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Pricing For Traffic Safety

How Efficient Transport Pricing Can Reduce Roadway Crash Risks

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By Todd Litman

Victoria Transport Policy Institute

Summary

This report evaluates the traffic safety impacts of various transport pricing reforms including fuel tax increases, efficient road and parking pricing, distance-based insurance and registration fees, and public transit fare reductions. This analysis indicates that such reforms can significantly reduce traffic risk, in addition to providing other important economic, social and environmental benefits. Crash reductions depend on the type of price change, the portion of vehicle travel affected, and the quality of alternative transport options available. If implemented to the degree justified on economic efficiency grounds (for example, to reduce congestion, recover road and parking facility costs, and make insurance more actuarially accurate), these reforms are predicted to reduce North American traffic casualties 40-60%. Low per capita traffic fatality rates in European and wealthy Asian countries result in significant part from their higher transport prices, which result in more efficient, multi-modal transport systems where residents drive less and rely more on alternative modes. However, these benefits are often overlooked: pricing reform advocates seldom highlight traffic safety benefits and traffic safety experts seldom advocate pricing reforms. This is particularly important for developing countries which are now establishing pricing practices that will affect their future travel patterns and therefore crash risks.

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Introduction

Traffic safety is an important transport planning objective. Traffic accidents cause millions of disabilities and deaths, and hundreds of billions of dollars in economic costs annually worldwide (Litman 2024; WHO 2004). As a result, safety is a paramount consideration in roadway design and operation, and many motorists willingly pay a premium for optional safety features. Experts are continually searching for new ways to increase traffic safety.

Many factors affect traffic risk, including the amount and type of travel that occurs, roadway and vehicle type, and driver behavior. One significant but often overlooked factor is *transport pricing*, that is, the fees charged for vehicles, road and parking facilities, fuel, vehicle insurance and public transport use. Analysis described in this report indicates that transport pricing reforms can significantly increase traffic safety. However, these impacts are often overlooked, both when evaluating pricing reform benefits and when searching for traffic safety strategies. As a result, such reforms are implemented less than optimal.

The current traffic risk *paradigm* (the assumptions used to define a problem and evaluate possible solutions) tends to ignore pricing as a traffic safety strategy because it assumes that traffic crashes result primarily from special risks, such as drunk or distracted driving, unsafe vehicles, and poorly designed roadways. It considers "normal" vehicle travel (a responsible, sober driver, wearing seatbelts, in a modern car, on a well-designed highway) a safe activity that need not be reduced. This paradigm tends to measure risk using distance-based indicators (such as fatalities per 100,000 vehicle-miles) and so does not recognize the safety benefits that result from policies which reduce total vehicle travel. From this perspective, transport price increases are inefficient and unfair ways to increase safety because they "punish" all motorists for risks caused by a minority.

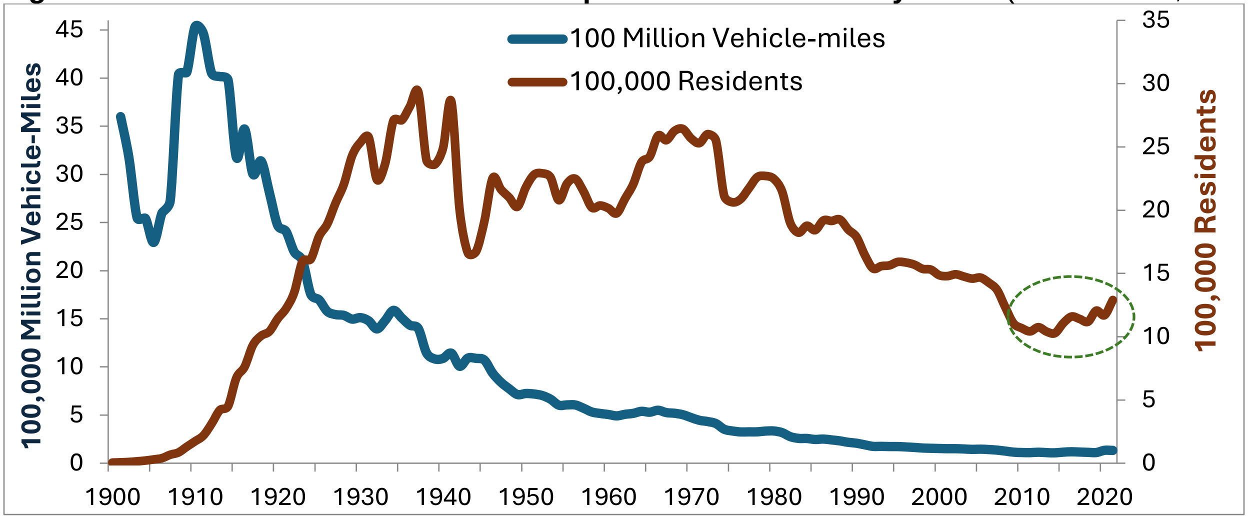
There are good reasons to question this paradigm. Current traffic safety programs are not very effective. Despite billions of dollars invested to create safer roads and vehicles, and to encourage safer driving behavior, traffic risk continues to be a major cause of deaths and injuries, and the U.S. has one of the highest per capita traffic fatality rates among developed countries. According to some research, much of the reduction in traffic fatalities during the last half-century resulted from improvements in emergency response and medical treatment, rather than from traffic safety programs.

According to this analysis transport pricing reforms can provide large crash reductions. Traffic safety is just one of several justifications for these reforms. More efficient transport pricing can help achieve various planning objectives including congestion reduction, equitable road and parking facility finance, equitable and affordable vehicle insurance, energy conservation, pollution reduction, and more efficient land use patterns. Traffic safety adds another important benefit to this list.

Risk Analysis

Traffic *crashes* (also called *accidents* or *collisions*) can be measured in various ways that lead to different conclusions about the nature of this risk and the effectiveness of safety strategies (Litman 2024). For example, *crash* rates tend to increase with urban density due to increased vehicle interactions, but crash *severity* and therefore *casualties* (injuries and deaths) tend to be higher in rural areas due to higher speeds. Risk analysis is affected by the *reference units* (units in the denominator) used. Figure 1 illustrates two traffic fatality rates. When measured per unit of travel (e.g., per 100 million vehicle-miles), fatality rates declined significantly during the last century. From this perspective, past traffic safety strategies were successful and should be continued; we just need to continue current practices.

