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Increasing **ROAD SAFETY**

in Latin America
and the Caribbean

Lessons from Behavioral Economics



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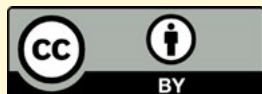
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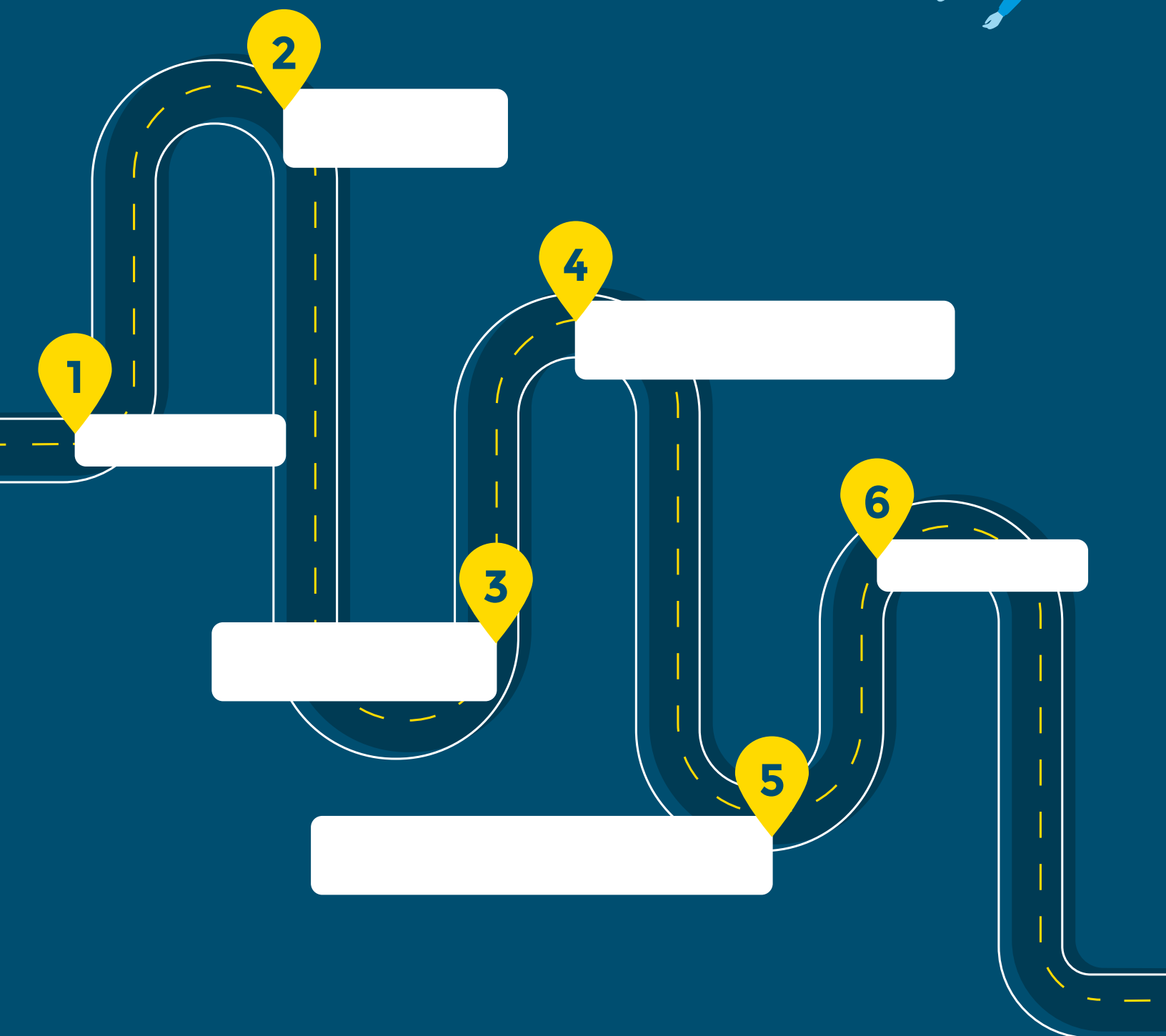
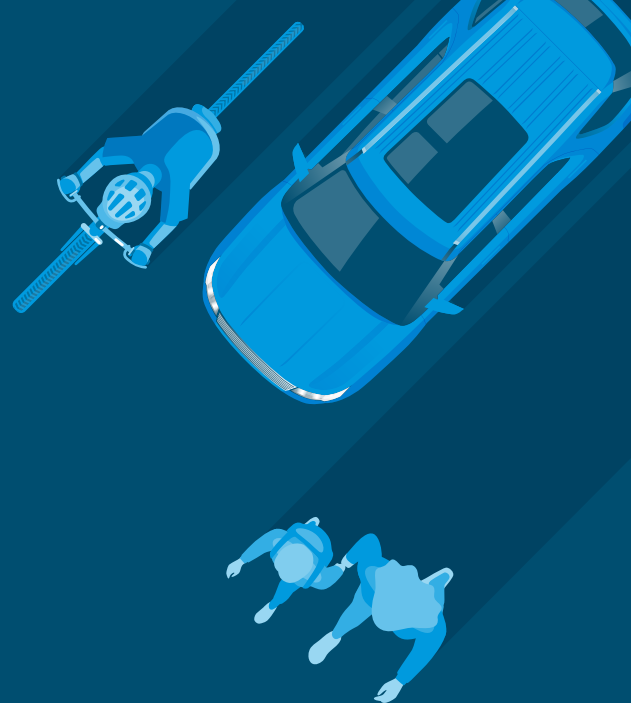
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Increasing **ROAD SAFETY**

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ABSTRACT

Road crashes are a significant public health issue in Latin America and the Caribbean, resulting in a staggering toll of approximately 110,000 fatalities and over 5 million injuries annually. These tragedies have far-reaching economic implications, costing Latin America and the Caribbean between 3 and 5 percent of its gross domestic product. A great many road crashes can be attributed to a variety of unsafe behaviors, such as distracted driving, speeding, and impairment from alcohol or drugs. Through an understanding of cognitive and social factors that influence such behaviors, behavioral sciences offer valuable insights for developing effective interventions and strategies to promote road safety. **This report focuses on the behavioral and cognitive biases that make accidents so common in our region, on initiatives implemented around the world using behavioral insights that could be beneficial to the region, and on the behavioral interventions that have been implemented in Latin America and the Caribbean to increase road safety.**

We thank the Transport Division of the IDB for the exchange of ideas and information that made this publication possible.


All illustrations included in this report are a true representation of the intervention to which they relate.



INTRODUCTION

1. INTRODUCTION

Road crashes are a main cause of premature deaths in Latin America and the Caribbean, especially among low-income populations and the young.¹ Around 110,000 people die and more than 5 million are injured annually in road crashes in the region. Accidents are the leading cause of death for children between the ages of 5 and 14 and the second leading cause for young adults. The people affected are commonly those in their most productive years, between the ages of 15 and 29, which leads to a loss of productive capacity in our countries. Annually, road crashes cost from 3 to 5 percent of the region's gross domestic product.



The poorest individuals are disproportionately affected by road crashes.


They often lack the resources to protect themselves, recover from injuries, or receive proper compensation and health care. Their limited access to justice and adequate health care exacerbates their economic and social hardships, perpetuating their vulnerability in the long term.

Among road users, the most vulnerable—motorcyclists, pedestrians, and cyclists—account for most traffic fatalities in the region, with **motorcyclists comprising 26.5 percent, followed by pedestrians at 23.5 percent and cyclists at 7.1 percent.** The specific impact varies by country, with motorcyclists most heavily affected in countries like Barbados, Colombia, the Dominican Republic, Jamaica, and Suriname, while pedestrians produce the most fatalities in El Salvador, Guatemala, and Panama. In countries like Argentina, Bolivia, and Chile, fatalities are primarily among drivers and passengers of four-wheeled vehicles.

The World Health Organization has identified road traffic injuries and fatalities as a substantial public health concern, both because of the many lives lost and the large population that is left disabled or suffering other consequences. The problem is especially severe in low- and middle-income countries like those in Latin America and the Caribbean, where substantial financial resources are allocated to care for and rehabilitate those injured in accidents. The state, which largely covers this care through public health services, incurs a significant societal cost. A heavy and distressing psychological burden is also imposed on those directly affected, as well as on their families, friends, and communities, emphasizing the need to understand how the chaos on the roads affects people's mental health.

Despite recent investments in transportation infrastructure to provide access to essential services and increase the productivity of the rural and urban populations, road safety improvements in the region remain limited. Efforts to create institutions and implement actions to reduce fatalities have not achieved the same results as in high-income countries, which have successfully reversed their upward trends in vehicle-related deaths.

Behavioral science is a multidisciplinary field that studies the behavior of individuals and groups. It draws on principles from psychology, sociology, anthropology, economics, and other social sciences to understand, predict, and change human behavior.



Since behavior plays a crucial role in road crashes by directly influencing the actions of drivers and other road users, the tools of behavioral science can be used to reduce the likelihood of accidents by delving into the psychology of road users.²

¹ Factual information from this section comes from Pinto *et al.* (2023).

² Behavioral science has proven that it can help steer behaviors in a cost-effective way, increasing the impact of public interventions and reducing the cost of public policy (Rapoport, Rojas Méndez, and Scartascini, 2020).



2




BEHAVIOR AND ROAD SAFETY

2. BEHAVIOR AND ROAD SAFETY

Imagine you are driving on a highway in a rush to get to your destination. **How much time do you think you will save if you drive the last 10 kilometers at 60 kilometers per hour instead of 50 kilometers per hour?** Some might answer thirty minutes, others ten, but the actual number is much lower; you will only save two minutes. The truth is that the higher your speed, the less time you save by increasing your speed even more.


