sparse that encounters between opposing motorists within the shift zone are unlikely. Generally, the speed reduction from a lateral shift is less significant than that achieved through a chicane.

COST

Varies based on type of intervention

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project could be funded under the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**

COUNTERMEASURE:

LEFT TURN CALMING

GOAL

To protect pedestrians in crosswalks and reduce driver speed during left turns

HOW DOES IT WORK?

The Left Turn Calming Technique aims to improve pedestrian safety at intersections by reducing vehicle turning speeds and altering driver behavior. This technique is particularly focused on left-turning vehicles, which pose a significant risk to pedestrians in crosswalks. By implementing physical design changes such as rubber bumps, delineator posts, and thermoplastic striping, the initiative seeks to make intersections safer and decrease the likelihood of collisions between vehicles and pedestrians.

The Portland Bureau of Transportation (PBOT) piloted the Left Turn Calming Technique in 2019-2020 to evaluate its effectiveness. The intervention involved installing hardened centerlines and "noses" (small extensions into intersections) at 42 signalized intersections. These measures aimed to slow turning speeds and encourage a wider turning radius, allowing drivers to face the crosswalk more directly, thereby improving visibility of pedestrians.

Data collection showed that left turn calming effectively reduced vehicle turning speeds by an average of 13%, with greater reductions observed when "noses" were included in the design. Additionally, the technique nearly eliminated instances of drivers crossing the centerline, which can increase crash risk. Hardened centerlines using rubber bumps proved to be nearly as effective as those using delineator posts while being more cost-effective and easier to maintain.

While the pilot program demonstrated promising results, PBOT acknowledged the need for further research, particularly with crash data, to assess long-term safety benefits. The evaluation also highlighted installation and maintenance considerations, such as ensuring compatibility with snow plowing and cyclist safety.

Given its success, PBOT recommended expanding left turn calming at intersections where permissive left turns create pedestrian risks. The report also emphasized the need for standardized guidelines to help planners, engineers, and maintenance staff determine the best locations and materials for future installations.

Ultimately, the Left Turn Calming Technique represents a proactive approach to traffic safety, using infrastructure design to reduce vehicle speeds, enhance pedestrian visibility, and create safer urban intersections.

COST

The cost of implementing the Left Turn Calming Technique varies based on the materials used and the specific design of each intersection.

- **Hardened centerline with rubber bumps:**
  Installation: $820 per leg
  Maintenance: $0 during the pilot

- **Hardened centerline with delineators:**
  Installation: $1,298 per leg
  Maintenance: $143 per leg

- **Wedges (corner extensions with bumps and striping):**
  Installation: $519 per wedge
  Maintenance: $0 during the pilot

PBOT found that rubber bumps were nearly as effective as delineators but more cost-efficient, making them a preferred choice for future implementations. However, potential long-term costs, such as replacements due to snow plowing or wear and tear, were not fully assessed in the pilot.

CASE STUDY / NATIONAL

The **Left Turn Calming Pilot Project** was conducted by the Portland Bureau of Transportation (PBOT) between 2019 and 2020 to evaluate the effectiveness of left turn calming measures in improving pedestrian safety at intersections. The study involved installing various configurations of hardened centerlines, including rubber bumps and delineators, at 42 signalized intersections throughout Portland. Data collection, which included pre- and post-installation turning speed measurements and driver behavior analysis, was completed by March 2020. The final evaluation report was last updated on June 2, 2020, and aimed to inform future implementation strategies based on observed safety benefits and cost considerations.

COUNTERMEASURE:

MINI-ROUNDABOUT

GOAL

Small roundabouts that require mininal right-of-way and address safety on low-traffic streets

HOW DOES IT WORK?

Mini-roundabouts are compact circular intersections featuring small diameters and traversable central and splitter islands. They provide most of the benefits of standard roundabouts while requiring less space, making them ideal for areas with physical constraints. Unlike simple traffic-calming measures, mini-roundabouts function as full intersections, improving traffic flow and safety. Best suited for low-speed environments, they serve as alternatives to stop-controlled or signalized intersections, reducing excessive delays on minor approaches. By requiring vehicles to navigate a central island, they naturally slow traffic and minimize severe conflict points, decreasing accident frequency and severity.

A study of **14 mini-roundabouts** in Michigan found that converting signalized intersections into mini-roundabouts reduced total annual crashes by 25%. However, replacing two-way and all-way stop-controlled intersections resulted in a 4% and 5% increase in crashes, respectively.

Mini-roundabouts are particularly effective in urban settings where space is limited. They can be implemented within existing intersection boundaries without requiring additional land acquisition, making them a cost-effective solution for improving traffic efficiency and safety. **Temporary mini-roundabouts** may also be a viable tactical urbanism project.

COST

Medium Cost

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project could be funded under the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**

COUNTERMEASURE:

NARROWED LANE WIDTHS

GOAL

Narrowed lane widths can reduce speeding and the severity of crashes

HOW DOES IT WORK?

Narrowing lane widths is a traffic-calming approach that improves road safety by slowing vehicle speeds and promoting driver attentiveness. Studies show that narrower lanes, typically between 10 to 11 feet, are linked to lower crash rates compared to wider lanes. A **Johns Hopkins University study** found that 9-foot lanes often lead to fewer accidents than wider lanes, challenging the usual preference for 12-foot lanes.

The study also revealed that narrower lanes do not increase the risk of accidents. When comparing 9-foot and 11-foot lanes, there was no significant difference in crash rates. However, widening lanes to 12 feet resulted in more crashes, likely because drivers tend to speed up and become less cautious with more space.

Speed limits are a key factor in how lane width impacts safety. At speeds of 20-25 mph, lane width had little effect on crash rates. But at speeds of 30-35 mph, wider lanes were associated with a higher number of crashes compared to 9-foot lanes.

In addition to safety benefits, narrower lanes have environmental advantages by using less space, reducing asphalt use, and minimizing land consumption and impervious surfaces. They can also promote economic growth by increasing property values, supporting local businesses, and enabling new development.

Although this strategy is beneficial for safety, it's not suitable for all contexts, such as roads with heavy bus or freight traffic that require wider lanes. In other contexts, the concept can be expanded. For example, in low-traffic residential areas, a narrow street with on-street parking can require one car to yield to another to continue. This allows enough room for minimal traffic to flow while reducing speed and reducing pavement that requires maintenance. This type of street is common in older residential neighborhoods across the country.

COUNTERMEASURE:

RAILROAD CROSSING IMPROVEMENTS

GOAL

Reduce crashes at railroad crossings for all road users

HOW DOES IT WORK?

Improving safety at railroad crossings is crucial for preventing accidents and protecting both drivers and pedestrians. While large-scale projects like grade separations are effective, smaller interventions can also make a significant impact on safety.

Implementing intelligent transportation technologies, such as the Dedicated Short-Range Communication (DSRC)-enabled train safety system, provides real-time notifications to drivers about oncoming trains, particularly at unmanned crossings. This system has been proven effective for trains moving up to 35 mph, giving drivers 25-30 seconds to react and avoid collisions.

Adding lane dividers or channelization devices helps prevent drivers from bypassing lowered gates. These low-cost measures have been successful in changing unsafe driving at road-rail intersections.

Regular upkeep to remove vegetation that blocks sightlines ensures that both drivers and train operators can clearly see the crossing area, lowering the risk of accidents. The Federal Highway Administration **highlights** the importance of eliminating obstructions to enhance safety at highway-rail grade crossings.

COST

Medium Cost

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project could be funded under the following funding categories:

- **FFE-Highway Safety Improvement Program (HSIP)**

COUNTERMEASURE:

REDUCING POSTED SPEED LIMITS

GOAL

Reducing the posted speed limit aims to slow down motorists' speeds — increasing safety and decreasing crashes.

HOW DOES IT WORK?

Lowering the posted speed limit may encourage people to drive more slowly. However, reducing the posted speed limit alone does not necessarily increase safety of the road for all users. Speeds traveled are based on the driver's perception of the road and surrounding environment. Therefore, a combination of smart street design and the reduction of speed limits is the best approach and will yield the best results.

Pairing this strategy with others that include road dieting, or the addition of detailing or speed bumps would likely make this a more successful approach. Keeping speed limits within reason is also important. Residential roads, narrow roads, and areas with more development along the sides of streets would be better for a lower posted speed limit.

Speed limits are often subject to change based on studies and redefined based on the 85th percentile (speed) that drivers are found driving. This is called "prevailing speed" and is the major consideration for setting speed limits because it is the "safest" speed that 85 percent of drivers are driving. However, speed is the greatest factor in road safety and what the majority of drivers are doing may not actually be a safe speed for drivers or vulernable road users like people walking or biking.

Reducing speeds through lowering speed limits is a time-honored countermeasure. Evidence shows, though, that actual speeds are reduced by only a fraction of the reduction in speed limits – typically 1-2 mph speed reduction for every 5-mph speed limit reduction. However, even 1-2 mph reductions in average speed are estimated to yield substantial fatal and injury crash reductions over all, with higher percentage reductions on streets with lower initial speeds. Reducing posted speeds is a first-step in reducing dealths as infrastructure improvments are implementd.

CONSIDERATIONS

Relying solely on this strategy will not create a lasting impact on making the environment safer for pedestrians, cyclists, and drivers. Motorists tend to drive at speeds they feel comfortable and safe with, which is largely influenced by the road's design. However, **some evidence**, including studies from **Seattle**, suggests that reducing speed limit signs can be an effective strategy for reducing deadly crashes, particular in urban areas.

COST

Low-cost to medium cost

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

/ **FFE-Highway Safety Improvement Program (HSIP)**

CASE STUDY / NATIONAL

Boston, Massachusetts lowered their city street speed limits by just 5 mph in January 2017. Throughout that time, Boston advertised this change through social media and other traditional media outlets.

Boston looked at the vehicles that exceeded the speed limits at 25, 30, and 35 mph and evaluated the odds associated with the new posted speed limit of 25 mph. Researchers found that the odds of drivers exceeding the multiple speeds decreased, with the largest being in drivers who drove over 35 mph. Drivers who drove over 35 mph dropped 29.3%, those who exceeded 30 mph decreased 8.5%, and those who drove over 25 mph fell only 2.9%.

What this study did not evaluate was the crash reports in Boston after the reduction of speed, which is the next step. However, higher travel speeds are likely to increase the risk of injuries or death when a crash occurs. This happens because the faster a car is moving, the less reaction time a driver has. Reducing the speed limit allows for a longer reaction time and can reduce the severity of a crash when it does happen. **Click here** for the full article.

SPOTLIGHT

The Role of Design in Regulating Speed and Managing Volume

Speed management is one of the most effective tools cities have to reduce crash severity and save lives. Speed is not just a behavioral issue—it's a design outcome. The width, curvature, and alignment of a street all signal to drivers how fast it feels "natural" to travel. When streets are built to highway standards in community settings, people respond accordingly by driving faster, braking less often, and paying less attention to their surroundings. Design can just as easily communicate the opposite message. By narrowing lanes, tightening curves, and shaping intersections to reflect surrounding land use, streets can be engineered to achieve safer, more predictable travel speeds without relying solely on enforcement.

A proactive approach begins with selecting a target speed, the greatest speed a street is planned to safely accommodate under ordinary conditions. Target speeds are based on what the human body can physically tolerate in a collision, balanced with the street's purpose and context. Design speed refers to the speed used to determine physical features such as curves, lane widths, and sight distances. Well-designed streets use geometry and context to naturally guide drivers to travel at or below the target speed, reinforcing both the posted speed and local safety goals. The posted limit should match the target speed (not the speed that currently feels comfortable behind the wheel) and should be clearly communicated through both signage and design cues.

