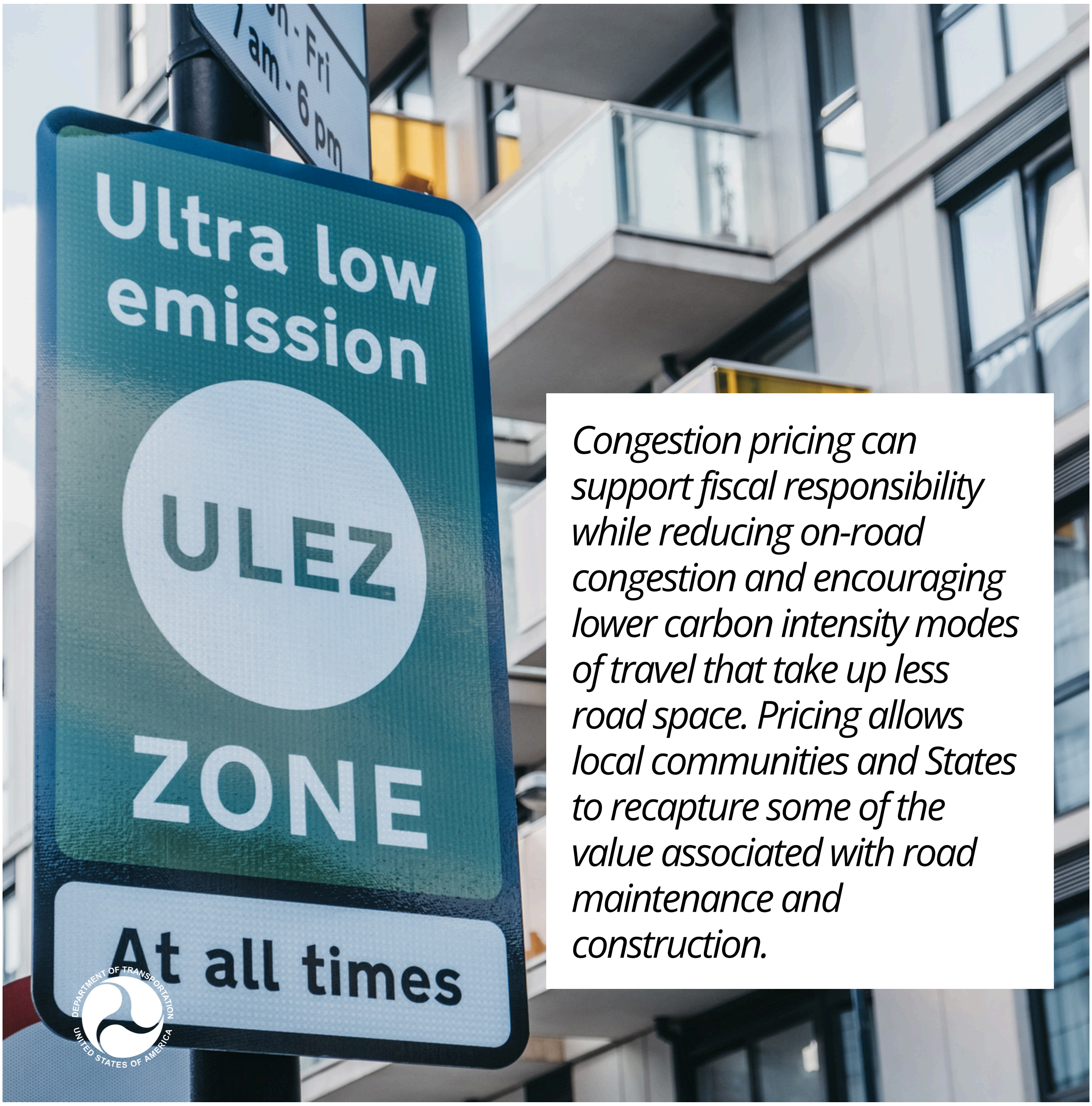
U.S. Department of Transportation, Climate Change Center
Climate Strategies that Work

ROAD PRICING



Congestion pricing can support fiscal responsibility while reducing on-road congestion and encouraging lower carbon intensity modes of travel that take up less road space. Pricing allows local communities and States to recapture some of the value associated with road maintenance and construction.

