A cost-effective path to road safety

By understanding the root causes of traffic injuries and fatalities, stakeholders can more fully evaluate the available countermeasures.

"We ignore road crashes at our peril.... This is predominately a killer of the poor. It is the poorest communities which live alongside the fastest roads. It is the poorest children who have to negotiate the most dangerous routes to school. It is the most vulnerable road users, pedestrians, and cyclists who are at greatest risk yet are the most routinely forgotten by the planners and policy makers."

—Desmond Tutu[1]

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The chance of dying in a traffic crash is almost ten times higher in South Africa than it is in the United Kingdom. This doesn't mean that emerging economies, where 90 percent of the road casualties in the world occur, are the only ones that could do better on road safety. In fact, the chance of dying in a crash in the United States is more than three times higher than it is in the United Kingdom. Each year, traffic crashes kill more than 1.2 million people and injure up to 50 million.[2] They are the leading cause of death among people 15 to 29 years old[3] and cost the global economy around $518 billion.[4] And the problem is expected to get worse. Total annual fatalities from crashes are expected to approach 2 million by 2020. To try to reverse this trend, the United Nations—working with the World Health Organization and the World Bank—has called for a "Decade of Action for Road Safety," aiming to halve the number of deaths from their current levels by 2020. If this goal is achieved, about 5 million

[1] Foreword, *Make Roads Safe: A Decade of Action for Road Safety*, Commission for Global Road Safety, May 2009.
[2] *Global Status Report on Road Safety: Supporting a Decade of Action*, World Health Organization, 2013.
[3] *Id.*
[4] *Global Status Report on Road Safety: Time for Action*, World Health Organization, 2009.

lives will be saved and 50 million injuries will be prevented over the course of the decade.

We have developed a novel, end-to-end approach to help national and municipal governments and policy makers (such as transportation ministers and mayors) evaluate the preventative measures available. The heart of the approach is a "road-safety cost curve" that makes it possible to compare different countermeasures by their anticipated impact and costs. We have also cataloged more than 200 road-safety countermeasures based on our research of academic and corporate literature. This methodology is similar to the approach successfully used to reduce greenhouse-gas emissions, address global and national water scarcity, incorporate adaptation measures into economic-development strategies,[5] and deal with obesity and smoking reduction in public-health policy. By using a consistent methodology to evaluate all possible countermeasures, policy makers have a much clearer basis for budget-allocation decisions.

Several countries and cities, from Europe to Asia to Latin America, are now using just such an approach to improve road safety. For example, a European city that recently used this approach plans to invest approximately €5 million per year through 2020 in a variety of prioritized countermeasures expected to cut traffic fatalities and severe injuries in half. A large proportion of these investments will not require new money but will be funded by reallocating resources already within the budget. Over time, the program will ultimately be cost negative, saving the city about €60 million per year. This article will discuss how any government can use the approach to enhance its road-safety efforts.

Why a cost curve can help

A whole-systems approach to road safety can have dramatic impact in a short time. Take the example of the Australian state of Victoria, which in 1990 instituted its first formal—but unpublicized—road-safety strategy with the goal of reducing traffic fatalities by 50 percent. The state's leaders analyzed the tools that could help it achieve its goal, exploring solutions related to engineering, legislation, law enforcement, education, research, and the possible synergies of interagency coordination. Over the next two years, Victoria introduced several new traffic-safety laws and regulations to strengthen police powers and stiffen penalties. One of these laws established a blood-alcohol limit of zero for new drivers, which lasted for the first three years after getting a license. Anyone convicted of a second drunk-driving offense was subject to immediate license revocation. The state's random breath-testing program was expanded to the point where, statistically, one in three drivers could be expected to be tested in any given year. The demerit-points scheme for driver's licenses was made tougher. Speed cameras were installed to aid in enforcement of speed limits. A compulsory helmet law was introduced for bicyclists. A long-term program of public education on traffic safety was launched. By 1992, Victoria had almost reached its target. The number of annual traffic fatalities had fallen to around 400, a drop of more than 40 percent from the levels of the mid- to late 1980s.