For decades, transportation planning has prioritized vehicle throughput and congestion reduction, treating delay as the primary problem to solve. While this approach may appear efficient, it often results in higher driving speeds and an increased risk of severe crashes, particularly during periods of lighter traffic. Building for speed and capacity can also backfire over time, as wider roads encourage more driving, push short trips onto regional corridors, spread destinations farther apart, and increase long-term maintenance costs.

Effectively managing traffic volumes means giving people real choices in how they travel. Streets that safely and comfortably support walking, biking, and transit relieve pressure on the road network by offering alternatives for short and moderate trips. Every person who can make a trip without a car frees up capacity for those who need to drive (freight, emergency vehicles, and longer commutes). This is not about taking away the ability to drive, but about using limited public space efficiently and responsibly. Cars are among the least space-efficient modes, both when moving and when parked. A single transit lane or protected bike facility can move far more people within the same footprint while improving safety and reliability for everyone.

These strategies only work when paired with supportive land use and high-quality options that make it easy and safe to reach daily destinations without a car. When design, speed management, and multimodal access work together, personal vehicles remain a viable choice, but not the only one. The result is a transportation system that provides freedom, safety, and real options for everyone.

COUNTERMEASURE:

ROAD DIETS: REDUCING NUMBER OF LANES

GOAL

To reduce the lane width and/or the number of lanes to reduce speeds and allow for different modes to safely travel.

HOW DOES IT WORK?

Road diets are an increasingly common strategy for towns and cities. They focus on the idea of removing a lane(s) and then using the new space for other modes (wider sidewalks, bike lanes, etc.) or greenery.

One way of adding space for other modes (bicycles, walking, transit) is to reduce lane width. Historically, lane width has been wider to accommodate faster travel speeds as well as to provide a space for loading and unloading. To combat this, research has found that lanes as little as 9-feet wide do not restrict traffic flow and encourage people to drive slower because of the close proximity to other cars. Reducing the number of lanes in general is also part of road dieting where the lane(s) would ideally be used for another use. This could be used for the widening of sidewalks, creation of a dedicated public transit lane, or even putting in protected bike lanes.

The most popular road diet adaption is to reduce four-lane roads down to three-lanes, with a center turn lane and one lane in either direction. 4-Lane to 3-Lane, Road Diet Conversions are proven safety countermeasure and offer a 19-47% reduction in total crashes per the Federal Highway Administration.

Road diets may also make room for bike lanes, wider sidewalks, landscaping, or dedicated bus lanes encouraging mode shift and beautifying a community. Furthermore, they reduce ongoing road maintenance costs by reducing the amount of road miles to maintain.

COST

High-cost

CASE STUDY / NATIONAL

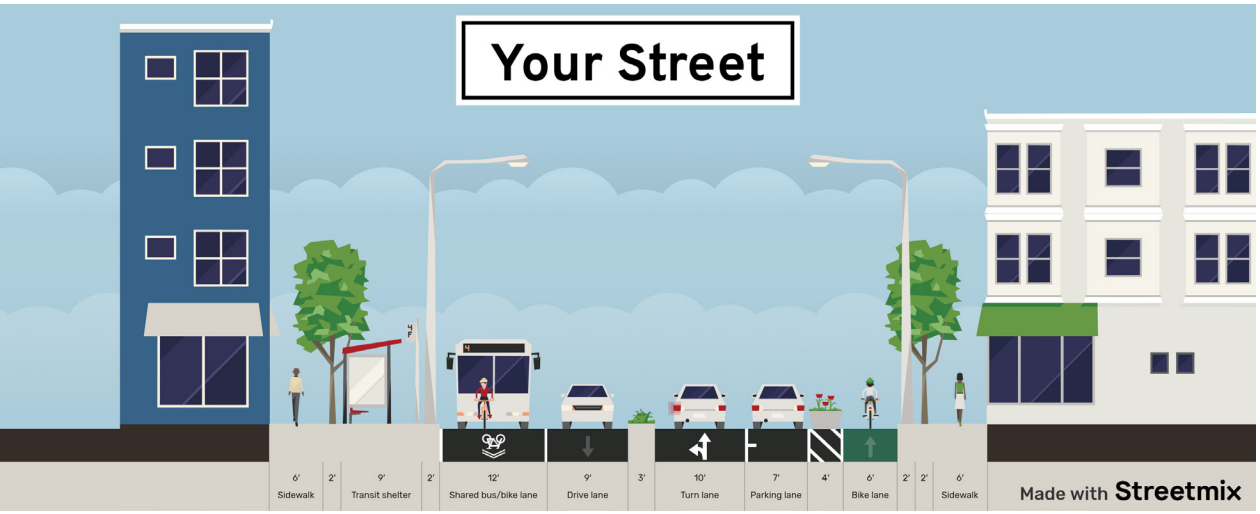
Genesee County, Michigan adopted a Complete Streets program in 2009 which promoted road diets. The Genesee County Metropolitan Planning Commission assessed every 4-lane road in its jurisdiction to convert them to 3 lanes. They started by working on roads that saw lower volumes of traffic per day (6,000-8,000 vehicles) and worked their way up to roads that saw 15,000 vehicles per day.

Overall from 1996-2007, Genesee County saw a decrease in crashes where road diets were implemented.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**
- **FFE-Congestion Mitigation and Air Quality (CMAQ)** If providing congestion or air quality benefit such as reducing vehicular traffic
- **FFE-Transportation Alternatives (TA)** For portions of the project focusing on people walking, biking, or those with disabilities



Interested in what a road diet on your street could look like? Street Mix allows you to design, remix, and share your street. Add bike paths, widen sidewalks or traffic lanes, learn how all of this can impact your community. Try it out at **streetmix.net**

CONSIDERATIONS

Speed tables should not be installed on a sharp curve, and coordination between operators of emergency services and public transit should be prioritized.

COST

Low-cost

Speed bumps and speed tables cost on average $2,500 (ranging from $1,000 to $6,900 depending on size, materials, design, and drainage conditions).

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

/ **FFE-Highway Safety Improvement Program (HSIP)**

CASE STUDY / NATIONAL

A **neighborhood in Naples, Florida** faced a high rate of speeding on residential roads. Located near the coast, Seventh Avenue traditionally experienced high traffic and speeding because of people who used their neighborhood as a cut-through to get to the beach. Before any measures were taken to reduce speed, average driver speed was 33 mph and they had approximately 8,000 vehicles through per day. The residents of 7th Ave. went to the City, a traffic study was conducted, and applied multiple strategies to slow traffic including medians, landscaping, and a speed table. After the improvements, another study was done which determined that the traffic count reduced from 8,000 to 5,000 vehicles per day and average speed dropped from 33 mph to 22 mph.

COUNTERMEASURE:

SPEED TABLES/RAISED INTERSECTIONS

GOAL

To protect pedestrians and reduce driver speed with a raised crosswalk or speed table roadway obstacle.

HOW DOES IT WORK?

Raised intersections and speed tables create a safer, slow-speed crossing at an intersection. By slowing driver speed, both pedestrians and drivers are able to better anticipate one another and ultimately, these design solutions encourage drivers to yield to pedestrians at the crossing.

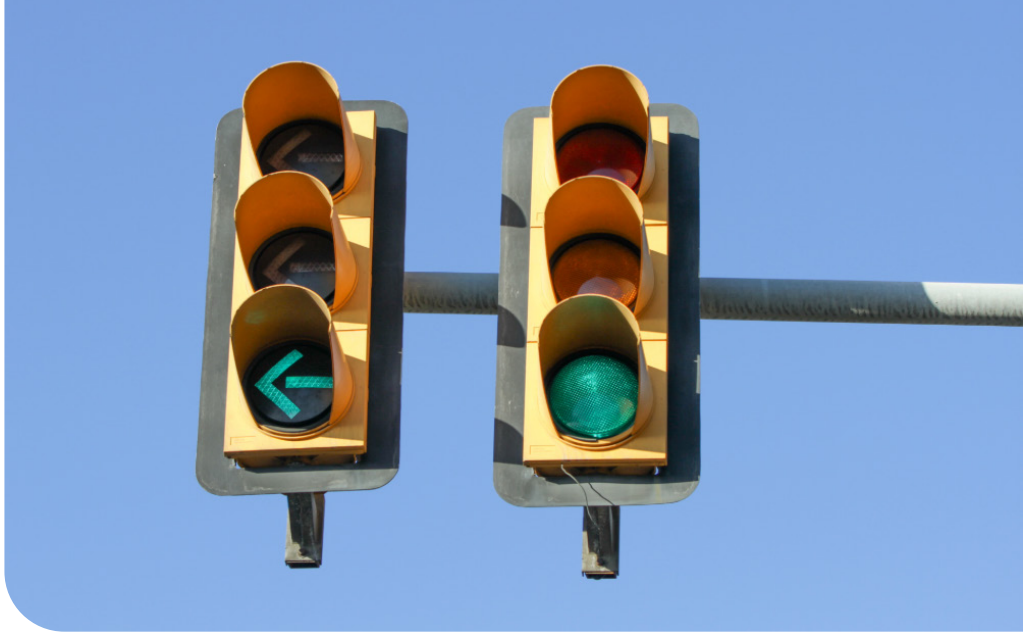
Raised crosswalks or speed tables are similar to speed bumps in that they are both elevated a few inches above the pavement to reduce driver speed. But unlike speed bumps, they raise the whole vehicle and are flat-topped, often longer than speed bumps, and are more suitable for higher speed areas. Typically, these crosswalks are 3-3.5 inches high, 22 feet in length, and are located in areas with speed limits ranging from 25-45 mph. They can be used as a **raised midblock crossing**; which allows for safer pedestrian crossing in the middle of a roadway. These developments can be found near schools, parks, smaller commercial corridor sections, and other similar destinations.

Signage should accompany a raised crosswalk to warn drivers of the sudden height change, as well as to warn them to be on the lookout for pedestrians. These crosswalks should be installed in areas where there is a significant pattern of pedestrian street crossing (i.e. the middle of a block with development on both sides). Crosswalks can be designed with pavers or other distinctive materials that help define the crosswalk. Speed tables are designed to increase driver awareness of pedestrians, and make drivers slow down more than if they were approaching a speed hump.

Strategies to consider when introducing a new crosswalk include a setback to allow drivers a longer reaction/slow down time to avoid collision with a pedestrian and adding some type of reflectors or lights to increase visibility in the evening. Medians and safety islands could also be built in to create a safer crossing. Bollards at corners of Raised Intersections keep drivers from crossing whether intentionally or not into the pedestrian space.

COUNTERMEASURE:

UPGRADED TRAFFIC SIGNALS



GOAL

To reduce conflicts in time for road users

HOW DOES IT WORK?

Managing conflicts in time that acknowledges that road users will need to occupy the same physical space on the roadway and creates a safer environment by separating the users in time. Upgraded traffic signals can better manage timing to improve safety and efficiency across all modes of transportation and also improve post-crash care.

Upgraded traffic signals can detect and adapt to traffic needs, improving overall service and accommodating different road users while collecting data that can inform other decisions. Signal timing can be used to provide transit priority, detect pedestrians to provide longer pedestrian crossing times, and enable emergency vehicle preemption. An emergency vehicle preemption system uses technology at signalized intersections to provide a green interval for an emergency vehicle approaching an intersection, and a red interval on all conflicting approaches. This allows emergency vehicles to travel through traffic more safely efficiently.

