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Vision Zero

**The journey to safer
roads in the Middle East**

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About the Fédération Internationale de l'Automobile

The Fédération Internationale de l'Automobile (FIA) is the governing body for world motor sport and the federation of the world's leading mobility organizations. Founded in 1904, with headquarters in Paris and Geneva, the FIA is a nonprofit organization. It brings together 243 Member Organizations from 147 countries on five continents. Further details can be found at www.fia.com.

EXECUTIVE SUMMARY

Countries in the Middle East, particularly in the Gulf Cooperation Council (GCC),¹ have a significant opportunity to improve road safety on their way to “Vision Zero,” which aims for no deaths or serious injuries on the roads. A concerted effort would bring major benefits reducing the numbers of road fatalities, which are high compared with those of many other countries. It would also have tangible implications for healthcare systems and the economy more broadly. Were GCC countries only to attain Target 4 of the 12 global road safety performance targets, they could reduce yearly road fatalities by around 2,800 and achieve a collective economic benefit of approximately US\$250 billion over the course of 20 years.²

A comprehensive “Vision Zero” strategy requires action in five areas

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- A vertical graphic on the left side of the page with the text "Vision Zero" written in a large, white, sans-serif font, oriented vertically from bottom to top.
- 01** Improved infrastructure that integrates safety standards into the design, implementation, operation, maintenance, and use of roads
 - 02** Smart vehicles that meet safety-critical standards
 - 03** Empowered commuters assisted by real-time information sharing
 - 04** Efficient operations including advanced traffic and incident management
 - 05** Robust enforcement including the use of cutting-edge technology

The strategy needs critical enablers, including political will and supportive policies, improved driver education and awareness through state-of-the-art driving schools with curricula centered on safety, data-informed planning and operations that can develop tools such as predictive incident maps, and interoperable, disruptive technology that facilitates road safety. Adequate funding is also required. Funding opportunities are available through public-private initiatives such as the implementation of road usage tolling fees, and fines from safety-critical violations such as speeding.

Safer roads in the GCC can save lives and improve livelihoods across the region, helping to transform mobility as a whole and making Vision Zero a reality.

A NEW DETERMINATION TO IMPROVE ROAD SAFETY

The effort to eliminate road losses is a global movement that GCC countries in particular are pursuing with great determination. Road safety for all is a U.N. Sustainable Development Goal³ and a priority for the G20 countries. The World Health Organization (WHO) and the U.N. regional commissions, in cooperation with other partners in the U.N. Road Safety Collaboration, have developed a “Decade of Action” for road safety.⁴ This global plan aims to reduce road traffic deaths and injuries by at least 50 percent by 2030, bringing the total down to approximately eight traffic fatalities per 100,000 people each year.

The two organizations also set out 12 global road safety performance targets in 2017 to guide countries’ efforts and accelerate progress toward safer roads. Target 3, for instance, sets a goal of having 100 percent of new roads in 2030 achieve technical standards for all users that take road safety into account. Target 4 is a goal for more than 75 percent of travel to be on roads that meet technical standards for all users and take road safety into account.⁵

Countries around the world have adopted Safe System as an effective way to address and mitigate the risks intrinsic in today’s complex transportation ecosystem. The Safe System approach provides a comprehensive framework that goes beyond traditional road safety. Safe System aims to improve human behavior and refocus transportation system design and operation on anticipating human mistakes, reducing crash severity, and saving lives, recognizing that humans, vehicles, and the road infrastructure must interact in a way that ensures a high level of safety (*see Exhibit 1*).

EXHIBIT 1

The Safe System approach is based on guiding principles that aim to eliminate fatal and serious injuries

Safe System—Guiding Principles



Source: Global Plan: Decade for Action for Road Safety 2021–2030, the Safe System Approach (FHWA), the Safe System Approach in Action, Strategy& analysis

In Saudi Arabia, enhancing traffic safety is a key objective of Saudi Vision 2030. To that end, Saudi Arabia has launched the National Road Safety Center (NRSC), an initiative of Saudi Vision 2030's National Transformation Program. The NRSC aims to improve road safety standards through coordination with stakeholders such as academic institutions, automotive suppliers, and public interest groups. A provision of Saudi Vision 2030 is targeting a higher auto insurance penetration rate so that it more than doubles in the next three to five years. Another key measure that is already underway is more rigorous traffic law enforcement through a state-of-the-art automated traffic violation management system leveraging artificial intelligence (AI) technology, which has made a contribution to road safety improvement in recent years in Saudi Arabia. In fact, the country has witnessed a 6.8 percent decrease in recorded major crashes in 2022 compared with 2021, accompanied by a 2.1 percent drop in road fatalities.⁶

In addition to these efforts, Saudi Arabia's minister of transport and logistics services announced a new road sector strategy in February 2023. Under the supervision of the Roads General Authority, the strategy aims to increase road safety and quality of roads as well as to improve traffic flow and density. One of the key targets for the strategy is to decrease annual road fatalities to fewer than eight for every 100,000 people in the population by 2030.⁷ That aim is reinforced by the Ministry of Interior's target to significantly reduce road fatalities.⁸

