To: City of Bend Citywide Transportation Advisory Committee & CTAC Funding Work Group
Attn: Susanna Julber, Karen Swirsky, and Eric King
From: Steve Porter and Michelle Porter
Date: September 11, 2019

Public Comment:

Transportation System Funding: VMT Fees

Dear Bend Citywide Transportation Advisory Committee & CTAC Funding Work Group:

In earlier comments we have indicated that vehicle miles traveled (VMT) fees are the most efficient mechanism for generating transportation system funds. Any rational funding approach would establish VMT fees as its foundation because VMTs are the essential nexus between transportation system usage and cost.

By charging VMT fees, a direct connection is established between the usage costs that individuals generate and those individuals' payments for the system. This enables both direct transportation system depreciation and social externalities to be commensurately redressed by the individuals who create them. Through VMT fees, private gains accruing to users of the system become reconciled against the public costs of that usage.

This comment sets forth a summary description of a VMT fee framework that might be readily instituted in Bend, based in part upon Oregon's "OReGO" program. If implemented, we estimate annual VMT fee revenue of approximately $16.1 million could be realized.

In addition to significant revenue capacity, our economic modeling predicts that, if a $0.03 per mile VMT fee were imposed, Bend's annual VMTs would decrease by about 72.5 million miles, carbon dioxide pollution would fall by 67.1 million pounds per year, Bend annual street maintenance costs would decrease by over $2.0 million, and Bend aggregated living standards would rise by more than $225.0 million.

We request that the Funding Work Group reconsider VMT fees as a core funding tool and demand-management mechanism for Bend's transportation system.

VMT Fees

VMT fees (also called "road user charges" and "mileage-based user fees") are similar to tolls. Motorists are charged for roadway use, in proportion to their usage. Drivers pay "based on distance driven and, perhaps other costs of road use, such as wear and tear on roads, traffic congestion, and air pollution."[1] These fees establish a market for roadways, wherein the price paid for road consumption is set by the supplier (in this instance, the municipality) and a determination of efficient consumption is made on an individual basis by the buyers (i.e., motorists). A VMT fee is thus a market-based mechanism for road resource allocation and funding.

At present, the effective price for motorist road usage in Bend is set at $0.00.[2] This artificially low price means that roads do not generate sufficient funds to pay for their construction or maintenance, and thus subsidies are needed to fund motorist activities. Bend taxpayers, businesses, and employees subsidize motorists in a number of ways. The city's provision of abundant "free" public parking, use of property taxes (or, similarly, transportation system development charges (TSDCs)) to fund roadway expansions, and failure to require that motorists compensate society for negative driving externalities like safety costs or air and noise pollution, are some salient examples.

The key consequence of subsidizing driving is oversubscription of Bend's roads by motorists. This leads to harmed human wellbeing, excessive negative externalities, added traffic congestion, and structural funding shortfalls for transportation system maintenance and modernization. VMT fees help correct these failures.

VMT fee imposition also would reduce the total quantum of funds required by the system, which should be a core goal of any transportation system funding program.[3] Through the imposition of price, VMT quantity consumed would decrease,[4] stemming from more efficient roadway usage by motorists and from modal substitution.[5] Both mechanisms engender socioeconomic, environmental, health, and fiscal gains.[6]

These gains derive, in part, from cost differences among transportation modes and, in part, from the net negative externality profile of driving versus the net positive externality profiles of walking and cycling. Motor vehicles generate direct and externalized costs that are substantially larger than alternative transportation modes. For example, on a per-mile basis, motor vehicles generate transportation system costs about 133 *times* that of

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[1] "Fixing Funding by the Mile: A Primer and Analysis of Road User Charge Systems," National League of Cities (2018).

[2] In fact, depending on the manner in which price is defined, the current effective price may be less than zero due to subsidies and sunk cost claiming.

[3] Porter, "How Funding Needs & Transportation System Efficiency Respond to Funding Sources" (July 23, 2018).

[4] This reflects the law of demand. We address demand elasticity particulars in our discussion of modeling VMT fees in Bend.

[5] Porter, "Evidence & Implications of Supply-induced Demand in Transportation Systems" (July 9, 2018).

[6] Porter, "Transportation System Funding" (July 31, 2018).

pedestrians, and over 26 *times* that of cyclists.[7] These figures ignore the positive externalities associated with walking and biking, which encompass improved social capital, public health, education attainment, and innovation rates, among other things.[8] Imposing VMT fees on motorists is therefore both financially and socially fair, not to mention economically efficient.[9]

We believe the foregoing points have been well-established in our previous written public comments, and we will not elaborate further here. For as strong as the arguments in favor of VMT fees may be, however, we recognize that uncertainty still inheres in operationalizing VMT fees. Even if it is agreed that VMTs are, in principle, desirable and appropriate, how can they be implemented?