Another design strategy involves implementing dedicated left turn lanes and left-turn phasing, which can make turning maneuvers safer for drivers. Left turn phasing provides left-turning vehicles with a dedicated green or yellow arrow while halting oncoming traffic and parallel pedestrian crossings. This approach effectively eliminates conflicts between left-turning vehicles and oncoming traffic.

CASE STUDY / NATIONAL

The benefits of transitioning from permissive to protected left-turn phasing are **well-documented**. In Utah, such a change led to an 87% reduction in fatal and serious injury crashes at treated intersections. Similarly, in Detroit and Grand Rapids, Michigan, upgrading permissive left-turn signals to protected phasing at three intersections resulted in an 84% decrease in left-turn head-on crashes, a 59% reduction in injury crashes, and a 32% overall decrease in total crashes per year. In an Austin, Texas **study** of their Vision Zero work, 9 of the 13 study locations received treatments to address crashes involving one motor vehicle going straight and one turning left, including converting signals to exclusive left turn phasing or flashing yellow arrows. Following implementation these locations saw a 56% reduction in the annual number of left turn across path crashes and a 55% reduction in injury or fatal crashes of this crash type. This is compared with a 1% and 5% reduction, respectively, for the citywide control group over the same time period.

COUNTERMEASURE:

CROSSWALKS

GOAL

To increase driver awareness of pedestrian crossings, and to increase safety for pedestrians crossing the street.

HOW DOES IT WORK?

Crosswalks are essential for bike and pedestrian safety. There are multiple painted crosswalk solutions, all of which are easier for drivers to see: zebra stripes; combination designs with vertical stripes across the width of the intersection and two horizontal lines on both sides (create an outline); and full-color crosswalks (where the whole width of the crosswalk is colored).

CONSIDERATIONS

Crosswalks are beneficial but not a full-proof countermeasure for pedestrians and bicyclists. A variety of marking materials and application methods are available for marking crosswalks. Many agencies' marking material decisions depend on a combination several factors, including but not limited to traffic volumes, snowplowing activity, lighting conditions, climate, and resurfacing schedule. High visibility crosswalks are associated with greater increased driver yielding compared to basic markings. However, even with high visibility crosswalks safety outcomes appeared to improve with the application of marked crossing locations on narrower roads but appear to degrade along wider or higherspeed roads unless combined with other safety measures like improved design. FHWA maintains a guide on crosswalk implementation known as the **Crosswalk Marking Selection Guide**.

COST

Low-cost

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible as part of larger safety or intersection project for the following funding categories:

- **FFE-Highway Safety Improvement Program (HSIP)** - Typically as part of larger safety project
- **FFE-Transportation Alternatives (TA)**

COUNTERMEASURE:

CURB EXTENSIONS

GOAL

To protect pedestrians and bicyclists on the sidewalks of intersections by extending them and reducing the time and distance of crossing a street.

HOW DOES IT WORK?

Curb extensions are traffic calming measures used to extend sidewalks at intersections and narrow roadways. They reduce the amount of time and distance a pedestrian or bicyclist has to spend crossing the street. Vehicle drivers can also better see pedestrians and bicyclists crossing since the extension aligns with the parking lane and does not prohibit visibility where it otherwise would without the extension.

Curb extensions are usually accompanied by no parking or stopping signs and with visual reinforcement such as painted road markings, barriers, bollards, or planters and benches. They are also paired with other traffic calming measures such as rumble strips or speed bumps.

Curb extensions have other purposes as well, they can be used for bus bulbs (the area where a person waits to get on a bus) or implemented at midblock crossings (known as pinchpoints) to reduce the distance a person must cross. To read more, **click here**.

Image Source: Photo by Carl Sundstrom, obtained from pedbikeimages.org

COST

Low- to high-cost

Curb extensions cost from $2,000 to $20,000 per corner depending on design and site conditions including drainage.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG) -** As part of larger intersection project
- **FFE-Highway Safety Improvement Program (HSIP)** - Typically as part of larger safety project
- **FFE-Transportation Alternatives (TA)**

CASE STUDY / NATIONAL

SE Division Street in Portland, Oregon acts as a through street with various land uses lining it. Over time, the street became a destination point for people to visit with an increase in neighborhood retail shops and more use from pedestrians and bicyclists. Despite having a posted speed limit of 25 mph, drivers were exceeding it, driving anywhere from 26-31 mph. Travel lanes replaced curbside parking during rush hour and were underutilized.

Through an in-depth multi-year design and outreach process, the City of Portland worked with multiple teams on a plan for improving the corridor and planning for growth over the next 20 years. The street was redesigned with better travel lanes, curb extensions, marked crossing, improved bus stops, on-street bike parking, bioretention planters, and large trees.

By eliminating lanes, space was able to be reclaimed for other uses such as sidewalk improvements with added ramps to make sure the walkways were ADA compliant. Trees were used for shade and beautification, and stormwater management played a large role for development. By incorporating stormwater facilities with the curb extensions, it helped manage excess stormwater runoff from the street and keep pedestrians safe by reducing crossing distance and enhancing pedestrian visibility for the drivers.

COUNTERMEASURE:

DAYLIGHTING

GOAL

To increase visibility of pedestrians and those in wheelchairs at crosswalks with parking.

HOW DOES IT WORK?

Converting the parking space(s) immediately before a crosswalk into a No-Parking Zone at a minimum of 10 feet long, Daylighting increases the visibility of pedestrians crossing the street.

Often when cars are parked too closely to the intersection, it is difficult for drivers to see pedestrians crossing the street. Additionally, uncontrolled crosswalks (or those without a signal) and too-closely parked cars make it difficult for the pedestrian to see any oncoming car.

A solution is installing plastic delineators, bollards, or even pavement markings to keep cars from parking in the space next to the crossing. Simply making the space next to the intersection a no-parking-space or filling it bike parking or bollards make it easier for drivers to see pedestrians.

CASE STUDY / NATIONAL

In **Hoboken, New Jersey**, a constant demand for on-street parking led to illegally parked vehicles too close to intersections. This action significantly hindered visibility of pedestrians by oncoming traffic as well as pedestrians to see if it was safe to cross.

Looking for a low-cost solution, the city installed vertical delineators to mark no-parking zones at intersections. This treatment was called Hoboken Daylighting. Each corner leading into an intersection had two plastic delineators installed.

Pedestrians and motorists both had improved visibility through intersections where vertical delineators had been installed. From 2009 to 2011, through a series of pedestrian safety measures that included the installation of vertical delineators, the City of Hoboken witnessed a 30% decrease in pedestrian injuries caused by vehicles.

COST

Low-cost and generally not eligible for IMPO-managed funding unless combined with a larger project

FUNDING FOR THIS PROJECT

The IMPO does not have a funding source for daylighting but it could be incorporated into larger IMPO-funded projects.

Image Source: CURBED

COUNTERMEASURE:

FLASHING SIGNAGE AT ROADWAY CROSSINGS

Image Source: LightGuard Systems

GOAL

Improve pedestrian safety and reduce the number of crashes at designated crossings.

HOW DOES IT WORK?

Implementing flashing signage or ground lights at crosswalks can improve the visibility and likelihood of motorists to stop for crossing pedestrians. These flashing lights can be installed in new or existing signage above or in the roadway. Embedded crosswalk flashers are located in the roadway on the pavements surface. By installing flashing lighting at crossings raises motorist awareness of potential pedestrians and reduces speeds near these points. These installed lighting can always be flashing, or they can be programmed to turn on when pedestrians push a button.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**
- **FFE-Transportation Alternatives (TA)**

CASE STUDY / NATIONAL

San Jose, California desired to determine what kind of crosswalk recognition works best in their community. The City tested two different crosswalk safety measures, flashing beacons and ground flashers. Both were installed on similar roadways and driver stopping distances and percent of vehicles that yield were recorded. At the end of the study San Jose found that both flashing beacons and crosswalk ground flashers increased the braking distance of vehicles approaching the intersection. In most cases doubling the braking distance. However, the embedded crosswalk flashers were found to have the greatest success in getting drivers to yield to pedestrians crossing. The number of drivers yielding quadrupled within a six-month period. Embedded crosswalk flashers work in some communities, but it can increase roadway maintenance costs. Street sweepers and snow removal equipment would have difficulties avoiding these flashers and could easily damage them. This makes them difficult to implement in cities with a temperate climate.

COUNTERMEASURE:

LEADING PEDESTRIAN/BICYCLE INTERVALS

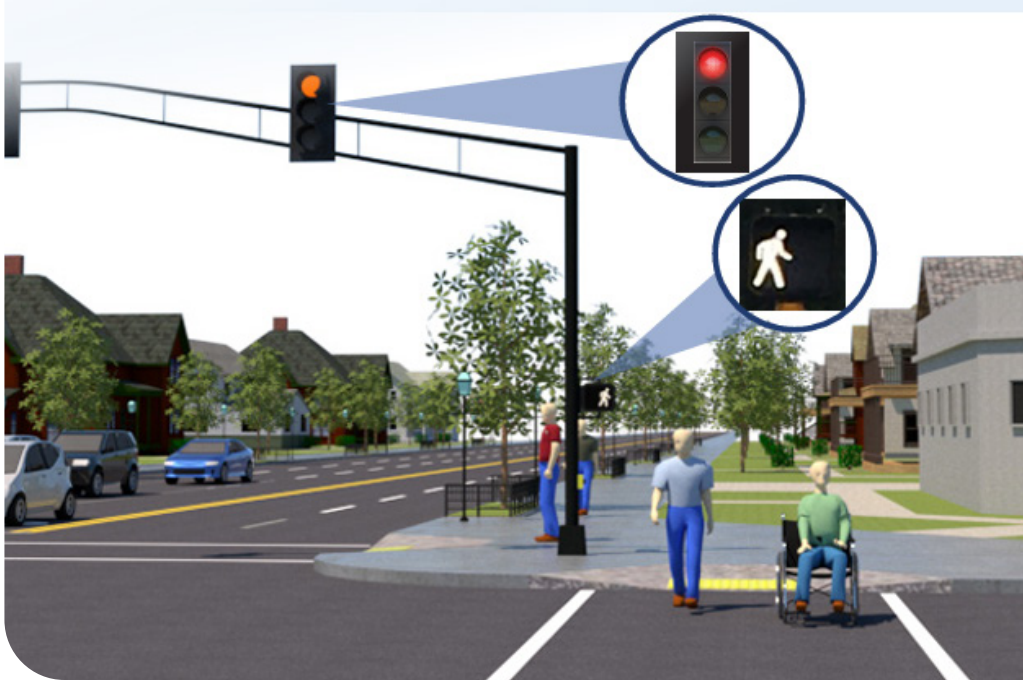
GOAL

To increase pedestrian safety by allowing them the ability to cross at an intersection and increase their presence before vehicles are given right of way to travel through or turn at a traffic light.

HOW DOES IT WORK?

Leading pedestrian/bicycle intervals (LPI) help create pedestrian and bicyclist presence in an intersection anywhere from three to seven seconds before a traffic light turns green and gives vehicles the right of way. This allows for vehicles turning left to have increased awareness of those crossing while giving priority to pedestrians and bicyclists and increasing safety at intersection crossings. When bike lanes are present within a street, bike signal priority can also be implemented to prevent conflict with a turning vehicle and a bicyclist going straight through the intersection.

