Preliminary "High-Level" Evaluation Tool for Supporting Initial Prioritization of Ozone Reduction Measures

Pricing Subcommittee
September 28, 2010

Strategies Included:

- Fuel Tax Pricing Strategies
- Transportation Facility Pricing
- Mileage Based Fees
- Pay As You Drive Insurance
- Priced parking

(Strategy documents include sub-committee comments/suggestions)

Preliminary Draft for Discussion Only

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Preliminary High-Level Evaluation Tool
for Supporting Initial Prioritization of Ozone Reduction Measures
Draft: Not for Distribution
September 28, 2010

Measure type: Transportation Pricing

Measure name and description: Fuel tax pricing strategies

Fuel tax pricing strategies would increase the gasoline tax to reduce vehicle miles traveled (VMT) and generate revenue. The current state gas tax is $0.22/gallon and the federal gas tax is $0.184/gallon for passenger vehicles.

Preliminary sense of anticipated air quality benefits (e.g. NOx/VOC reductions? Potential reduction amount?):

Air quality benefits would occur from reduced VMT and traffic congestion. Additional benefits may also be realized from associated reduced idling, start-ups, and other ancillary emission producing activities associated with vehicle use. In order to evaluate and quantify the benefits of fuel tax pricing strategies, additional analysis would be required (see below). Nonetheless, we do know that the air quality benefits are closely tied to regional factors that affect demand elasticities, such as income and travel time/cost; and may vary in the short and long term. Further refinement of air quality benefits will also likely be obtainable using CDOT's revenue model (see below).

Preliminary sense of anticipated costs and economic impacts

- All motorists would incur additional fuel costs. For example, if Colorado doubled the state gas tax (to $0.44/gallon), the average cost to a consumer would increase by $132 annually (assuming the average person drives 13,500 miles per year[1], and an average fuel economy of 22.5 mpg[2]).
- Additional cost to business due to increased transportation-related cost (e.g direct or indirect costs for higher cost of fuel).

Additional technical analysis needed to refine benefits/costs estimates:

Useful evaluation of this measure would require an in-depth analysis of the following, in coordination with CDOT and CDPHE

- Run several fuel pricing strategy scenarios using CDOT's revenue model. This model, which is usually run for purposes other than air quality benefit predictions, can offer additional perspective on the air quality impacts of raising the gas tax (i.e. costs, driver behavior, the estimated revenue CDOT can expect given changes in fuel prices, etc.). It can also evaluate the

[1] FHWA, 2003. *Average Annual Miles per Driver by Age Group.* http://www.fhwa.dot.gov/ohim/onh00/bar8.htm

[2] Bureau of Transportation Statistics, 2010. *Average Fuel Efficiency of U.S. Passenger Cars and Light Trucks.* http://www.bts.gov/publications/national_transportation_statistics/html/table_04_23.html

effect of gas tax increases on driving behavior and VMT and account for other variables related to the gas tax, such as tax at the rack versus the pump, the increased cost of driving, vehicle miles travelled, and the percentage of tax money we receive back from the federal government each year. Running these scenarios would require a commitment of CDOT staff resources.

- Updated emissions reduction estimates using assumptions from the above analysis and EPA's new emissions model (MOVES). Also using assumptions from the above analysis, conduct additional photochemical air quality modeling to determine impact of lower emissions on ambient ozone levels.

Implementation feasibility (e.g. Who has authority? Who needs it? Who implements the measure?):

Authority to raise the gas tax would have to be provided by the Colorado General Assembly through new legislation. We would also need to confirm that TABOR does not prohibit this approach (see "Other Considerations" below).

Demonstrated ability to take "SIP Credit" for the measure:

There currently is no clear demonstrated ability to take SIP credit for this measure. It would have to be further investigated. At this point, any air quality benefits associated with such a strategy would need to be considered in the air quality baseline modeling, conducted by DRCOG, results of which are then fed into the travel demand model. These steps provide the emission estimates for motor vehicles.

Likelihood that measure could be in place in time for SIP inclusion (approx 2015); and, if later, how much later (e.g. 2 years? 10 years, etc?):

Fuel tax pricing strategies could be developed and implemented in time for the SIP only with aggressive analysis and associated legislative action, occurring very quickly (analysis in time either for 2011 or 2012 legislative action).

Preliminary Assessment of Co-benefits (e.g. other air quality, economic, quality of life, transportation etc):

- GHG emission benefits through reduced VMT, congestion and fuel usage.
- Increase funding source, for existing transportation and alternative transportation options, via tax revenue.
- Higher fleet vehicle turnovers as organizations seek to use more fuel efficient vehicles.

Other Considerations/Comments (e.g. Employed elsewhere, particular challenges/opportunities etc?):

- The gasoline tax is a well established funding mechanism for transportation, with the federal gasoline tax in existence since 1932.
- Some states index their gas tax to inflation, which incrementally increases the tax as inflation increases.
- This measure presents equity concerns for low-income residents because this is a regressive tax (low-income individuals pay a higher percentage of their income toward tax compared to individuals of higher income). However, revenues could be redistributed to offset potential inequities to enhance mobility options for low-income individuals.