Other localities can replicate Victoria's success, but it can be difficult to know where to begin. There are many tested measures for improving road safety, but many have been tried in only one or two places and thus are not widely known. For example, a pilot program in Kenya significantly improved the safe-driving habits of minibus

[5] Greg Hintz, Marcel Normann, and Jens Riese, "Get adept at adaptation," *McKinsey on Society*, March 2011 (mckinseyonsociety.com).

drivers. By placing stickers on over 1,000 buses encouraging passengers to complain about dangerous driving, the program reduced insurance claims involving injury or death for those vehicles by two-thirds. The cost of the program was $2 per disability-adjusted life year.[6] It can be challenging to find all the possible countermeasures, sort through them, and determine which are most relevant for a particular locale. For example, new vehicle technologies such as automatic braking and lane-departure warning systems work very well on North American highways but have much less impact when implemented in emerging megacities in China, where roadways are congested and vehicle speeds are much lower.

National and local government agencies—which have primary responsibility for traffic laws, vehicle-safety regulations, and road-infrastructure development and maintenance—are facing ever-tighter budgets, so they often must make difficult choices. And these different agencies are all responsible for different aspects of the problem (departments devoted to infrastructure development and maintenance take care of roads, while police and internal security agencies handle law enforcement, and so on), which means they have to compete against one another for public funds, making coordination difficult.

Government officials often approach the problem with hypotheses on the measures they believe will work, but without all the facts to show whether these beliefs are correct. Absent these facts, it is difficult to compare the impact of countermeasures against one another. It does not help that vendors or others promoting a specific solution will all claim that their solution is best.

[6] James Habyariman and William Jack, “Heckle and chide: Results of a randomized road safety intervention in Kenya,” Center for Global Development working paper, number 169, April 2009 (cgdev.org).

Compounding this problem is the number of nongovernmental stakeholders that need to be involved in addressing road safety, including transportation providers, nongovernmental organizations, health care systems, insurance companies, automobile clubs, and car manufacturers. Each of these stakeholders recognizes the problem and wants to reduce accidents, but it is difficult to align all their interests and ideas and to coordinate their actions. Without such coordination, many effective countermeasures will not be implemented.

Getting alignment on the problems to address

One of the most important things a government must do is involve all stakeholders that would be needed to implement any chosen countermeasures. By getting these stakeholders involved early, giving them full transparency into the process, and allowing them to participate in data collection and the development of options, the government can reap several benefits. Stakeholders will have an increased sense of ownership over the proposed countermeasures and be more willing to collaborate when it comes time to plan implementation.

The first thing the assembled stakeholder team should do is figure out what is causing traffic-related injuries and fatalities in the locality. This can be done by gathering data on the root causes of accidents from a variety of sources, such as government bureaus and insurance companies. Several types of data need to be collected, including basic facts (weather conditions, time of day, day of month, day of week, how many people involved, age of parties involved), type of accident (car/car, car/motorcycle, car/pedestrian), behavioral elements (speeding, driving under the influence of alcohol or drugs, mobile-phone use, falling asleep), types of vehicles and technologies used (motorcycles, trucks, bicycles), and the existing enforcement measures being violated.

The stakeholder team should aggregate this data to create a "crash profile" for the locality and then analyze the data through several lenses. For example, Exhibit 1 shows a road-accidents/fatalities dashboard that one city created. Several interesting insights emerged from this dashboard, some more surprising than others. For example, it was no surprise that the great majority of accidents involved male drivers, who are often more aggressive on the road, and that the primary age group to watch for among drivers was from 20 to 40 years old. On the other hand, it was interesting how few crashes happened at night. In most countries, there are more crashes during the day simply due to more traffic.

Another interesting thing that decision makers can do with the crash-profile data is to benchmark it against the crash profiles for other

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cities or countries. This benchmarking exercise may point the way to root causes that otherwise might be hidden. One city government (labeled "B" in Exhibit 2) found that its population had higher rates of using powered two-wheel vehicles (motorcycles, mopeds, scooters) than many other cities and countries. As might be expected, crashes between these types of vehicles and cars have much higher mortality rates than crashes between two cars. In addition to root causes, decision makers need to know how much traffic accidents are costing society. What are the associated health care, property-damage, and ambulatory costs?