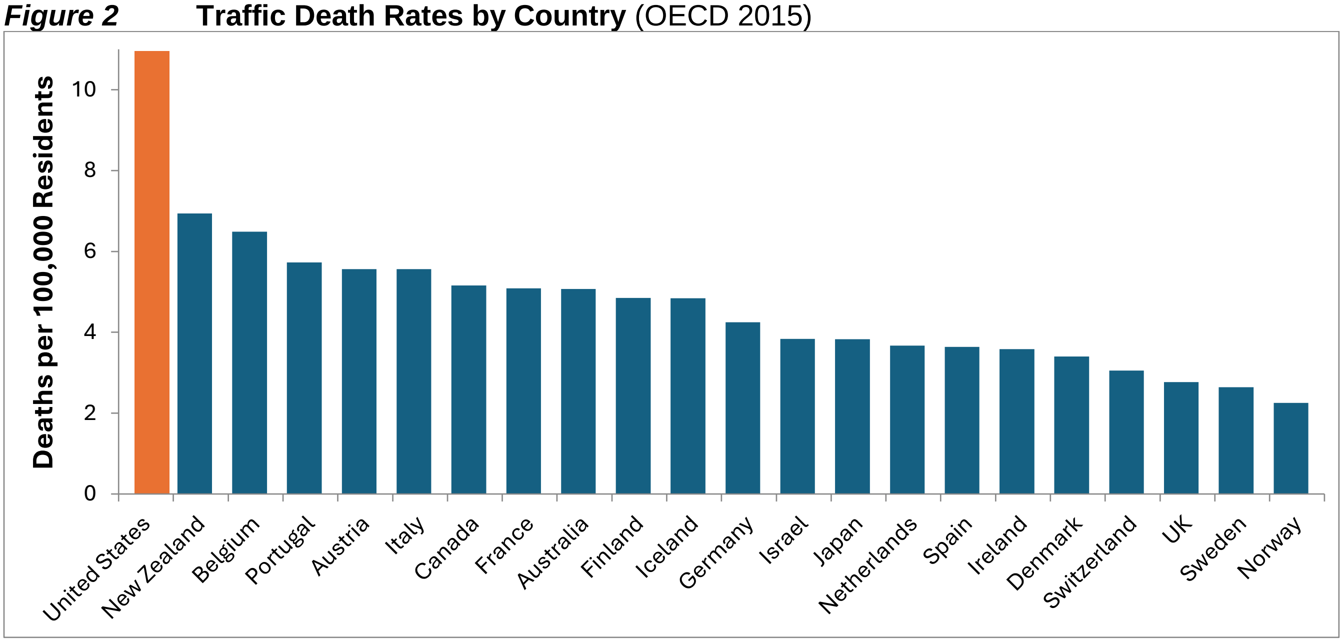
Figure 1 **Per Vehicle-Mile and Per Capita U.S. Traffic Fatality Rates** (FHWA 2022, FI-201)



Traffic fatality rates declined during most of the Twentieth Century, but increased after 2011.

However, per capita vehicle mileage increased significantly during that period, offsetting much of this decline. When measured *per capita* (e.g., per 100,000 population), as with other health risks, there was little improvement despite large improvements in road and vehicle design, traffic safety programs and emergency response. Taking these factors into account, much greater gains would be expected. For example, seat belt use increased from nearly 0% in 1960 to 75% in 2002, which should reduce traffic fatalities about 33% but per capita traffic fatality rates declined only 25%. Traffic crashes continue to be a major cause of deaths and disabilities. The U.S. now has one of the highest traffic fatality rates *per capita* among peers, as illustrated below. From this perspective, traffic risk continues to be a major problem, existing strategies are ineffective and new approaches are needed to achieve safety targets.

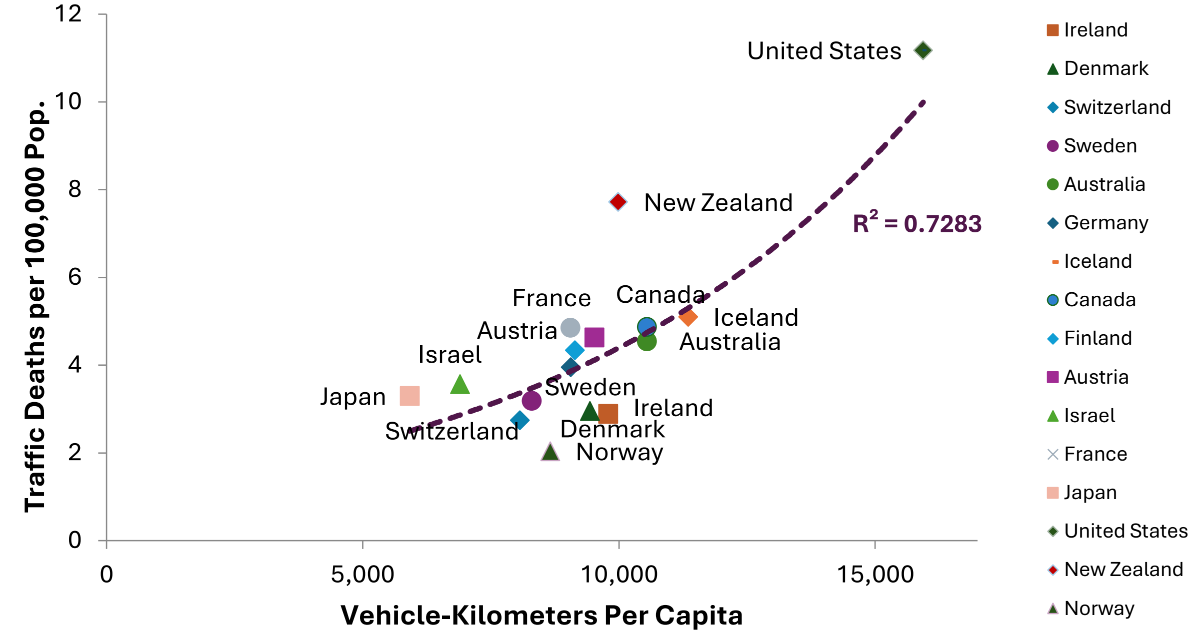
Figure 2 **Traffic Death Rates by Country** (OECD 2015)



The U.S. has, by far, the highest traffic fatality rate among peer countries.

An abundance of research indicates that high U.S. traffic death rates reflect high per capita vehicle travel which increases risk exposure. The following figures illustrate this effect.

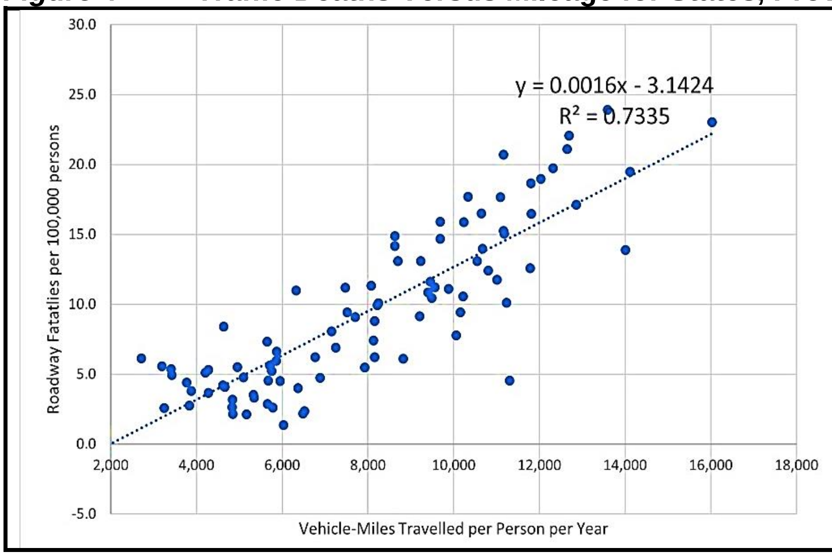
Figure 3 **Per Capita Traffic Deaths versus Vehicle-Travel** (BITRE 2018)



International data show that per capita traffic fatalities tend to increase with annual vehicle-kilometers.