The traditional economic model suggests that all individuals have access to this information and are able to process the changes in speeds and times instantaneously. This is not seen in reality on our streets. In the real world, drivers are often influenced by cognitive biases, emotions, and social influences, leading to deviations from purely rational economic decision making.



Road crashes, in general, are influenced by a complex interplay of factors.


Poorly designed or maintained road infrastructure, for example, including inadequate signage, confusing intersections, poor road surface conditions, insufficient lighting, or lack of pedestrian crossings, can contribute to crashes. Similarly, roadside hazards, such as obstacles, sharp curves, or an absence of barriers close to the road, can increase the crashes' severity. Vehicle-related factors may include mechanical failures, lack of maintenance, defective brakes or tires, or inadequate safety features, such as airbags and seatbelts. Driving can also be rendered more

hazardous by adverse environmental conditions, including weather events like rain, snow, fog, and ice that reduce visibility and road traction, and glare from the sun, which can affect driver visibility. Inadequate enforcement of traffic laws can lead to more violations and risky behaviors on the road.



This report focuses on the influence on crashes of road users, particularly on the role played by driver, pedestrian, and cyclist behaviors.


Driver-related behaviors that may lead to accidents include distracted driving, impaired driving, fatigue, aggressive driving, and failure to obey traffic rules.³ Drivers can be distracted by using electronic devices, adjusting the radio, eating, or engaging in any activity that diverts attention from the road. Driving under the influence of alcohol or drugs impairs cognitive and motor skills, significantly increasing the risk of crashes, and driving while tired impairs reaction times and decision making. Aggressive driving behaviors include speeding, tailgating, weaving between lanes, road rage, failure to yield the right of way, and engaging in confrontational or intimidating actions toward other drivers; these may increase not only the risk but the severity of crashes. Disobeying traffic rules by, for instance, not wearing seatbelts or running red lights and stop signs increases the risk of injury or death in a crash.



Pedestrians, like drivers, also have a responsibility to minimize the risk of accidents by following traffic rules and exercising caution.

³ Driver behavior may be influenced by age and experience, as indicated by Williams (1997), Hartling *et al.* (2004), and Chapman, Masten, and Browning (2014). Cognitive immaturity can lead to impulsive actions, poor decision making, and excessive confidence—traits often observed in adolescents and young adults who exhibit riskier driving behaviors—while a lack of driving experience may result in inappropriate responses to perilous situations or difficulties with nighttime driving or navigating inter-municipal roads. Older people may have slower reaction times or health-related issues that affect their driving.

Jaywalking—crossing streets outside of designated crosswalks, pedestrian bridges, or intersections—can catch drivers off guard and lead to accidents, as can ignoring traffic signals, such as crossing on a red light or before the “walk” signal appears. Using smartphones, headphones, or engaging in other distractions while walking can impair awareness of traffic conditions and hinder timely reactions to oncoming vehicles. Similarly, walking while under the influence of alcohol or drugs can impair coordination and judgment, making it more challenging to navigate traffic safely.



Responsible and cautious cycling is also essential for safety, both that of the cyclists and of the road environment overall.

Cyclists disobeying traffic signals and signs can lead to their colliding with vehicles or pedestrians, and they may be at greater risk of injury if they ride without a helmet or without reflective

clothing or proper lighting to make them more visible. Using smartphones or headphones or engaging in other distractions while cycling can impair awareness of the road and surrounding traffic, and riding a bicycle with worn-out brakes or tires or other mechanical issues can compromise safety, as well. Traveling on a bicycle at excessive speeds for road conditions, especially in crowded areas or on busy streets, can reduce reaction time and increase the severity of accidents. Motorists may find it difficult to anticipate the movements of cyclists who do not signal turns or stops, ride erratically, weave between lanes, or fail to maintain a consistent line.

All of these behaviors are influenced by cognitive biases—that is, inherent mental shortcuts and patterns of thinking that can lead to systematic deviations from rationality in judgment and decision making (Korteling and Toet 2022). Cognitive biases affect how we perceive, interpret, and respond to information, ultimately influencing our behavior and the outcomes of our decisions. Recognizing and addressing them is essential to making more informed and objective choices.




3

COGNITIVE BIASES AND BEHAVIOR



3. COGNITIVE BIASES AND BEHAVIOR




Cognitive or behavioral biases can significantly influence the eventuality of road crashes by leading drivers and other road users to make poor decisions.

These biases result from the way our brains process information, often resulting in errors in our thinking and perceptions. They are not deliberate or conscious; rather, they are mental processes of which we are not aware. **The following are among the common behavioral biases that can affect road safety:**

- **OVERCONFIDENCE BIAS** refers to the tendency of people to be more confident in their judgments and abilities than their actual performance or understanding justifies. Overconfident road users may believe they are better at handling risky situations than they actually are, leading to aggressive driving, speeding, and the taking of unnecessary risks.
- **NORMALCY BIAS** refers to the tendency to underestimate the likelihood of a disaster or severe event occurring because things have been “normal” for an extended period of time. Road users may underestimate the severity of a situation, assuming that everything will continue as usual, even when faced with dangerous conditions like severe weather or road hazards.
- **OPTIMISM BIAS**, also known as positivity bias, is a cognitive bias in which individuals tend to underestimate the probability of negative events happening to them while simultaneously overestimating the probability of positive events occurring. Some road users may believe they are less likely to experience accidents or negative events than others, leading them to disregard safety precautions.
- **CONFIRMATION BIAS** refers to the tendency of individuals to search for, interpret, favor, and remember information in ways that confirm their preexisting beliefs or hypotheses. Drivers may selectively perceive information that confirms their preconceived notions, such as assuming other drivers will yield the right of way, leading to misjudgments and accidents.
- **RISK COMPENSATION** refers to people's tendency to take on greater risks in response to a belief that the use of safety measures or technologies makes them safer, thereby partially or completely offsetting the benefits of the safety measures. Some road users may adjust their behavior based on perceived risk, engaging, for example, in riskier driving behaviors because they assume the advanced safety features in their vehicles will protect them.
- **ANCHORING BIAS** occurs when individuals rely too heavily on the first piece of information they encounter (the “anchor”) when making decisions, even if that information is irrelevant or arbitrary. Drivers may, for instance, anchor their following distance to the car in front of them. If that car is tailgating or driving too close to the vehicle ahead of it, the following driver may anchor his or her behavior to this unsafe distance, disregarding the recommended safe following distance. In general terms, drivers may fixate on a specific speed or distance from other vehicles, even if it's inappropriate for the current conditions, leading to accidents when they fail to adapt to changing situations.
- **TIME DISCOUNTING** is the tendency of individuals to assign a lower value to future rewards or costs than to immediate ones. In other words, people often prefer to receive a smaller benefit today rather than wait for a larger benefit in the future.

Drivers may prioritize short-term convenience over long-term safety, such as choosing to use a mobile phone while driving despite the known risks.

- **AVAILABILITY HEURISTIC** refers to a mental shortcut that involves making judgments and decisions based on the ease with which relevant information comes to mind. Drivers tend to assess the risk of certain events based on the availability in their memories of similar events. If they have recently heard about or witnessed a specific type of accident or hazard, they may overestimate the likelihood of its happening to them.
- **STATUS QUO BIAS** is the tendency of individuals to prefer things to stay relatively the same or to maintain their current state of affairs. Some drivers resist changing their driving habits or routes, even when safer alternatives are available, because they are accustomed to their current routines.
- **STEREOTYPE** refers to a fixed, oversimplified, and generalized belief or mental image that individuals hold about a particular group of people or things. Often arising from cognitive shortcuts and generalizations, stereotypes can influence how people perceive, judge, and interact with others and can influence behaviors on the road. Stereotypes about gender differences in driving abilities, for example, such as a belief that women are less skilled or more cautious drivers than men, can lead to biased behaviors like tailgating or aggression.⁴



Cognitive overload and social norms are other aspects of behavior that influence the occurrence of cognitive biases in road users.

Cognitive overload occurs when an individual's cognitive resources are overwhelmed by the volume or complexity of information and tasks that need to be processed simultaneously. Cognitive overload can lead to decreased cognitive performance, decision-making errors, reduced attention, and increased stress. It can have a significant impact on road user behavior that may lead to unsafe driving practices and greater risk taking. Drivers may experience cognitive overload when they attempt to multitask, such as by using a mobile phone and texting while driving. Trying to adjust in-car entertainment systems while driving may also prompt it. This divided attention can result in distracted driving, reduced reaction times, and an increased risk of accidents.

Social norms are “the informal rules that govern behavior in groups and societies” (Bicchieri, Muldoon, and Sontuoso 2018). These norms shape how people interact and conform to societal standards. They can vary across cultures, and they may evolve over time. Failing to comply with social norms can be met with disapproval from peers. With reference to road users, social norms are the unwritten rules or expectations within a society or community regarding how individuals should behave when driving, walking, or cycling.

Some social norms related to road user behavior can be detrimental to road safety and overall societal well-being by encouraging or tolerating behaviors that are unsafe, discourteous, or even illegal on the road. In some communities or social groups, for example, a norm may promote speeding as a sign of confidence or a way to assert dominance on the road.

⁴ As outlined by Jimenez-Mejias *et al.* (2014), a series of surveys conducted with 1,574 students at the University of Granada in Spain from 2007 to 2010 demonstrated that men are more prone to view themselves as superior drivers and display greater confidence in their driving abilities than women. Similarly, in response to the 2019 Road Risk Perception Survey conducted by the District Secretariat of Mobility in Bogotá, Colombia, 72 percent of respondents said they believed that women are more cautious on the road than men, while 60 percent agreed with the notion that women are less skilled drivers (Alcaldía Mayor de Bogotá, DC 2019). This perception that men are better drivers than women can result in men's driving at higher speeds, even when children are in the vehicle (Montoya-Robledo *et al.* 2020).