- No other states have increased the gasoline tax for the purpose of reducing vehicle miles traveled.
- The State of Colorado Constitution requires that funds from the gas tax go into the Highway User Trust Fund (HUTF). However, there is noteworthy debate on whether the fuel pricing strategies developed for reasons such as congestion management, transit support, and air quality constitute user fees or a tax. It is not clear and could be argued either way under the Tax Payers Bill of Rights (TABOR) and needs to be more fully evaluated. If fuel pricing strategies were deemed to be a tax, adopting them would require voter approval.

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Preliminary High-Level Evaluation Tool
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Measure type: Transportation Pricing

Measure name and description: Transportation facility pricing

Transportation facility pricing strategies are designed to charge motorists for using certain travel facilities, in order to cause them to choose travel options other than a single occupant vehicle, thereby reducing VMT, congestion and air emissions. They also are a revenue generation tool that can be used to support other transportation management strategies, such as existing road modifications for "managed (or HOV) lanes", new "managed" lanes. There are several examples of transportation facility pricing strategies. They include*: cordon pricing, congestion pricing*, and *highway tolling. Cordon pricing* establishes tolls that are paid by motorists who pass through a specific area, usually the Central Business District (CBD) or other center. *Congestion pricing* establishes tolls paid by motorists for using a congested facility (e.g. a particular road). Congestion pricing tolls vary by time/day and are set to achieve a desired level of service on a roadway segment. *Tolls* are generally used on interstate highways or other limited access roads and are tolled on a per-mile basis, fees do not vary by time of day.

Preliminary sense of anticipated air quality benefits (e.g. NOx/VOC reductions? Potential reduction amount?):

Air quality benefits will be tied to reduced VMT and congestion; additional benefits may be realized from reduced idling, start-ups, and other ancillary emission producing activities associated with vehicle use.

A 1998 EPA study estimated that regional congestion pricing could reduce regional VMT by 0.6 – 2.6% using a $0.08 - $0.19/mile rate range (modeled for 2010)[3]

The best apparent method for estimating the emission or congestion reduction potential of priced facilities is to do a micro-simulation of a specific corridor. In a micro-simulation, a segment of road and surrounding area are modeled to see how specific changes affect travel (e.g. adding a managed lane to a roadway segment). In 2010, the US 36 Corridor completed such a micro-simulation using value pricing (congestion pricing) along US 36. Three scenarios were analyzed for years 2012 and 2035 along the corridor. In the simulation, two scenarios of managed lanes and one scenario of “no build” were analyzed. Overall, the managed lanes reduced VMT along the corridor, lowered travel time, and reduced fuel usage. The two scenarios had the following VMT reductions: (1) $160 Million Build: Hot lanes modeled on US 36 in both directions from Federal Blvd. to Wadsworth Parkway: 2012 VTM reductions of 0.4% (AM Peak) and 0.1% (PM Peak); 2035 VMT reductions of 0.2% (AM Peak) and VMT increase of 1.2% (PM Peak); (2) $260 Million Build: HOT lanes modeled on US 36 in both directions from Federal Blvd. to

[3] Environmental Protection Agency, 1998. Technical Methods for Analyzing Pricing Measures to Reduce Transportation Emissions. http://www.epa.gov/oms/stateresources/policy/transp/tcms/anpricng.pdf

Interlocken Interchange: 2012 VTM reduction of 1.3% (AM Peak) and VMT increase of 0.2% (PM Peak); 2035 VMT reductions of 0.9% (AM Peak) and VMT increase of 0.8% (PM Peak); [4]

Preliminary sense of anticipated costs and economic impacts

While actual cost numbers are not available without further analysis, we can offer a general sense of likely costs as follows:

- Infrastructure development (conversion of existing roadways to managed lanes, new lanes, completely new travel facilities)
- Consumer transponder costs and toll costs;
- Administrative costs;
- Cost of additional infrastructure to manage new alternative demand (i.e. light rail, bus rapid transit, bike/pedestrian facilities).

Additional technical analysis needed to refine benefits/costs estimates:

Useful evaluation of this measure would require an in-depth analysis of the following, in coordination with other transportation pricing strategy analyses, and DOT and CDPHE:

- Regional price points and associated elasticities to determine the extent to which transportation facility pricing approaches would affect VMT and associated emissions for both the short and long term; particularly involving tolling on new lane capacity and tolling on select existing lanes
- Selected corridors for their potential for effective use of these strategies. If RAQC wanted to pursue on expedited basis, analysis could focus on corridor most able to accommodate strategy in shortest time period.
- Updated emissions reduction estimates using assumptions from the above analysis and EPA's new emissions model (MOVES). Also, using assumptions from the above analysis, conduct additional photochemical air quality modeling to determine impact of lower emissions on ambient ozone levels.
- Costs associated with VMT tracking: (GPS, odometer reads, other tracking devices), administrative costs, and revenue recovery estimates.
- Photochemical air quality modeling to determine impact of lower emissions on ambient ozone levels.
- Revenue generating potential and how additional revenue would be used to advance transit.
- Determine from EPA what elements of this strategy type would need to be in place and when to receive SIP-related benefits.