OReGO in Bend

The Oregon Department of Transportation (ODOT) has been piloting a program to answer this question. After several years of legislative and developmental work, "OReGO" launched in July 2015.[10] "With OReGO, you pay by-the-mile. You pay only for the number of miles driven on Oregon roads."[11] OReGO provides "a fair, reliable source of revenue…to fund road maintenance, preservation and improvements for all Oregonians." It is a "user-pays solution."[12]

OReGO sets a road usage charge at $0.017 (1.7 cents) per mile for cars and light-duty commercial vehicles. Users "have their choice of secure mileage reporting options offered by OReGO's private-sector partners…[so that] information will be kept secure and private." "Choose your provider. Plug in your device. Drive, then settle your account. It's that simple."[13]

Bend is fortunate to have the technical details of VMT fees already worked out by ODOT. We propose that Bend piggyback the technical efforts of OReGO, including any relevant partnerships with OReGO's private-sector technology/device providers, to facilitate implementation of a similar program in Bend.

Comparable to ODOT's OReGO, we envision a system in which Bend residents, employees, and students are issued acceptable VMT-tracking devices to plug into their vehicles. The devices would tally VMTs that occur within

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[7] Litman, "Whose Roads?" Victoria Transport Policy Institute (2013). Litman, "Transportation Cost and Benefit Analysis II," Victoria Transport Policy Institute (2018). Porter, "Evidence Demonstrating the Efficiency, Safety & Economic Benefits of 20mph Speed Limits" (July 13, 2018).

[8] Speck. *Walkable City*. North Point Press (2012).

[9] Porter, "Fuel Tax Arguments & Counterarguments" (August 29, 2019).

[10] OReGO Website, "About" (myorego.org; accessed September 2019).

[11] OReGO Website, "Home" (myorego.org; accessed September 2019).

[12] OReGO Website, "About" (myorego.org; accessed September 2019).

[13] OReGO Website, "About" (myorego.org; accessed September 2019).

Bend's geography by using location data.[14] Monthly, quarterly, or annual bills would be issued by the city to residents in a manner similar to the city's present issuance of water bills. The city would then collect the remittances and use those funds as a cornerstone of transportation system funding.

The remainder of this comment goes into greater detail about this proposal. First, we outline the economic modeling used to obtain our estimated revenue capacity figures for a Bend VMT fee, as well as the anticipated reductions in VMTs and CO2 emissions, and increases in quality of life for Bend residents.

Second, we address certain issues that may be expected to arise in connection with VMT fee implementation, including security concerns, opt-out considerations, compliance and enforcement, equity questions, visitor and tourist treatment, fund usage, and administration costs.

Economic Model Outline & Results

We have modeled "flat fee" or "uniform fee" VMT charge structures. Uniform fees occur when every motorist, regardless of vehicle type, time of travel, or specific road usage, pays the same per-mile rate.[15] We have modeled a $0.01/mile fee, a $0.02/mile fee, and a $0.03/mile fee. Our preference is for the $0.03 fee, and so we focus discussion on that fee's results.

We favor a $0.03/mile VMT fee in Bend for four reasons:

1) VMT fees have significant beneficial effects on VMT demand, and these benefits escalate as VMT fees rise. A $0.03/mile VMT fee causes substantial salutary effects on VMTs, CO2 emissions, and Bend resident wellbeing.

2) VMT fees have the ability to raise significant revenue. At a $0.03/mile fee, our model generates revenue figures large enough to obviate Bend's adoption of damaging general obligation bonds (GO bonds) and larger distortionary TSDC rates for transportation system funding.

3) A $0.03 per mile charge is small enough to be reasonably borne by household budgets. If a vehicle is driven 6,000 miles per year on Bend's roads, the corresponding VMT fee would be $180 per year. This compares

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[14] Whether the devices rely upon radio frequency identification (RFID) or global positioning system (GPS) to determine if a vehicle is "in" or "out" of bounds is unimportant; in either case, the technology is proven, reliable, and inexpensive. The OReGO system charges participants "for all miles driven, including those outside of Oregon, unless [participants] use a device that collects location data." For Bend, because of the relatively low proportion of total driver miles occurring within the city, use of location data would be of greater importance. "Fixing Funding by the Mile: A Primer and Analysis of Road User Charge Systems," National League of Cities (2018).