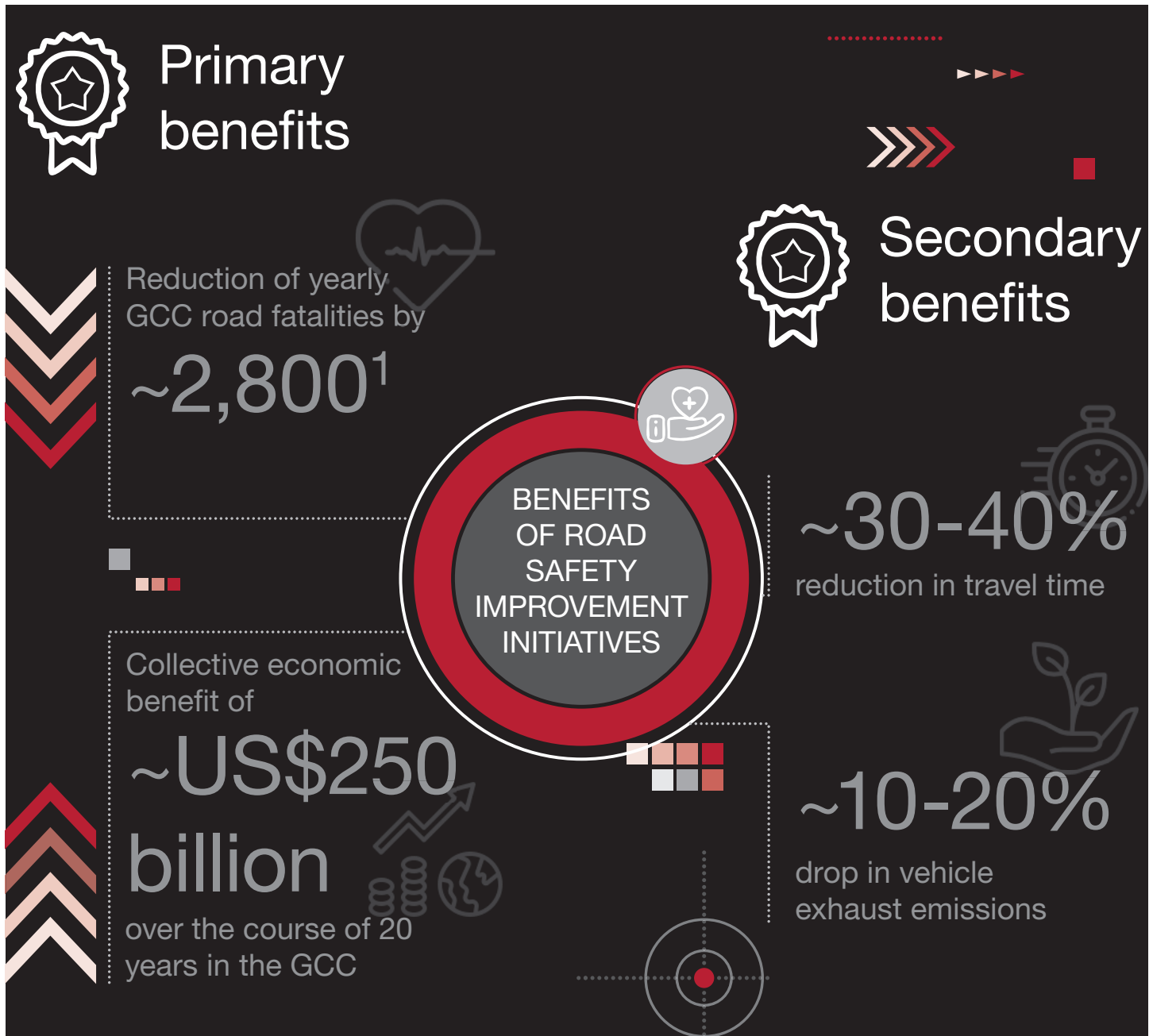
In the United Arab Emirates (UAE), both Dubai and Abu Dhabi have established traffic safety plans. Dubai wants to reduce the number of road fatalities to zero by 2026 by implementing 53 strategic initiatives within four key categories: traffic control, vehicle and highway engineering, traffic awareness, and systems and management.⁹

Safety saves lives and strengthens the economy

The potential gain from a renewed road safety push is significant. Considering similar projects and their respective impacts on road-related metrics in comparable countries, we believe that a comprehensive road safety strategy can result in a notable reduction in human and material losses, less congestion, lower transportation emissions, and better-utilized resources. According to the International Road Assessment Programme (iRAP), experience in countries or regions that have implemented comprehensive road safety plans suggests that improving road safety could decrease the impact of crashes (in terms of the number of fatalities and serious injuries) by as much as half.¹⁰ Moreover, improved road safety initiatives could induce a 30 to 40 percent drop in total travel time.¹¹ Vehicle exhaust gas emissions could decline by 10 to 20 percent. Indeed, by achieving Target 4 alone of the 12 global road safety performance targets, GCC countries could reduce yearly road fatalities by around 2,800—roughly equivalent to a 22 percent reduction—and realize a collective economic benefit of US\$250 billion over the course of 20 years (see *Exhibit 2*).¹²