Implementation feasibility (e.g. Who has authority? Who needs it? Who implements the measure?):

Implementation feasibility may prove to be a major hurdle for the following reasons:

- Per Senate Bill 09-108, existing facilities may only be tolled if the have " obtained the approval of every local government that includes territory in which all of any portion of the highway segment or highway lanes upon which the user fee is to be imposed pass or that will otherwise be substantially impacted by the imposition of the user fees on the highway segment or highway

[4] DynusT Research Laboratory, 2010. *US 36 Value Pricing Scenario Analysis.* Prepared for CDOT.

lanes." New facilities or new lanes on existing facilities may be tolled if there is concurrence from the regional planning authority (within the ozone non-attainment area that would be DRCOG, NFR, and UFR). Concurrence on tolling is often difficult.

- The High Performance Transportation Enterprise (HPTE) is authorized to implement tolls. [5]
- There is a limit of 10% of annual revenues that can be obtained through state or local taxes for HPTE facilities.
- Any tolling needs to be interoperable with E470, Northwest Parkway and N I-25/ US 36 HOT lanes.
- Regional Public Highway Authorities can create tolled facilities (an example of this E-470 Public Highway Authority).[6]
- Private entities can also create private, priced roads.
- Not sure what EPA's views are regarding what elements of this strategy type would need to be in place and when to receive SIP-related benefits.

Demonstrated ability to take "SIP Credit" for the measure:

There currently is no clear demonstrated ability to take SIP credit for these measures. This would have to be further investigated. At this point, any air quality benefits associated with such strategies would need to be considered in the baseline modeling, conducted by DRCOG, results of which are then fed into the travel demand model. These steps provide the emission estimates for motor vehicles.

Likelihood that measure could be in place in time for SIP inclusion (approx 2015); and, if later, how much later (e.g. 2 years? 10 years, etc?):

Not likely that measure could be in place by 2015, unless extremely aggressive action taken as soon as possible on a particularly well–positioned tolling option. The timing of project completion depends on the individual facility type, construction timelines and funding sources. Projects can take several years to complete, for example US 36 BRT lanes will not be completed until 2012.[7]

Preliminary Assessment of Co-benefits (e.g. other air quality, economic, quality of life, transportation etc):

- Potential ability to fund infrastructure enhancements and transit through the fees collected from the use of that infrastructure.
- GHG emission benefits can be realized through reduced VMT, congestion and fuel usage.

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[5] Colorado Department of Transportation, 2010. *High-Performance Transportation Enterprise.* http://www.coloradodot.info/about/high-performance-transportation-enterprise-hpte

[6] C.R.S. § 43-4-806

[7] Colorado Department of Transportation, 2009. *US 36 Managed Lanes/Bus Rapid Transit.* http://www.36commutingsolutions.org/linked_documents/TIGER%20Grant%20Exec.%20Summary.pdf

- Co-benefits include increased quality of life, reduced congestion, faster travel times, and increased revenue for transportation.

Other Considerations/Comments (e.g. Employed elsewhere, particular challenges/opportunities etc?):

- This measure presents equity concerns for low-income residents because this is a regressive tax (low-income individuals pay a higher percentage of their income toward tax compared to individuals of higher income). However, revenues could be redistributed to offset potential inequities to enhance mobility options for low-income individuals.
- Existing tolling facilities in Colorado include: E-470 (priced lanes), US36 (HOV/HOT lanes), I-25 (HOV/HOT lanes). Facility pricing is common throughout the U.S. and abroad.
- The State of Colorado has the authority to price highways through the High-Performance Transportation Enterprise (HPTE)[8].
- New York City considered using CBD congestion pricing in 2007; however, the State Legislature ultimately blocked the measure from implementation.[9].
- Central London uses congestion pricing (£8/day or about $12/day) [10] to control demand for facilities in the central city. Since this program was implemented, the affected area has seen a daily average reduction between 65,000 and 70,000 in the number of vehicles. Traffic entering the zone is 21% lower than before the charge was implemented[11].

[8] C.R.S. § 43-4-806

[9] Schaller, Bruce, 2010. *New York City's Congestion Pricing Experience and Implications for Road Pricing Acceptance in the United States.* **Transport Policy.**

[10] Transport for London, 2010. *Payments.* http://www.tfl.gov.uk/roadusers/congestioncharging/6741.aspx

[11] Transport for London, 2010. *Benefits.* http://www.tfl.gov.uk/roadusers/congestioncharging/6723.aspx

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Measure type: Transportation Pricing

Measure name and description: Mileage-based fees

Drivers would be charged based on how many miles they drive, sometimes referred to as a Vehicle Miles Traveled (VMT) fee. Periodic odometer readings (automatic through transponders or manual through inspection) would be the basis for determining the level of fees a driver must pay. Mileage-based fees could be used in place of the existing gas tax (Colorado state gas tax), as more fuel efficient (or non-gasoline-powered) vehicles become more prevalent, mileage based fees provide a funding source tied to the use of facilities. Such fees would be used for to generate revenue and to reduce VMT by increasing the cost/visibility of vehicle operating costs.