LPIs require adjustments to the existing signal timing making this a low-cost solution. It has also been recorded that they can reduce pedestrian-vehicle collisions up to 60 percent at intersections that have adopted this strategy. This strategy can also work well paired with curb extensions to increase pedestrian visibility; especially at high-conflict intersections.



FUNDING FOR THIS PROJECT

This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**
- **FFE-Transportation Alternatives (TA)**

CASE STUDY / NATIONAL

A leading pedestrian interval was created at three signalized intersections in downtown St. Petersburgh, Florida. Studies were done prior to and after the installation to collect data and determine if an LPI was a good strategy to implement. No public outreach or marketing was done throughout the study to ensure that the results would not be biased.

After the study concluded, there were 44 pre-treatment observation periods at all three sites. On average, there were between two and three conflicts per 100 pedestrians with some having up to five conflicts. After the LPI was installed, 34 of the 41 sessions had no conflicts – no more than two conflicts were recorded per session per 100 pedestrians.

COUNTERMEASURE:

PEDESTRIAN HYBRID BEACON OR HAWK SIGNAL CROSSINGS

GOAL

Improve the safety of pedestrians crossing the street where long block segments exist with limited safe crossing opportunities present.

HOW DOES IT WORK?

A Pedestrian Hybrid Beacon or Hawk Signal Crossing is a combination of a beacon flasher and a traffic control signal for marked crosswalks. Pedestrians press the button activating the beacon, and approaching drivers see a flashing yellow light indicating they should slow down, and be prepared to stop for people walking or biking. The flashing yellow light is followed by a solid yellow period, and then solid red, requiring drivers to stop at a marked line, similar to a typical traffic signal. Once the solid red light has been established, a "walk" signal is illuminated, indicating safe crossing for the pedestrian. During this period, the motorist is required to stay stopped until the crosswalk is clear of pedestrians. Pedestrian Hybrid Beacons should only be used at mid-block crossings.

Image Source: Arizona Public Media

COST

Moderate-cost

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**
- **FFE-Transportation Alternatives (TA)**

COUNTERMEASURE:

PEDESTRIAN PUSH BUTTON COUNTDOWN AND AUDIBLE (APS)

GOAL

Allow pedestrian and bicyclists a proper signalized time for crossing streets safely.

HOW DOES IT WORK?

By installing a push button countdown (signalized crosswalk) and making them audible agencies may encourage inclusion and compatibility for multiple users. The signal will graphically and audibly let the pedestrians know when it is safe to cross. The signals must be timed to offer pedestrians a long enough block of time to cross the road before the signals change to allow traffic to pass through. Some ITS solutions include sensors that allow longer crossing time for users who might be crossing more slowly such as elderly users.

Push button countdowns can be used at mid-block locations and incorporated where there are existing traffic signals at intersections. Pedestrian phasing (leading pedestrian intervals) should be encouraged for setting up timers to continue to reduce the potential conflicts between people walking and vehicles.

Evidence **suggests** shorter pedestrian wait times (under 30 seconds) significantly reduce dangerous crossing. Having a cellphone in one's hand reduced the likelihood of starting to cross on red. Contrasting, looking at traffic was more than four times associated with crossing illegally.

COST

Low- to moderate-cost depending on the extent to which this would be implemented and if new construction would have to take place.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**
- **FFE-Transportation Alternatives (TA)**

COUNTERMEASURE:

PEDESTRIAN SAFETY ISLANDS AND EXTENDED CURBS

GOAL

Create pedestrian refuges to provide a safer means of crossing high-traffic streets. These are typically implemented on three or more lane roads where higher speeds discourage a pedestrian and bicyclist friendly environment.

HOW DOES IT WORK?

Pedestrian safety islands reduce the amount of time a pedestrian or bicyclist will spend in an intersection. They should be at least 6 feet wide, but larger is better if the location allows for it. The cut-through or ramp of a pedestrian safety island should also be the same width of the crosswalk (or smaller if it cannot be the same). An extension past the crosswalk is also preferable since it acts as a "protective obstacle" for people on the island. Additional features can include curbs, bollards, reflectors, etc. Landscaping would require additional maintenance to provide sight lines.

Where there are intersections that are unsafe or have underused spaces, a curb could be extended to fill the underused space creating opportunities for a plaza or other pedestrian-oriented space. This extension often realigns roadways and intersections increasing safety for all roadway users. Crosswalks and other bicycle and pedestrian facilities should be reconstructed and striped. The construction of this extended curb can often shorten the distance for pedestrian crossings, create right-angle intersections, and reduce roadway pavement (and associated maintenance).

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**
- **FFE-Transportation Alternatives (TA)**

CASE STUDY / NATIONAL

In New York City, **Adam Clayton Powell Jr. Boulevard** was historically known for being a dangerous street to cross. High speeds and traffic volume paired with the 100-foot right-of-way discouraged people to cross the street because of the fear of getting hit. The right-of-way had three lanes in either direction (12 feet wide), a 9-foot parking lane on either side, and a 10-foot median island.

A study of one section showed prior to any project implementation that 62% of drivers exceeded the 30 mph posted speed limit, with speeds reaching as high as 52 mph. Due to an increase in driver-pedestrian related collisions and fatalities, NYC Department of Transportation (DOT) looked into where these crashes were occurring and trying to find a way to combat the problem.

Part of the redesign of the road involved trying to find a way to shorten the distance pedestrians had to walk to cross the street. One of the strategies implemented was to preserve the 10-foot median but widen it at the intersections to shorten the crossing distance. Previously, the median stopped short of the crosswalks, but the redesign extended the medians into the crosswalk with an addition 8-foot width on one or both sides. This means the median increased from 10 feet to either 18 or 26 feet total near the crosswalks and allows for a larger safety barrier for pedestrians.

COUNTERMEASURE:

REDUCING CURB RETURN (REDUCING CORNER RADIUS/RADII)

GOAL

Reduce the speed that drivers make right turns, and reduce the distance that pedestrians must cross to get across the street, and to increase driver awareness of pedestrians by increasing visibility.

HOW DOES IT WORK?

One of the most common vehicle-pedestrian crash types involves right-turning vehicles striking pedestrians. A wide turn radius allows higher turning speeds, reducing drivers' reaction time to pedestrians and cyclists in their path. A key solution is reducing curb radii at intersections to force slower turns, improving safety.

By tightening or reconstructing the corner to force a driver to navigate a tighter turn will result in slower right turns. In addition to reducing the turning speed of the vehicle, it can also reduce the distance pedestrians travel across an intersection decreasing the likelihood of interactions with vehicles. Curb radii should be designed to accommodate the types of vehicles using the roadway.

Image Source: Alta Planning

Mountable features like aprons and overruns help control vehicle speeds across different sizes. They use pavement that can be driven over but feels uncomfortable to cross, typically along the edge of a lane. This design tightens the roadway geometry for smaller vehicles while still allowing larger ones to pass over at low speeds.

Curb radii should be designed to accommodate the types of vehicles using the roadway. The smallest practical radii (5–10 feet) should be used whenever possible. For urban streets with high pedestrian volumes, a radius of 15–20 feet is appropriate, while arterial streets with frequent turning buses and trucks may require 25–30 feet. Since reducing turning radii can pose challenges for freight and transit vehicles, adjustments should be context-sensitive.Smaller curb radii can be implemented through temporary tactical urbanism projects or permanent infrastructure changes, contributing to safer and more efficient intersections.

- **FHWA Crash Modification Factor for Corner Radius Full Study**
- **FHWA Crash Modification Factor for Corner Radius Brief**
- **NACTO Corner Radii Guidance**

CONSIDERATIONS

Reducing curb radii can create safer environments for pedestrians however, it can also create limitations for larger vehicles. Trucks, buses, and emergency vehicles may have difficulty at narrow intersections with small curb radii which could cause conflicts with pedestrians. These large vehicles cannot make sharp turns and could result in these vehicles driving on the curb potentially damaging it or hitting pedestrians.

COST

Low- to high-cost

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)** - Typically as part of larger intersection project
- **FFE-Highway Safety Improvement Program (HSIP)** - Typically as part of larger safety project
- **FFE-Transportation Alternatives (TA)** - Typically as part of larger project such as Safe Routes to School

COUNTERMEASURE:

ROADWAY MEDIANS

GOAL

To provide a safe area for pedestrians when crossing the road, to help manage left-hand turning pocket with narrower or fewer lanes, and to provide space for landscaping.

HOW DOES IT WORK?

Similar to pedestrian safety islands, **roadway medians usually reside in the middle of a roadway and can serve as a pedestrian refuge.** Medians are used for the narrowing of roads, reduce head on crashes, prevent dangerous overtaking manoeuvres, and reduce turn options for vehicles making movements more predicable and potential safer for people using crosswalks. There are a few ways to design medians:

- A painted median flush with the road surface, with little to no construction; or
- A raised median, which is a higher cost; or
- A depressed median, which is a higher cost.

Medians are likely to be the most useful on higher volume, higher speed roads as opposed to lower speed roads. Medians should not replace potentially better solutions such as wider sidewalks, bicycle lanes, buffer strips, and on-street parking depending on the areas that are having problems that need to be addressed. To learn more, **click here**.

Where no median is present, islands can be used as a measure to narrow the roadway. These work well in mid-block locations or neighborhood entrances as well.

COST

Low- to high-cost

The cost for adding a raised median is approximately $15,000 to $30,000 per 100 feet, depending on the design, site conditions, and whether the median can be added as part of a utility improvement or other street construction project.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)** As part of intersection or ITS improvements
- **FFE-Highway Safety Improvement Program (HSIP)**

CASE STUDY / NATIONAL

Luten Avenue in Staten Island, New York wanted to address some safety concerns along the street. The New York City Department of Transportation wanted to implement a road diet by reducing the 4-lane roadway to a 2-lane roadway with a center median and parking lanes. Due to the location of this road, it did experience heavy pedestrian activity and some access to residential areas.

The goal of this road diet was to reduce speeds of vehicles driving by because of a fatal accident with a student. Using information, the NYCDOT was able to narrow the road from 2 lanes down to one with a painted center median and parking lanes.

Studies have shown that after the road diet, vehicles exceeding the speed limit decreased by 34% southbound and 21% northbound along Luten Avenue.

COUNTERMEASURE:

STREET TREES & LANDSCAPING

GOAL

To create a visually appealing edge and barrier for motorists to decrease driving speeds - protecting pedestrians.

HOW DOES IT WORK?

Landscaping, especially the inclusion of street trees, can play a significant role in shaping how people experience and move through a corridor. Trees and planting strips create a more comfortable and appealing walking environment, offering shade, visual interest, and a sense of protection from moving traffic. For drivers, these same elements help define the edges of the roadway and signal that they are traveling through a shared, human-centered environment rather than a high-speed road. This “visual enclosure” effect subtly narrows the driver’s field of view, encouraging more cautious and consistent speeds. Regular tree spacing and continuous plantings also help establish rhythm and scale, reinforcing the intended design speed and visually distinguishing community streets from regional corridors.

When placed strategically between the sidewalk and the roadway, trees and landscaping act as a soft buffer that improves both real and perceived safety for people walking, biking, or waiting at transit stops. Beyond safety, well-planned landscaping improves stormwater management, reduces heat, and enhances property values, making it one of the most cost-effective design tools for building safer, more livable streets.

COST

Low- to moderate-cost depending on the implementation level.

One planting can cost from roughly $250 - $600 including maintenance for the first three years. They are generally planted anywhere from four to eight feet from the curb.