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OVERVIEW

Best Suited for:
Short term, pilot and educational campaign followed by full roll out
Urban

Traffic congestion can mean increased travel times, higher incident rates due to stop-and-go conditions, poor air quality, and impacts to trucking and higher cost of goods. **Road pricing programs involve charging drivers a toll to drive on busy roads to alleviate traffic congestion and reduce air pollution and greenhouse gas emissions from vehicles.** Tolls may be levied as flat fees to use a particular corridor or a specific zone or can be charged by vehicle mile traveled (VMT). VMT-based fees are also referred to as road usage charges (RUCs). There are four main types of road pricing strategies: variably priced lanes (e.g., express toll lanes), variable tolls on entire roadways, cordon charges for driving within or entering a congested urban area, and area-wide charges (per-mile fees on all roads within an area). Pricing programs may also be applied at ports to reduce freight-related congestion at terminals and connecting roadways.

Under most pricing programs, tolls typically vary by time of day and are collected electronically at regular roadway speeds. Revenues can be used to reduce the burden of pricing on low-income individuals and communities by for example, supporting toll discounts and subsidizing public transit passes.

Did you know?

In a 2015-2017 road usage charges pilot in California, 73% of participants felt that a road charge was a more equitable approach compared to the gas tax (CalSTA, 2017).

Pricing programs can also offset infrastructure costs by investing profits in local public transit, road maintenance, and active transportation projects. Generally, road pricing strategies work best when combined with other programs, including low and no-emission zones, off-peak delivery support, and transit-oriented development.

Congestion pricing, sometimes called value pricing, is one type of pricing strategy that helps to shift peak-period travel to off-peak times and other transportation modes. **Removing a fraction (potentially as small as 5%) of vehicles from a congested area can lead to significant travel efficiency improvements.** Congestion pricing can also reduce vehicle idling and associated emissions and provide an alternative to highway capacity expansions. See the Convenient Transportation: An Action Plan for Energy and Emissions Innovation, a joint report by USDOT, the Department of Energy, Environmental Protection Agency, and Department of Housing and Urban Development, for more information about road pricing and other fiscally-responsible transportation investments.

As vehicle fleets become more fuel efficient and electrified, State and local governments are likely to see decreasing revenues from gas taxes. Road usage charges (RUCs) are one alternative funding mechanism to support road maintenance and repair.

To date, 14 states and regional pilots have received federal funding to explore alternative funding sources, including RUCs.

- California
- Eastern Transportation Coalition: A partnership of 17 states and DC
- Hawaii
- Minnesota
- Missouri
- New Hampshire
- Oregon
- RUC America: A consortium of 19 state transportation departments
- Utah
- Washington

GREENHOUSE GAS REDUCTION POTENTIAL

This section provides an overview of greenhouse gas (GHG) emission reductions associated with the strategy. It highlights key findings and relevant metrics from GHG modeling resources, peer-reviewed studies, and real-world applications.

ROAD USAGE CHARGES IN THE U.S.

U.S. Department of Energy (DOE) analysis found that congestion pricing, combined with transit deployment and off-hours delivery policies, can provide a 14% improvement in system level efficiency, compared to the deployment of clean vehicles alone (Auld et al., 2024).

Oregon and Utah were the first two states to enact road usage charge programs in the US. Both programs were implemented as alternatives to the fuel tax as vehicles have become more fuel efficient and electric (UDOT, n.d.; ODOT, n.d.). Although neither program has published statistics on associated climate impacts, drivers in both states are expected to drive less often and drive fewer miles because of the VMT-based fees.

Today, nearly 35 states are either in the research or active stages of implementing RUC programs (ODOT, n.d.).

According to the Final Environmental Assessment for the New York City congestion pricing program, the program will reduce daily VMT within the Manhattan Central Business District (CBD) by at least 5% and reduce the number of vehicles entering Manhattan at 60th and below by at least 10% (MTA Congestion Relief Zone).

LOW EMISSIONS ZONES

A modeling study of a Low Emissions Zone in the Phoenix Metropolitan Area resulted in up to 4.5% reduction in fuel consumption when both eco-vehicle incentives and enhanced transit services, such as low fares and faster travel times, were offered. Eligible eco-vehicles would receive incentives ($0.50 to $1.50) for their use within the LEZ boundaries (Yelchuru et al., 2015).