Preliminary sense of anticipated air quality benefits (e.g. NOx/VOC reductions? Potential reduction amount?):

At this point and without further study, air quality benefits for this region can not be quantified. Air quality benefits would primarily be tied to reduced VMT; additional benefits may be realized from reduced idling, start-ups, and other ancillary emission producing activities associated with vehicle use. Mileage-based fees research often focuses on revenue generation and piloting technology necessary to transition to such a fee based program.

In a 1998 study, the EPA analyzed VMT reduction and associated air quality benefits offered by this strategy and determined that a mileage-based fee of $0.02/mile would reduce VMT by 4.6 – 5.6 percent.[12]

Preliminary sense of anticipated costs and economic impacts

Primary costs include those for implementing a transportation pricing program and those that would be incurred directly by consumers. Estimated costs of implementing the program vary based on the tracking mechanisms used. Tracking units vary in price from $5 - $500[13] [14] (varying from tracking at gas pumps via credit card, radio frequency transponders to advanced GPS units) and cost of infrastructure to gather VMT data varies greatly; additional infrastructure for recording VMT varies in cost from $2,500 – $25,000 per unit. The cost per mile to consumer and commercial vehicles vary based on the fee, for

[12] Environmental Protection Agency, 1998. Technical Methods for Analyzing Pricing Measures to Reduce Transportation Emissions. http://www.epa.gov/oms/stateresources/policy/transp/tcms/anpricng.pdf

[13] ULI, 2008. *Moving Cooler.* Prepared by Cambridge Systematics

[14] Kim, David S. et al, 2002. *Technology Evaluation for Implementation of VMT Based Revenue Collection Systems.*

example a charge of 1 cent per mile would add up to $135 annually (assuming 13,500 miles driven per year[15]).[16]

Additional costs include administrative costs to the state for implementing and enforcing the program as well as overseeing education and public outreach.

Additional technical analysis needed to refine benefits/costs estimates:

- Review the results of CDOT's Mileage Based User Fee (MBUF) Pilot Study Framework. This effort is exploring a scope and structure for a future "Pilot Study" that will be conducted to evaluate the feasibility and effectiveness of introducing MBUF in Colorado. It will frame the public policy discussion around MBUF, with the goal of increasing revenue in a manner which correlates roadway usage with payment. The study should take 9 – 12 months to complete.
- Pricing usage could potentially use vehicle hours traveled (VHT) rather than vehicle miles traveled (VMT). Analysis of the benefits/costs of using one metric over the other should be included.

Additional detailed analysis needed includes:

1. Administrative costs (including program development, enforcement, etc)
2. Technology costs
3. Infrastructure costs
4. Consumer costs
5. VMT reduction benefits for Colorado based on an assumed cent per mile increase
6. Air Quality benefits for Colorado based on VMT reduction benefits

- Analysis of long-term VMT changes should be done including the long-term price elasticity associated with mileage-based fees (i.e. how long can we expect people to drive less?).
- Updated emissions reduction estimates using assumptions from the above analysis and EPA's new emissions model (MOVES). Also using assumptions from the above analysis, conduct additional photochemical air quality modeling to determine impact of lower emissions on ambient ozone levels.

Implementation feasibility (e.g. Who has authority? Who needs it? Who implements the measure?):

Legislation for mileage-based fees would be required through the Colorado General Assembly. CDOT's planned study is being conducted through its research program. State agencies currently do not have the authority to adopt mileage-based fees. There are also important considerations regarding the feasibility of this strategy as a state only strategy. Due to jurisdictional problems, it may make more sense for such a strategy to be advanced as a federal measure, not only for benefits to air quality, but congestion mitigation, infrastructure and transit revenue etc.

Demonstrated ability to take "SIP Credit" for the measure:

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[15] FHWA, 2003. *Average Annual Miles per Driver by Age Group.* http://www.fhwa.dot.gov/ohim/onh00/bar8.htm

[16] Baker, Richard T., 2010. *A Model for Projecting Revenues from State Vehicle Miles Travelled (VMT) Fee.* **Transportation Research Board Annual Meeting, 2010.**

There currently is no clear demonstrated ability to take SIP credit for this measure. It would have to be further investigated. At this point, any air quality benefits associated with such strategies would need to be considered in the baseline modeling, conducted by DRCOG, results of which are then fed into the travel demand model. These steps provide the emission estimates for motor vehicles.