Data indicate, for instance, that young men, in contrast to women, typically have a greater propensity for risk-taking, pursuing intense experiences, driving at high speeds, exhibiting antisocial conduct, overestimating their driving proficiency, and succumbing to external influences (OECD 2006).⁵

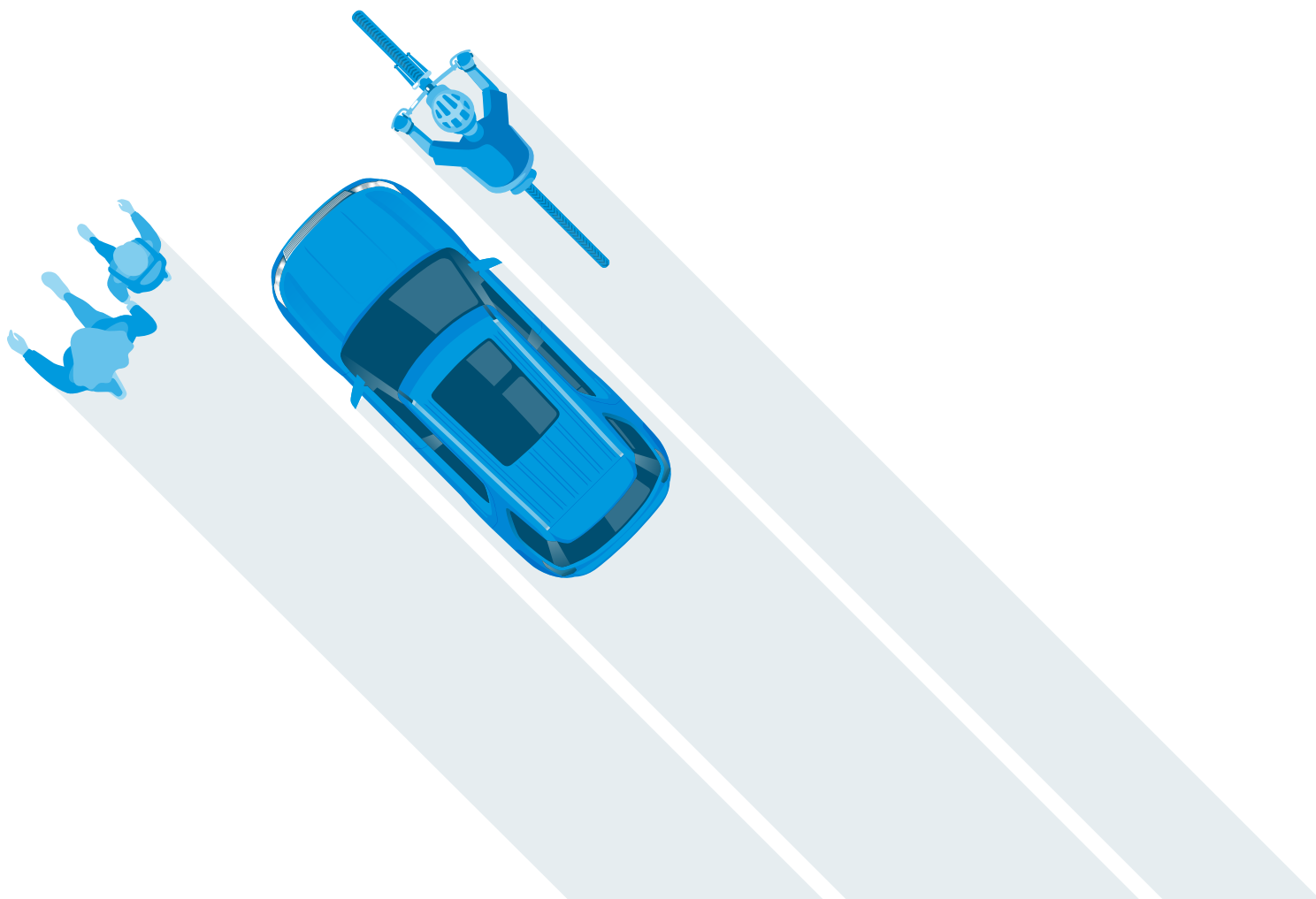
Similarly, certain social circles may exhibit a casual attitude toward drinking and driving. **Across all countries in Latin America and the Caribbean, the proportion of fatalities due to alcohol consumption among individuals ages 15 and older is consistently greater for males than for females (Pinto et al. 2023).** Negative social norms are also prevalent regarding the use of helmets among female bicycle users. Studies conducted in Colombia, Japan, and the United States show that

women often consider helmets uncomfortable, ugly, and unflattering to their physical appearance (Garrard, Handy, and Dill 2012; Montoya-Robledo et al. 2020).

Understanding how behavioral biases, cognitive overload, and social norms influence road users' behavior can help us develop interventions that mitigate their effects.



The next section discusses some of the ways behavioral science principles can be applied.



⁵ In contrast, women tend to embrace cautious behaviors that minimize their vulnerability to road dangers (Cordellieri et al. 2016). Evidence from several European nations indicates women are less inclined to engage in reckless driving, typically adhere to lower speed limits, and obey traffic regulations more closely than men (European Transport Safety Council 2013).



4

**LEVERAGING
BEHAVIORAL
SCIENCE FOR
ROAD SAFETY**

4. LEVERAGING BEHAVIORAL SCIENCE FOR ROAD SAFETY

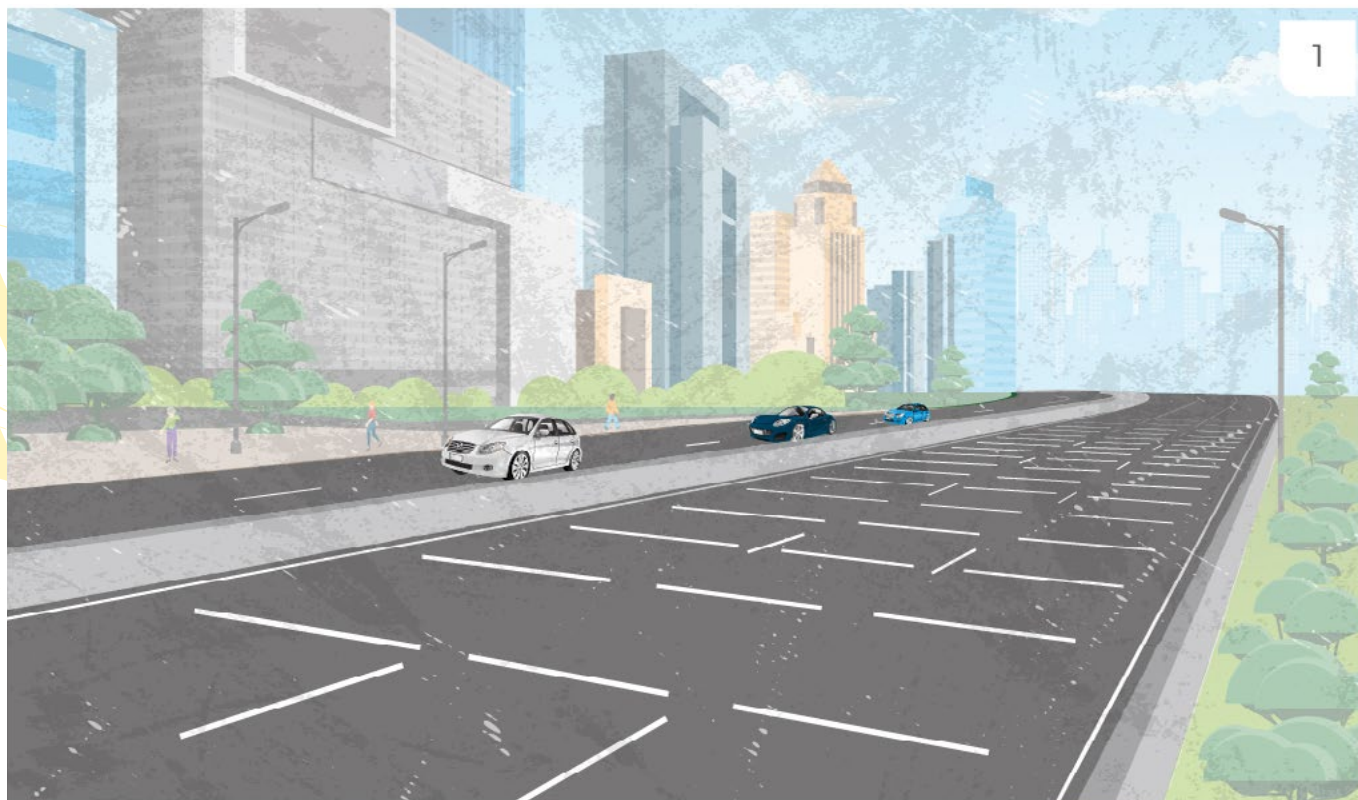
Behavioral science can enhance road safety through an understanding of the cognitive and psychological factors influencing road user behavior. By applying insights from this field, policymakers and safety organizations can design more effective interventions, making roads safer for everyone. Some behavioral science applications include the use of optical illusions, education and awareness campaigns, nudging techniques, feedback and monitoring, incentives and rewards, strengthening of public policy and legislation, and strategic design of road infrastructure. **These are discussed in detail below.**