CO-BENEFITS

This section outlines the multiple co-benefits associated with the strategy, including safety benefits, local air quality improvements, and improved accessibility. Each co-benefit presents examples that demonstrate how the strategy enhances regional or community well-being while addressing emissions.

SAFETY

Pricing programs that target downtown cores can reduce traffic in congested areas and lead to safety improvements for all road users (Singichetti et al., 2021).

> For example, estimated reductions in the number of road traffic crashes in Stockholm's zone-based charging area have been estimated at 3.6% per year, while London's zone-based charging area has led to an estimated 35% fewer crashes per month (Eliasson, 2009; Green et al., 2016).

COST SAVINGS

Transportation can be "repriced" in an equitable manner by converting fixed costs to variable costs. This saves travelers money while encouraging more efficient travel choices. Fixed transportation costs such as insurance premiums, vehicle taxes, and registration fees can be converted to variable costs by charging them on a per mile basis. Employer-provided parking converted to cash payouts similarly rewards travelers for more efficient choices. An FHWA study found that bundling six different repricing strategies could reduce vehicle miles traveled by 32% and save low-income drivers $460 per year (MAPC, 2019; Greenberg, 2024).

RUC programs may offer cost savings to people who drive less through discounted vehicle registration fees.

> For example, the Oregon RUC program provides a registration fee discount to electric and high-mpg vehicle owners and the Utah RUC program allows drivers to either pay per mile or pay a flat registration fee (ODOT, n.d.; UDOT, n.d.).

More fuel efficient and electric cars on the road means less in gas tax revenues for state governments. Road usage charges can help replace lost revenue and fund road, bridge, and tunnel maintenance and repair (Verra Mobility, 2022).

ECONOMIC GROWTH

Congestion pricing, sometimes called value pricing, harnesses the power of the market to reduce delay costs associated with traffic congestion. For example, the Texas Transportation Institute estimates that annual congestion costs in the 15 largest urban areas ranged from $1,200 to over $3,000 per commuter in 2022 (TTI, 2024).

Congestion pricing and parking pricing can support fiscal responsibility while reducing on-road congestion and encouraging lower carbon intensity modes of travel that take up less road space. Pricing allows local communities and states to recapture some of the value associated with road maintenance and construction. As an example at the federal level, the heavy motor use tax generates revenue that goes towards maintaining federal highway infrastructure.

By 2030, as much as half of the revenue that could be generated from the gas tax will be lost as a result of increasing vehicle efficiency and electrification. Road usage charges can provide a more sustainable revenue source for public roads (Verra Mobility, 2022).

New York City congestion pricing program is expected to generate sufficient annual net revenues to provide $15 billion for capital projects for the MTA Capital Program (MTA Congestion Relief Zone).

> See the Convenient Transportation: An Action Plan for Energy and Emissions Innovation for more information about the economic benefits of pricing programs.

ACCESSIBILITY AND EQUITY

Congestion pricing programs can include equity-related performance measures to ensure that they are not disproportionately harming lower income individuals or other disadvantaged communities.

> A UC Davis review of congestion pricing strategies in North America and worldwide found that the most equitable programs include a meaningful community engagement process to help policymakers identify equitable priorities, pricing structures that balance efficiency and equity, while encouraging multi-modal travel, clear plans for investing congestion pricing revenues to balance the costs and benefits of congestion relief, and plans for comprehensive reporting and monitoring to ensure equity goals are met (D’Agostino et al., 2020).

Freight emissions disproportionately impact low-income people and communities of color who live near port facilities and industrial zones. Congestion pricing for freight can encourage mode choice to less polluting modes, like rail and maritime, wherever possible (AGU, 2021; Chen et al., 2018).

Pricing programs can be designed and implemented in such a way that reduces harm to vulnerable communities; for example, cities might consider expanding public transit and ramping up service before implementing driving fees. Cities can also offer discounts to low-income drivers and exemptions to persons with disabilities and certain classes of vehicles.

New York City's congestion pricing plan considers the impact for people with disabilities. People with disabilities, caregivers, or organizations that transport people with disabilities can apply to receive an exemption from the toll for a designated vehicle (MTA 2024).