[15] We have not modeled uniform fees because we prefer them over other VMT fee structures; instead, we have proceeded in this way because we lack data sufficient to allow us to model more sophisticated VMT fee types. The uniform fee nevertheless provides a useful foundation for estimating revenue and demand-side effects of VMT fees in Bend. For purposes of completeness, we note that we would favor implementation of a "multiple fee" VMT charge structure in which the per-mile fee scales with vehicle MPG and vehicle weight so that heavier and less fuel-efficient vehicles pay more than lighter and more fuel-efficient vehicles. We prefer this approach because it more closely captures vehicle-related usage costs imposed via road wear and negative externalities, and because it motivates beneficial vehicle-type substitution. Our $0.03 per mile uniform modeling may be viewed as equivalent to a target weighted-average rate that would derive from a multiple fee structure.

favorably with the Funding Work Group's estimate of household impact of proposed GO bonds, which, at $300 million in bond gross revenue, would impose annual property tax increases of about $900 per year on properties assessed a slightly below Bend's recent median observed home value.[16] We estimate that the proposed $0.03/mile VMT fee would generate approximately the same level of net revenue as a $300 million GO bond over 20 years. Accordingly, if it is believed that Bend resident households can collectively pay for GO bonds of $100 million to $400 million (or more) for transportation system funding, then there must be budget capacity for both residents and visitors to pay a $0.03/mile VMT fee. We note here that a dollar of VMT fee revenue is "worth more" than a dollar of GO bond revenue because of the VMT fee's beneficial reductions in driving demand and spending needs, which make total funding requirements smaller with VMT fees than with GO bonds.

4) A $0.03/mile VMT fee corresponds, in our view, appropriately with our earlier-proposed $0.144/gallon average fuel tax. This is because, while fuel consumption does generate negative externalities (e.g., CO2, noise, and other environmental pollution), those externalities are relatively small compared with the negative results of automobile usage as disaggregated from fuel considerations. Vehicles of any type create particulate matter, noise, and safety problems. They also impose infrastructure costs in rough proportion to weight and size. Since fuel-independent negative externalities are larger, we view a larger effective per-mile VMT fee as appropriate. A $0.144/gallon average fuel tax approximates a $0.007/mile tax rate; a $0.03/mile VMT fee is roughly four times the per-mile cost of the fuel tax, a ratio we view as reasonably equitable, all factors considered. At a minimum, we view $0.03/mile as a useful starting-point for VMT fee consideration.

Elasticity

In our earlier public comment discussing fuel taxes, we described own-price demand elasticity with respect to fuel. A 1.0% increase in fuel price corresponded with a 0.7% decrease in fuel quantity demanded in our estimation model, and that reduction in fuel demand caused proportionate reductions in VMT demand.[17] Our modeling for VMT fees relies upon the same long-run demand elasticity value and construct as used in our modeling of fuel taxes.

As such, we have treated a VMT fee as effectively equivalent to a fuel tax from a VMT demand perspective. For any given VMT fee, we have identified the analogous fuel tax rate by using fleet average fuel economy statistics.[18]

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[16] CTAC Meeting #12, "2040 Transportation System Plan Project & Program Evaluation and Preliminary Priorities" (August 22, 2019). "Initial Funding Assessment: An Interim Report to Inform Bend's Transportation Plan" (October 31, 2018).

[17] Porter, "Transportation System Funding: Fuel Tax" (August 8, 2019).

[18] Our model equilibrates a VMT fee of $0.01 per mile with an average fuel tax of about $0.22 per gallon. This is because fleet average fuel economy is just below 22 miles per gallon (MPG). For VMT fees of $0.02/mile and $0.03/mile, the analogous average fuel tax rates are about $0.44/gallon and $0.65/gallon, respectively.

This is sensible because VMT fees can be viewed as analogous to a fuel tax since both raise the marginal cost of vehicle travel.[19]

VMTs

In a previous comment we estimated that Bend's annual VMTs are approximately 610.0 million miles.[20] For purposes of modeling the proposed VMT fee, we have assumed a baseline VMT value of exactly 610.0 million miles.

Results

If a $0.03 per mile VMT fee is imposed and applied to every motorist using Bend's roads, our model estimates annual gross revenue of about $16.1 million.

VMTs in Bend would decrease from a 610.0 million mile baseline value to about 537.6 million miles, a decrease of 72.4 million miles, or 12%. CO2 emissions would also decline by 12%, from 564.9 million pounds to 497.8 million pounds, a reduction of 67.1 million pounds.