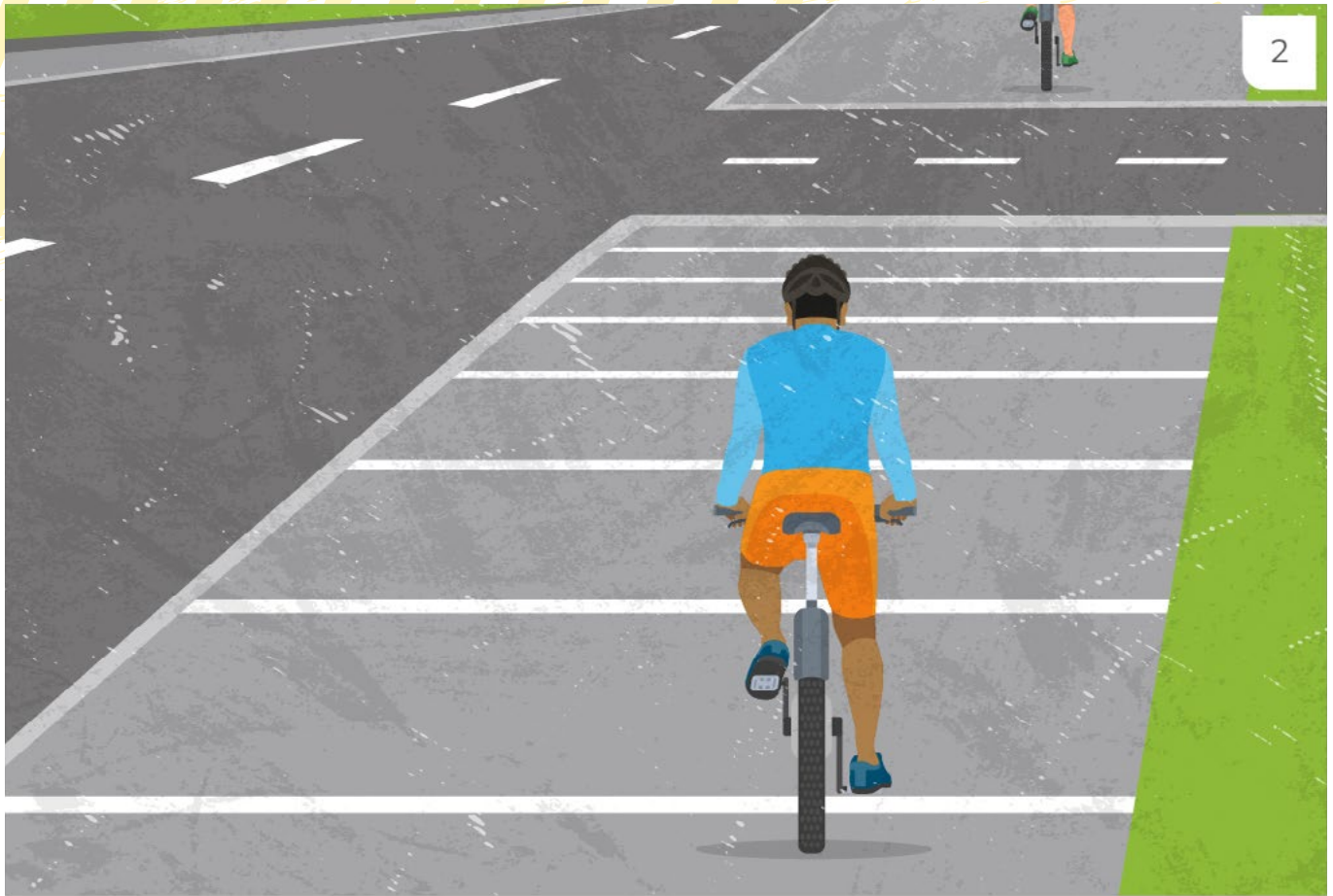
OPTICAL ILLUSIONS

Optical illusions can be used strategically to increase road user safety. Painted road markings that create the illusion of narrowing lanes or

create the appearance of speed bumps, for example, can be placed in areas where reducing vehicle speed is necessary. These illusions give drivers the impression that they need to slow down, even if no physical obstacles are present, which can be helpful in school zones or areas with high pedestrian traffic.

An example known for its success is the optical illusion adopted by the Chicago Department of Transportation in the city on the curve at Oak Street on Lake Shore Drive. For years, the curve was known as a crash hot spot, even though its design was based on typical engineering guidance for curves. The Department of Transportation at first responded with gradual alterations, such as making lane markings more distinct, enlarging curve warning signs, and adding flashing lights, but these measures were ineffective. The department then painted a set of transverse bars on the roadway that get closer to each other as drivers approach the curve (see [Image 1](#)), making them think they are going faster than they actually are. **The Department of Transportation has reported an improvement in driver behavior and a reduction in the number of crashes since the implementation of this measure.**





The painting of transverse stripes has also proved effective in helping cyclists adapt their speed before intersections. An intervention implemented in Sweden, designed by MeBeSafe⁶ (2023), had an array of stripes running right across the bicycle lane, getting closer and closer together as the intersection approached (see [Image 2](#)). Its effectiveness was tested by placing one camera on each subject's bicycle to capture speed and trajectory and another on the cyclist's head to find out in which direction the rider looked. The latter camera, which was intended to measure attention, was particularly important because if the intervention took too much of it, the cyclist might fail to look both ways before crossing the intersection. **The paintings were found effective**

in reducing speed and did not adversely affect attention.

In another use of road painting to enhance safety, optical illusions of three-dimensional crosswalks are being implemented in various countries around the world to slow down speeding cars. In a small fishing town in Iceland, for example, the crosswalks are painted in such a way that the stripes appear to be three-dimensional and floating above the ground (see [Image 3](#)). The innovative design makes pedestrians more careful as they cross the road by giving them a feeling of walking on air, while also getting the attention of drivers and influencing them to decrease their speed.

⁶ Measures for Behaving Safely in Traffic (MeBeSafe) was a research project funded by the European Union and conducted between 2017 and 2020 that developed and tested solutions to guide car drivers and cyclists toward safer behavior in common traffic situations with elevated risk.



Other interventions that make use of optical illusions are **pavement art and humanized signage**. Artistic optical illusions on road surfaces can capture drivers' attention and encourage them to slow down or pay closer attention to their surroundings, especially in areas with high pedestrian

activity (see [Image 4](#)). In Bangalore, India, life-size cardboard cutouts of policemen influence drivers to behave by reminding them of the force of the law (see [Image 5](#)). Similar tricks are used in China, the United States, and some European countries (Moskvitch 2014).






EDUCATION AND AWARENESS CAMPAIGNS

Designing campaigns that appeal to emotions and use relatable scenarios, with messages focused on the possible consequences of risky behaviors, can raise awareness about safe driving practices and encourage people to adopt them. Mass media campaigns, for example, can alter the knowledge and attitudes of a large proportion of individuals and provide social support for behavioral change (Wundersitz and Hutchinson 2011). Among the least expensive countermeasures to address road safety issues, they tend to be effective in changing social norms, although behavioral change may take a number of years to happen. They can be also useful for agenda setting, by helping to form beliefs or reinforce existing beliefs. **To be effective, campaigns must meet certain criteria.** In particular, they need to define target behavior and audience; the main message to be conveyed; the approach for conveying the message (for example, through humor, threats,

and so on); the duration and intensity of the campaign; the types of media to be utilized; and the activities accompanying the campaign.

One such successful campaign was Washington State's Nighttime Seat Belt Enforcement Program (Thomas et al. 2017). In 2006, Washington's daytime rate for seatbelt use was among the highest in the United States, but nighttime fatalities were four times greater than daytime fatalities. Implemented to address the high fatality rates at night, the program combined high-visibility enforcement supported by paid media (radio and television). The media campaign took a threat approach to convey its main message that "extra seat belt-focused law enforcement patrols are taking place at night because the death rate at night is four times higher than it is during the day" (Thomas et al. 2017). The target audience comprised male blue-collar individuals between the ages of 18 and 34. Over the course of two years, the intervention sought to reach motorists numerous times. Evaluation activities included observations of seatbelt use and public awareness

surveys, which found that media messages and enforcement campaigns successfully delivered the main message. Of the motorists surveyed at driver licensing offices, 70 percent reported seeing and hearing the messages and noticing increased enforcement at night.



During the implementation of the program, the numbers of occupant fatalities fell by 3.4 during the night and 4.1 in the daytime per month.

Education and awareness campaigns can be delivered by many means other than mass media. An anti-drunk driving campaign developed in Scotland relied on placing stickers on urinals to deliver its main message (Wundersitz and Hutchinson 2011). In Kenya, a campaign that used stickers to urge passengers to report reckless driving incidents and introduced a lottery system to reward minibus drivers for keeping these stickers on their vehicles resulted in a remarkable 60 percent reduction in insurance claims for accidents involving injury or death (Habyarimana and Jack 2011). By not only promoting passenger engagement in road safety but also providing a strong incentive for drivers to prioritize safe driving practices, this approach ultimately led to significantly improved road safety outcomes.




NUDGING TECHNIQUES

The use of subtle cues, or “nudges,” can influence behavior. Placing signs that remind drivers of speed limits in areas prone to accidents, for instance, can prompt them to slow down. One study examined the application of the “left-digit effect” as a nudge to reduce road speed (Rubaltelli *et al.* 2021). In marketing, this effect is based on assigning prices with a low leftmost number and a high rightmost number (for example, the price tag says \$9.99 rather than \$10.00). The rationale is that cognitive resources are focused on the leftmost digits, so the higher rightmost digits carry less weight—in other words, \$2.99, say, is perceived as much lower than \$3.00. For this study, college students at a university in Italy drove in

a simulator along a route that featured both the regular unmodified road signs (50 km/h) as well as the identical road signs decreased by one unit (49 km/h). The objective of the nudge was to alter the perception of the speed limit by making it feel lower than it actually was. For the analysis, the authors compared the median speeds in road segments with unmodified and modified signs. The results indicated that median speeds in segments with modified signs were significantly lower (Rubaltelli *et al.* 2021).