The figure above shows the strong positive relationship between per capita vehicle travel and fatality rates among OECD (Organization for Economic Cooperation and Development) countries. The figure below shows this relationship for various U.S. states, Canadian provinces and OECD countries.

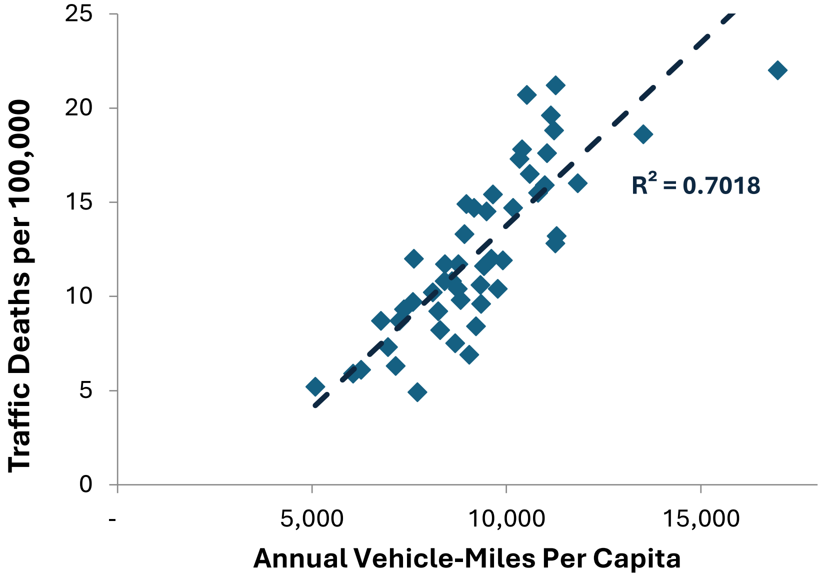
Figure 4 **Traffic Deaths Versus Mileage for States, Provinces and Countries** (Meth 2024)



This graph shows traffic fatality rates versus vehicle-miles travelled per person by state, province, and territory for the United States and Canada, plus 25 countries for 2022. It shows that traffic death rates increase with per capita VMT. The R^2 of 0.73 indicates that differences in per capita vehicle travel explains 73% of the variation in roadway fatality rate, a strong statistical relationship.

The figure below shows the strong positive relationship between per capita vehicle mileage and traffic fatalities for U.S. states.

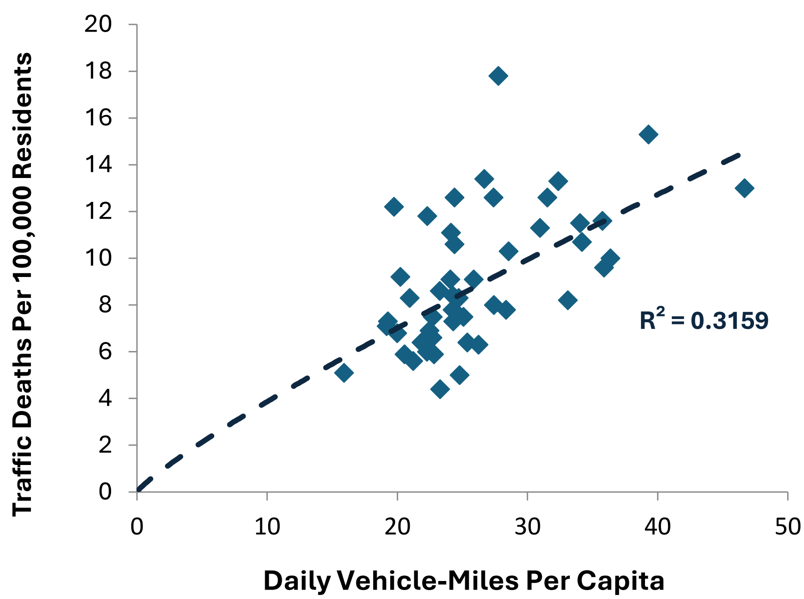
Figure 5 **Traffic Fatalities Versus Mileage for U.S. States** (IIHS 2020)



All else being equal, traffic fatality rates increase with annual vehicle-miles per capita. As a result, planning decisions that stimulate vehicle travel tend to increase crashes, and vehicle travel reduction policies tend to increase safety.

The following figure shows the positive correlation between vehicle travel and traffic fatalities for U.S. urban regions.

Figure 6 **Traffic Deaths Versus Mileage for U.S. Urban Regions** (FHWA and CDC data)



Per capita traffic fatality rates tend to increase with per capita vehicle-miles in U.S. Metropolitan regions.

These studies reflect simple correlations that may overlook confounding factors related to vehicle travel and risks. More sophisticated analyses that account for various demographic, geographic and economic factors show statistically-strong positive relationships between mileage and traffic deaths. For example, Ahangari, Atkinson-Palombo and Garrick (2017) used annual data from the U.S. between 1997 and 2013 to capture the effect of seven factors that influence traffic risks: exposure, travel behavior, socioeconomics, macroeconomics, safety policies, and mitigating factors such as health care. Their results indicate that *Vehicle Miles Traveled* and *Vehicles per Capita*, have the strongest impact on per capita traffic fatality rates. Similarly, using data that accounts for various geographic and demographic factors from 147 urbanized areas in the United States, Yeo, Park and Jang (2015) found that each 1% increase in per capita VMT is associated with a 0.549% increase in traffic deaths. Similarly, comprehensive analysis using 2010 U.S. data, Ewing, Hamidi and Grace (2016) found that, normalizing for other factors, each 1% increase in VMT is associated with 0.3% increase in per capita traffic deaths.

The study, "The Growing Gap in Pedestrian and Cyclist Fatality Rates Between the United States and the United Kingdom, Germany, Denmark, and the Netherlands, 1990–2018," (Buehler and Pucher 2021) found that per kilometer U.S. pedestrian fatality rates were 5-10 times higher, and bicyclist fatality rates 4-7 times higher, than in peer countries, and this gap is increasing. They concluded that these differences reflect:

- Better walking and cycling infrastructure.
- Fewer vehicle km travelled.
- Lower urban speed limits.
- Better enforcement of laws against speeding, drink driving and smartphone use while driving.
- Smaller and less powerful personal motor vehicles.

The relationship between risk and mileage is particularly strong for individual motorists who reduce their mileage since most risk factors do not change (Ferreira and Minike 2010). For example, a motorist who drives 20% fewer miles in response to a price incentive does not usually become more hazardous. Sivak and Schoettle (2010) found that the 14% decline in U.S. traffic crashes between 2005 and 2008 is largely explained by comparable reductions in per capita vehicle travel.

Reductions in total vehicle travel can cause proportionally larger reductions in *total* crash damages since about 70% of crashes involve multiple vehicles, so each vehicle removed from traffic reduces both its chances of causing a crash *and* of being the target of crashes caused by other vehicles, and reducing multi-vehicle crashes reduces multiple claims (Vickrey 1968; Edlin and Karaca-Mandic 2006; Litman and Fitzroy 2010).