Bend would be expected to save about $2.1 million per year in street maintenance costs. And Bend resident living standards would increase by at least $228.4 million as a consequence of reduced particulate matter and noise pollution.

Our calculations are set forth in Appendices 1 through 4 attached to this document. Table 1, below, summarizes our findings.

TABLE 1: VMT FEE SUMMARY RESULTS

VMT Fee ($/Mile)	Revenue ($ Millions)	VMTs (Millions)	CO2 (Millions Lbs.)	Maint. Svgs. ($ Millions)	Wellbeing Gain ($ Millions)
$0.00	$0.0	610.0	564.9	$0.0	$0.0
$0.01	$6.0	582.8	539.7	$0.8	$85.8
$0.02	$11.3	558.7	517.4	$1.5	$161.7
$0.03	$16.1	537.5	497.8	$2.1	$228.4

[19] It may be argued that fuel tax and VMT fee structures are sufficiently dissimilar as to give rise to different elasticities. We do not disagree in principle. As a practical matter, however, we believe any elasticity differences would be immaterial and so would have no substantial implications for system-wide modeling of the sort we are conducting here. In any case, we view our modeling as generally indicative in nature rather than an attempt at exacting precision.

[20] Porter, "Evidence Demonstrating the Efficiency, Safety & Economic Benefits of 20mph Speed Limits" (July 13, 2018).

Additional Considerations

Our "base case" model described above provides useful information as a starting-point for evaluating VMT fees' revenue and demand-side potential in Bend. It nevertheless entails certain limitations and assumptions that must be addressed. The following sections of this comment outline issues we have identified and thoughts pertaining to their resolution.

Privacy Concerns & Opting Out

Some Bend residents, employees, and students may object to enrollment in a VMT fee system on grounds of privacy concerns. The tabulation of VMTs on a user basis necessitates certain data collection, including, to some extent, location data. Prospective users may perceive risk associated with this compilation and maintenance of personal information. In an era of repeated information security breaches, such concerns are understandable.

At the same time, in the current era, it must be stated that such objections are largely specious. Virtually any user of cellular telephony, the internet, grid-based energy and water, banking and credit, insurance, or any other of a number of modern systems already has ceded privacy to a much greater extent than would be implicated through VMT tracking.[21] Nevertheless, for those unmoved by this fact, we would suggest an opt-out program for Bend residents, employees, and students wishing not to participate.[22]

If opting out is made available, it stands to reason that some may wish to opt out not because of security concerns but instead because they are among the heaviest users of the transportation system and will perceive an arbitrage opportunity if their VMTs go untracked. For this reason we reject the concept of a predetermined annual fee imposed upon those opting out of per-mile VMT fees. Instead, we would propose the following. For a given year in which VMT fees are imposed, the city would establish an anticipated revenue value based upon expected resident VMTs. At the end of the year, all collected VMT fees would be deducted from this revenue "budget," leaving a budget shortfall figure. This budget shortfall would be divided evenly among all those who opt out (on a per-vehicle basis), and the resulting figure would be the individuals' per-vehicle payment responsibility.[23]

Such arrangement would discourage heavy user opt-outs since, unless an individual could predict he is the very heaviest VMT user in Bend, he would end up directly subsidizing someone else's VMTs. At the same time, it would allow those with privacy concerns an alternative arrangement for contributing to VMT fees.

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[21] Palmer, K., "How Credit Card Companies Spot Fraud Before You Do," *U.S. News & World Report, Money* (July 10, 2013). Cash, C., "Court Upholds Smart Meter Data Collection in Privacy Challenge by Consumers," cooperative.com (August 23, 2018). Sutton, K., "Google Is Collecting Your Data - Even When Your Phone Isn't in Use," AdWeek (August 21, 2018). Cowley, S., "Equifax to Pay at Least $650 Million in Largest-Ever Data Breach Settlement," *New York Times* (July 22, 2019).

[22] Research from Richard Thaler highlights the importance of structuring the program as having an "opt-out" possibility, with the default action "opt-in." Thaler. *Misbehaving*. W.W. Norton (2015).

[23] Were actual remittances to somehow equal or exceed the anticipated budget, opt-out users could be charged the average per-vehicle amount paid by all Bend residents, employees, and students not opting out.