Additional landscaping costs will also vary depending on the plantings (flowers and shrubs).

FUNDING FOR THIS PROJECT

The IMPO may fund street trees and landscaping as part of larger transportation projects but these improvements are not eligible on their own at this time. Protective features, including natural infrastructure, to enhance the resilience of an eligible transportation facility are eligible for Surface Transportation Block Grant but natural protective features would need to be more substantial than street trees.

Erfurt, Edward. "**How to Use Optical Narrowing to Make a Street Safer.**" Strong Towns, 15 Sept. 2023.

CASE STUDY / NATIONAL

The Street Tree Effect and Driver Safety by Jody Rosenblatt Naderi, Byoung Suk Kweon, and Praveen Maghelal explores how roadside trees influence driver behavior, safety perception, and speed. The authors **found** that tree-lined corridors encourage slower, steadier driving and help drivers better distinguish the roadway from the pedestrian environment. The visual enclosure created by trees narrows the perceived width of the street, promoting caution and attentiveness behind the wheel. For pedestrians and cyclists, trees offer shade, comfort, and a physical and psychological buffer from traffic, improving the walking experience.

A University of Washington Safe Street **study** compared local crash rates between two identical roadways, one with streetscape improvements and one without. The results indicated "for mid-block crashes (11% fewer), injuries (31% fewer), and fatalities (none versus 6). Pedestrian and bicyclist injuries were likewise fewer in the improved road sections."

Design of Safe Urban Roadsides: An Empirical Analysis by Eric Dumbaugh, examines safety outcomes on non-freeway urban roadsides by testing three design strategies—wider paved shoulders, wider fixed-object offsets, and "livable-street" treatments—using statistical crash analysis. The **study found** that only livable-street treatments, which typically include pedestrian-scaled features and context-sensitive design elements, were consistently associated with fewer roadside and mid-block crashes. In contrast, wider shoulders were linked to higher crash rates, and fixed-object offsets produced mixed results. Dumbaugh also noted that most collisions with trees and utility poles occurred behind driveways or side streets along higher-speed arterials, suggesting that the problem lies not in isolated driver error but in systemic design choices that encourage excessive speed and unsafe roadside exposure. The findings challenge traditional rural-inspired "clear zone" approaches.

COUNTERMEASURE:

BIKE BOX

GOAL

Increase cyclists visibility and safety at intersections.

HOW DOES IT WORK?

Bike boxes are designated zones in front of the vehicle stop bar at signalized intersections. These zones are meant for the cyclists to wait at the intersection for the phasing to change at the light. This space improves visibility of cyclists at intersections and decreases the likelihood of collisions from through traffic and those turning at the intersection. This queuing of riders also offers experienced or faster cyclists the opportunity to pass the slower cyclists reducing potential conflicts within the bike lane. Bike boxes that extend across the entire intersection can assist cyclists in making left turn movements. This placement can also decrease the encroachment of motorists into crosswalks.

Image Source: NACTO

CONSIDERATIONS

Potential conflicts could arise with right turn movements by motorists who encroach into bicycle and pedestrian zones. To avoid this, it is recommended that these intersections restrict turning movements during red light phases.

COST

Low-cost

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**
- **FFE-Transportation Alternatives (TA)**

COUNTERMEASURE:

BOLLARDS AND BIKE LANE DELINEATORS

GOAL

Bollards and bike lane delineators will provide a visual barrier to try and reduce collisions from occurring.

HOW DOES IT WORK?

Bollards and bike lane delineators serve as traffic lane dividers to create visual and physical separation between roadway users and to reduce collisions. Bollards and delineators are either impact resistant or non-impact resistant. They can be permanent or semi-permanent and made of multiple materials such as steel or hard plastic.

Bollards and delineators are used as a traffic calming technique to protect pedestrians and bicyclists. These installations are versatile and can be used to prevent parking or direct traffic in construction zones preventing motorists from changing lanes. They can also be installed with reflective properties increasing their visibility at night.

Types of bollards include:

- **Steel pipe bollards** – set and filled with concrete to provide impact resistance from vehicles.
- **Removable bollards** – installed so they can be removed from the ground when necessary but do not provide enough impact resistance to stop a vehicle.
- **Retractable bollards** – these are similar to removable bollards but are more expensive; they can retract into the ground. This is useful for areas where vehicles may need access at limited times (such as for maintenance).
- **Flexible bollards** – composed of plastic polymer, they can bend up to 90 degrees upon impact and return to their original form. While they will not stop a crash, they do provide a visual barrier.
- **Collapsible bollards** – adjustable posts that can collapse or fold-down on and be placed back up.

COST

Low- to moderate-cost depending on the strategy and extensiveness of installation.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Highway Safety Improvement Program (HSIP)** - Typically as part of larger safety project
- **FFE-Transportation Alternatives (TA)** - Typically as part of larger safety project

COUNTERMEASURE:

PARALLEL (CONVENTIONAL) BIKE LANES

GOAL

To provide a space for bicyclists to feel safer while traveling near motor vehicle traffic areas.

HOW DOES IT WORK?

Bike lanes are smaller designated lanes specifically in the roadway for bicyclists. Multi-use trails will sometimes have designated bike and pedestrian separation as well. Bike lanes provide a safer space for bicyclists to ride though without physical separation from vehicles bikers are still are significant risk. Bike lanes work best where there is relatively low vehicular traffic volume and should be as wide as possible, at minimum 5 feet but 6 feet is preferred. Design consideration should be made for parked cars (risking opening doors hitting people biking and travel direction of vehicles.

COST

Low-cost

FUNDING FOR THIS PROJECT

This project type is eligible for the following funding in the Surface Transportation Block Grant (STBG), Transportation Alternatives (TA), Highway Safety Improvement Program (HSIP) if part of larger safety project, and the Congestion Mitigation and Air Quality (CMAQ) program if it will reduce car trips.

CASE STUDY / NATIONAL

A study was conducted on the on-street bicycle lanes on New York City streets which had been installed prior to 2007 to determine the whether they had an impact on crash rates. They collected police reports on crashes before and after the installation. They found that the addition of bicycle lanes did not increase crash rates even with the lanes encouraging a new form of transportation to conflict with pedestrian and vehicular traffic. In fact, it was found that there was a decrease in crash rates where bicycle lanes were installed. In most cases they saw roughly 30 percent decrease in all crash types along the roadway segment as narrower lanes reduce speeding overall. At intersections overall crashes went down by 18 percent however, some pedestrian and bicycle crashes did show an increase in crash rates likely related to the increase in use of these bicycle facilities.

COUNTERMEASURE:

PROTECTED (SEPARATED) BIKE LANES

GOAL

To provide a space for bicyclists to feel safe traveling from place to place near motor vehicle traffic areas.

HOW DOES IT WORK?

Unlike parallel bike lanes, separated/protected bike lanes provide a protective barrier between them and automotive traffic, creating a safer environment for bicyclists. These cycle lanes are appropriate for higher speed roads with higher traffic volume. This separation from motor traffic offers an added safety and comfort. There are multiple methods to separate the bike lanes from motor traffic from flexible delineators, raised curbs, and planters to parking lanes.

Different types of seperation provide different levels of protection. Flexible delinators are the least expensive but careless drivers can run them over. Stronger seperations like curbs and planters offer the strongest protection.

Bike lanes are frequently blocked by vehicles, often for short-term activities like deliveries. The Boston MPO has developed a **resource** outlining strategies municipalities can use to address this issue. Recommended interventions include physical buffers, enforcement measures such as automated camera enforcement, designated pick-up/drop-off areas, relocation of loading zones, curb management strategies, and adjusting parking meter rates to maintain 85% occupancy.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)** - Typically as part of larger safety project
- **FFE-Congestion Mitigation and Air Quality (CMAQ)** If providing congestion or air quality benefit such as reducing vehicular traffic
- **FFE-Transportation Alternatives (TA)**

COUNTERMEASURE:

SHARED-USE PATHS: CREATING BIKE-PED DESIGNATED TRAILS AND BRIDGES

GOAL

To create a public pathway away from vehicular traffic dedicated to pedestrians and bicyclists and allow for alternative safe travel and recreational options for people.

HOW DOES IT WORK?

Designated trails and bridges that are located away from the roadway to allow for a safer means of travel not only create safer travel for pedestrians and bicyclists but increase quality of life for surrounding areas. Creating a space and travel lanes that are not meant for vehicular traffic can greatly reduce the chances of collisions and fatalities.

Trails and bridges work best when they connect to existing bike-ped infrastructure, future bike-ped development, are near parks, public transit stops, schools, job centers, and neighborhoods. This encourages people to use them while also providing access to multiple amenities and places.

CASE STUDY / LOCAL

The **Indianapolis Cultural Trail**, located in the heart of downtown Indianapolis, Indiana, is a huge success story showcasing the benefits of a shared-use path built off of right-of-way from parking lanes and roads. Through a private-public partnership, an eight-mile trail that makes a loop around the downtown and connects five cultural districts and neighborhoods and the city's greenway system.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**
- **FFE-Congestion Mitigation and Air Quality (CMAQ)** If providing congestion or air quality benefit such as reducing vehicular traffic
- **FFE-Transportation Alternatives (TA)**

COUNTERMEASURE:

TWO-STAGE TURN QUEUE BOX

GOAL

Improve the safety of cyclists at multi-lane intersections which are performing left turn movements.


Image Source: NACTO

HOW DOES IT WORK?

Two-stage turn queue boxes are used at intersections for cyclists attempting to turn left. This is most useful at multi-lane signalized intersections. Typical bike lanes are not conducive to left turn movements which cross multiple lanes because it requires them to merge into traffic. With a two-stage turn queue box the cyclists turning left stop in the intersection in the queue box aligning with the desired bicycle facility and waits for the light to shift.

CONSIDERATIONS

This intersection configuration is much safer for cyclists however it does add time their travel as they may have to wait though two light cycles.

COST

Low-cost

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP) -** - Typically as part of larger safety project
- **FFE-Transportation Alternatives (TA)**

COUNTERMEASURE:

TWO-WAY SEPARATED BIKE LANES

GOAL

Provide a multi-lane protected bike lane for the efficient movement of bicycles and improving cyclist connectivity.

HOW DOES IT WORK?

Bike lanes typically only travel one direction and align with automotive traffic. Two-way separated bike lanes, or cycle tracks, are unique in they permit two directional movement of bicycle traffic on the same side of the roadway. This type of protected bike lane reduces the necessary buffers for two directional bicycle traffic instead of creating two separate protected bike lanes on either side of the road. Two-way separated bike lanes are still separated from automotive and pedestrian traffic through painted buffers, bollards, raised median, raising the bike lanes, etc. These types of bike lanes are appropriate for higher speed roadways because they reduce the opportunities for collision with automobiles. This also offers a safer area for inexperienced cyclist to utilize the city's bicycle network.

CONSIDERATIONS

Potential conflicts that could occur include driveways and curb cuts where drivers could collide with cyclists, at intersections if there is not proper signalization to dictate the movement of the various roadway users, the potential need to reach a destination located on the opposite side of

the bike lane, cyclist speeds often vary greatly and thus ample space for passing is needed, and the potential for an increasing the likelihood of cyclist on cyclist collisions especially if ample space for passing other cyclists is not provided.

COST

Moderate- to high-cost depending on the level of implementation.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)** - Typically as part of larger safety project
- **FFE-Congestion Mitigation and Air Quality (CMAQ)** If providing congestion or air quality benefit such as reducing vehicular traffic
- **FFE-Transportation Alternatives (TA)**

COUNTERMEASURE:

MODAL FILTERS

GOAL

Filter modes of transport or speeds of traffic

HOW DOES IT WORK?