Traffic safety experts often focus on special risk factors (young and inexperienced drivers, impairment, distraction, speeding, etc.), which implies that safety programs should reduce higher-risk but not low-risk vehicle travel. But high- and low-risk travel are complementary; policies that stimulate lower-risk driving, such as roadway expansions, low vehicle user charges and sprawled development patterns also tend to stimulate higher-risk driving. Described more positively, policy reforms that reduce overall vehicle travel can provide significant traffic safety benefits.

Pricing Reform Safety Impacts

This section evaluates the impacts of various transport pricing reforms.

A basic economic principle is that markets tend to be most efficient and equitable if *prices* (what consumers pay for a good) reflect *marginal costs*, that is, the full incremental costs of providing that good (Clarke and Prentice 2009; Litman 2006). This means that motorists should pay directly for the costs of the road and parking facilities they use, plus fees that reflect the congestion delays, risk and pollution emission damages they impose on others. Currently, vehicle travel is inefficiently priced. Several pricing reforms can be justified on market principles, including increased fuel taxes, more efficient road and parking pricing, distance-based insurance and registration fees, and reduced public transit fares. These reforms can reduce various transport problems including traffic and parking congestion, crashes, fuel externalities, pollution emissions, inefficient land development, and inadequate mobility for non-drivers.

People sometimes doubt that pricing affects vehicle travel – they point to fuel price changes that caused little perceived change in travel behavior – but extensive evidence indicates that motorists do respond to prices, particularly over the long-run (CARB 2010/2011; Goodwin, Dargay and Hanly 2004; Litman 2021). Travel impacts tend to be greater if prices increase relative to consumer wealth (for example, if fuel prices increase relative to median incomes), and with improved transport options (such as better public transit services or telework opportunities). For example, the *Traffic Choices Study* (PSRC 2005) found commute travel price elasticities are four times higher than average for commuters with high quality public transit service, and both Gillingham (2010) and Guo, et al. (2011) found that vehicle travel is more price sensitive for households located in more accessible, transit-oriented communities than comparable households in sprawled, automobile-dependent communities.

The following section evaluates the travel and safety impacts of these pricing reforms.

Fuel Tax Increases

Justifications

Fuel tax increases are often recommended to finance transportation improvements, and to encourage fuel conservation to achieve various economic and environmental objectives including energy security and emission reductions (Litman 2009; Metschies 2009; Wachs 2003).

Travel Impacts

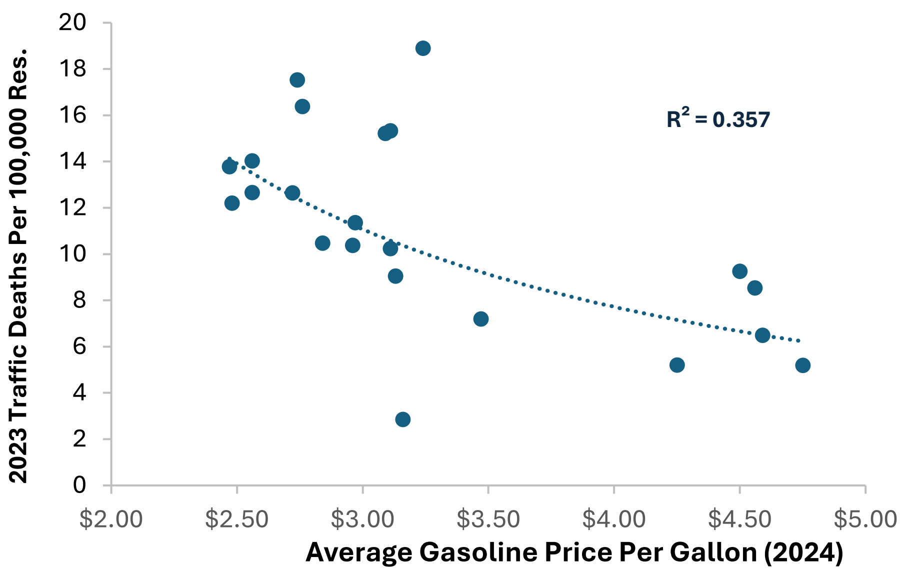
Fuel price increases tend to reduce overall vehicle travel. The long-term elasticity of fuel consumption with respect to price is about –0.7, so a 10% price increase typically causes a 7% reduction in fuel use, but about two thirds of this resulting from consumers purchasing more fuel efficient vehicles and about one third from vehicle mileage reductions, so a 10% increase in fuel price typically reduces vehicle travel 2-3% (Goodwin, Dargay and Hanly 2004; Litman 2021).

There is debate concerning the sensitivity of vehicle travel to fuel pricing (Litman 2012). Small and Van Dender (2007) and Hymel, Small and Van Dender (2010) found U.S. vehicle travel price elasticities declined to less than -0.1 (a 10% fuel price increase reduced vehicle travel less than 0.1%) between 1970 and 2004, but this was a unique period of increasing travel demand, rising incomes, highway expansions, and declining real (inflation-adjusted) fuel prices. Recent studies indicate that driving has since become more price sensitive (Litman 2012). Li, Linn and Muehlegger (2011) found a -0.235 fuel price elasticity between 1968 and 2008 (a 10% fuel price increase reduced fuel consumption 2.3%) with higher values for durable price increases. Gillingham (2010) found medium-run (two-year) elasticities of vehicle travel with respect to gasoline price ranging from -0.15 to -0.20, with impacts increasing over time. This suggests that travel elasticities have returned to more normal levels.

Safety Impacts

Various studies indicate that, all else being equal, higher fuel prices tend to reduce per capita traffic fatality rates. Ahangari, et al. (2014) employed a panel data model of 14 industrialized countries between 1990 and 2000 using gas prices, unemployment, health index, vehicle ownership and vehicle travel as independent variables and per capita traffic deaths as a dependent variable. The results revealed a significant inverse relationship between gas prices and the road fatality rates. The elasticity analysis indicates that a 10% decrease in gasoline prices resulted in a 2.19% increase in road fatalities. Likewise, a 10% decrease in unemployment rate resulted in a 0.65% increase in road fatalities. The analysis also implied that the health index has the highest impact on road fatality rates.

Figure 7 **State Traffic Fatality Rates Versus Fuel Prices** (NHTSA and AAA Data)



Large urban region traffic fatality rates tend to decline with higher fuel prices. The statistical relationship is strong (R2 = 0.537). This probably reflects the greater range of non-auto travel options in some cities which allows residents to respond to high fuel prices with reduced driving.