EXHIBIT 2

Road safety improvement initiatives could have a positive impact on the GCC's safety, economy, environment, and congestion



¹ Estimate based on GCC countries attaining Target 4 of the 12 global road safety performance targets; analysis uses the International Road Assessment Programme (iRAP) Framework (<https://tinyurl.com/vzkaw5bm>).
Source: Strategy& analysis

IMPROVING THE GCC'S ROAD SAFETY RECORD

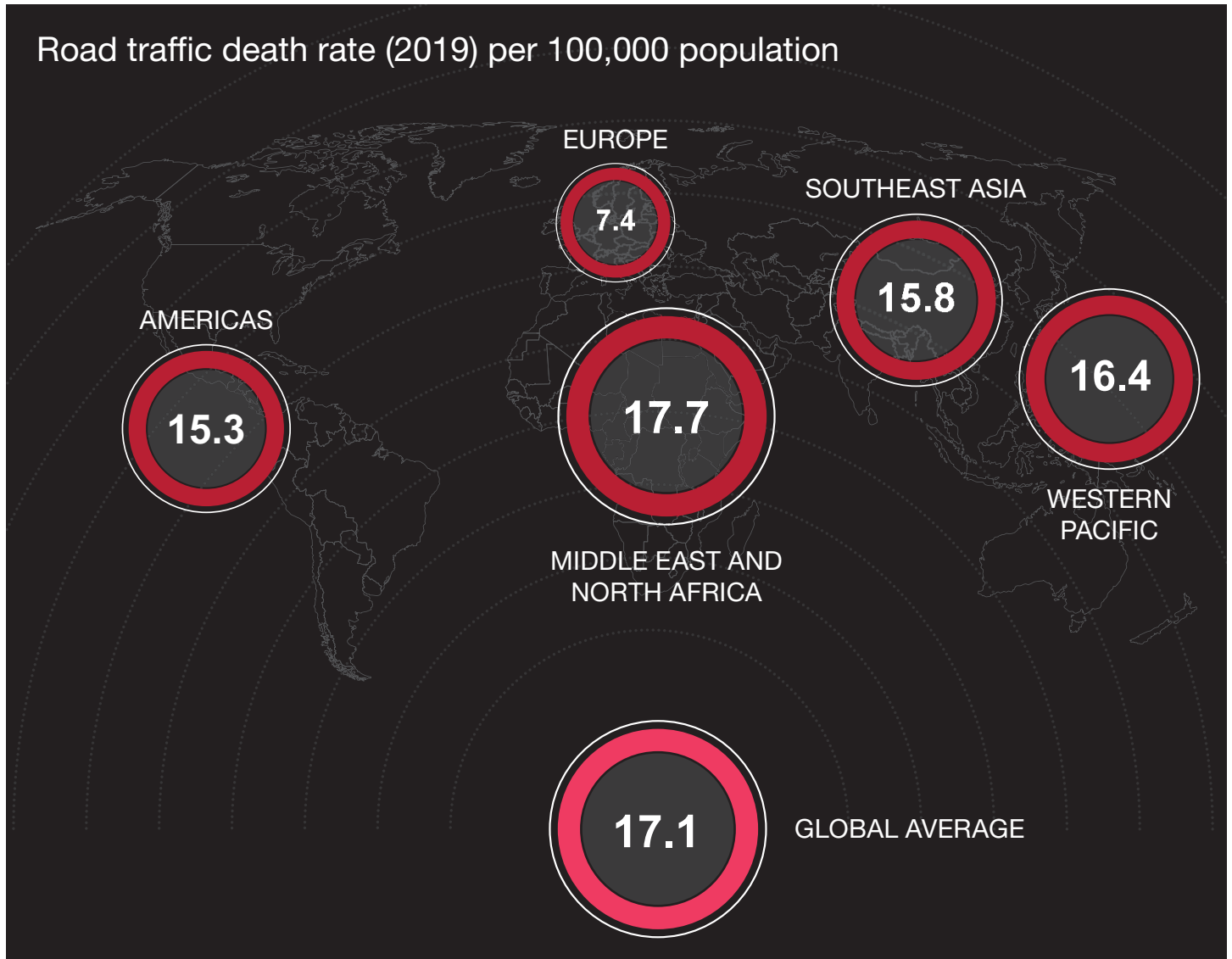
Compared with many other regions, the Middle East has a relatively high rate of traffic crashes. The European average for road-related fatalities was 7.4 per 100,000 people in 2019, according to the WHO. Norway and Singapore had a fatality rate of less than 2.5 per 100,000 people. Middle East countries have higher rates; the Middle East and North Africa (MENA) average for road fatalities is a little above the global average, and more than twice the European average (see *Exhibit 3*).