> California investigated road charges as an alternative to the gas tax for funding transportation solutions. Findings from a 2015-2017 pilot showed that 73% of participants felt that a road charge was a more equitable approach compared to the gas tax (CalSTA, 2017).

AIR QUALITY AND HEALTH

Congestion pricing reduces traffic congestion, which in turn limits idling and stop-and-go behavior, leading to improvements in local air quality (FHWA, Congestion Pricing).

Pricing programs can encourage drivers to drive less and choose travel to off-peak hours. They can also promote a choice to less polluting modes. When coupled with low-emission zones and incentives for alternative fuel and electric vehicles, road pricing can have sizable local and regional air quality benefits.

Congestion pricing in New York City will provide a net air quality benefit to the region. The pricing program is expected to sharply reduce vehicles emissions in the CBD, an area that today has some of the worst air quality in the U.S. (MTA Congestion Relief Zone).

> In the City of London, NO_2 concentrations in central London are estimated to be 44% lower than they would have been without the ULEZ and its expansion (C40, 2022).
>
> The City of London used congestion pricing revenues towards the purchase of over 500 zero emission buses; as of 2021, all new buses must be zero emission (OECD, 2022).

COST CONSIDERATIONS

The cost to develop pricing programs and low-emission zones varies widely depending on the scale of the program coverage area.

Program costs include marketing and driver education, operations and maintenance, administrative costs, and enforcement costs.

The adoption of in-vehicle telematics, as a means for collecting mileage data, could dramatically reduce the impact of the adoption, administration, and enforcement costs of a road charge program (CalSTA, 2017).

Examples of congestion pricing revenues

Congestion charge net revenues from the City of London's program reached £307 million ($380M) in 2021/22. The ULEZ and LEZ generated a net income of £111 million ($137M) and £34 million ($42M) in 2021/22, respectively (Transport for London, 2022).

Stockholm's congestion pricing program has annual net revenues of approximately $155 million (SFCTA, 2020).

FUNDING OPPORTUNITIES

FHWA's **Value Pricing Pilot Program** provides tolling authority to State, regional or local governments to implement congestion pricing applications and report on their effects.

FHWA's **Congestion Relief Program**, established under BIL, provides competitive grant funding for programs that reduce congestion through pricing roadway use and parking, among other methods of decreasing congestion. This would have the benefit of encouraging other modes of travel that are less polluting and take up less road space, while recapturing some of the value associated with road maintenance and construction from those who use the roads most.

FTA's **Capital Investments Grant Program** funds transit capital investments, including heavy rail, commuter rail, light rail, streetcars, and bus rapid transit. Capital investment grants can be used to support public transit improvement potentially in concert with revenues from congestion pricing programs.

FHWA's **Congestion Management and Air Quality Improvement (CMAQ) Program** supports surface transportation projects and other related efforts that contribute air quality improvements and provide congestion relief. The BIL continues the CMAQ Program to provide a flexible funding source to State and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act, including carpool and vanpool projects.

COMPLEMENTARY STRATEGIES

Coordinated transportation planning helps identify where congestion pricing strategies could be most effective and ensures that alternative transportation options are available to commuters affected by pricing measures. Additionally, revenue generated from congestion pricing can be reinvested into transportation infrastructure and services, further supporting coordinated planning efforts. Ultimately, both strategies complement each other to promote more sustainable transportation choices.

Road usage charges and other pricing programs that charge higher tolls during peak hours may encourage carriers to shift deliveries to off-peak hours.

By implementing zoning codes that prioritize compact, walkable neighborhoods with access to public transportation, communities can create environments where congestion pricing measures are more effective.

Travel demand modeling plays a critical role in assessing the effects of cordon and congestion pricing on transportation systems. By analyzing how pricing schemes influence travel behavior, such as encouraging carpooling, using public transit, or shifting travel times, planners can anticipate changes in demand for road space. This understanding helps design effective congestion pricing strategies to manage traffic flow and reduce congestion while considering potential induced demand effects.

View All Strategies

CASE STUDIES

CALIFORNIA ROAD CHARGE PILOT

The California Road Charge Pilot Program operated over a 9-month period in 2016-2017 to investigate a long-term sustainable replacement to the gas tax. It was managed by Caltrans and involved over 5000+ vehicles statewide and 37+ million miles. The pilot included private vehicles and commercial vehicles and collected data via a combination of manual and automated reporting methods. The California State Highway Administration released pilot findings in 2017: 75% of participants felt a road charge was a more equitable transportation funding solution than the gas tax and the majority of participants were more aware of their typical mileage and the amount they pay for road maintenance. A follow-on pilot is planned for 2024-2025 to further explore RUC as a policy idea.