Using two decades of data for 144 countries, Burke and Nishitateno (2015), found that the average reduction in road fatalities resulting from a 10% increase in the gasoline pump price is in the order of 3-6%, and estimate that approximately 35,000 deaths per year could be avoided by the removal of global fuel subsidies. Morrisey and Grabowski (2011) find that a 10% U.S. fuel price increase reduces fatalities by 3.2–6.2% with the largest percentage reductions among 15- to 17-year-old drivers, and a 10% beer tax increase reduces motor vehicle fatalities by 17-24 year old drivers approximately 1.3%. Similarly, using European Union data between 2005 and 2018 Naqvi, Quddus and Enoch (2023) found that higher fuel prices collisions, casualties (injuries and deaths) and fatalities due to reductions in total vehicle travel and traffic speeds, particularly by younger, riskier drivers. For a 10% price increase reduced total collisions 1.4% for petrol and 1.2% for diesel models; fatalities 2.6% for petrol and 2.2% for diesel; and total casualties 1.6% for petrol and 1.4% for diesel. They conclude that shifts to more efficient and alternative fuel vehicles could increase crashes by reducing fuel costs which increases vehicle travel.

Sivak (2008) found that a 2.7% vehicle travel decline resulting from high fuel prices and a weak economy during 2007-2008 caused a much larger 17.9% to 22.1% month-to-month traffic fatality reductions, probably due to large vehicle travel reductions by lower income drivers (who tend to be young or old, and therefore higher than average risk) and speed reductions to save fuel. Grabowski and Morrisey (2004) estimate that in the U.S., each 10% fuel price increase reduces total traffic deaths 2.3%, with a 6% decline for drivers aged 15 to 17 and a 3.2% decline for ages 18 to 21 according to analysis. In follow-up research, Grabowski and Morrisey (2006) estimate that a one-cent state gasoline taxes increase reduces per capita traffic fatalities 0.25%, and traffic fatalities per vehicle-mile by 0.26%. Leigh and Geraghty (2008) estimate that a sustained 20% gasoline price increase would reduce approximately 2,000 traffic crash deaths (about 5% of the total), plus about 600 air pollution deaths. Based on New Zealand data, Schuffham and Langley (2002) found that per capita crash rates varied with changes in vehicle mileage, with crash reductions caused by fuel price increases.

Studies by Chi, et al. (2010a, 2010b, 2013a, 2013b, 2015) quantify fuel price impacts on traffic crashes in various U.S. regions. Fuel price increases reduce both total traffic crashes and distance-based crash rates (e.g., per million *vehicle miles traveled*), with impacts that vary by geographic and demographic factors, and increase over time. All these studies show that fuel price increases reduce per-mile crash rate, so a 1% reduction in total VMT provides more than a 1% reduction in total crashes. For example, in Mississippi, controlling for other risk factors (total vehicle travel, seatbelt use, state unemployment and alcohol consumption), they find that each 1% inflation-adjusted gasoline price increase reduces total (all types of drivers) crashes per million vehicle-miles traveled 0.25% in the short-run (less than one year) and 0.47% in the medium-run (more than one year) (2010a). In Minnesota they estimate that a $1.00 per gallon gasoline price increase would reduce total rural crashes 28.15%, rural injury crashes 3.9%, total urban crashes 18.40%, and urban fatal crashes 18.4%. They find that fuel price increases cause larger short-term crash reductions by younger drivers, and larger intermediate-term reductions by older and male drivers (2010a; 2011), and large drunk driving crash reductions (2010b). Using a Crash Prediction Model (CPM) based on fatal and injury crashes observed between 2004 and 2007 in Flanders, Belgium, Pirdavani, et al. (2013) find that a 20% fuel price increase would reduce annual vehicle travel 11.6% which would reduce total injury crashes by 2.8%.

There is some debate concerning the safety impacts of more fuel efficient vehicle fleets, which result from higher fuel prices. Lighter vehicle occupants face greater risk in crashes with heavier vehicles or stationary objects, but this tends to be offset by their lower crash frequency, reduced risk to others, and safer designs. The increased safety larger vehicles provide to occupants is offset by the increased risk they impose on others (Davis 2021).

Road Pricing

Description

Road tolls and congestion fees are often implemented to generate revenue and reduce traffic congestion. Road tolls are often used to finance new highways and bridges, and congestion pricing has been implemented in several cities including London, Stockholm and Singapore.

Travel Impacts

Road pricing typically reduces affected vehicle travel 10-30%, depending on price, facility type, and type of users. In most jurisdictions only a minor portion of total vehicle travel is tolled, so reductions tend to be small relative to total regional vehicle travel.

Safety Impacts

Available data indicate that road pricing reduces crashes. Cities with congestion fees, such as London, Stockholm, Singapore and Milan tend to have low per capita traffic fatality rates due to low per capita vehicle travel, low traffic speeds and effective traffic law enforcement. London's congestion fee reduced total vehicle travel in the charging zone about 15%, but crashes declined even more (1,865 crashes reported in 2004 compared with 2,598 in 2001), a 28% reduction, compared with a 22% reduction throughout the region during that same period (TfL 2007), although motorcycle accidents may increase since they are except from the charge (Noland, Quddus and Ochieng 2008). Comparing crash data for major UK cities, Green (2020) estimated that London's congestion pricing reduced crashes by 40%. Using a macro-level collision prediction model (CPM) that analyzes crash rates at a fine geographic scale, Lovegrove, Lim and Sayed (2010) predict that a typical road pricing program would reduce total neighborhood collision by 19% and severe collisions by 21%. After Milan, Italy introduced a €5 (US$7) fee for entering the city center, vehicle trips declined 28% and injury crashes 26.3% (ITF 2014).

Tolling grade-separated highways could increase per-mile crash rates if it shifts traffic to surface roads, but since many tolled facilities (particularly bridges) have few alternative routes, the magnitude of this impact is probably small and offset by reductions in total vehicle travel, so in most situations tolling probably reduces total crashes.

Parking Pricing

Description

Parking pricing (motorists pay directly for using parking facilities) can be implemented to generate revenues, reduce parking congestion and therefore the need to expand parking facilities, reduce urban traffic problems, or a combination of these objectives. There is considerable potential for more efficient parking pricing since currently, most parking is unpriced, significantly subsidized, bundled, or rented by the month or year, which gives motorists little incentive to shift mode part-time (Shoup 2005).

Travel Impacts

Cost recovery parking pricing (prices that reflect the full costs of providing that parking facility) and *parking cash out* (offering non-drivers the cash equivalent of the parking subsidy they would receive if they arrive by automobile) typically reduce vehicle travel 10-30%, although impacts vary depending on conditions, including the type of trips and users affected, and the availability of alternative parking and travel options (Litman 2021; Spears, Boarnet and Handy 2010).

Safety Impacts

Although little research specifically investigate parking pricing traffic safety impacts, they are probably similar to road pricing. Since parking pricing is most commonly implemented in congested urban areas where crash rates are high, it is likely to provide large crash reductions. Since parking pricing could be widely applied, safety benefits are potentially large.

Pay as You Drive (Distance-Based) Pricing

Description

Pay-As-You-Drive (also called *distance-based*) pricing converts vehicle insurance premiums and registration fees from fixed into variable costs, which gives motorists additional savings for reducing annual mileage (Ferreira and Minike 2010; Litman 1997).

Travel Impacts

With fully-prorated vehicle insurance (total premiums are divided by average annual mileage, so a $600 premium becomes 5¢ per vehicle-mile, a $1,200 premium becomes 10¢ per vehicle-mile, and $1,800 premium becomes 15¢ per vehicle-mile) the average motorist would pay about 8¢ per vehicle-mile, which is predicted to reduce their vehicle travel 8-12%, and somewhat more if other fixed vehicle charges, such as registration fees, are also made distance-based.