Modal filters use physical or operational treatments to reduce through-traffic and calm vehicle speeds, while maintaining access for local residents, service vehicles, and emergency responders. They help create low-traffic streets that are safer and more comfortable for people walking, biking, and taking transit. Because through-trips tend to be faster and more aggressive than local access trips, interrupting roadway continuity helps remove speeding opportunities and improve safety for all users. Filters are most effective when paired with complementary speed management tools such as raised crosswalks, curb extensions, or narrowed lanes.

WHERE DOES IT WORK?

Modal filters can be used in a variety of settings including:

- **Intersection Filters:** Fully restrict through movements on one or more approaches. Common treatments include diagonal diverters or median closures. Transit or emergency access may be maintained through removable or camera-controlled elements.
- **Mid-Block Filters:** Interrupt vehicle travel between intersections to prevent neighborhood cut-throughs. These are especially useful where intersection geometry limits filtering options, though clear signage is important to minimize driver confusion.

- **Approach Filters:** Restrict full or partial movements to or from a specific leg of an intersection. Often used to limit turns or through-movements on constrained streets or in proximity to schools, parks, neighborhoods with children playing, or other areas with vulnerable users.

TYPES OF FILTERS

- Physical filters such as bollards, planters, curbs, or small landscaped islands use design elements to block or narrow vehicular movement while allowing pedestrians and cyclists to pass freely.
- Camera-enforced filters may permit certain users, like buses or emergency responders, to proceed while discouraging cut-through driving by others.
- Flexible or retractable bollards are particularly effective in balancing safety with operational needs, ensuring emergency access without compromising the filter's deterrent effect.
- Timed filters can require higher risk modes (such as vehicles) to stop before being allowed to proceed, allowing drivers to access the street at a safe speed.

COUNTERMEASURE:

HIGH FRICTION SURFACE TREATMENT (HFST)

GOAL

To increase friction on pavement for motorists to help maintain better control while drive in both dry and wet conditions.

HOW DOES IT WORK?

High friction surface treatment (HFST) is a tactic to help maintain control while driving. HFST provides pavement friction in areas where critical braking or corner maneuvers are generally going to wear down the pavement. When excessive braking occurs, pavement can become polished and cause vehicles to lose control. HFST works to counter this result.

This surface treatment is a high-quality aggregate that is applied to the pavement using a polymer binder to restore and maintain pavement friction. It is usually applied to roads in areas that have potential to be a high-risk crash site or areas that already are high risk. Local and collector streets are generally good areas to consider HFST but are not limited to other areas. High volume intersections, interchange ramps, and selected segments of interstate alignments would benefit from these treatments as well. To learn more, **click here**

COST

Low-cost

Image Source: Kwik Bond Polymers

CASE STUDY / NATIONAL

After reviewing a variety of low-cost safety options in both wet and dry conditions, the KYTC (Kentucky Transportation Cabinet) started an initial program to improve skid resistance on roads by using high friction surface treatment. The program proved to be successful, showing a 69% decrease in skid-related crashes and fatalities on roadways treated with HFST.

This resulted in a state-wide program at over 75 location (2010) to improve pavement friction. Sites were selected based on crash data analysis to ensure appropriate placement.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Highway Safety Improvement Program (HSIP)**

COUNTERMEASURE:

IMPROVED SIGNAGE

GOAL

Improve driver awareness of curves, oncoming intersections, hidden drives, etc. through the use of signage that is easily seen at all points throughout the day.

HOW DOES IT WORK?

Signage is an important component for motorists and other roadway users. Signage provides information for location and direction; warning of upcoming roadway features; and instructs the motorist on proper usage of the roadway. The placement and quantity of signage on roadways is typically based on engineering specifications, studies, or best judgment related to traffic volume and roadway features, such as the curvature of roads. Signage acts as an important guide and warning for drivers in countless situations keeping them aware of their surroundings.

Sign visibility is important to allow motorists proper time to react. Retroreflectivity is an important feature of signage at night. Retroreflectivity is the optical phenomenon where the rays of light are reflected directly back to its source. This allows drivers to more easily see signage and reduces sign glare on adjacent properties. The level of retroreflectivity can determine whether a driver misses a sign and potentially causes a crash. Retroreflectivity should be evaluated to ensure that signs are clearly visible from a distance offering proper time to stop if needed. Putting signage in combination with one another has shown a decrease injury related crashes and non-injury related crashes. Partnering warning signs (turn/advisory speed signs) with others will continually bring attention and give information to the driver.

When motorists approach a curve, signage may be needed to properly warn motorists of its severity. Chevron alignment along curves help to signify the sharpness of a curve. Chevrons should be installed four feet above the roadway surface and outside the curve, in line with the approaching traffic. Spacing of chevrons are determined by the curve radius and advisory speed. This tactic has seen a decrease in crashes when installed on rural highway curves. Directional arrow signs can also be used to define sharp curves. Usually they will appear on the outside of the curve per direction for the curve/turn. It is suggested that these signs could be used in combination with chevrons and/or doubled up to increase awareness.

COUNTERMEASURE:

RESTRIPING, REFLECTORS, AND RUMBLE STRIPS

GOAL

Restriping (repainting) lines in the roadways, adding reflectors, and adding rumble strips will help increase driver visibility and awareness of where they are within a travel lane and potentially prevent drive-offs and collisions with others.

HOW DOES IT WORK?

Restriping (repainting) road markings, adding road surface reflectors, and adding rumble strips are all effective measures for drivers that can increase awareness of their location in the travel lane. Road markings are a continuous source of information for drivers. Without proper designation, crashes can occur because of a lack of visibility or knowledge of the edge of a road causing a drive-off or collisions with other cars from driving over the center line or when a T-intersection or cross road is not properly signified based on road markings. This is especially dangerous in the evening hours when sunlight is limited or nonexistent and on country roads or even highways.

- Restriping lines with reflective paint will help increase both visibility and driver awareness of their location in the travel lane.
- Adding reflectors within a center line or even to use as dividers of lanes on a multi-lane road helps the driver to be aware especially if paint has faded. They are durable and longer lasting than reflective paint. They can be used in multiple places and even programmed for uses such as a flashing signal for pedestrian crosswalks in roadways or when approaching curves.
- Rumble strips are particularly useful along higher speed roads with shoulders. This allows for drivers to know if they are not within the travel lane by “rumbling” their vehicle to alert them of their location.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Highway Safety Improvement Program (HSIP)**

COUNTERMEASURE:

RETROREFLECTIVE BACKPLATES (BORDERS ON SIGNALS)

GOAL

Increase driver awareness of lights

HOW DOES IT WORK?

Adding reflective backplates to traffic signals helps to increase contrast for improved visibility both during the day and night times. They are good for people who might be colorblind and work well during power outages by providing the reflection of headlights, signifying the intersection. It is a low-cost safety treatment that can be implemented throughout communities.

To learn more, **click here**.

COST

Low-cost

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

/ **FFE-Highway Safety Improvement Program (HSIP)**

CASE STUDY / NATIONAL

Columbia, South Carolina was facing a problem where drivers were driving through signalized intersections due to low visibility. The low visibility at these intersections resulted in a high number of collisions and which the South Carolina Department of Transportation took notice of. To combat the low visibility, they installed yellow retroreflective borders around the perimeter of the face of the existing signal backplates at the intersections in June 2005.

As a result, all intersections saw a decrease in late-night/early morning crashes (a 49 percent decrease). Total crashes decreased 28 percent overall after retrofitting these signals. This was a low-cost solution that was relatively quick to install (two hours per intersection).

COUNTERMEASURE:

ROUNDABOUTS

GOAL

Keep traffic flowing without the need for stopping at an intersection, while also reducing the number of potential collision points.

HOW DOES IT WORK?

Roundabouts have proven to be safer than traditional stop sign or signal-controlled intersections. They are designed with characteristics that make a driver more aware and drive slower than at a traditional intersection. Roundabouts are designed with:

- Channelized approached,
- Yield control at all entries,
- A counterclockwise circulation of all vehicles that enter the circle, and
- Appropriate geometric curvature to encourage slower travel speeds through the intersection and are the center island.

With a roundabout, traffic is moving slower than it would through a standard intersection. It is physically is designed to make a driver slow down when approaching and entering the circular intersection. With this decrease in speed, roundabouts help maintain constant movement and traffic flow since there is less “stop and go” while driving through. The chances of a collision (specifically a T-bone collision) decreases because cars follow the same movement through the intersection instead of interacting at right angles.

CASE STUDY / LOCAL

Carmel is internationally known for its roundabout network. Since the late 1990’s Carmel has been building and replacing signalized intersections with roundabouts. Carmel now has more than 138 roundabouts, more than any other city in the United States.

As Carmel implemented roundabouts the number of injury accidents in Carmel has been reduced by about 80 percent and the number of accidents overall by about 40 percent. Carmel also found that it reduced their ongoing maintenance costs by eliminating the need to install, maintain, and replace stoplights.

Carmel's roundabouts, among other transportation safety achievements, have received national and international attention for their effectiveness with several studies confirming their safety benefits.

FUNDING FOR THIS PROJECT

The IMPO holds an annual call for projects at which time local public agencies can apply for IMPO-managed funding. This project type is eligible for the following funding categories:

- **FFE-Surface Transportation Block Grant (STBG)**
- **FFE-Highway Safety Improvement Program (HSIP)**
- **FFE-Congestion Mitigation and Air Quality (CMAQ)** If providing congestion or air quality benefit such as reducing congestion

CASE STUDY / NATIONAL

The Minnesota Department of Transportation (MnDOT) has **published** a study examining driver yield behavior to pedestrians and bicyclists at 16 roundabouts across the state. Across 16 roundabouts, staging about 100 crossings per site, the study observed an overall driver yield rate of 80% at roundabout entries, but only about 40% at roundabout exits.

The study confirms that geometric and design elements have a significant impact on driver behavior, influencing whether drivers yield to people walking or biking. Key factors influencing yield rates include the number of lanes, lane width, approach versus exit locations, presence of pedestrian refuge islands, rectangular rapid flashing beacons, raised crosswalks, and other design features. The report concludes with recommendations for improving safety and yield rates through design.

COST

High-cost

Although the prices do range depending on the location and design of the roundabout the average roundabout funded with IMPO support averages $2.4 million though smaller and locally funded roundabouts may be less.

COUNTERMEASURE:

ONE-TO-TWO-WAY CONVERSIONS

GOAL

Balance traffic flow and operations on corridors

HOW DOES IT WORK?

Converting a street from one-way to two-way operation can be a powerful tool in advancing Vision Zero's aim of eliminating fatalities and severe injuries. Two-way conversions tend to calm traffic flow by requiring more deliberate driver actions (turns, lane choices, and yielding) rather than encouraging continuous high-speed movement in a single direction. This shift helps reduce speeds and vehicle conflicts, making streets safer for all users, especially pedestrians and cyclists.

On one-way streets, drivers may treat the road as a fast corridor with few opposing movements, which can encourage speeding and aggressiveness. By restoring two-way flows, traffic behavior becomes more constrained and predictable, breaking long uninterrupted driver sightlines that reinforce high speeds. This change can reduce crash frequency and severity, especially at intersections where left-turn and crossing conflicts are better anticipated in a two-way environment.