Likelihood that measure could be in place in time for SIP inclusion (approx 2015); and, if later, how much later (e.g. 2 years? 10 years, etc?):

Not likely in near-term or mid-term. This appears to be a long term potential measure. CDOT's preliminary study will not be completed until 2011 and a subsequent pilot study is not likely to be completed by 2015.

Preliminary Assessment of Co-benefits (e.g. other air quality, economic, quality of life, transportation etc):

Potential benefits from mileage-based fees vary based on the level of deployment; *Moving Cooler* estimated GHG reductions between 1.2 – 4.4 percent.[17]

- Could increase funding for transportation
- Household financial impacts will vary based on miles driven and fuel efficiency of vehicles.
- This measure presents equity concerns for low-income residents because this is a regressive tax (low-income individuals pay a higher percentage of their income toward tax compared to individuals of higher income). However, revenues could be redistributed to offset potential inequities to enhance mobility options for low-income individuals.[18]

Other Considerations/Comments (e.g. Employed elsewhere, particular challenges/opportunities etc?):

- To date, no entity in the United States or abroad has adopted mileage-based fees in practice.
- Oregon House Bill 3946 directed Oregon DOT to form a Road User Fee Task Force and create a pilot program to evaluate the replacement of the gasoline tax with a mileage-based fee. The pilot ran for 12 months beginning in April 2006. It included 299 motorists and two service stations in Portland, OR. The final report concludes mileage-based fees to be a viable alternative to the gasoline tax.[19] Since the pilot, there has been no legislation to enact a mileage-based fee to date in the State of Oregon.
- Minnesota DOT advanced its own mileage-based pilot after being authorized to do so through the 2007 MN State Legislative Session. The pilot project was established to demonstrate technologies to support future replacement of the gas tax with a fuel-neutral mileage charge.

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[17] ULI, 2008. *Moving Cooler.* Prepared by Cambridge Systematics

[18] Oregon State University,2008. *Techniques for Assessing the Socio-Economic Effects of Vehicle Mileage Fees.* http://www.oregon.gov/ODOT/TD/TP_RES/docs/Reports/2008/ODOT-VMT_Fee_Impacts.pdf?ga=t

[19] Oregon Department of Transportation, 2007. *Oregon's Mileage Fee Concept and Road User Fee Pilot Program.* http://www.oregon.gov/ODOT/HWY/OIPP/docs/2005LegislativeReport.pdf

The research/pilot project was integrated into the existing IntelliDrive research effort.[20] One of the key research components of this study was the public opinion survey that emphasizes the importance of public outreach/education surrounding mileage-based fees.[21] To date, Minnesota has not legislated any mileage-based fees.

- The Puget Sound Regional Council performed a pilot study with assistance of the FHWA to test mileage-based fees along congested facilities. 450 people participated in the study. The primary aims of the Traffic Choices Study were to (1) accurately describe the behavioral response to the congestion-tolling of roadways, (2) better understand issues of policy related to the Puget Sound Regional Council Traffic Choices Study implementation of road network tolling, and (3) test an integrated system of technical solutions to the problem of tolling a large network of roads without deploying substantial physical hardware on the roadside.[22]
- The University of Iowa is currently in the process of testing a mileage-based road user charge to see how the public responds, the study is currently underway.[23]
- The Netherlands was moving forward with a mileage-based fee tracked via GPS units, the program would charge roughly 7 cents (USD conversion) per mile. [24]
- Texas Transportation Institute created a revenue model (this was a revenue study, it did not look at VMT reduction) for the state of Texas for mileage-based fees in which commercial vehicles would be charged 2.9 cents per mile and personal vehicles charged 0.95 cents per mile to produce the same level of revenue in 2010 as the state gas tax.[25]
- Mileage-based fees, unlike the gasoline tax, do not directly incentivize fuel efficient vehicles (however, the fee could be structured to incentivize fuel efficient vehicles).
- CDOT is expecting to release a Request for Proposal for its Mileage Based Study Pilot Framework early October (see above for more details) Potential elements to be studied include: congested facilities, time of day, vehicle type, among others that will be developed further during the study. The study is expected to take 9 – 12 months. Conducting the actual Pilot Study would likely require conceptual support from the Colorado General Assembly.

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[20] Minnesota Department of Transportation, 2010. *Minnesota IntelliDrive/Mileage Based User Fee Program.* http://www.dot.state.mn.us/guidestar/2006_2010/intellidrive.html

[21] Minnesota Department of transportation, 2001. *Mileage-Based User Fee Public Opinion Study.* http://www.dot.state.mn.us/funding/mileage-based-user-fee/09mbufphase3finalrpt.pdf

[22] Puget Sound Regional Council , 2008. *Traffic Choices Study.* http://psrc.org/assets/37/summaryreport.pdf

[23] University of Iowa, 2010. *National Evaluation of a Mileage-Based Road User Charge.* http://www.roaduserstudy.org/howitworks.aspx

[24] Squatriglia, Chuck, 2009. *Netherlands To Tax Drivers By the Kilometer.* **Wired.** http://www.wired.com/autopia/2009/11/dutch-road-tax/

[25] Baker, Richard T., 2010. *A Model for Projecting Revenues from State Vehicle Miles Travelled (VMT) Fee.* **Transportation Research Board Annual Meeting, 2010.**

Measure type: Transportation Pricing

Measure name and description: Pay-as-You-Drive (PAYD) Insurance

Mandatory PAYD insurance charges drivers their insurance premium costs based in part on how many miles their vehicles are driven in a given year. Drivers have the opportunity to save money by driving fewer miles and practicing safe driving habits. Many insurance companies already factor into insurance prices the annual miles driven, such that insured individuals pay less for vehicles that are driven fewer miles per year.