Safety Impacts

To the degree that distance-based pricing reduces vehicle travel it reduces crashes. Crash reductions tend to be proportionately larger than mileage reductions for two reasons. First, higher-risk motorists pay more per vehicle-mile and so have a greater incentive to reduce mileage. For example, a low-risk driver who currently pays $360 annual premiums would pay 3¢ per mile and so would be expected to reduce mileage only about 5%, but a higher-risk driver who pays $1,800 in premiums would pay 15¢ per vehicle-mile and so would be expected to reduce mileage more than 20%. Some distance-based insurance pricing systems base premiums on when, where and how a vehicle is driven, which can provide additional safety benefits by discouraging particularly risky driving activity.

Second, since about two-thirds of traffic crashes involve multiple vehicles, widely-applied distance-based pricing can provide external safety benefits, that is, reduced risk to other road users regardless of whether or not drivers reduce their mileage (Vickrey 1968; Edlin and Karaca-Mandic 2006; Litman and Fitzroy 2010). As a result, if fully implemented in an area, distance-based pricing can reduce traffic crashes by 12-15%, and possibly even more, depending on price structure and other factors such as the quality of transport options.

Transit Fare Reductions

Description

Public transport (including vanpools, buses, trains and ferries) fares can be reduced in various ways, including public funding, targeted discounts and commuter benefits (employers paying a portion of employee transit fares, often as a substitute for parking subsidies). A variation is to use increased subsidies to improve public transit service quality without raising fares.

Travel Impacts

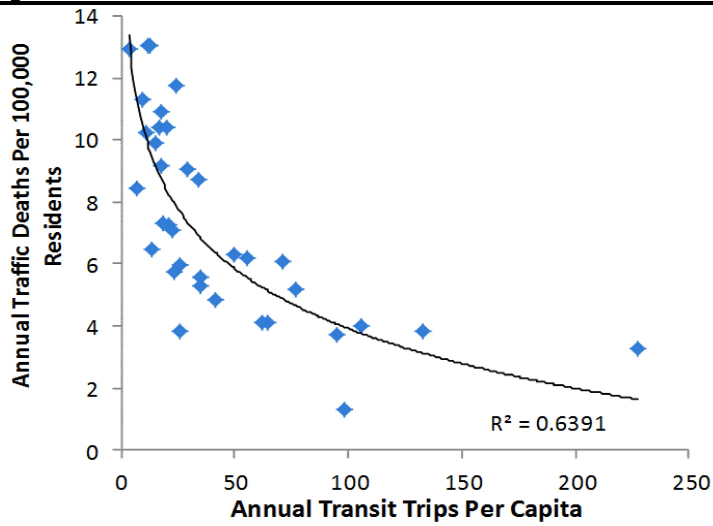
Public transit fare reductions and service quality improvements tend to increase transit ridership. A 10% fare reduction typically increases transit ridership 3% (Litman 2021). A portion of this transit travel substitutes for automobile travel, particularly with higher-quality public transit such as rail transit. In addition, high quality public transit service, which attracts a significant amount of discretionary travel (that would otherwise be by automobile), tends to leverage additional vehicle travel reductions by affecting transport and land use patterns (ICF 2008; Litman 2006).

Safety Impacts

Public transport tends to have low traffic crash and casualty rates per passenger-mile and overall traffic fatality rates tend to decline in an urban area as public transit ridership increases, as indicated in the following figures.

Lim, et al (2006) describes how Bus Rapid Transit improvements in Seoul, South Korea increased transit ridership more than 20%, reduced bus crashes 26% and bus casualties 11%. This shows how public transit service quality improvements can provide safety benefits.

Figure 8 **U.S. Traffic Fatalities Versus Transit Trips** (FTA 2012; NHTSA 2012)

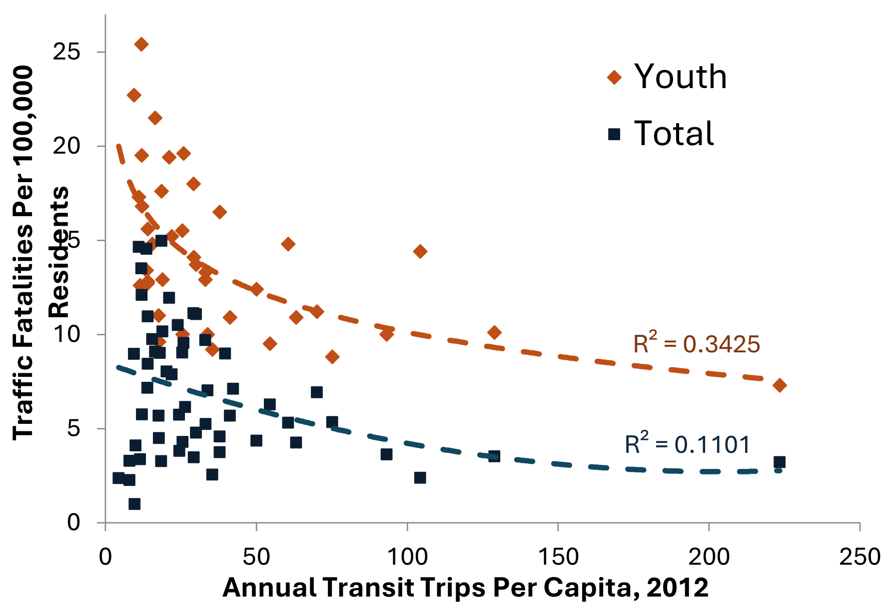


This graph illustrates the relationship between per capita transit ridership and total (pedestrian, bicyclist, automobile occupant and transit passenger) traffic fatalities for 35 large North American cities.

As transit travel increases, traffic fatalities tend to decline significantly. Cities with more than 50 annual transit trips per capita have about half the average traffic fatality rate as regions with less than 20 annual trips per capita, indicating that relatively modest increases in transit travel are associated with large traffic safety gains.

The statistical relationship between transit ridership and traffic safety is particularly strong for youths, age 15-25, as illustrated below, which suggests that many young people want to reduce their driving and associated risk, but can only do so if they have adequate alternatives.

Figure 9 **Youth and Total Traffic Fatality Rates Compared to Transit Travel** (CDC 2012)



Youths (15-25 years old) have about twice the traffic fatality rates as the total population average, and both youth and total fatality rates tend to decline with increased transit ridership.

This statistical relationship is particularly strong for youths. This suggests that many young people are willing to reduce their driving and associated risk, but can only do so if they have adequate alternatives

Summary

The table below summarizes pricing reforms and their impacts. Total safety impacts depend on the amount and type of travel reduced. These reforms tend to be most effective and acceptable if implemented as an integrated program that includes improvements to alternative modes, encouragement programs, and smart growth land use policies. Comparisons between otherwise similar geographic areas indicate that those with more efficient transport pricing (i.e., road, parking and insurance prices that reflect marginal costs) have significantly less per capita vehicle travel and traffic casualties (typically 40-60% lower) than those where fuel, road and parking are significantly underpriced relative to costs (Buehler 2010).