Another nudging technique that has proved effective is the **use of anti-speeding messages to discourage drivers from exceeding speed limits and engaging in reckless driving.** A study conducted in Belgium in 2021 investigated the effects of reason-based versus emotion-based anti-speeding messages on the self-reported speeding intentions of drivers who received speeding tickets (Raymaekers *et al.* 2023). The rational anti-speeding message explained the advantages of adhering to speed limits and provided tangible strategies for doing so. The emotional message targeted perceived vulnerability by focusing on the possible severe consequences of speeding. Individuals who received an emotion-based anti-speeding message reported being more likely to reduce speed in school zones and residential areas.

Similarly, a study conducted in Australia sought to determine whether various anti-speeding messages displayed on roadside signage would influence drivers’ speeding behavior (Glendon and Lewis 2022).



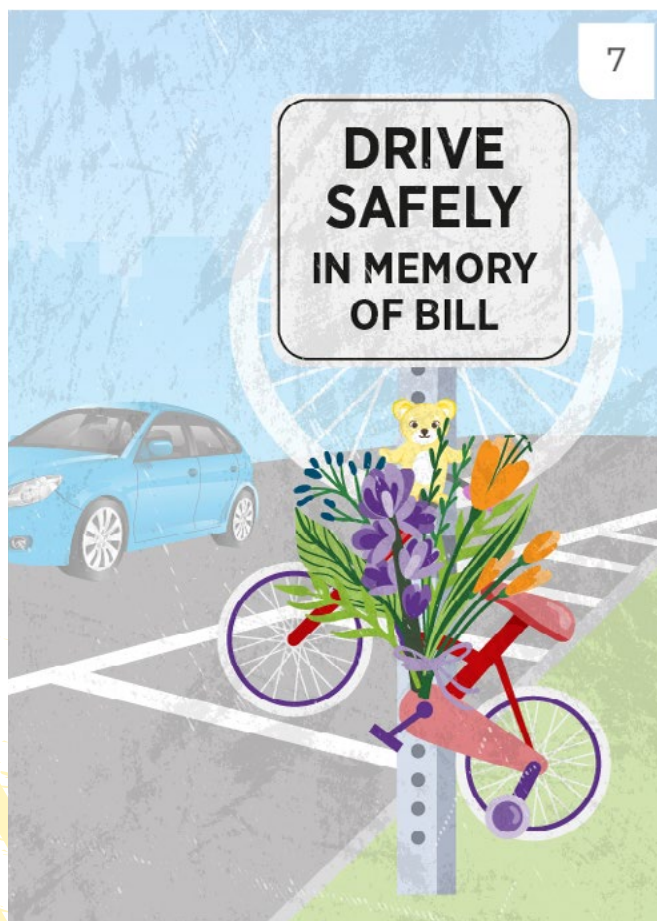
Two of the messages displayed were “SPEEDING? PENALTIES APPLY!!” and “REDUCE YOUR SPEED. KEEP YOUR FAMILY SAFE.”

Speed detection devices collected data during a three-week period (the first week before the messages were displayed, the second while they were displayed, and the third afterward). Mean speeds and the percentage of drivers exceeding the speed limit were lower during the second week than in the first. The numbers rose in the week

after the messages were displayed but were still lower than beforehand.

Nudges that engender empathy in road users can also influence their behavior. Effective communication often involves a combination of emotional strategies, tailored to the specific target audience and the desired change in behavior. Messages common on road signs in the United States include, for example, “My daddy works here. Please slow down” (see [Image 6](#)); “Drive like your kids live here”; and “Drive safely. In memory of Bill,” where Bill is the name of a person who died in a road crash (see [Image 7](#)). It is important to note the balance the messages strike between evoking emotions and providing clear, actionable information on safe road behavior.

Sound nudges, which use auditory cues to prompt certain behaviors or alert individuals to specific situations, can also be used to influence road users. An audible signal when a vehicle exceeds the posted speed limit, for example, can remind drivers to slow down. Some vehicles have a persistent and attention-grabbing chime to encourage seatbelt use. At crosswalks, a distinctive sound, such as a chirp or beep, can indicate when it’s safe to cross, alerting visually impaired pedestrians and reminding others to pay attention. Audible countdowns can also indicate the remaining time to cross the street, prompting pedestrians either to move quickly or wait. In busy areas or transportation hubs, announcements or recorded messages can remind pedestrians to watch their step, not block pathways, or be aware of their surroundings.





FEEDBACK AND MONITORING

The use of technology, like telematics⁷ devices, to provide real-time feedback on various aspects of driving can make individuals more aware of their behaviors and prompt them to do better.⁸ Dashboard displays that show fuel efficiency or driving speed relative to the speed limit, for instance, can encourage more responsible driving. Researchers in Nigeria, where speeding-related crashes as a proportion of total number of crashes increased from 27 percent in 2010 to 44 percent in 2017, tested the effectiveness of an Intelligent Speed Assistance (ISA) application in modifying driver speeding behavior (Etika, Merat, and Carsten 2021). Between November 2016 and February 2017, study participants (all males aged 35–60 years) who were recruited from a fleet company drove rented cars in real traffic on a 46 kilometer test route with three speed limit zones (50, 60, and 80 km/h). Data were logged using a GPS logger and downloaded after every drive. **The study was conducted in two phases.** For the baseline, participants drove the test route without the ISA system. This was meant to reflect normal driving behavior. For the second phase, participants drove with a smartphone with the ISA application mounted on the windshield of the car. The app displayed the current speed limit, the vehicle speed, and a digital map. At baseline, the mean speed was higher than the speed limit for the 50 km/h and 60 km/h speed zones. With the app in use, there was a statistically significant reduction in the mean speed for all the speed zones—in fact, speeding was eliminated.

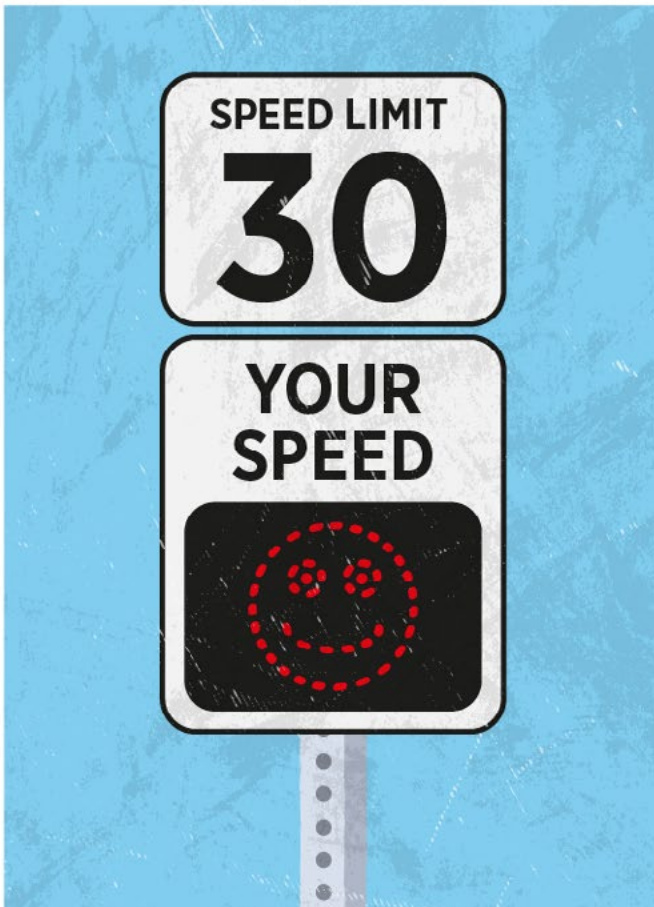
With the growing prevalence of smartphones, this intervention could serve as an effective speed management tool and a complement to conventional interventions against speeding. It could also help increase speed limit awareness.



In another study using a telematics smartphone application, researchers in India conducted a randomized field experiment with 1,069 drivers designed to improve their driving performance through nudges (Choudhary *et al.* 2022). **Notifications from the app delivered three types of performance nudges:** how drivers performed on their current trip with respect to their personal best performance; how they performed with respect to their personal average; and how they performed with respect to their latest driving performance. The experiment also included a control group that didn't receive performance nudges. Results showed that the personal best and personal average nudges increased driving performance and improved driving consistency (in terms of variation of the performance score). Additionally, the researchers found that high-performing drivers, who did not frequently seek feedback, benefited the most from personal best nudges, while low-performing drivers, who were frequent feedback seekers, benefited the most from the personal average nudges. **These results demonstrated that feedback provided through these nudges could help adjust individuals' perceptions of their own driving ability, which they tend to overestimate.**

⁷ Telematics refers to the technology that combines telecommunications and informatics. It is often used in vehicles to collect and transmit data related to driving behavior, vehicle diagnostics, and GPS location.

⁸ Many insurance companies offer discounts for safe driving based on this feedback. **Rewards** such as reduced premiums or discounts can also encourage safe driving behaviors.



Other means of providing feedback to drivers include **electronic signs** that display a driver's current speed and flash when they exceed the limit or show a happy face when they meet it (see [Image 8](#)). These signs provide immediate feedback and encourage drivers to slow down. Some vehicles have built-in systems that alert drivers when they exceed the speed limit or display their fuel efficiency, which can promote more fuel-efficient as well as safer driving. The key to influencing behavior in these ways is to provide feedback that is timely, relevant, and constructive.

maintaining a visible police presence to deter speeding and other violations by tapping into people's fear of being caught.

In 2014, speed measurements suggested that 30 percent of cars in Ricany, Czech Republic, were exceeding the limit (Dušek and Traxler 2022).