Preliminary sense of anticipated air quality benefits (e.g. NOx/VOC reductions? Potential reduction amount?):

Air quality benefits would occur from reduced VMT, but additional benefits may be seen from more fuel efficient driving habits (ex: acceleration rates, most current PAYD insurance providers monitor driver acceleration/deceleration rates). The research on mandatory PAYD insurance estimates VMT reductions to be between 6.5% - 10%.[26] [27] [28] [29] [30]

Preliminary sense of anticipated costs and economic impacts

The mechanism for tracking mileage varies, options include:

- GPS monitoring (tracks mileage, acceleration/deceleration, driving habits), cost estimate: $100 - $200/vehicle.
- Certified odometer readings (tracks mileage), cost estimate: $5 - $10/year/vehicle.[31]
- Tracking mechanisms used to gather driving activity (ex: gas station monitors).

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[26] SWEEP. 2009. *Transportation Blueprint for the New Energy Economy.*

[27] Bordoff, Jason E. 2008. "Pay-As-You-Drive Insurance" Brookings Institution. www.brookings.edu/articles/2008/spring_car_insurance_bordoff.aspx.

[28] Parry, Ian W. H. 2005. "Is Pay-As-You-Drive Insurance a Better Way to Reduce Gasoline than Gasoline Taxes?" www.rff.org/Documents/RFF-DP-05-15.pdf

[29] Greenberg, Allen. 2009. "Costs and Benefits of Varying Per-Mile Insurance Premiums Based Upon Measured Risks Specific to Each Mile Driven." *TRB 2010 Annual Meeting.*

[30] Cambridge Systematics. 2006. "Mileage-Based user Fee Demonstration Project: Potential Public Policy Implications of Pay-As-You-Drive Leasing and Insurance Products" *Minnesota Department of Transportation.* www.lrrb.org/pdf/200639C.pdf

[31] Litman, Todd. 2008. "Distance-Based Vehicle Insurance Feasibility Costs and Benefits: Comprehensive Technical Report." Victoria Transport Policy Institute, Victoria, B.C.

- Households could save money based on the amount they drive. The Brookings Institution has projected that 63.5% of all households would save an average of $496 annually (28% off current premiums) if PAYD insurance were made mandatory.[32]
- PAYD insurance may result in fewer automobile accidents (ex: Progressive Insurance's rate structure includes an assessment of driver behavior, drivers are incentivized for safer driving practices).[33]
- Potential costs for state to administer a mandatory program such as enforcement of such a measure.

Additional technical analysis needed to refine benefits/costs estimates:

More refined emission estimates would require an in-depth analysis of the following, in coordination with CDOT and CDPHE

- Regional price points and associated elasticities to determine the extent to which a range of PAYD Insurance costs would affect VMT and associated emissions in BOTH the short and long-term.
- Research on potential legal implications of making PAYS insurance mandatory.
- Updated emissions reduction estimates using assumptions from the above analysis and EPA's new emissions model (MOVES). Also using assumptions from the above analysis, conduct additional photochemical air quality modeling to determine impact of lower emissions on ambient ozone levels.
- Additional research to determine whether SIP credit could be take for this measure if it were to become mandatory.

Implementation feasibility (e.g. Who has authority? Who needs it? Who implements the measure?):

Voluntary PAYD insurance is currently available in Colorado through several insurance providers. For PAYD insurance to be mandatory, legislation would need to be passed through the Colorado General Assembly.

Demonstrated ability to take "SIP Credit" for the measure:

There currently is no clear demonstrated ability to take SIP credit for this measure. Based on what we know today, it appears that any air quality benefits associated with such a strategy would have to be considered in the air quality baseline modeling, conducted by DRCOG. The results would then be fed into the DRCOG's travel demand model to the basis for estimating emissions.

Likelihood that measure could be in place in time for SIP inclusion (approx 2015); and, if later, how much later (e.g. 2 years? 10 years, etc?):

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[32] Bordoff, Jason and Noel, Pascal J. 2008. "Pay-As-You-Drive Auto Insurance: A Simple Way to Reduce Driving-Related Harms and Increase Equity." The Brookings Institution, Washington, D.C.