Table 1 **Transport Pricing Reform Impacts**

Pricing Type	Description	Travel Impacts	Traffic Safety Impacts
Higher fuel prices	Increase fuel prices to finance roads and traffic services, and to internalize fuel economic and environmental costs.	European-level fuel prices reduce per-capita vehicle travel 30-50% compared with North America. Affects most vehicle travel.	Reducing vehicle travel provide about proportionate or greater crash reductions (i.e., a 30% mileage reduction provides 30%+ fatality reduction).
Road pricing	Tolls to reduce congestion and generate revenue.	Typically reduces affected vehicle travel 10-30%. Usually applied on a limited number of highways and large city centers.	Can significantly increase safety where applied, but total impacts are generally small due to the small portion of travel affected.
Parking pricing	User fees to finance parking facilities. Can also include parking cash out and unbundling.	Typically reduces affected vehicle trips 10-30%. Most common in city centers, campuses and hospitals.	Can significantly increase safety where applied.
Distance-based pricing	Prorates vehicle insurance premiums and registration fees	Fully-prorated pricing typically reduces affected vehicle travel 8-12%, although most current examples have smaller price and travel impacts.	Potentially large safety benefits to affected vehicles. If widely applied can provide large total safety benefits.
Public transport fare reductions	Reduce fares and commuter transit benefits to make public transit travel more attractive and affordable.	A 10% fare reduction typically increases ridership 3%, although only a portion of this substitutes for driving.	Fare reductions alone have modest impacts, but integrated programs can provide large safety benefits.

This table summarizes major pricing reform categories and their travel and safety impacts.

This suggests that if pricing reforms were implemented to the degree justified on economic principles (congestion reductions, cost recovery of road and parking facilities, actuarially accurate insurance pricing, etc.), vehicle travel and crashes are likely to decline significantly, probably 30-60% in the U.S., reducing per capita traffic casualty rates to the lower levels enjoyed by its peers (Litman 2007).

Research by Hosford, et al (2021) also indicates that efficient transportation pricing is beneficial for a number of transportation and health outcomes, particularly in areas where total vehicle travel declines significantly, but that there may be some inequities in the distribution of these impacts, with greater benefits to higher income groups.

Comprehensive Impact Analysis

Conventional transport planning tends to be reductionist: individual problems are assigned to specific organizations with narrowly-defined responsibilities. For example, transport agencies are responsible for reducing traffic congestion, environmental agencies are responsible for reducing pollution, social service agencies are responsible for improving accessibility for disadvantaged people, and public health agencies are responsible for improving public fitness and health. This type of analysis can result in these agencies rationally implementing solutions to the problems they are responsible that exacerbate other problems facing society, and it tends to undervalue strategies that provide multiple benefits.

Comprehensive analysis considers how policy and planning decisions affect various planning objectives. Table 2 illustrates this concept. Many traffic safety strategies only achieve one or two planning objectives. For example, wider lanes and shoulders, and grade-separated intersections can help reduce congestion, vehicle operating costs and accidents. Vehicle occupant crash protection (airbags and other safety features) and increased safety education and enforcement tend to reduce crash risk, but provide few other benefits. More efficient transport pricing can help achieve a variety of planning objectives including congestion reductions, road and parking facility cost savings, energy conservation and emission reductions. If implemented as part of an integrated program that includes improvements to alternative modes and smart growth land use policies they help create more diverse transport systems and more accessible communities, which improves mobility options for non-drivers, increase public fitness and health and reduces sprawl costs.

Table 2 **Comparing Strategies Including Travel Impacts**

Planning Objective	Roadway Expansion	Crash Protection	Safety Enforcement	Pricing Reforms
Congestion reduction	✓			✓
Roadway cost savings				✓
Parking cost savings				✓
Consumer cost savings	✓			Mixed
Reduced accident damages	✓	✓	✓	✓
Improved mobility options				Mixed
Energy conservation				✓
Pollution reduction				✓
Physical fitness and health				✓
Land use objectives				✓

Roadway expansion, vehicle occupant crash protection and safety enforcement programs tend to achieve a limited set of planning objectives. Pricing reforms tend to achieve more of these objectives, particularly if they help create more diverse transport systems and more accessible, multi-modal communities.

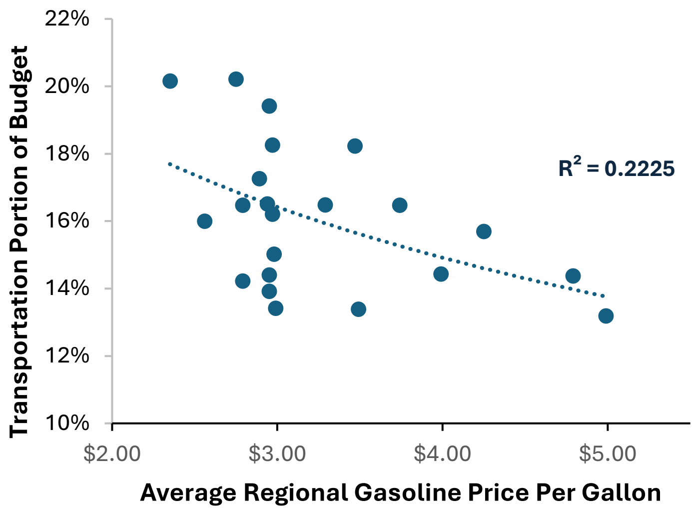
Pricing reform direct consumer impacts tend to be mixed. Some reforms (parking cash out, distance-based pricing, and transit fare reductions) offer consumers new opportunities to save money when they reduce their vehicle travel. Others (higher fuel prices, efficient road and parking pricing) increase user costs, but these are economic transfers, so their overall impacts depend on how revenues are used. The following section discusses these impacts in detail.

Consumer Impacts

Pricing reforms are often criticized as harmful to consumers, particularly those with lower incomes, but such criticism often reflects incomplete analysis (Litman 2022). Although user fees are regressive with respect to income (a dollar of taxes or tolls is a greater share of income for lower- than higher-income households), they are generally less regressive than other infrastructure funding options. For example, Schweitzer and Taylor (2010) found that toll financing of urban highway expansion is less regressive (it imposes less financial burden on lower-income households) than general tax financing.

Efficient pricing tends to increase demand for non-auto modes, which makes them more efficient and increases their political and social support. Underpricing automobile travel tends to increase automobile dependency and sprawl, which reduces affordability. The following graph shows that *lower* fuel prices are associated with *higher* household transportation expenditures. Transportation pricing reforms can provide various benefits to disadvantaged people, including better travel options (if revenues fund affordable mode improvements), reduced bus delay (from decongestion road tolls) and reduced sprawl.