LEE COUNTY, FLORIDA: BRIDGES VARIABLE PRICING

Lee County, Florida, which includes the Fort Myers and Cape Coral metropolitan areas, has used variable bridge tolls to manage congestion since 1998. The objectives of the program are to provide travelers with an incentive to travel during non-peak periods, lower out-of-pocket transportation costs, and encourage the use of electronic tolling. Tolls are charged at three bridge points: a midpoint plaza, Cape Coral Plaza, and Sanibel Island Plaza. The tolling program includes significant discounts for traveling during off-peak hours and using electronic transponders.

NEW YORK CITY CONGESTION PRICING

New York City is the first city in the United States to charge all motorists for driving in its congested core. The Central Business District Tolling Program, which went into effect in January 2025, is projected to result in significant VMT reductions from 60th Street to the southern tip of the Financial District in Manhattan. The Metropolitan Transit Agency estimates that there will be 80,000 fewer vehicles entering the zone every day. The program includes flat fees for passenger vehicles and motorcycles, fees for trucks depending on size, and surcharges for taxis and rideshares. The congestion pricing program will also support improvements to transit service using the expected increase in transit ridership and associated increase in transit revenues.

INTERNATIONAL CONGESTION PRICING EXAMPLES

City of London Congestion Charges and Low-Emission Zones

The City of London's congestion charges, in addition to other improvements, have helped London achieve a significant modal optionality. By 2019, trips by private car were about 15% below 2000 levels, and the city saw increases across the board in public transit use, walking, and biking (OECD, 2022; C40 Cities Climate Leadership Group, 2022).

The City of London's Low Emission Zone (LEZ) for heavy goods vehicles and Ultra Low Emission Zone (ULEZ) for trucks and residential vehicles have been highly successful in discouraging older, more polluting vehicles (particularly diesel cars) from entering inner London and promoting a choice to cleaner vehicles. In 2022, over 90% of vehicles driving in the ULEZ meet emission standards on an average day and over 80% meet the standards in outer London. The London ULEZ specifically has reduced CO_2 emissions from transport in the zone by around 6% (OECD, 2022; C40 Cities Climate Leadership Group, 2022).

Despite approximately a 20% increase in population, traffic congestion in the City of London has remained stable since congestion charges were first implemented in 2003, at about 20 billion vehicle miles per year. During peak hours specifically, the new ULEZ has helped to ease congestion with around 13% fewer vehicles on the roads (OECD, 2022).

Stockholm Congestion Charges

Since Stockholm's congestion charges went into effect in 2007, the city has seen a 14% decrease in transportation related GHG emissions (SFCTA, 2020). In the first decade of Stockholm's congestion pricing program being active, the city's population increased by 10% while traffic levels decreased by 22%. In parallel, the city's public transit system has seen a 5% increase in ridership. (SFCTA, 2020).

IMPLEMENTING ROAD PRICING STRATEGIES: **WHAT TO READ NEXT**

FHWA Resources on Road Pricing

FHWA's Road Pricing resources include information on Freight and Port Pricing, Pricing of HOV Facilities, Express Lanes, and various USDOT-sponsored VMT fee and congestion reduction demonstrations.

FHWA's Congestion Pricing Website provides information and resources to help equip state agencies and practitioners with tools to implement congestion pricing projects and incorporate pricing into transportation planning.
See Congestion Pricing: A Primer.

Road Use Charges

RUC America provides resources and funding for projects related to the feasibility and implementation of RUC programs.

California Road Charge Pilot: The website for California's Road Charge Pilot provides helpful pilot study and other research findings, including impacts to communities.

- 2017 Pilot Findings
- 2024-2025 Pilot Study

Fare Collection Technology

The same technology used for electronic and open road tolling (overhead gantries, transponders, etc.) can also be used for pricing programs.