[33] Progressive Insurance. 2010. "Terms and Conditions" *Snapshot Discount.* http://www.progressive.com/snapshot/terms-conditions.aspx

PAYD insurance strategies could be developed and implemented in time for the SIP only with aggressive analysis and associated legislative action, occurring very quickly (analysis in time either for 2011 or 2012 legislative action).

Preliminary Assessment of Co-benefits (e.g. other air quality, economic, quality of life, transportation etc):

- GHG emission benefits through reduced VMT, congestion, and fuel usage.
- Fewer traffic incidents due to lower VMT.[34]
- Potentially fewer uninsured motorists on the road

Other Considerations/Comments (e.g. Employed elsewhere, particular challenges/opportunities etc?):

- Many states and insurance companies currently offer voluntary PAYD insurance alternatives. Each state has different legal requirements for insurance companies and coverage and policy terms vary by state.
- No states have mandated PAYD insurance.
- There is no record of PAYD insurance included in baseline modeling as a voluntary measure.
- PAYD insurance is being evaluated and implemented voluntarily by numerous insurance companies. There is substantial ongoing research and experimentation related to identifying the usage-based data that is relevant to driving risk, practical and affordable to collect, and acceptable to consumers to use.
- PAYD insurance programs may have more impact when the cost is visible to the consumer; such when insurance is paid at the pump.
- PAYD insurance has the potential to reduce the number of uninsured motorists.[35]

[34] Greenberg, Allen. 2008. "Costs and Benefits of varying Per-Mile Insurance Premiums Based Upon Measured Risks Specific to Each Mile Drive." Federal Highway Administration. http://www.vtpi.org/AG_PAYD.pdf

[35] Parry, Ian W.H. 2005. "Is Pay-As-You Drive Insurance a Better Way to Reduce Gasoline than Gasoline Taxes?" Resources for the Future. http://www.rff.org/RFF/Documents/RFF-DP-05-15.pdf

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Measure type: Transportation Pricing

Measure name and description: Priced parking

The private cost of parking is often bundled into the price of retail goods/ services, housing, or lease/purchase of business space. By unbundling this cost, the cost of parking becomes more visible to drivers and could influence the amount of driving, including individual trips.[36] Most commercial and residential development provides for vehicular parking, whether it includes structured or surface parking, or is on or off-site parking. Local land use codes typically establish parking minimums (and in some cases maximums) for different types of development. For example, in Denver's zoning code, a retail establishment must provide at least 1.25 off-street parking spaces for each 1000 sq ft of gross floor area (a 4000 sq ft shop would require 5 parking spots).[37] Without meeting this requirements, the retail establishment has to seek a variance (approval from the local planning body) to operate in that particular location

Parking pricing strategies include those designed to either (1) increase the cost of driving a single occupancy vehicle by charging for parking, or (2) increase the use of alternative transportation in lieu of parking (ex: parking cash-out: where an employer may offer cash, or a transit pass instead of free parking).

Parking is traditionally priced when there is high demand for parking facilities, such as central business districts (CBD), during special events, or other locations where the demand for parking exceeds the supply. On-street parking is managed by the locality, or district in which it is located. Structured/surface lots may be operated by public or private entities.

Preliminary sense of anticipated air quality benefits (e.g. NOx/VOC reductions? Potential reduction amount?):

Air quality benefits would occur from reduced VMT, but additional benefits may be seen from reduced idling, start-ups, and reduced congestion from cars driving around looking for available parking spots. Several studies have looked at the VMT reduction potential of priced parking. In, *The High Cost of Free Parking,* Donald Shoup estimates that for one individual, charging $50/month for parking will reduce

[36] Greenberg, Allen. 2009. "Traffic Congestion and Pollution: Mileage, Insurance, Carsharing, and Parking Strategies". *TR News.* Number 263.

[37] Denver, Colorado, Municipal Code. Article 8-45. http://www.denvergov.com/Portals/646/documents/DZC/8_Downtown_DZC_91710.pdf

their individual VMT by 30% (using an elasticity of -.5).[38] VMT reduction could come from reduced trips, use of alternative transportation, or redirected trips. As discussed below, additional analysis would be needed to estimate air quality benefits in our region of the associated VMT decrease.

Preliminary sense of anticipated costs and economic impacts

- Additional cost to drivers to park.
- Additional cost to those businesses not passing added cost on to consumers.
- Opportunity for revenue generation or cost recovery for providing parking facilities.
- Reduced car-traffic in otherwise high-traffic areas (which could both beneficial and costly; for example: individuals that previously drove somewhere, may avoid shopping trips and instead buy elsewhere, while others will visit more frequently as parking is more readily available).