Evaluating the options

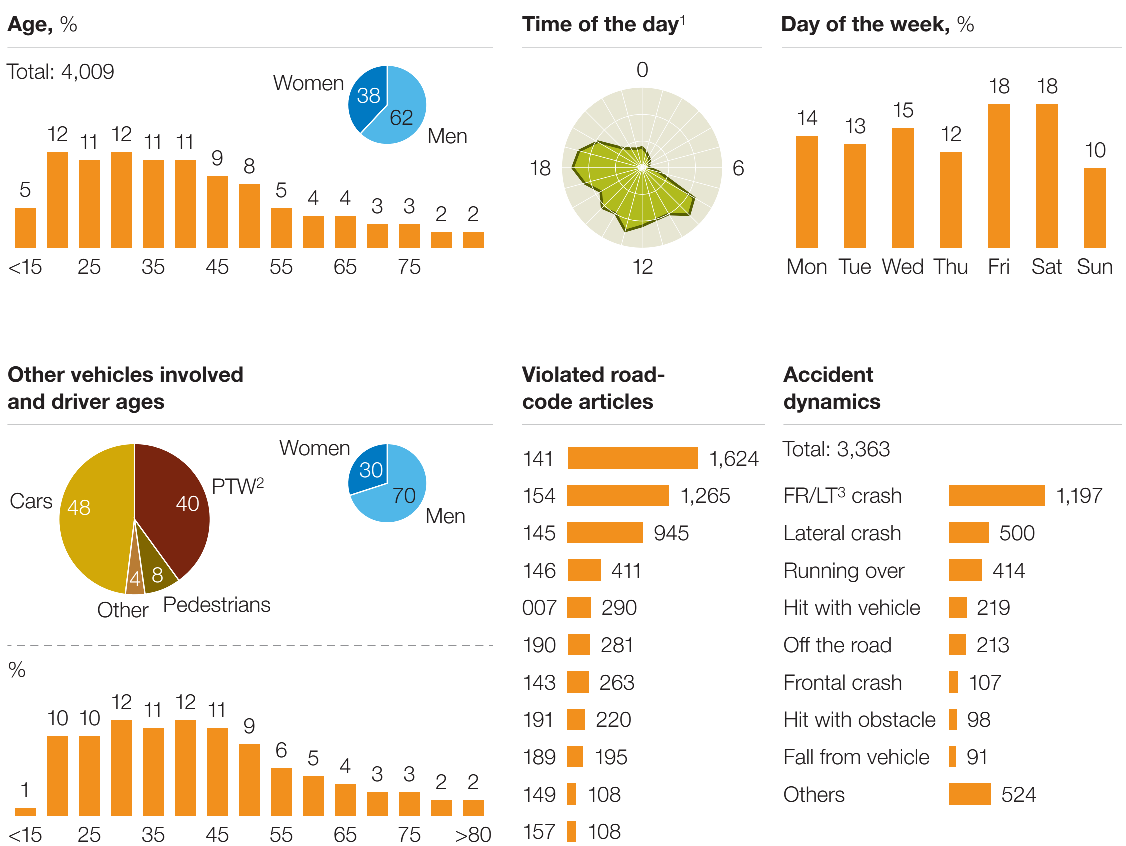
Once the stakeholder team understands the root causes of accidents and the costs associated with them, it can select the countermeasures most relevant to the primary root causes. This is an

Exhibit 1

Dashboard highlights problems to solve.

DISGUISED CITY EXAMPLE

2009, accidents with injuries



[1]Based on 2009–10.
[2]Powered two-wheel vehicles.
[3]Frontal/lateral.

Source: Local-police and national-government statistics

Exhibit 2

One city's high fatality rate was due to the prevalence of two-wheeled vehicles.

2008

[1]Powered two-wheel vehicles.