Beyond the human toll, this rate of fatalities has tangible implications for healthcare systems. For example, road crashes were the second most frequent reason for patients and casualties to be offered first aid and transported by Saudi Red Crescent Authority ambulances in 2021.¹³ In the UAE, road injuries are one of the leading causes of death for children. Two-thirds of children who die from fatal injuries have been in traffic crashes.¹⁴ Similarly, road crashes are the top cause of death for Egyptians between 15 and 35 years old.¹⁵ In Oman, road injuries were the second-highest cause of death (after heart disease).¹⁶ Bahrain now regards traffic crashes as a “public health concern.”¹⁷

The economic and societal costs are also significant, including costs from such factors as material losses, secondary crashes, induced congestion, and pollution. Road incidents cost each economy substantial amounts every year.¹⁸ They also have a significant impact on insurance companies. For example, in Saudi Arabia, the average motor loss ratio, which generally provides insurance companies with an overview of their financial performance by comparing the costs paid for claims versus the premiums received, was about 73 percent, significantly above the average loss ratio elsewhere of 50 percent in 2019.¹⁹

EXHIBIT 3

The Middle East has a relatively high rate of road traffic fatalities compared with other regions



Note: The exhibit uses 2019 data as 2020 and 2021 data were affected by COVID-19 pandemic lockdowns. Data for 2022 data are not yet available.
Source: World Health Organization road traffic mortality data (<https://tinyurl.com/4uykzcb>).

Numerous causes lie behind these statistics:

- Countries in the region are still in the process of establishing a robust institutional governance model covering funding, legislation, licensing, regulation, and research.
- Drivers can be undisciplined, traveling at unsafe speeds, disobeying traffic signals, driving while overtired—or even deliberately drifting across lanes and exhibiting other dangerous behavior. For example, although seatbelts are compulsory, many victims of vehicular deaths did not fasten them. The MENA region has an average score of 6.4 out of 10 on the WHO’s seatbelt enforcement indicator, whereas the average for E.U. countries is 7.1, and Norway scored 10 out of 10. The same applies to motorcycle helmet law enforcement: The MENA region scored 5.5 out of 10, compared with an E.U. average of 8.²⁰ Speed limits, where present in the MENA region, tend not to be robustly enforced.
- Beyond driver behavior and lack of law enforcement, road infrastructure and vehicle conditions in the MENA region represent avoidable causes of road crashes. For example, some key safety standards are not applied, including frontal impact standards, electronic stability control, pedestrian protection, and motorcycle antilock braking systems.²¹
- Automotive insurance rates tend to be below global averages. This contributes to a large number of vehicles in bad condition or abandoned by the side of the road, which in turn makes driving more hazardous.
- Operational and policy issues are at play. Poor road conditions and inefficient transportation systems management and operations do not allow for effective traffic and incident management procedures in most GCC countries.



The path for GCC countries to improve their traffic safety record is a comprehensive road safety strategy that is informed by data and enabled by technology.

BUILDING A ROAD SAFETY STRATEGY IN FIVE AREAS

The path for GCC countries to improve their traffic safety record is a comprehensive road safety strategy that is informed by data and enabled by technology. The strategy covers five areas and is supported by a group of enablers (see *Exhibit 4*).

1. Improved infrastructure

Road infrastructure design plays a vital role in road safety outcomes. Poor road conditions contribute to as many as half of road crashes.²² Safe infrastructure supports other road safety areas by encouraging appropriate road user behavior, such as proper speed and correct lane position, and by providing a supportive road environment if things go wrong.

The comprehensive approach to the safe design, implementation, operation, maintenance, and use of roads is generally referred to as “road safety infrastructure management.” The objective is to integrate road safety activities throughout the design and operation of an individual road or network. This systematic approach reduces death and serious injury.

Road designers, urban planners, city planners, road inspectors, and road construction companies can use the iRAP methodology to improve designs before roads are constructed or upgraded and to assess the safety of road design.²³ At the urban level, new solutions can be introduced to reduce speed and better protect vulnerable road users. For example, “smart” speed bumps—road bumps that automatically alter in shape, size, or rigidity based on the speed of the car passing over them—can ensure that drivers observe the set speed limits. In Sweden, which has set a goal of zero fatalities, the city of Uppsala has installed smart speed bumps that have reduced the percentage of speeding drivers from 75 percent to 21 percent.²⁴ Another option is smart crossings that alert road users to the presence of pedestrians.

AI also has a role to play. Algorithms can monitor roads for cracks, potholes, and other damage, helping authorities predict and prioritize maintenance efforts. Such solutions can run on affordable dashcams or smartphones attached to the windshield of public buses or municipal vehicles such as vans and street sweepers, thereby reducing road maintenance costs. Saudi Arabia is already piloting such AI-enabled solutions through multiple use cases.