Additional technical analysis needed to refine benefits/costs estimates:

Refinement of the evaluation of this measure would require an in-depth analysis of the following, in coordination with CDOT and CDPHE

- Research on potential legal implications of making priced parking mandatory.
- Analysis of mechanisms for tax/fee collection, and overall administration (ex: would you need to establish a special district, could localities collect fee/tax, etc).
- Regional price points and associated elasticities to determine the extent to which priced parking would affect VMT and associated emissions in BOTH the short and long-term.
- Investigate where pricing strategies that presumably reduce VMT and associated emissions would offer the most benefit to regional ozone values (for example: Central Business Districts, along key corridors, etc).
- Updated emissions reduction estimates using assumptions from the above analysis and EPA's new emissions model (MOVES). Also using assumptions from the above analysis, conduct additional photochemical air quality modeling to determine impact of lower emissions on ambient ozone levels.
- Research where voluntary programs have been used.
- Consider pilot potential or priced parking (such as cash-out program).

Implementation feasibility (e.g. Who has authority? Who needs it? Who implements the measure?):

Implementation of this measure will require extensive collaboration with municipalities and businesses, since imposition of parking pricing measures do not fall under the jurisdiction of state or regional air quality management agencies.

Parking pricing strategies includes those designed to either (1) pricing parking, by increasing the cost of driving a single occupancy vehicle by charging for parking, or (2) incentives, to increase the use of alternative transportation in lieu of parking (such as parking cash-out, preferred parking for carpoolers, etc).

[38] Shoup, Donald. 2005. *The High Cost of Free Parking.* American Planning Association: Chicago.

Pricing strategies

Mandatory Programs

We found no examples of mandatory priced parking in the United States. However, there are examples in Asia: Beijing, Guangzhou, Hanoi and Jakarta.[39]

Voluntary Programs

An example of voluntary program that exists today:

- Model fee structure/equations for pricing municipal parking facilities. For example, the State of Washington has created a website that showcases model parking codes. [40]
- Policies that reduce employee parking subsidies, so that commuters must pay some or all of their parking costs (such as many employers do in Denver).

Examples of voluntary programs that may exist today (although further research is needed):

- Public parking in lieu of private parking. Encourage localities to allow developers to pay a fee in lieu of providing parking spaces. That revenue can then be used for public parking infrastructure or used for alternative transportation.[41]
- Coordinate on/off-street parking facility management and charging for it. For example, motorists will choose the most affordable parking choice, if on-street is cheaper than off-street; coordination is needed to manage pricing/supply.

Incentives

Mandatory/Voluntary Programs

1. Programs such as Parking Cash Out offer incentives to employees to use alternative transportation rather than driving alone. Employees might be offered a transit pass in lieu of a parking spot. Implementation could be voluntary, or mandatory. The City of Santa Monica, CA implemented a mandatory Parking Cash Out program for employers with over 50 employees.[42]
2. Create development incentives, such as faster permit processing for meeting specific parking requirements (parking minimum/maximums/shared use, etc).[43]

Demonstrated ability to take "SIP Credit" for the measure:

As far as we have determined to date no state has taken SIP credit for a parking pricing program. However, the cost of parking is generally included in baseline transportation modeling. Any air quality benefits in this region associated with such a strategy would be considered in the air quality baseline

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[39] "Reinventing Parking" http://www.reinventingparking.org/2010/09/puzzling-policy-price-controls-on.html

[40] Municipal Research and Services Center of Washington. 2010. "Sample Off-Street Parking Provisions". http://www.mrsc.org/Subjects/PubSafe/offpark.aspx

[41] Shoup, Donald. 2005. *The High Cost of Free Parking.* American Planning Association: Chicago.

[42] California Health and Safety Code § 43845 http://www.leginfo.ca.gov/cgi-bin/displaycode?section=hsc&group=43001-44000&file=43845

[43] Municipal Research and Services Center of Washington. 2010. "Sample Off-Street Parking Provisions". http://www.mrsc.org/Subjects/PubSafe/offpark.aspx

modeling, conducted by DRCOG, results of which are then fed into the travel demand model. These steps provide the emission estimates for motor vehicles.

Likelihood that measure could be in place in time for SIP inclusion (approx 2015); and, if later, how much later (e.g. 2 years? 10 years, etc?):

Not likely in near-term or mid term. This strategy would be difficult to implement in a mandatory sense, it has not been implemented in the U.S. This would require each jurisdiction to pricing parking which creates a competitive disadvantage.

Preliminary Assessment of Co-benefits (e.g. other air quality, economic, quality of life, transportation etc):

- GHG emission benefits through reduced VMT, congestion, and fuel usage.
- Increased revenue for localities and businesses.
- Increased quality of life due to lower congestion.

Other Considerations/Comments (e.g. Employed elsewhere, particular challenges/opportunities etc?):

- This measure may present equity concerns for low-income residents because parking pricing is considered regressive (low-income individuals may pay a higher percentage of their income toward pricing compared to individuals of higher income). However, revenues could be redistributed to offset potential inequities to enhance mobility options for low-income individuals.
- There was no record of mandatory priced parking in the US in a preliminary literature review, however, as mentioned above there are voluntary programs in place in some states/regions
- Parking pricing is typically market-driven where demand for parking facilities exceeds supply. Therefore, it may be more pragmatic to control supply of parking facilities rather than mandating pricing.
- Voluntary/market driven implementation is relatively easy to accomplish at local level.