Two-way conversions also enhance street legibility and accessibility. Because drivers can approach destinations from either direction, the need for circuitous routing or backtracking is reduced, especially for local traffic. This can improve pedestrian crossing safety by shortening desirable crossing paths and dispersing turning movements more evenly.

Finally, converting one-way to two-way operation supports a more balanced and resilient street network. It restores permeability and redundancy, giving emergency vehicles, transit, and local traffic multiple routing options and reducing pressure on a single direction of travel. Moreover, this flexibility can help prevent over-reliance on a few high-speed corridors and distribute traffic more evenly across the network, which in turn can reduce volume, speeds, and crash risk on those corridors. These conversions also have economic benefits. One-way streets have a negative impact on storefront exposure, which is lost when one direction of travel is eliminated, as well as when traffic speeds up due to one-way traffic. Conversions can improve business access, providing an economic development benefit.

The benifits of these conversions is well documented:

- **Converting One-Way Streets to Two-Way Streets to Improve Transportation Network Efficiency and Reduce Vehicle Distance Traveled**
- **The economic impact of one to two-way street conversions: advancing a context-sensitive framework**
- **City of Austin: One-Way and Two-Way Street Conversions**

COUNTERMEASURE:

FEELINGS OF ENCLOSURE

GOAL

Use land use and urban design context to naturally slow traffic

HOW DOES IT WORK?

Feelings of enclosure refer to the spatial experience created when the edges of a street (its buildings, trees, and other vertical elements) visually frame the roadway. This quality, sometimes described as a "street wall" or "outdoor room," helps define the limits of space and gives users a sense of orientation and scale. Streets that feel enclosed tend to have buildings close to the sidewalk, regularly spaced street trees, consistent street furniture, and narrower or visually constrained travel lanes. Other design elements that contribute include raised curbs, planting strips, lighting poles, bollards, low walls, and architectural canopies or awnings. Even changes in pavement texture, color, or material can enhance the perception of edges and boundaries. Together, these features reduce the sense of vast openness that often encourages higher driving speeds, while making walking and biking environments feel more inviting and comfortable.

From a safety perspective, enclosure works by influencing driver psychology. Research in environmental design and traffic safety shows that drivers subconsciously adjust their speed based on how wide, open, and forgiving a street appears. Wide, unbounded roads convey a sense of speed and low risk, leading to faster driving. In contrast, a visually narrow, well-framed street signals constraint and complexity, prompting drivers to slow down and pay more attention. Enclosed environments also strengthen spatial definition, making it easier for drivers to perceive where they should and should not go, while reducing lateral drift and lane encroachment. For pedestrians and cyclists, this clarity translates into a heightened sense of security, the edge elements act as both physical and psychological buffers from moving traffic, increasing comfort and perceived safety.

Evidence for these effects comes from multiple studies in transportation and urban design. A **2015 study** found that enclosure features such as street trees and building continuity increased people's perceived safety in streetscape images. **A 2019** study measured heart rates and physiological responses in different street environments and discovered that more enclosed streets correlated with lower stress and greater comfort. The World Resources Institute and the National Cooperative Highway Research Program both highlight enclosure as a key element of context-sensitive, safe street design, noting that trees, vertical elements, and appropriate street proportions help calm traffic. A quantitative **2023 study** further links visually complex, enclosed environments with lower rates of driver fatigue and more stable vehicle operation.

Erfurt, Edward. "**How to Use Optical Narrowing to Make a Street Safer.**" Strong Towns, 15 Sept. 2023. Licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

"**Two Photos Reveal Why the Key to Slowing Traffic is Street Design, Not Speed Limits**" Strong Towns, 13 Dec. 2019. Licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

SPOTLIGHT

Parking Reform and Curb Management as a Road Safety Strategy

Effective parking management is an essential part of achieving Vision Zero goals. The way we plan, design, and regulate parking directly shapes how people move, how fast they drive, and how safely streets function. Streets with well-managed parking operate more efficiently, provide better access for businesses and residents, and create safer conditions for everyone whether walking, biking, using transit, or driving. By contrast, excess or poorly located parking often encourages more driving, reduces visibility near crossings, and increases the risk of crashes. Integrating parking strategies into a community's Vision Zero framework ensures the street network prioritizes people and safety, not vehicle storage.

Parking Mandates and Their Impacts

Parking mandates, zoning rules that require new developments to provide a minimum number of off-street spaces, have far-reaching effects on safety, affordability, and fiscal health. While originally intended to manage congestion, these mandates often lead to an oversupply of parking, which in turn induces more driving and higher travel speeds. Parking mandates often lead to large parking lots that push buildings farther apart, reducing access to jobs and forcing people to travel longer distances at higher speeds. When buildings are spread out, communities must extend and maintain more roadways and utility lines, increasing long-term infrastructure costs.

The economic and fiscal impacts are equally significant. Each surface parking space typically consumes 300–400 square feet of land and can cost $500–$1,500 per year to maintain. Structured parking costs three times as much. These costs are passed on through higher rents, home prices, or retail prices, making housing and small business space less affordable. In many communities, parking mandates have been shown to raise housing costs by 10% or more, with the burden falling hardest on low-income households and seniors who may not own cars.

Excessive parking also imposes a fiscal cost on municipalities. Parking lots generate little tax revenue compared to housing or mixed-use development and reduce the financial productivity of land. In Hartford, Connecticut, city officials estimated that parking uses cost roughly $50 million per year in lost tax revenue, a key factor in their decision to eliminate mandates altogether. Across the country, cities that have reduced or removed parking mandates (such as Buffalo, South Bend, and Portland) report more housing production, stronger local business activity, and more efficient use of public infrastructure.

Removing or reforming parking mandates gives communities flexibility to build according to real demand rather than outdated, auto-centric standards. It allows more land to be used for housing, green infrastructure, or tax-generating development instead of underutilized asphalt. It also supports long-term Vision Zero goals by reducing car dependency, calming streets, and creating environments where walking, biking, and transit are practical and attractive options.

Managing the Curb

As travel behavior evolves (with the rise of deliveries, ride-hailing, and micromobility) curb management has

become a critical safety tool. Clearly marked zones for loading, drop-off, short-term parking, and deliveries help reduce sudden stops, double-parking, and conflicts in bike lanes or crosswalks. Dynamic curb management (using time-of-day rules, smart meters, or digital permitting) ensures that limited curb space is used efficiently while maintaining clear sightlines and access for emergency vehicles.

Treating the curb as a shared public asset rather than private storage for vehicles allows cities to prioritize safety, access, and equity.

Reclaiming Street Space

When parking and curb policies are aligned with Vision Zero, the results extend well beyond safety. Reclaiming portions of the curb for wider sidewalks, bus boarding islands, green buffers, or parklets can help calm traffic, lower maintenance costs, and create more welcoming public spaces. Parking design standards can also support these goals, placing parking behind or beside buildings, screening lots with trees and landscaping, and ensuring safe pedestrian access between sidewalks and entrances.

Hartford eliminated parking mandates in 2017 after estimating that excess parking cost the city more than $50 million in lost annual tax revenue. The change encouraged new infill housing, reduced vacant surface lots downtown, and supported walkable, mixed-use redevelopment. Other cities such as Buffalo, NY and South Bend, IN have since followed similar paths resulting in development demonstrating that reducing or eliminating parking mandates can strengthen local economies while improving safety and revenue.

- **Eliminate or reduce parking mandates**
  Replace outdated mandates with flexible, context-sensitive policies that reflect real parking demand and community priorities
- **Adopt right-sized parking strategies**
  Implement shared parking, unbundled parking, and parking maximums to manage supply and reduce unnecessary costs
- **Integrate parking reform into Vision Zero and housing policies**
  Coordinate parking management with safety, housing, and sustainability plans to align investments across sectors
- **Redesign curbs** for safety and efficiency
  Create designated loading, drop-off, and micromobility zones to prevent conflicts and maintain clear sightlines
- **Evaluate fiscal performance**
  Track the tax revenue, infrastructure costs, and land productivity impacts of development
- **Charge the right price for parking** Donald Shoup's research, curb parking works best when about one or two spaces per block (roughly 10–15 percent) are open at all times. Cities can achieve this balance by adjusting parking prices based on demand ensuring convenient access without congestion or cruising for parking.

Resource: **Parking Benefit District Guide**

COMMUNICATIONS

This chapter provides communication materials that can help to influence behavioral change across multiple channels. Effective messaging language and tools plus strategies that demonstrate a decrease in deaths and serious injury will create change and continued support. The materials included in this component can be tailored for whatever you most need. That may be communicating with and sharing out to elected officials, media, advocates, technical experts, partners, community members, and your colleagues.

TALKING ABOUT CRASHES

The way governments and media discuss crashes can shape solutions

VISION ZERO AND COMMUNICATIONS

Even subtle editorial choices surrounding traffic crash reporting have major impacts on a reader's understanding of the crash including if the reader sympathizes with the victim or blames them and what solutions the reader wants to see. The risk of a deadly crash is largely determined by vehicle speed and speed is largely determined by road design. If we accept the premise of Vision Zero, we cannot accept the status quo that refers to deadly traffic crashes as isolated "accidents" because road design is a policy choice and crash deaths are systemic. By acknowledging the preventable nature of traffic crashes, communications professionals can frame the crisis as solvable and encourage solutions.

MORE RESOURCES

- **World Health Organization** - ***Reporting on road safety: a guide for journalists***
- **Collaborative Sciences Center for Road Safety** - ***Shaping the narrative around traffic injury: A media framing guide for transportation and public health professionals***
- **Berkley SageTREC** - ***Media Narratives of Pedestrian & Bicyclist-Involved Crashes***
- **Vision Zero Reporting** - **News article analysis tool**

BEST PRACTICES FOR REPORTING ON VULNERABLE USERS

The research paper ***Does news coverage of traffic crashes affect perceived blame and preferred solutions?*** from Texas A&M University offers an analysis of the effects of news coverage and best practices. The study showed that communications professionals can significantly reduce victim blaming of traffic crash victims through careful framing and sentence structure. The study also showed that thematic framing with a focus on the ongoing crisis (i.e. by mentioning the number of people who have died in traffic accidents) significantly increased support for infrastructure improvements that would reduce crashes.

Status Quo	Better Practice	Effect of status quo
Accident: "Pedestrian killed in accident on Main Street."	Crash: "Pedestrian killed in crash on Main Street."	Obscures preventable nature of crashes
Non-agentive: "A pedestrian was hit and killed." (No agent)	Agentive: "A pedestrian was hit and killed by a car."	Obscures role of a human actor
Focus on pedestrian: "A pedestrian was hit and killed by a car."	Focus on vehicle: "A car hit and killed a pedestrian."	Increases blame for the focus of the sentence
Object-based language: "A car jumped the curb."	Person-based language: "A driver drove over the curb."	Obscures role of a human actor
Counterfactual statements: "The pedestrian darted into the street."	Not included	Increases perceived blame for the victim
Episodic framing: Treats the crash as an isolated incident.	Thematic framing: "This is the tenth fatal collision this year."	Prevents readers from connecting the dots between incidents and thus shifts attention to individual rather than systematic solutions

AUDIENCES

There are several different audiences that can use the tools provided in this chapter. These, groups, and the roles they might take in using or advocating for Vision Zero, are described below.