Source: Autopromotec 2009; Eurostat; US Federal Highway Administration; McKinsey analysis

essential step in the development of any cost curve. If the root cause is speeding, decision makers might ask whether they should invest in additional enforcement manpower, new technologies (speed cameras, intelligent speed adaptation), or public-education campaigns. If the locality has high rates of drunk driving, it might consider reducing blood-alcohol limits, enacting new regulations aimed at young drivers, buying new technologies, or redeploying the police force. If mobile phones are the problem, decision makers might ask which types of education campaigns, road rules, technologies, or enforcement efforts are most likely to reduce accidents caused by mobile-phone distraction. For example, based on the findings for city B in

Exhibit 2, decision makers realized that they were devoting too many educational and enforcement resources to car drivers. Due to the high level of motorcycle and pedestrian casualties, these communities needed to be addressed more urgently.

As noted earlier, we have developed a library of some 200 countermeasures grouped into six broad categories—enforcement, regulation, education, infrastructure, post-accident care, and technology—so that decision makers can access what is very often sporadic university research (on roads, accidents, fatalities, countermeasures) for a specific project. For example, in our research we did not find any studies conducted in Western countries comparing the effectiveness of legal requirements that motorcycle riders wear helmets that cover the full head (including the chin) against those that require them to wear half helmets that cover only the crown of the head. But there were studies in Taiwan and Thailand that showed significant reductions in head injuries and deaths when riders used the full helmets. These findings could be important to help change people's mind-sets in southern European locales, where riders tend to prefer half helmets because of the hot climate.

After identifying relevant countermeasures, the team needs to determine which ones will have the highest impact for the cost. Data on impact (that is, how much the countermeasure affects the probability or severity of a crash) are available through various analyses and assessments published by academia, public agencies, and technology providers.[7] Estimating costs is less straightforward. The local costs of implementing road-accident countermeasures—redesigning a road, training the police force, or requiring advanced technology in new vehicles—vary, and this is where a large part of the team's effort will be focused.

Building the cost curve

Once the team estimates the impact and costs, it can build the cost curve (Exhibit 3). The curve's y-axis shows the costs of each proposed countermeasure offset by the number of deaths it can prevent and their associated expense to society. The x-axis shows how many fatalities and severe injuries are prevented each year. The measures that save the most lives per euro are on the left of the curve.