PUBLIC POLICY AND LEGISLATION

Utilizing behavioral insights to shape road safety policies, such as stricter enforcement of seatbelt laws or the implementation of traffic calming measures, can encourage compliance with regulations. **Behavioral insights can equip police and law enforcement agencies to develop more effective enforcement strategies**—for instance,

To address this, the government set up cameras on five commuter roads that recorded the average speed of all cars, license plates, and time stamps, based on which the local police began to send out speeding tickets. The innovative aspect of the procedure was that the enforcement threshold—the exact cutoff above the posted speed limit that triggered issuance of a ticket—was not prescribed in any legislation, which meant authorities were able to choose this number according to their criteria. Based on an analysis of all the

data recorded by the speed cameras from 2014 to 2018, Dušek and Traxler (2022) concluded that automated speed camera systems were highly effective at enforcing speed limits. **After receiving their first speeding tickets, drivers reduced their speed in all camera zones, both inside and outside the city, with the result that the speeding rate dropped by a third and re-offense rates by 70 percent.** The results were persistent over time, with no backsliding toward speeding even two years after receiving a ticket. The findings showed that an ambiguous enforcement cutoff would contribute to larger behavioral responses to punishment than would a strict, publicly known cutoff.

Behavioral insights can also be used to enforce the timely payment of fines. A study conducted in Prague, Czech Republic, investigated the use of simplification and salience nudges for this purpose (Dušek, Pardo, and Traxler 2022).⁹ The standard notification used by enforcement authorities in Prague is a formalistic legal text of about 700 words, with the payment deadline and penalty for late payments hidden amid the verbiage. Drivers caught speeding by a camera system receive a demand for payment of a fine by a given deadline. Delayed payments trigger additional enforcement measures that are costly for both the ticketed individuals (because of late penalties) and the authorities (because of administrative costs). Dušek, Pardo, and Traxler (2022) designed a randomized controlled trial covering all speeding tickets processed by an enforcement authority in the suburbs of Prague between November 2017 and August 2019. The experimental treatment consisted of adding cover letters to about 80,000 payment notifications. The letters were brief and simple (less than 70 words) and emphasized the payment deadline, the late penalty, or both. The control group received only the standard notification without a cover letter. Results showed that

the cover letter emphasizing the late penalty and the one emphasizing both the deadline and the penalty increased payment compliance, with the highest increase in payment rates resulting from the letter that emphasized both. **A cost-benefit analysis showed that the most effective cover letter both saved administrative costs and increased revenues.** Specifically, total gains would cover about 25 percent of the costs for ticket administration personnel. This letter was implemented as a permanent measure by the enforcement authorities.



DESIGN OF ROAD INFRASTRUCTURE

Accidents can be reduced by applying principles from behavioral science to the design of roadways and intersections in ways that consider the behavior and needs of road users and make safe behaviors more intuitive. To illustrate, consider a project near India's open railway crossings, where the goal was to prompt overconfident and inattentive drivers to reduce their speed (Moskvitch 2014). Final Mile, a behavioral science and design company located in Mumbai that uses psychological techniques to encourage Indian drivers to reduce their speed and become more attentive, designed speed bumps that are diagonal rather than perpendicular to the road (see **Image 9**). The way in which a car's front wheels traverse the diagonal bumps induces a side-to-side swaying motion in the vehicle—an unfamiliar experience that leads drivers to slow down significantly and become more vigilant about approaching trains. **Additionally, the speed bumps are sometimes painted with thicker yellow lines, creating an illusion of greater height.** This clever visual trick deceives drivers into slowing down as they approach these bumps (Moskvitch 2014).

⁹ **Simplification nudges** involve breaking down complex ideas or instructions into more straightforward and easily understandable terms. **Salience nudges** emphasize or highlight certain information to influence decision making or behavior. The latter technique draws attention to specific options or details to guide individuals toward particular choices.



The use of zigzag lane markings can also prompt drivers to become more attentive. In northern Virginia, the typical straight dashed lines on the road were replaced with a sequence of zigzag patterns (see [Image 10](#)). These unique markings, part of an initiative by the Virginia Department of Transportation (VDOT), warn drivers to exercise caution at points where the road is crossed by the Washington & Old Dominion Railroad Regional Park trail, which is frequently used by bicyclists and pedestrians (VDOT 2010). Following a comprehensive year-long examination, authorities at VDOT concluded this road marking approach was effective and recommended its inclusion in the Manual on Uniform Traffic Control Devices, which provides guidelines for street designers in the United States. The study revealed that the zigzag markings successfully reduced the average speed of vehicles, heightened drivers' awareness of pedestrians and cyclists, and improved the likelihood of drivers yielding. Importantly, it observed that this design alteration remained effective

even after motorists had become accustomed to it, with drivers continuing to reduce their speed a year after installation (VDOT 2010).

Another effective application of behavioral science principles is their incorporation into the design and implementation of traffic calming measures, whose purpose is to boost safety and elevate the quality of life by decreasing vehicle speeds and/or limiting the flow of traffic on roadways. They encompass physical elements of road design that may include traffic circles or islands, speed bumps, and stop signs, among others, that can nudge drivers to adopt safer behaviors. They can also positively impact the environment. A study conducted in the United States by Ahn and Rakha (2009) that estimated the energy and environmental impact of traffic calming measures found significant savings in vehicle fuel consumption and emission rates were achievable by eliminating sharp acceleration maneuvers through driver education.



In sum, behavioral science techniques are invaluable in enhancing road safety.

By understanding the psychology and behaviors of road users, transportation authorities and designers can implement effective interventions that encourage safer driving habits, reduce risky behaviors, and improve overall compliance with

traffic rules. Strategies like using nudging techniques to influence driver decisions, designing user-friendly road signage, and employing cognitive psychology to optimize traffic flow all contribute to creating safer road environments. **Ultimately, integrating behavioral science into road safety initiatives is a proactive and evidence-based approach that holds significant promise for reducing accidents and saving lives on our roads.**



5

EXAMPLES FROM LATIN AMERICA AND THE CARIBBEAN





5. EXAMPLES FROM LATIN AMERICA AND THE CARIBBEAN

Road safety in Latin American and Caribbean countries presents both challenges and opportunities for improvement, as many of the region's countries have high rates of accidents, injuries, and fatalities. The examples below show several ways in which the tools of behavioral science have been used to improve road safety in the region.



STREET ART

While no applications of behavioral science in the form of optical illusions were found in the region for inclusion in this report, the use of **street art** for road safety initiatives can be a similarly creative and engaging approach to influencing road user behavior. Street art can convey important road safety messages in a visually appealing and memorable way, with vibrant murals, graffiti, or pavement art depicting safe pedestrian behaviors, communicating the importance of seatbelt use, or warning about the dangers of speeding. In Fortaleza, Brazil, for instance, improved street design has been crucial to enhancing safety for all road users (Pinto *et al.* 2023). Initiatives carried out through the “Cidade da Gente” (or “City of the People”) program have focused on converting areas prone to conflicts between motorized vehicles and more vulnerable pedestrians and cyclists into secure, dynamic, and lively spaces (see [Image 11](#)). City authorities have effectively enhanced road safety by creating innovative street layouts through the use of budget-friendly materials like paint, planters, and furnishings.

“Caminhos da Escola” (or “Roads to School”) is another initiative implemented in Fortaleza to enhance safety and accessibility at municipal schools and other public facilities through largely visual means (Pinto *et al.* 2023). The intervention has included the establishment of a 1,000-square-meter plaza where children can play and enjoy their local surroundings safely while maintaining access to public transportation and school buses (see [Image 12](#)).



EDUCATION AND AWARENESS CAMPAIGNS

Regarding **education and awareness campaigns**, the Mexican civil association El Poder del Consumidor (“the Power of the Consumer”), which is dedicated to advocating for and advancing consumer rights, conducted an examination of vehicle safety in Mexico. They found that out of the ten bestselling cars in Mexico in 2020, only two received a five-star rating in the Latin New Car Assessment Program (Latin NCAP) evaluation.¹⁰ **Alarmingly, the third bestselling car received a rating of 0 stars for safety.** Based on their findings, the civil association launched a public awareness campaign. In particular, using media strategies grounded in technical evidence, the association collaborates with the Latin NCAP organization to furnish prospective buyers with information regarding the comparative safety performance of the most popular vehicles available in the Mexican market.

Educating operators of public transportation is another essential investment in the safety, efficiency, and quality of transportation services on the roads, benefiting both passengers and the broader community.



¹⁰ The Latin NCAP is an independent vehicle safety assessment program for Latin America and the Caribbean. It is part of the Global NCAP network, which evaluates the safety of vehicles in various regions worldwide. The Latin NCAP evaluation involves crash tests and safety assessments of vehicles. Vehicles are rated on a scale of 0 to 5 stars, indicating the level of protection afforded to both adult and child occupants.