Figure 10 **Transportation Spending Versus Fuel Price** (BLS 2023; Gas Buddy 2024)



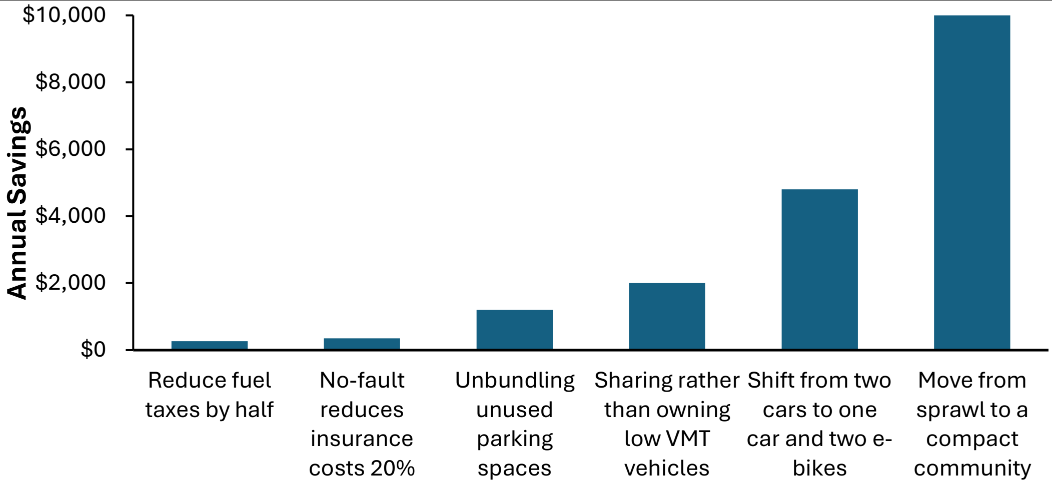
The portion of household spending devoted to transportation tends to decline with regional fuel prices: higher prices are associate with more affordable transportation in a region.

This suggests that higher fuel prices help create communities with more affordable travel options, or that citizens in more multimodal communities are willing to accept higher fuel prices.

Because they own fewer vehicles, drive less and rely more on non-auto travel, lower-income households are particularly likely to benefit from unbundled parking, parking cash out and pay as you drive pricing. Pricing reform impacts depend on the quality of housing and travel options available. For example, if communities are automobile dependent and sprawled, efficient road and parking pricing will impose more costs on lower-income households than if they have more affordable travel and affordable housing options in compact, multimodal neighborhoods. As a result, pricing reforms tend to be most beneficial to consumers and most progressive with respect to income if implemented in conjunction with improvements to affordable modes and smart growth development policies.

Most vehicle cost reduction strategies, such as low fuel tax and no-fault insurance, provide modest savings. For example, fuel only represents about 20% of total vehicle costs and taxes represent only about 20% of fuel prices, cutting fuel prices in half only reduces total costs about 2%. Strategies that reduce vehicle ownership and parking costs provide much larger savings, as illustrated below.

Figure 11 **Savings from Transportation Affordability Strategies** (Litman 2022)



Most vehicle cost saving strategies provide a few hundred dollars in annual savings. Strategies that reduce vehicle ownership unnecessary parking costs can provide much larger savings.

Implications for Developing Countries

Transport pricing reforms are particularly relevant for developing countries. Although per capita traffic fatality rates tend to decline as countries develop economically, the speed and amount of these declines is affected by transport pricing and planning practices. Developing countries that apply efficient pricing and multi-modal planning, as in Europe and wealthy Asian countries, will likely achieve much lower per capita traffic fatality rates of countries that follow the North American model of low transport pricing and automobile-oriented planning. Table 3 compares these models.

Table 3 **Contrasting Transport Pricing and Planning Practices**

Feature	European & Wealthy Asian	North American
Fuel pricing	High taxes	Low taxes and indirect subsidies
Road tolls	Few roads are tolled. Where tolled, revenues are often dedicated to highways.	Roads are tolled to reduce congestion and finance transport programs
Parking pricing	Parking is often priced	Parking is seldom priced
Parking requirements	Relatively low parking requirements	Generous minimum parking requirements.
Transport planning	Multi-modal. Considerable effort to improve walking, cycling and public transport.	Automobile-oriented. Little effort to improve alternative modes.
Land use planning	Creates accessible, multi-modal communities.	Creates automobile-dependent sprawl.
Vehicle travel	Low relative to income (5,000 to 10,000 annual kilometers per capita).	High relative to income. (15,000 to 25,000 annual kilometers per capita).
Walking and cycling	Moderate to high non-motorized mode share.	Low non-motorized mode share.
Traffic fatalities	Low (4-8 annual traffic deaths per 100,000 population)	Moderate (10-20 annual traffic deaths per 100,000 population)

Different transport pricing and planning models result in different transport patterns and fatality rates.

Traffic safety is just one of many reasons that developing countries may want to implement efficient transport pricing and multi-modal planning. Others include reduced traffic and parking congestion, reduced road and parking facility costs, improved mobility for non-drivers, energy conservation, reduced economic costs of importing vehicles and fuel, emission reductions, more efficient land development, and improved public fitness and health. Since traffic accidents are one of the largest transport costs, increased safety is one of the most important justifications for these reforms.

Conclusions

A basic economic principle is that prices for a good should reflect its marginal costs. Transportation pricing often violates this principle: a major portion of costs are fixed or external and so do not reflect marginal costs. This increases transport problems including traffic and parking congestion, facility costs, energy consumption, pollution emissions, reduced transport options, and traffic risk.

Various pricing reforms can help reduce these problems, including higher fuel prices, efficient road and parking pricing, distance-based insurance and registration fees, and lower public transit fares. Advocates generally promote individual reforms to achieve specific objectives, such as road tolls to generate revenues and reduce congestion, and fuel tax increases to generate revenue and conserve fuel. Traffic safety benefits are often overlooked. Yet, pricing reforms can significantly increase safety, and this is often among their greatest benefits.

The much lower per capita traffic fatality rates in Northern European countries and wealthy Asian counties can be largely explained by their relatively high transport prices, which reduces vehicle travel directly and helps create more multi-modal transport systems. Yet, even these countries could implement additional pricing reforms such as more efficient road and parking pricing, and distance-based vehicle insurance and registration fees, further reducing crash rates.

Fuel tax increases and distance-based pricing can probably provide the largest total safety benefits because they tend to affect the largest portion of total vehicle travel. Distance-based insurance can provide additional safety benefits because it gives higher risk drivers an extra incentive to reduce mileage. Efficient road and parking pricing can provide significant safety benefits where they are applied. Public transit fare reductions provide smaller direct safety benefits but can provide a catalyst for transit-oriented development which leverages additional travel reductions and safety benefits.

These pricing reforms are particularly relevant for developing countries. Countries that establish efficient transport pricing and multi-modal planning will have much lower traffic fatality rates, than if they develop with low transport pricing and automobile-oriented planning.

Critics often claim that higher road tolls, parking fees and fuel taxes are regressive, but they are often less regressive than alternative financing options. These pricing reforms can benefit physically, economically and socially disadvantaged people by giving them by improving their mobility and accessibility options, and by providing additional financial savings to people who rely on alternative modes. For example, a non-driver usually benefits overall from efficiently priced roads and parking, since they are not forced to pay for facilities they don’t use. Pricing reforms tend to be more effective and beneficial if implemented in conjunction with improved mobility and accessibility options, such as better walking, cycling and public transit services, and more affordable housing in accessible neighborhoods.

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