EXHIBIT 4

The comprehensive road safety strategy is built in five areas dependent on a set of enablers

Areas and enablers



Source: Strategy&

2. Smart vehicles

The design and safety features of vehicles protect occupants and other road users when crashes happen. Ensuring that existing vehicles are safe is key. To that end, the Global New Car Assessment Programme, originally established in the U.K., has defined a list of safety standards and a car safety rating system so that consumers and manufacturers can ensure their vehicles meet the highest safety standards.²⁵ Adopting such safety-critical standards can include fixes such as retrofitting new technologies where appropriate, requiring more frequent vehicle inspections in state-of-the-art inspection centers, and encouraging wider adoption of safer vehicles.

Connectivity will also be key. Vehicles can communicate with one another and with traffic signals while obtaining data from the cloud to create a 360-degree “awareness” of their surroundings. Automotive telematics provide a two-way communication platform for monitoring vehicles by combining real-time data exchanges on driver behavior, vehicle technology, and smart city services. These solutions can be implemented in a cost-efficient, simple way, including through a mobile app for smartphones. A gamification algorithm can reward good driving behavior with insurance policy discounts or other benefits. Evidence to date suggests that the use of telematics and gamification can reduce the number of vehicle crashes and simultaneously cut fuel consumption through consistent driving.²⁶

Automation is another important safety-oriented trend, achieved through the gradual production of vehicles that can operate in various environments with limited or no human intervention. Full vehicle automation is expected to be reached by the end of this decade, and its expected long-term benefits include significant reductions in traffic deaths, a 40 percent reduction in travel time and transportation costs, and a 15 to 20 percent improvement in fuel efficiency for fuel-based vehicles.²⁷

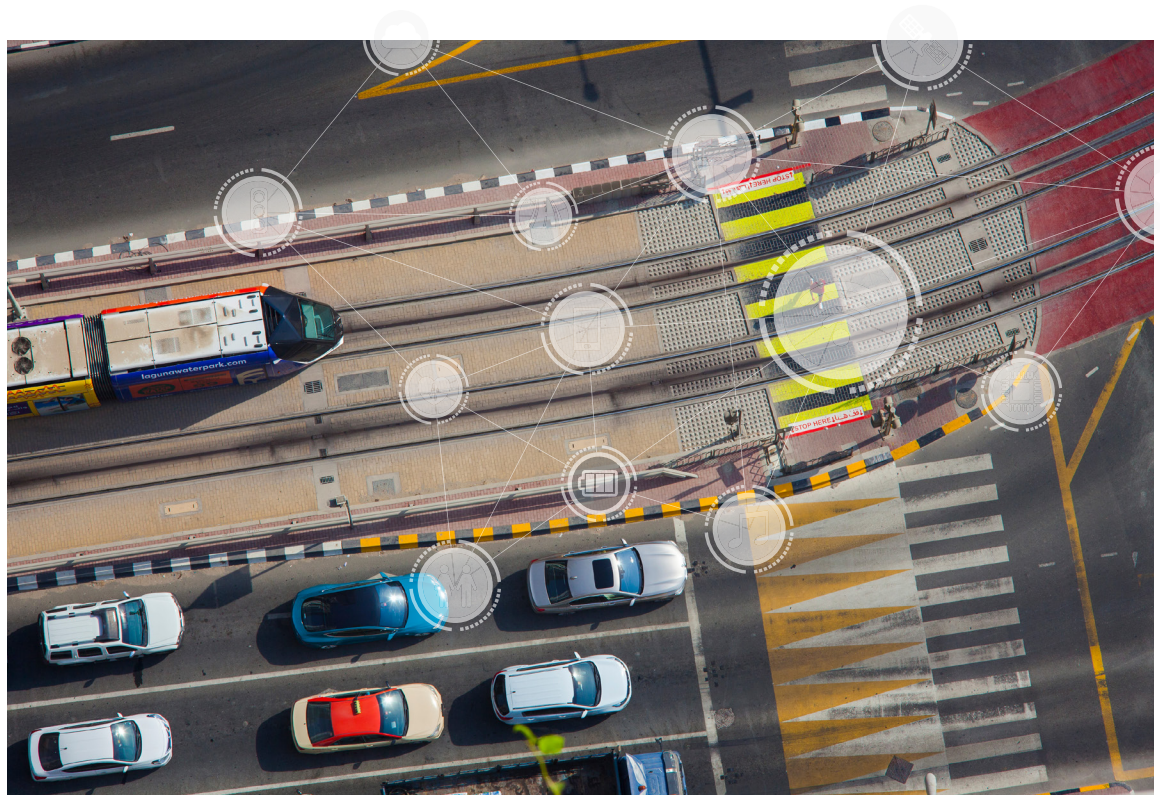
3. Empowered commuters

It is vital to adopt a people-centric approach that covers all commuters. For drivers, real-time information—delivered through dynamic message signs, speed indicator displays, or alerts and warnings through in-vehicle units or personal devices—ensures continued awareness of road safety hazards and assistance in decision making. Chandler, Arizona, installed 66 radar speed display signs at 12 intersections in 2008 as a pilot project. The result was a 79 percent reduction from 2002 figures in the number of traffic fatalities at these locations.²⁸ Similarly, changes to pedestrian crossings and designated bike lanes can protect those traveling on foot and by bicycle.