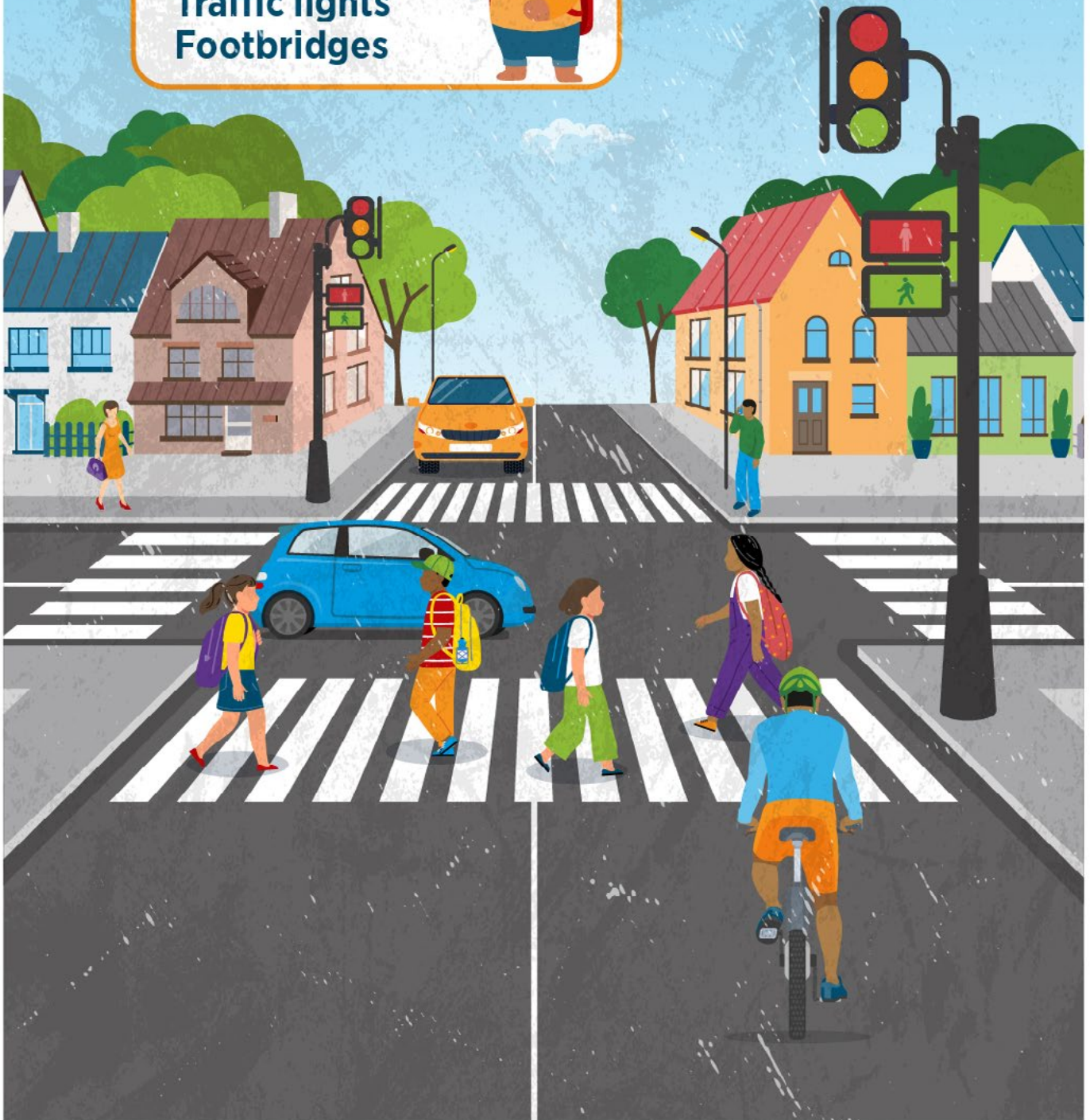


By integrating behavioral science into the training of these operators, transportation authorities can develop more effective training programs that address the specific behaviors and challenges they face, ultimately leading to safer, more efficient, and more customer-friendly services. The state of Puebla, Mexico, for example, has a program for **training and certifying operators of public and freight transportation** (Pinto et al. 2023). Through it, all drivers receive training related to vehicle operation and maintenance, stress and conflict management, key concepts of road safety, passenger protection, and the respectful treatment of people with disabilities and older adults. Mandatory certification for the issuance of drivers' licenses allows the state's transportation department to monitor and ensure that operators of transportation services have the necessary skills to operate their units safely.

Another educational program to promote road safety was introduced between 2014 and 2015 by the Costa Rican government. “Vamos Seguros a la Escuela” (or “Let’s Get to School Safely”) was produced through a collaboration of the Inter-American Development Bank (IDB), the producers of Sesame Street, and other organizations to provide road safety education to children using Sesame Street resources (see [Image 13](#)). The program was implemented in the southern area of San José, near the Paso Ancho overpass road project. Through Vamos Seguros a la Escuela, over 4,500 children, along with teachers and families, have received education on road safety. The curriculum covers various topics, including different modes of transportation, safety equipment, traffic signals, safe behaviors at intersections, and elements of road infrastructure designed to enhance safety and warn of potential dangers.

Activity

#1

FOR FUN**Cross in safe places:****Corners****Crosswalks****Traffic lights****Footbridges**

As discussed in the previous section, educational programs that promote road safety may seek to do so by influencing social norms. An example in the region was a program intended to encourage the use of child restraint systems (CRSs, or car seats) to safeguard children in crashes. In 2007, the Fundación Gonzalo Rodríguez (FGR), a non-profit organization based in Uruguay dedicated to promoting road safety and preventing traffic accidents, collaborated with the media to advocate for the adoption of car seats (Pinto *et al.* 2023). Their objective was to raise awareness and foster commitment to their use among the public and authorities. **This awareness campaign resulted in a notable shift in cultural norms, a transformation that was validated through post-campaign measurements.**

According to data collected by FGR, the percentage of children traveling without car seats in Montevideo decreased by 6.4 percentage points following the campaign. A concurrent 4.8-point increase was observed in their utilization.



NUDGING TECHNIQUES

Among the **nudging techniques** that have been implemented in Latin America and the Caribbean to promote road safety is vehicle labeling, which involves the use of labels, stickers, or markings on vehicles to convey important safety information or warnings to both drivers and passengers.¹¹


Image 14, for example, shows a car with a label



¹¹ The use of such labeling may have benefits that go beyond road safety. A study conducted in the United States by Daziano *et al.* (2021) showed that individuals' selection of new vehicles could also be affected by the greenhouse gas emissions information provided in labels, offering an enhanced approach to heightening environmental awareness and policy recommendations for tackling the issue of climate change.

that displays its crash test ratings, **providing consumers with information that will help them make informed decisions when choosing a vehicle** (Pinto *et al.* 2023). Labels can also indicate whether a vehicle is equipped with child safety features such as LATCH (Lower Anchors and Tethers for Children) systems or rear-seat airbags. Stickers or markings on side mirrors or rear windows can warn drivers about blind spots, encouraging them to check these areas before changing lanes. **Effective vehicle labeling enhances road safety by providing important information to car buyers and drivers and promoting responsible vehicle use.**

Incorporating **incentives and rewards** as a nudging technique can be highly effective in promoting road safety by providing positive reinforcement for safe behaviors.



In Argentina, data from the National Road Safety Agency (ANSV) in 2019 revealed that only 64 percent of motorcycles in circulation had both drivers and passengers wearing helmets (Pinto *et al.* 2023).

ANSV studies suggested that lack of knowledge about the associated risks was not the primary reason for not using helmets. This behavior, rather, was found to be deeply ingrained in societal customs. A belief that helmets are unnecessary for short routes or low speeds and discomfort when wearing them contribute to the low usage rate. To encourage helmet use, **ANSV launched an incentive program offering helmets to the most vulnerable riders: young people obtaining their first motorcycle licenses.** The campaign allows beneficiaries to choose the helmet's color, which takes into account the emotional aspects that influence their safety equipment preferences. To prevent stigmatization, the helmets are free from logos or program identifiers. ANSV plans to conduct an observational survey to assess the project's outcomes and its impact on helmet usage.



POLICY AND LEGISLATION

Policy and legislation influenced by behavioral science principles have helped **elevate Bogotá, Colombia, to the top ten most bicycle-friendly cities in the world.** Among major Latin American cities, Bogotá stands out for its comprehensive policy framework supporting safe cycling. Its policies take a multisectoral approach, involving mobility, sports and recreation, education, and health. Carvajal *et al.* (2020) have listed the main policies and programs Bogotá has implemented to promote safe cycling and bicycle use. The “Plan Bici de Bogotá” (or Local Bicycle Plan for Bogotá) aims to make cycling the primary mode of transportation by addressing infrastructural, safety, cultural, environmental, and health aspects. **The program “Al Colegio en Bici” (or “Let’s Bike to School”) seeks to make education more accessible to low-income students by supplying bicycles and creating safe routes for children living two to three kilometers away from school.** The “Ley Probici” (or “Bicycle Law”) provides incentives like a half-day off and free public transportation for every thirty bicycle commutes to work. It also mandates the provision of bicycle parking spaces in all car parking lots. The “Ciclovía” (or “Open Street”) program closes main streets to motor vehicles every Sunday and holiday, allowing exclusive use not only for cycling but for walking, running, and other leisure activities.

In Chile, authorities took a significant step in 2016 to make children safer on the roads by committing to a regulatory change mandating the use of child restraint systems. As of 2017, the age until which car seats must be used was extended to nine years, and a comprehensive communication plan was implemented to support the law's enforcement (Pinto *et al.* 2023). The communication initiatives aimed to encourage and facilitate the correct use of car seats among the general population and ensure compliance with the regulations nationwide. During this period of legal reform and communication efforts, the total number of children below the age of eleven who lost their lives in road crashes declined by 32 percent.¹²

¹² To sustain this kind of reform over the long run, additional measures that align with those put into place following the law's enactment are crucial (Nazif-Muñoz *et al.* 2017). These include police enforcement, public awareness campaigns, and the engagement of health care professionals to educate parents about the advantages of using car seats.



ROAD INFRASTRUCTURE DESIGN

An application of the tools of behavioral science to **road infrastructure design** in the region is the “Camina Xalapa” (“Walk Xalapa”) program. In collaboration with the community of Xalapa, Veracruz, in Mexico, state and municipal governments successfully implemented low-cost, secure

infrastructure to reclaim public spaces and encourage safe walking in the city (Crotte and Peon 2019). **The objective was to connect the city through strategically located safe crossings, reducing vehicle speeds in these zones, and creating attractive and pleasant areas for pedestrians.** Pedestrian crossings were permanently established using relatively inexpensive materials and furnishings, such as paint, bollards, and reflective materials (see [Image 15](#)).