Automated reporting methods include (CalSTA, 2017):

- Plug-in Device – reports miles electronically with a device that plugs into a vehicles data (OBD-II) port
- Smartphone (with and without location awareness) – reports miles using a smartphone app
- In-Vehicle Telematics – reports miles using technology integrated into vehicles

RESOURCES

GENERAL RESOURCES

RUC America: This organization brings together statement transportation organizations to share best practices and research on road usage charges.

FHWA Road Pricing: The website includes resources on Freight and Port Pricing, Pricing of HOV Facilities, Express Lanes, and various USDOT-sponsored VMT fee and congestion reduction demonstrations.

FHWA Congestion Pricing Website: The website provides information and resources to help equip state agencies and practitioners with tools to implement congestion pricing projects and incorporate pricing into transportation planning. See Congestion Pricing: A Primer for a quick reference on value pricing strategies.

C40 How to Design and Implement a Low Emission Zone: C40 offers an implementation guide for low emission zones, including the benefits of these zones, information on information on policy options, design considerations, and strategies to address challenges.

NYC MTA Congestion Relief Zone: The New York Metropolitan Transportation Authority (MTA) Congestion Relief Zone website provides information on the State's Congestion Pricing program. The website includes information on tolling zones, toll structure, discounts and exceptions, and frequently asked questions.

TOOLKITS AND MODELING APPROACHES

National level

EPA Motor Vehicle Emission Simulator (MOVES): This resource provides vehicle emission rates and mobile-source inventories.

Argonne National Laboratory Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Modele: The model provides life-cycle emissions assessment for different vehicle technologies and futures.

State level

Sonoma County Vehicle Miles Traveled Reduction Calculator: The calculator can be used to evaluate the effectiveness of mitigation measures on the transportation effects of land use projects under the California Environmental Quality Act (CEQA).

California Quantifying the Effect of Local Government Actions on Vehicle Miles Traveled (VMT): This research resulted in a Vehicle Miles Traveled (VMT) Impact spreadsheet tool, which lets users easily see impacts for any census tract, city, or region in California.

REFERENCES

Auld, J., Cook, J., Gurumurthy, K. M., Khan, N., Mansour, C., Rousseau, A., ... & Zuniga-Garcia, N. (2024). Large-Scale Evaluation of Mobility, Technology and Demand Scenarios in the Chicago Region Using POLARIS. arXiv preprint arXiv:2403.14669. https://arxiv.org/pdf/2403.14669.

Baghestani et al. (2020). Evaluating the Traffic and Emissions Impacts of Congestion Pricing in New York City. https://www.mdpi.com/2071-1050/12/9/3655

C40 Cities Climate Leadership Group, (C40). (2022). How road pricing is transforming London. Greater London Authority, C40 Knowledge Hub https://www.c40knowledgehub.org/s/article/How-road-pricing-is-transforming-London-and-what-your-city-can-learn?language=en_US

C40 Cities Climate Leadership Group. (C40). (2019). How to design and implement a low emission zone.C40 Knowledge Hub. https://www.c40knowledgehub.org/s/article/How-to-design-and-implement-a-clean-air-or-low-emission-zone?language=en_US

California State Transportation Agency (CalSTA). (2017). California Road Charge Pilot Program. https://dot.ca.gov/programs/road-charge/final-report

Chen, D., Ignatius, J., Sun, D., Goh, M., & Zhan, S. (2018). Impact of congestion pricing schemes on emissions and temporal shift of freight transport. Transportation Research Part E: Logistics and Transportation Review, 118, 77-105.

Community Service Society (CSS). (2023). Congestion Pricing Will Mean Fewer Cars, Safer Streets and Cleaner Air. https://www.cssny.org/news/entry/congestion-pricing-will-mean-fewer-cars-safer-streets-and-cleaner-air

D’Agostino, M. C, Pellaton, P., & White, B. (2020). Equitable Congestion Pricing. UC Office of the President: University of California Institute of Transportation Studies. http://dx.doi.org/10.7922/G2RF5S92 Retrieved from https://escholarship.org/uc/item/17h3k4db

Eliasson, J. (2009). A cost–benefit analysis of the Stockholm congestion charging system. Transportation Research Part A: Policy and Practice, 43(4), 468-480. https://www.sciencedirect.com/science/article/pii/S0965856408002140.