4. Efficient operations

Effective traffic and incident management can achieve road safety goals. For example, smart traffic lights can be actuated, and signal lengths adapted, based on patterns in traffic data from cameras and sensors flowing through a central control system. In Pittsburgh, an AI-enabled traffic signal solution has reduced travel time by as much as 25 percent and lowered the exhaust emissions from vehicles idling at lights by 20 percent.²⁹ Dynamic speed regulation can change speed limits according to real-time traffic, road, or weather conditions so that vehicles drive at the most efficient speed.

Similarly, new technological tools can drastically reduce incident detection time. These include AI-enabled incident prediction and detection, and drones for monitoring. Computer-aided dispatch can help emergency first responders by monitoring their location and allowing them to directly contact the command-and-control center. In Foyno, Norway, for example, AI-enabled closed-circuit television (CCTV) cameras detect crashes automatically within 10 seconds after they occur, saving precious time for first aid support.³⁰



5. Robust enforcement

Certain offenses are more likely to cause death or injury. These include motorists failing to wear seatbelts, using mobile phones while driving, speeding, running red lights, switching lanes illegally, making U-turns, and driving in the wrong direction on one-way roads. Technology exists to capture these violations automatically, including speed cameras, radar monitoring, and road sensors. There are also mobile violation capture systems such as drones, smart patrol vehicles, radar speed guns, and handheld and vehicle-fitted cameras. AI-enabled CCTV cameras, which can run computer vision algorithms to detect many different types of violations simultaneously, are becoming more cost-efficient. Once the related CCTV hardware has been deployed, it requires only limited incremental cost to add layers of violation detection algorithms. Edge computing—that is, processing of the captured images within the camera itself rather than in the cloud—reduces both costs related to manual violation processing and costs from connectivity to centralized processing centers due to heavy data transfers of the captured images or video streams. Saudi Arabia has already introduced edge computing for traffic law enforcement in some areas as part of its advanced traffic safety program.



Safer roads in the GCC can save lives and improve livelihoods across the region, helping to transform mobility as a whole and making Vision Zero a reality.

CRITICAL ENABLERS SUPPORT THE ROAD SAFETY STRATEGY

To implement a road safety strategy in these five areas requires several enablers: political will and supportive policies, improved driver education and awareness, data analytics, interoperable technology, and adequate funding.

Political will and supportive policies

Road safety governance requires the political will to create and implement national and local road safety strategies. Traffic safety policies, protocols, laws, and regulations should be consistent with leading practices and comprehensive standards, such as those developed by the U.N.'s Conventions on Road Traffic and Road Signs and Signals. These can help authorities with infrastructure design, maintenance, and operations, such as optimal lane width, pavement type, and speed bumps. Being consistent with international standards ensures that countries receive updates to existing road design specifications that keep pace with developing mobility and safety needs.

Crafting supportive policies can mean lowering urban speed limits, encouraging higher auto insurance penetration rates, and improving vehicle inspection mechanisms. These efforts can be accompanied by comprehensive road safety legislation that incorporates penalties for more effective enforcement.

Improved driver education and awareness

There should be a switch from the currently limited driving skills curriculum to a more comprehensive perspective that teaches road safety as a whole. That means improving the quality of driving schools and introducing ongoing tech-enabled driver education. Such digitally enabled driver education would incorporate the redefinition of driving functions given developing driver assistance technologies and increased vehicle automation. This new form of driver education would be part of a culture that promotes overall safer and more efficient transportation modes such as public transit and shared mobility.³¹

Targeted campaigns designed to address the most common causes of crashes can improve driver awareness. Such campaigns can achieve strong community support for road safety objectives by encouraging public and private stakeholders including schools, universities, and the media to promote road safety.

Data analytics

Data-informed planning and operations are vital to supporting a road safety strategy. Analyzing road incident data such as locations, causes, and severity can develop predictive incident maps. These in turn enable new initiatives aimed at achieving safer and more comfortable commuting conditions. Real-time assessment allows for better resource management and responses based on incident hot spots (identified by historical data). The result is better-informed operators and commuters, improved speed-limit management, and awareness of crash hazards.

Organizations, particularly those in the private sector, that include the road safety dimension in their sustainability reporting can find that it helps them assess their road safety performance and calculate their safety footprint, relying on a concept similar to that of carbon footprint calculators.³² Such a data-driven solution enables companies to achieve more sustainable use of road vehicles through continuous improvement and benchmarking of their performance.