Similarly, in the city of Cochabamba, Bolivia, low-cost measures to improve pedestrian safety were temporarily applied and evaluated at a four-lane intersection with no signage. Artificial intelligence was used to conduct a before and after analysis of the level of safety where crosswalks and pavement markings were painted as a nudge to encourage safe behavior at crossings (Scholl et al. 2019) (see [Image 16](#)). The results showed that painting large, conspicuous zebra stripes was effective in reducing the speed of drivers and the risk of injury to pedestrians. (See [Box 1](#) for more on the use of AI in enhancing road safety.)

An example of designing infrastructure to improve cyclist safety in Brazil applies a behavioral science focus on user-centered design—that is, on an understanding of the needs, behaviors, and

preferences of cyclists through surveys, observations, and feedback to inform the design process. The city of Fortaleza raised its standards for designing bicycle infrastructure to create protected pathways catering to cyclists of various ages and skill levels (Pinto et al. 2023). Through the use of visual cues, the designers sought to nudge both cyclists and drivers toward safer behaviors—for instance, by painting the borders of bicycle lanes in distinctive colors to make them conspicuous to all road users (see [Image 17](#)). Safety features like protective barriers and well-marked crossings were incorporated to minimize conflicts between cyclists and motorized traffic. This effort was complemented by other initiatives, including the introduction of public bicycle-sharing systems and the installation of bike racks.





Finally, the improved integration of bus rapid transit (BRT) systems into road infrastructure has enhanced road safety in some urban areas, with the establishment of dedicated bus lanes that decrease the volume of vehicles on the road, facilitate safer pedestrian crossings, and reduce interactions among various road users. The application of behavioral science to the planning, design, and operation of BRT systems has both created safer and more efficient transportation networks and

encouraged safer behavior among users in places like the Independencia corridor in Guadalajara, Mexico. **There, the introduction of the Macrobus BRT system resulted in a remarkable 46 percent reduction in monthly traffic accidents. Likewise, the implementation of the TransMilenio BRT on Caracas Avenue in Bogotá, Colombia, has been associated with a 60 percent drop in fatalities (Duduta et al. 2013).**

BOX 1.**Behavioral Science and Artificial Intelligence for Road Safety**

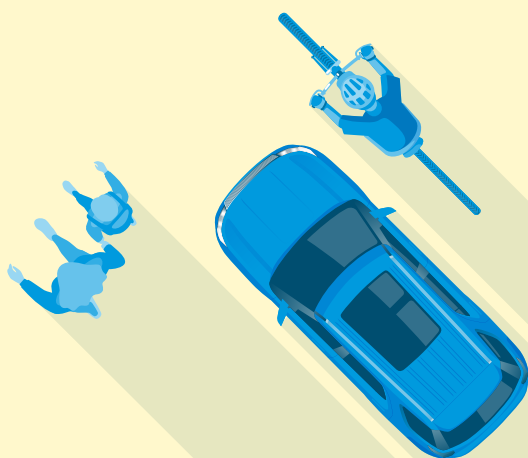
The combination of behavioral science and artificial intelligence (AI) holds great promise for enhancing road safety. The Inter-American Development Bank is at the forefront of applying digital technologies to road safety in Latin America and the Caribbean. In collaboration with the International Road Assessment Program (iRAP), IDB has harnessed artificial intelligence, specifically computer vision, to revolutionize the analysis of roads in the region.

Until recently, this characterization process required manual inspection, with experts painstakingly reviewing around 800 images per kilometer of roadway to assess various safety factors—a labor-intensive and time-consuming method. To put this into perspective, analyzing 10,000 kilometers of roads necessitated the full-time work of some ten to thirteen experts for three months (Pinto *et al.* 2023).

To address these challenges, the IDB and iRAP joined forces, resulting in the creation of [VIASegura](#), a program that employs advanced deep-learning vision algorithms designed by IDB—particularly convolutional neural networks—to automate extraction of the essential road characteristics required for iRAP’s safety ratings.^a The new process has reduced the time required to analyze 10,000 kilometers of roads from three months to just two weeks. By making the assessment process more efficient and accessible, it has been a significant step forward in enhancing road safety throughout the region (Pinto *et al.* 2023).

Behavioral science principles can guide the interpretation of the data provided by VIASegura toward the development of targeted interventions. By integrating AI and behavioral science, we can create a comprehensive approach to road safety that not only takes advantage of data and technology but also helps us increase our understanding and influence the behavior of road users, ultimately reducing accidents and saving lives.

^a The iRAP safety ratings are a widely recognized system for evaluating and assessing the safety of road infrastructure. They provide information about the safety performance of roads based on several key factors, including road design, features, and conditions. Governments, organizations, and transportation agencies use these ratings to prioritize road safety initiatives and investments, with the ultimate goal of reducing traffic accidents and saving lives.





6



CONCLUSIONS

6. CONCLUSIONS

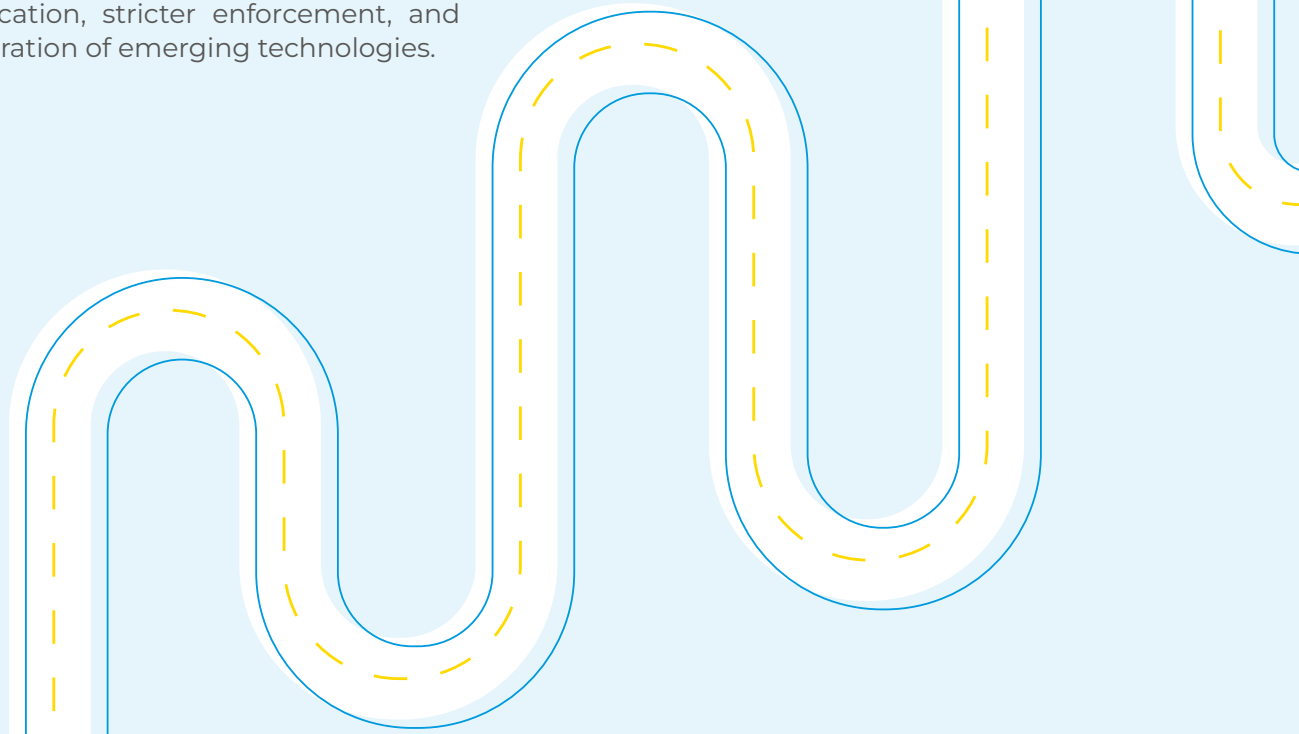
↘ **ROAD SAFETY AFFECTS EVERY FACET OF SOCIETY, WITH IMPLICATIONS STRETCHING FAR BEYOND INDIVIDUAL ROAD USERS.** The consequences of traffic accidents reverberate through health care systems, labor markets, and the rest of the social fabric, presenting an intricate web of challenges and opportunities. Recognition of the multifaceted nature of this issue makes clear that comprehensive and concerted efforts are essential to ensure the safety, health, and stability of our societies.

↘ **THE CHALLENGE PRESENTED BY THE STATUS OF ROAD SAFETY IN LATIN AMERICA AND THE CARIBBEAN IS COMPLEX.** While the region's diverse countries have made progress in improving infrastructure and implementing safety measures, road traffic accidents remain a major concern. Latin America and the Caribbean has some of the highest traffic mortality rates in the world, with issues such as inadequate road design, lax enforcement of safety regulations, and cultural factors contributing to the challenges. Urgently needed to mitigate them are innovative interventions, comprehensive education, stricter enforcement, and the integration of emerging technologies.

↘ **THE APPLICATION OF BEHAVIORAL SCIENCE TO ROAD SAFETY IN THE REGION HOLDS IMMENSE PROMISE.** By understanding the psychological factors that influence road user behavior and tailoring interventions to address them, we can make significant strides in reducing accidents and promoting responsible habits. From incentive programs to public awareness campaigns and user-centered design, the integration of behavioral science is a vital step toward creating safer, more efficient road systems that benefit not only individual travelers but entire communities.



As countries across Latin America and the Caribbean continue to grapple with road safety challenges, the judicious use of behavioral science can play a pivotal role in shaping a safer and more secure transportation landscape for all.



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