Federal Highway Administration (FHWA). (2022). Congestion Pricing: A Primer. https://ops.fhwa.dot.gov/publications/congestionpricing/sec2.html

Green, C. P., Heywood, J. S., & Navarro, M. (2016). Traffic accidents and the London congestion charge. Journal of public economics, 133, 11-22. https://doi.org/10.1016/j.jpubeco.2015.10.005.

Greenberg, A. (2024). Analysis of Emissions Benefits of State-Level Transportation Repricing. Federal Highway Administration. Office of Operations. https://www.transportation.gov/sites/dot.gov/files/2024-06/Climate%20Change%20Research%20%26%20Technology%2C%20FHWA.pdf.

McMullen, B. S., Wang, H., Ke, Y., Vogt, R., & Dong, S. (2016). Road usage charge economic analysis (No. FHWA-OR-RD-16-13). Oregon. Dept. of Transportation. Research Section. https://rosap.ntl.bts.gov/view/dot/30706.

Natural Resources Defense Council. (2019). Road Pricing Can Fix Traffic and Inequities. https://www.nrdc.org/bio/carter-rubin/road-pricing-can-fix-traffic-and-inequities

Natural Resources Defense Council. (2022). What is Congestion Pricing? https://www.nrdc.org/stories/what-is-congestion-pricing

New York Metropolitan Transit Agency (MTA). (2023). Congestion Relief Zone. https://congestionreliefzone.mta.info/

New York Metropolitan Transportation Authority (MTA). (2024). MTA Announces Details of Plans Enabling Individuals with Disabilities to Apply for Exemption from Congestion Pricing Toll. https://new.mta.info/press-release/mta-announces-details-of-plans-enabling-individuals-disabilities-apply-exemption

New York Metropolitan Transit Agency (MTA). (n.d.). Congestion Relief Zone. https://congestionreliefzone.mta.info/

Oregon Department of Transportation (ODOT). (n.d.). OReGO: Oregon's Road Usage Charge Program. https://www.oregon.gov/odot/programs/pages/orego.aspx

Oregon Department of Transportation (ODOT). (n.d). RUC America: New Paths to Road Funding. https://www.oregon.gov/odot/rucamerica/pages/default.aspx.

Organization for Economic Co-operation and Development (OECD). (2022). Policies in Practice: London's congestion charge and its low emission zones. https://www.oecd.org/climate-action/ipac/practices/london-s-congestion-charge-and-its-low-emission-zones-c6cd48e9/

San Francisco County Transportation Authority (SFCTA). (2020). Downtown Congestion Pricing Case Study: Stockholm. https://www.sfcta.org/sites/default/files/2020-02/Congestion%20Pricing%20Case%20Studies%20200213%20-%20Stockholm.pdf

Singichetti, B., Conklin, J. L., Hassmiller Lich, K., Sabounchi, N. S., & Naumann, R. B. (2021). Congestion pricing policies and safety implications: a scoping review. Journal of urban health, 98(6), 754-771. https://doi.org/10.1007/s11524-021-00578-3.

Texas A&M Transportation Institute (TTI). (2024). 2023 Urban Mobility Report. https://static.tti.tamu.edu/tti.tamu.edu/documents/mobility-report-2023.pdf.

Transport for London. (2022). Moving London forward safely, inclusively and sustainably Annual Report and Statement of Accounts 2021/22. https://board.tfl.gov.uk/documents/s18361/Annual%20Report%20and%20Statement%20of%20Accounts%20202122%20-%20Draft.pdf.

Utah Department of Transportation (UDOT). (n.d.). Utah's Road Usage Charge Program. https://roadusagecharge.utah.gov/

Verra Mobility. (2022). Road Usage Charging (RUC) is Here for the Long Haul. https://www.verramobility.com/road-usage-charging-ruc-is-here-for-the-long-haul/

Yelchuru, B., Fitzgerel, S., Murari, S., Pendyala, R. M., Zhou, X., Garikapati, V., & You, D. (2015). AERIS-applications for the environment: real-time information synthesis: low emissions zone (LEZ) operational scenario modeling report (No. FHWA-JPO-14-187). United States. Department of Transportation. Intelligent Transportation Systems Joint Program Office. https://rosap.ntl.bts.gov/view/dot/3538.

For more information visit the DOT Climate Change Center, https://www.transportation.gov/priorities/climate-and-sustainability/dot-climate-change-center