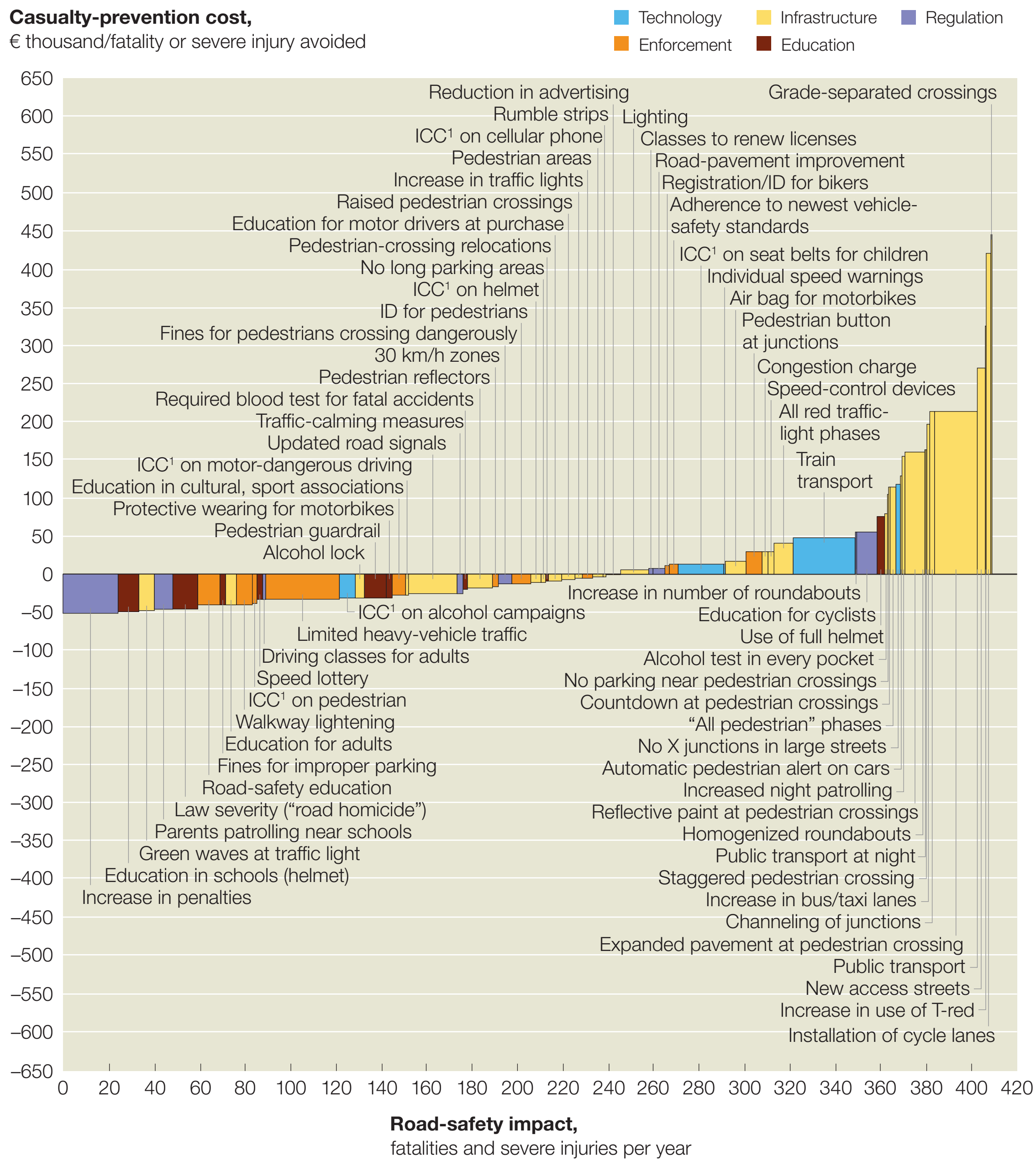
By placing each countermeasure along the cost curve, several insights emerge. For example, to counter speeding, many jurisdictions have been installing speed cameras. This technology can be expensive; options such as speed bumps, which have been shown to prevent a greater number of deaths, may be more cost-effective. With respect to vehicle technologies, the benefits of seat-belt reminders outweigh their costs by a factor of eight, alcohol ignition interlocks produce benefits of more than three times their cost, and collision-warning systems just about cover their costs.

The initial cost curve will typically include all the countermeasures relevant to the root causes of accidents in the locality, which will be too many to explore in detail. For example, the cost curve in Exhibit 3 includes more than 70 countermeasures. The stakeholder team can exercise its judgment regarding which countermeasures seem most feasible and effective. This exercise can bring the cost curve to a more manageable size, making it much easier to focus the group's planning (Exhibit 4).

[7] Some examples of data sources include Australia's Bureau of Infrastructure, Transport, and Regional Economics; the European Commission; the European Transport Safety Council; the Imperial College Centre for Transport Studies in the United Kingdom; the UN Commission for Global Road Safety; the UK Department for Transport; the US National Highway Traffic Safety Administration; and the World Health Organization.

Exhibit 3

The cost curve makes it easier to evaluate options.