Interoperable technology

Disruptive technologies can be deployed for the successful implementation of use cases across all road safety areas. Such technologies include AI, “vehicle-to-everything” (known as V2X) communications, and high-definition mapping. Interoperable technologies and communications are easier to deploy widely, especially across boundaries such as state lines and international borders. Harmonizing standards for vehicles and infrastructure elements at regional and international levels provides uniform conditions for such functionalities as automated number plate recognition technology, which can read license plates from different countries.

Adequate funding

Properly targeted funding allows for the adoption of technology in all areas of the comprehensive road safety strategy. Investments should be targeted at major issues to have the maximum impact. Governments can also generate revenues from sources such as enhanced traffic law enforcement or road usage tolling fees and then invest those funds in initiatives such as capital expenditure-intensive infrastructure improvements that help save lives and improve mobility as a whole. Globally, and within the region, road tolling programs have already proven to be an effective method for managing transportation demand, regulating and smoothing traffic patterns, ensuring efficient use of infrastructure, and generating revenues that can fund transportation improvement programs. Regional examples include Abu Dhabi’s Darb toll gate system and Dubai’s award-winning electronic-only road toll program known as Salik (“clear”).³³

CONCLUSION

Improving road safety is a necessity for countries in the Middle East and the GCC states in particular. A comprehensive strategy will allow the region to reduce crashes by deploying leading practices, improved management techniques, and the latest technology in a manner that is coherent and has maximum impact. The strategy will save lives and achieve broader economic gains by making roads safer and more efficient.

ENDNOTES

1. The GCC countries are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.
2. Estimate based on GCC countries attaining Target 4 of the 12 global road safety performance targets; analysis uses the International Road Assessment Programme (iRAP) Framework (<https://tinyurl.com/vzkaw5bm>).
3. U.N. Sustainable Development Goals, “Goal 3: Ensure Healthy Lives and Promote Well-Being for All at All Ages” (<https://tinyurl.com/yck6byz5>).
4. World Health Organization (WHO), “Decade of Action for Road Safety 2021-2030” (<https://tinyurl.com/mr4cexvw>); Jonathon Passmore, regional advisor, Road Safety World Health Organization—European Region, “Global Plan of Action for the Decade of Action for Road Safety 2021-2030,” WHO 2021 (<https://tinyurl.com/fen2tmuf>).
5. WHO, “Global Road Safety Performance Targets” (<https://tinyurl.com/2p952bh4>).
6. Saudi Gazette, “Major Accidents in Saudi Arabia Decreased to 6.8% in 2022; Deaths Too by 2.1%,” January 29, 2023 (<https://tinyurl.com/mr29tbah>).
7. Hazem Bin Hussain, “Roads Sectors Strategy: Global Leadership and Achieving Logistics Service Targets,” *Ar-Riyadh* (Arabic), March 2, 2023 (<https://tinyurl.com/dxtkjk3z>); “Minister of Transport: The Road Sector Strategy Will Contribute to Enhancing Safety and Quality Levels on the Kingdom’s Roads,” *Ar-Riyadh* (Arabic), February 28, 2023 (<https://tinyurl.com/59tt6evd>); Arabic CNN, “Saudi Arabia: Learn about the Objectives of the ‘Road Safety Strategy’ Announced by the Council of Ministers” (Arabic), March 1, 2023 (<https://tinyurl.com/bdd96a52>); Sabq News, “The Road Sector Strategy Enhances Safety, Encourages Innovation, Supports GDP Growth and Creates Jobs,” March 1, 2023 (<https://tinyurl.com/55s73hmp>); Saudi Press Agency, “52 Initiatives in the Road Sector Strategy to Improve the Road Network, Enhance Its Sustainability, and Raise Its Safety Standards” (Arabic), March 4, 2023 (<https://tinyurl.com/5n8drrja>).
8. Nick Webster and Patrick Ryan, “Why the Middle East Is Trailing in the Fight against Road Deaths,” *The National*, July 12, 2022 (<https://tinyurl.com/4mt4u3b5>).
9. “Launching Awareness Initiatives Targeting Delivery Service Sector,” Government of Dubai, press release, March 24, 2022 (<https://tinyurl.com/mtyup5ew>).
10. iRAP, “How Safe Are Our Roads?” (<https://tinyurl.com/vzkaw5bm>).