MPO BOARD MEMBERS WITH TECHNICAL EXPERTISE

Metropolitan Planning Organizations (MPOs) impact our lives at many scales — from our daily experiences using transportation systems to the regional economy — through the planning and programming decisions they make. There are 407 MPOs in the U.S., one for each urbanized area with 50,000 or more people. City and community engineers and planners are on the front lines in the fight against traffic deaths, and the role of MPOs is receiving increasing attention as more people across the country acknowledge the travesty of preventable loss of lives on our roadways. Last year, according to the National Safety Council, an estimated 40,000 people lost their lives and more than 4 million more were injured on U.S. roadways. Traffic deaths disproportionately affect those in communities of color, low-income communities, youth, the elderly, and those walking and biking.

Through regional planning, funding, and policy, MPO board members with technical expertise are uniquely positioned to understand Vision Zero and educate others. The people at the heart of these organizations know the issues unique to their community, and have the knowledge to make recommendations of how to implement the principles of Vision Zero in a way that is likely to make a meaningful impact.

ELECTED LOCAL OFFICIALS

Mayors, as well as town, city, and county council members, play a critical role in committing a community to Vision Zero, whether through legislative action or in direct partnership with other members of their communities. Once the commitment to pursuing a Vision Zero-friendly agenda is made, many elected local leaders have worked to invest resources from their communities to mobilize the right agencies and top leaders within the community to turn talk into action in a lasting and meaningful way.

Overall, elected local leadership plays the most important role in setting the vision, communicating priorities to the departments carrying out the work, ensuring funding aligns with goals, establishing the structure for collaboration and action, and fostering a climate that both celebrates successes and holds stakeholders accountable to the urgency of achieving Vision Zero.

STATE LEGISLATORS

Connected to mayoral leadership through governmental authority yet possessing a platform to drive change on a broader, statewide scale, these individuals can champion causes and amplify campaigns for greater impact. By committing to the principles of Vision Zero, state legislators and lawmakers can take meaningful steps working alongside local governments to drive effective implementation.

A stronger focus on Vision Zero initiatives at both local and state levels has the potential to spark new interest and engagement among a wider audience, further expanding the movement's reach and impact.

COMMUNITY ADVOCATES

Having witnessed the impact of preventable traffic fatalities and injuries, whether affecting someone they know personally or members of their community, these individuals are motivated to speak out and drive change. Community advocates play a crucial role in influencing legislators and policymakers, applying pressure to create meaningful structural improvements.

Beyond advocacy, they can take direct action by implementing tactical urbanism projects in their neighborhoods. To support these efforts, advocates need access to data and best practices. Additionally, they require backing from local and state governments to ensure their voices are heard and to be empowered to take meaningful action.

COMMUNITY PARTNERS

Community partners represent a diverse network of organizations with unique perspectives, all actively engaged in shaping the life of their communities. From law enforcement and educational institutions to nonprofits like AARP and United Way, as well as civic and economic groups such as chambers of commerce, these organizations share a vested interest in keeping communities safe, active, and accessible.

The impact of community partners varies from direct enforcement and public awareness efforts to organizing events and gathering critical data. Serving as a bridge between government and individuals, they play a key role in spreading awareness and advancing the Vision Zero agenda.

Given their trusted status and distinct priorities, an effective communication strategy must be adaptable and personalized. This is especially important when addressing the different needs of law enforcement and other organizations. Regardless of their specific focus, community partners are instrumental in reaching policymakers, mobilizing change, and amplifying awareness.

ALL MEMBERS OF THE PUBLIC

From shifting transportation habits to urging legislators to adopt proven road safety measures, the public plays a crucial role in advancing this agenda. Since Vision Zero is ultimately designed to protect the public, generating sustained interest is essential to ensuring long-term action beyond fleeting news cycles. To be effective, messaging must be clear, easily digestible, and actionable, outlining concrete steps while connecting people with the channels capable of driving real change. With public support, Vision Zero can continue making a lasting impact well into the future.

SPOTLIGHT

LOCAL SPOTLIGHT:

FOSTERING A VISION ZERO CULTURE IN BOONE COUNTY

For Boone County, successfully addressing traffic fatalities starts with fostering a culture around Vision Zero - both within and beyond the Boone County Highway Department. Former county engineer Craig Parks stressed the importance of messaging to establish buy-in from both leadership and those within the department. For him, that meant ensuring that every touch, every presentation, was embedded with reporting and documentation of traffic safety concerns and progress. It also meant living by the roadmap put forward in the County's Local Road Safety Plan. Parks stressed that the plan is not just a means for funding - it is about taking the responsibility seriously to get people home safely. For Boone County, Vision Zero isn't an empty declaration — every decision the department makes is framed around making the roads safer. From high level decision-making to the daily practices of the department's crews, safety is a priority. Employees are recognized for their safety practices, and their actions and attitudes help spread a culture of safety throughout the department.

Boone County Local Road Safety Plan

RESOURCES

Cities across the country are serious about reducing traffic fatalities and are using Vision Zero to get there. Use the resources included to see examples of strong Vision Zero action in cities across the country. Dive into national standards and recommendations for roadway design and proven crash reduction techniques with NACTO and the Crash Modification Factors Clearinghouse. And learn more about the important work the IMPO is leading to make our roadways safer.

NATIONAL RESOURCES

- **NACTO** The National Association of City Transportation Officials (NACTO) is a professional association of 93 cities and transit agencies leading the national standards and best practices for street safety.
- **PEDSAFE** Authored by the USDOT, the Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE) gives practitioners and city leaders an online tool and updated information about the best ways to improve the safety for those who walk.
- **Crash Modification Factors Clearinghouse** A powerful tool, the Crash Modification Factors (CMF) Clearinghouse clearly shows how specific countermeasures - design or policy solutions - impact the number of crashes at a specific site. This tool is data-driven and easily searchable for any sized community.
- The **Road to Zero Coalition** is a collaboration of organizations managed by the National Safety Council committed to ending roadway deaths. Recently, the group released a comprehensive report of strategies to reduce roadway fatalities including the prioritization of adopting a safe systems approach.
- The USDOT has adopted a **Safe System Approach** as the guiding paradigm to address roadway safety. It works by building and reinforcing multiple layers of protection to both prevent crashes from happening in the first place and minimize the harm caused to those involved when crashes do occur.
- Complete Streets, as outlined by **Smart Growth America**, is an approach to planning, designing, building, operating, and maintaining streets that enables safe access for all people who need to use them, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities.
- The Federal Highaway Administration provides resources to communites may complete a **Road Safety Audit** (RSA). This audit is the formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users.
- The **Vision Zero Network** is a collaborative campaign to help communities reach their goals of Vision Zero — eliminating all traffic fatalities and severe injuries — while increasing safe, healthy, equitable mobility for all.
- The **Global Designing Cities Initiative** includes complex guides on designing for safe speeds, designing streets for kids, and a global street design guide.

REGIONAL RESOURCES

- Ensuring safe, accessible, and desirable transportation in the region is central to the IMPO's mission. The IMPO's **Safety landing page** serves as a consolidated collection of resources to help communities impliment Vision Zero.
- The IMPO tracks and distributes funds through a program known as the Indianapolis Regional **Transportation Improvement Program** (TIP). The TIP tracks federal funding in the region and during the call-for projects communities can apply for funding to support their own safety projects.

Fremont, California

VISION ZERO ACTION PLANS

Major cities across the country continue to adopt and enact Vision Zero efforts. Not all of these plans are the same quality or have the same rate of success. In fact, some cities that have passed Vision Zero resolutions but not committed to funding and supporting the strategy have actually seen crashes increase. Inversely, some cities have seen massive success including cities like Oslo and Helsinki completely eliminating traffic crash deaths in some years. Some stronger English-language agencies that have committed to implementing Vision Zero including those below:

- **Vision Zero Hoboken** - Hoboken New Jersey is one of the most successful Vision Zero communities in the United States implementing safety policies and designs and achieving four years without a traffic crash death
- **Vision Zero New York City** - Between 2010 and 2020, NYC's traffic deaths fell 19%, while the US death rate rose 8% — an improvement that translates into a significant number of saved lives.
- **Vision Zero Fremont** - Fremont California has seen major crashes decrease by 45% since the program was adopted.
- **Vision Zero Edmonton** - Since Vision Zero was adopted in 2015, Edmonton, traffic-related fatalities have decreased by 50%, serious injuries have decreased by 32%, and pedestrian fatalities and serious injuries have decreased by 27% with the program focused on automated enforcement, design, and signage changes.
- **Vision Zero Philadelphia** - Implemented vision zero with a focus on road diets and speed reduction zones around schools. The projects have **reduced fatal and serious injury crashes** by 34%, and total injury crashes by 20%, compared to the High Injury Network trends.
- **Vision Zero Alexandria** - With a detailed action plan adopted in 2017 and a dedicated annual work plan for implementation, Alexandria, Virginia achieved zero traffic deaths in 2023.

SPOTLIGHT

ACCESS, OPPORTUNITY, AND JOYFUL CITIES

Vision Zero goes beyond traffic safety, it's about creating more joyful, inclusive, and opportunity-rich communities. By offering safe and efficient transportation options, it empowers people of all abilities and income levels with greater freedom to travel and improved access to essential destinations like jobs, schools, healthcare, and social spaces.

Access is at the heart of Vision Zero. **Access** considers total travel time across all modes, driving, walking, biking, and transit, while also addressing land use. Strategic decisions like zoning for housing near job centers or placing grocery stores in underserved areas enhance mobility and support goals such as reducing congestion, lowering emissions, expanding opportunity, and advancing equity.

Transportation is costly for both individuals and governments. Cars require ongoing expenses like maintenance and insurance, while governments must fund infrastructure upkeep. Vision Zero promotes a wider range of safe travel options, giving lower-income residents more flexibility and enabling more efficient public spending. For governments, denser development supported by multimodal transportation also produces **more tax revenue per mile** of infrastructure and requires fewer long-term maintenance costs than models where driving a car for all trips is the only choice available.

Vision Zero positively shapes the built environment, impacting health and well-being. Walkable areas with greenspaces reduce stress and improve **mental health**, while neighborhoods dominated by traffic, pollution, and blight experience higher rates of anxiety and depression. Expanded public transit options can reduce crashes, cut pollution, boost physical activity, and improve access to healthcare, nutritious food, services, and community.

Transportation is more than movement, it's a tool for creating healthier, more connected, and equitable communities. Vision Zero can help create a region with more transportation options, more access to things that matter, and a healthier, stronger community.

CONNECT WITH THE IMPO

The Indianapolis Metropolitan Planning Organization (IMPO) is Central Indiana's federally-designated regional planning organization. The IMPO develops short and long range plans to support local governments and advance the region's goals in transportation, economic development, housing, safety, sustainability, and other quality-of-life issues. The IMPO collects, analyzes, and communicates regional data to inform planning efforts and guide decision-making. The IMPO also tracks and distributes specific grant funds to local governments for the planning and construction of roads, trails, transit, and other infrastructure that moves people and goods throughout Central Indiana. Our planning area spans nearly 1,500 square miles and includes Marion County and parts of Boone, Hancock, Hamilton, Hendricks, Johnson, Morgan, and Shelby counties. The IMPO serves 36 member jurisdictions and approximately 1.78 million residents.

The IMPO's plans and recommendations are developed in cooperation with the Executive Committee, Transportation Technical Committee, and the Transportation Policy Committee which is the governing body of the IMPO. The Committees are represented by officials from jurisdictions within the region including municipal and county representatives, elected officials, transit organizations, and other partners.

Questions or comments on this Vision Zero Toolkit? Ideas for future safety projects? Please contact **Cole.Jackson@IndyMPO.gov** or **info@IndyMPO.gov**.