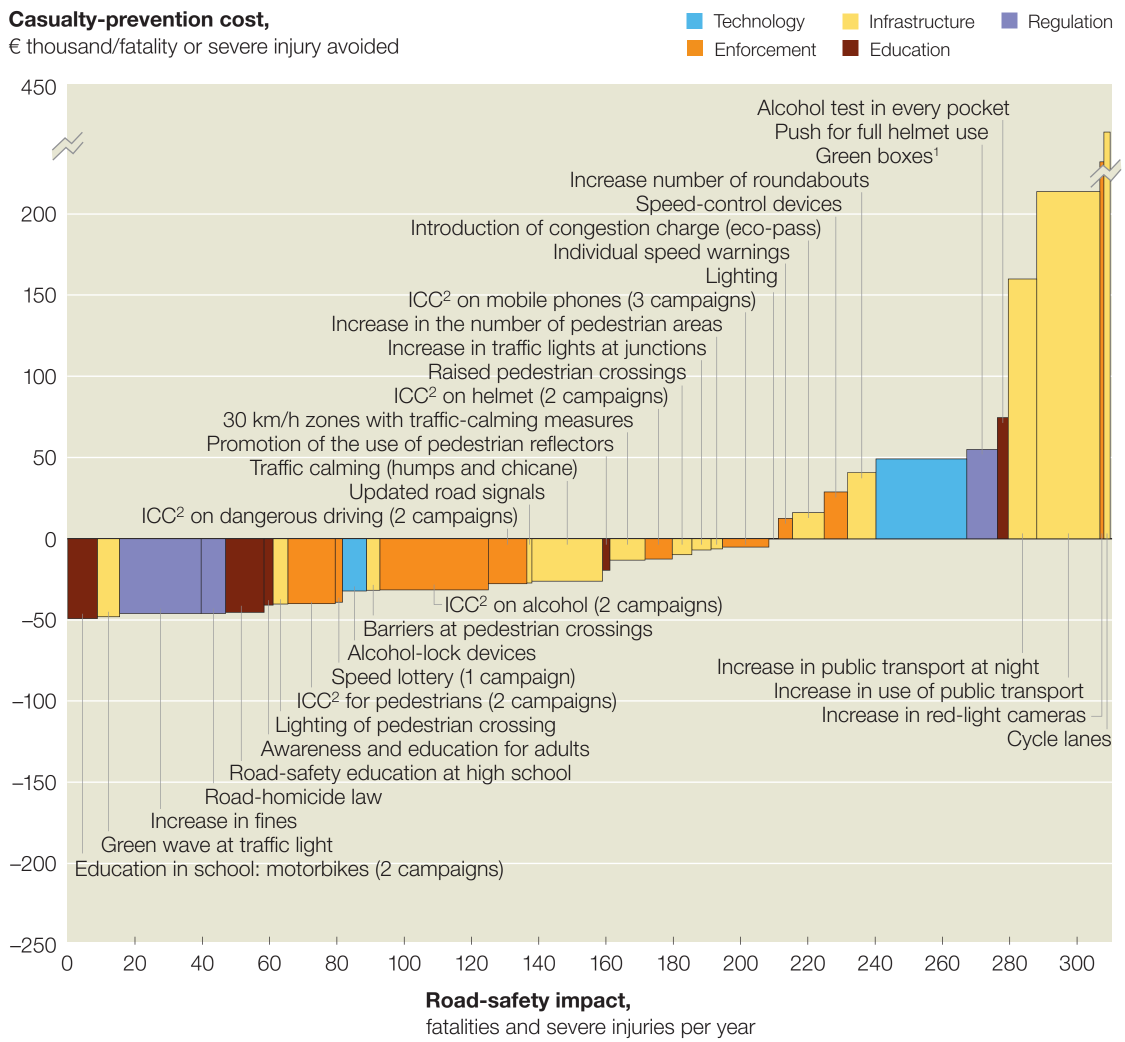


[1] Information, communication, and control campaign.

Source: European city road-safety plan

Exhibit 4

Tailoring the cost curve makes it more manageable.



[1] Technology primarily used in fleet vehicles to make drivers aware of their behavior (eg, green = safe, yellow = slightly hazardous, red = dangerous).
[2] Information, communication, and control campaign.

Working with the tailored cost curve, the stakeholder team decides which counter-measures should be implemented in the near term and which might be phased in over the longer term. The primary constraints that typically drive this decision-making process are budget and ease of implementation. Projects that require greater capital expenditures may take longer to implement.

The cost curve will differ based on geographical and cultural variations that affect what the root causes of accidents are. A locale's starting point will affect the analysis as well. For emerging economies, where not as many initiatives have already been implemented, there will be many quick-win opportunities. For example, a country such as Thailand or Vietnam could get an enormous amount of impact just by enacting laws to limit the number of people riding on a single motorcycle or to require riders to wear helmets. For initiatives that would require capital expenditures, such geographies can use the cost curve to ensure they can work within their budget constraints to choose the measures that will provide the most impact.

For more developed regions that are leaders in road safety, the data and analysis are more about finding additional investments that will produce enough marginal impact. And regardless of geography, the cost curve can help identify measures that are cost negative—either the measure will not cost the government anything or it will cost so little that the saving of lives more than offsets the cost of implementation.

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