11. Carnegie Mellon University, “Press Release: Smart Traffic Signals Pilot Results: Pollution Plunges, Traffic Clogs Cleared: Air Quality Improvement Brings Economic Benefit,” September 24, 2012 (<https://tinyurl.com/ytzn8dz9>); Prachi Patel, “Pittsburgh’s AI Traffic Signals Will Make Driving Less Boring: AI-Powered Traffic Light Coordination Would Cut Time Spent in the Car, Traffic Congestion, and Emissions,” IEEE Spectrum, October 17, 2016 (<https://tinyurl.com/4n2hp2ar>); Jackie Snow, “This AI Traffic System in Pittsburgh Has Reduced Travel Time by 25%,” Smart Cities Dive, July 20, 2017 (<https://tinyurl.com/2p8j3p6b>); Jim Motavalli, “It’s Time for Smart Traffic Lights: Our Current System Is Not Only Stupid, It’s 100 Years Old,” *Autoweek*, October 30, 2020 (<https://tinyurl.com/ya8crpm4>); Gavin, “Smart Traffic Control: The Pittsburgh Example,” Smart City Hub, April 14, 2021 (<https://tinyurl.com/3b9fsct7>); “RapidFlow Surtrac Is Now Miovision Surtrac” (<https://tinyurl.com/3prmym8v>).
12. Estimate based on GCC countries attaining Target 4 of the 12 global road safety performance targets; analysis uses the International Road Assessment Programme (iRAP) Framework (<https://tinyurl.com/vzkaw5bm>).
13. Saudi Arabia, Ministry of Health, Statistical Yearbook 2021 (<https://tinyurl.com/4kstbhsy>).
14. UAE government, “Road Safety” (<https://tinyurl.com/mryx4nr>).
15. The NADA Foundation for Safer Egyptian Roads (<https://nadaroadsafety.org/>).
16. IHME data for Oman, Institute for Health Metrics and Evaluation, University of Washington (<https://www.healthdata.org/oman>).
17. Julia Cassano, “Car Accidents in Bahrain Are Now a ‘Public Health Concern,’” The Daily Tribune—News of Bahrain, December 7, 2022 (<https://tinyurl.com/pttazab6>).
18. For example, in Saudi Arabia, “World Health Organization Together with Ministry of Health and Ministry of Interior Join Efforts to Reduce Mortality from Road Traffic,” United Nations, December 27, 2019 (<https://tinyurl.com/2zuzfmyz>).
19. “Saudi Insurance Sector,” Al Rajhi Capital, February 16, 2021 (<https://tinyurl.com/3bt5vmxn>).
20. “Global Status Report on Road Safety, 2018,” World Health Organization (<https://tinyurl.com/5f5veabx>).
21. “Global Status Report on Road Safety, 2018,” World Health Organization (<https://tinyurl.com/5f5veabx>).

22. See “Is America’s Aging Infrastructure Causing Car Accidents?” FVF Law, November 7, 2019 (<https://tinyurl.com/y8sp7km3>).
23. iRAP Methodology fact sheets (<https://tinyurl.com/b2r58ty5>).
24. Actibump, Results (<https://tinyurl.com/4dszuth4>).
25. Euro NCAP (<https://tinyurl.com/4cwkrwhe>).
26. See, for example, Keshav Bahadoor and Patrick Hosein, “Application for the Detection of Dangerous Driving and an Associated Gamification Framework,” conference paper, 2016 IEEE Fourth International Conference on Future Internet of Things and Cloud Workshops, August 2016 (<https://tinyurl.com/5n77ysnm>); “Gamification of Driver Behaviour,” Smartrak (<https://tinyurl.com/ys7sp8ht>).
27. Austin Brown, Brittany Repac, and Jeff Gonder, “Autonomous Vehicles Have a Wide Range of Possible Energy Impacts,” 2013 (<https://tinyurl.com/4mjts5dk>); Ji Eun Park, Wanhee Byun, Youngchan Kim, Hyeonjun Ahn, and Doh Kyoum Shin, “The Impact of Automated Vehicles on Traffic Flow and Road Capacity on Urban Road Networks,” *Journal of Advanced Transportation*, Vol. 2021, Article ID 8404951, 2021 (<https://tinyurl.com/mspxua4p>); UC Berkeley, Department of Civil and Environmental Engineering, “Eliminating Traffic Jams with Self-Driving Cars,” Featured Faculty: Alexandre M. Bayen, March 15, 2021 (<https://tinyurl.com/3jnvps9w>).
28. Intersection Safety, Chandler, AZ, Carmanah Traffic (<https://tinyurl.com/2p9h6hua>).
29. “AI Traffic Signal Control System Reduces Travel Time by 25% in Pittsburgh,” *Rapid Flow*, December 11, 2018; “Pittsburgh Cuts Travel Time by 25% with Smart Traffic Lights,” *Apolitical*, August 14, 2017 (<https://tinyurl.com/3sacffdz>).
30. “Automatic Incident Detection,” Navtech Radar (<https://tinyurl.com/2xahuyy8>).
31. Marwan Bejjani, Dr. Shihab Elborai, Mark Haddad, and Gustave Cordahi, “Sustainable Mobility Inverting the Transport Pyramid,” *Strategy&*, 2021 (<https://tinyurl.com/bdhmz3dp>).
32. Fédération Internationale de l’Automobile, “FIA Launches Road Safety Index to Improve Organisations’ Safety Footprint,” November 29, 2022 (<https://tinyurl.com/4u44rfhy>).
33. International Bridge, Tunnel and Turnpike Association, “Roads & Transport Authority (RTA), Salik Toll System Expansion: A Model of Tolling Excellence,” 2014 (<https://tinyurl.com/54fcfpyd>).

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