Compliance & Enforcement

The question of enforcement has been contemplated in connection with OReGO. ODOT notes several compliance issues with VMT fees:

1) Taxpayers will not sign up for the program.
2) Taxpayers will not install their devices, even if they have signed up for the program.
3) Taxpayers will take devices out of the vehicles or otherwise disable the devices.
4) Taxpayers will not pay.[24]

We believe these issues may be generally resolved with relative ease. First, we propose that signup for the program be made compulsory (either via opt-in or opt-out) on a rolling basis with vehicle registration.

Second, we propose that VMT tracking devices be configured in such way as to be visible through an equipped vehicle's front windshield.[25] An indicator light could show the device as operational and installed. Requiring devices to be visible would increase compliance rates directly by raising the risk of non-compliance detection. It also would simplify enforcement efforts, which could be conducted by local police as part of routine law enforcement.

Second, in the event of non-compliance, offenders could be given citations in the amount of 50% of the average annual per-vehicle VMT fee. A penalty of this size would add to natural compliance rates.

Third, a social enforcement protocol similar to that used by Bend in connection with reporting local property flammable vegetation or abandoned vehicle infractions might be instituted. A phone number could be publicized for members of the public to call in the event of observed non-compliance. The caller could provide the relevant vehicle's description, location, and license plate number. A report would generate a notice from the police department to the vehicle owner reminding them of the importance of VMT tracking.[26] A follow-up could occur a week later to confirm compliance. Factual misrepresentation to police, if discovered, could carry stiff penalties.

Finally, the use of data analytics could be used to flag questionable accounts in a manner similar to that used by banks and credit card companies that monitor for fraud.

The above solutions address ODOT's first three concerns. For the fourth, we observe that taxpayers already pay water bills, traffic and parking violations, property taxes, and other similar financial obligations. It is unclear why

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[24] Oregon Department of Transportation, "Oregon's Road Usage Charge: The OReGO Program Final Report" (April 2017).

[25] In addition to enhancing compliance, high visibility of reporting devices would likely increase the VMT fee's relative demand elasticity (a beneficial effect) by reminding motorists that they are paying for the miles they drive. Signaling value of this type has been found to be relatively large in behavioral economics research. Thaler. *Misbehaving*. W.W. Norton (2015).

[26] A database of covered vehicle license plate numbers could be referenced to determine if the vehicle is local and subject to VMT reporting.

payment compliance would be lower for VMT fees. Nevertheless, bank routing and account information or credit card information could be required at the time of vehicle registration for direct debit/charge for VMT fees.

Equity Issues

Two key equity issues may be raised in connection with VMT fees. The first is simply that, at a flat per-mile VMT fee, lower-income individuals pay more per mile as a percentage of income than higher-income households. This may be perceived as unfair. We reject this concern on grounds that most products carry a single market-rate price, and yet this does not imply unfairness on those with lower incomes. Indeed, this is the very mechanism by which rational consumption decisions occur. Is it unfair that laundry detergent is priced the same to all consumers regardless of income? We believe it is not, nor is a uniform-rate VMT fee unfair. This is particularly the case since VMT fees would comprise a very small share of any household's budget, distinguishing them from things such as housing-related costs that consume a very large share of low-income household budgets.

A second equity concern is more serious. Lower-income households may face structural issues that cause them to have to drive more miles than higher-income households. For instance, lower-priced housing may be located farther from workplaces, grocery stores, and other destinations, implying greater distances traveled per trip. It also has been observed that lower-income neighborhoods lack walking and cycling infrastructure equal to that of higher-income neighborhoods, thus necessitating more driving trips.[27]

We have three responses to this latter equity concern. First, the current approaches for transportation system funding in Bend already are severely regressive. Property taxes, TSDCs, and current parking policies impose disproportionately large harms upon lower-income households.

To illustrate, is has been observed that lower-income homeowners and renters spend a much larger share of budget on housing, so they are especially susceptible to property taxes, TSDCs, and minimum parking requirements applied to housing. For lower-income rental households, a uniformly greater proportion of property taxes imposed on landlords is paid than by higher-income renters due to relative market power differences. (See our discussion of tax incidence in an earlier comment for further discussion of this type of issue.[28]) The market power shortfall faced by lower-income renters is partly brought about by TSDCs, which distort housing development decisions, retarding low-income housing growth rates. This causes supply shortages at lower-priced housing levels and erodes low-income renter bargaining power. And, through unequal supply restriction, TSDCs effectively raise housing prices most on lower-income households where supply shortages already are greatest.

[27] Porter, "Evidence Demonstrating the Efficiency, Safety & Economic Benefits of 20mph Speed Limits" (July 13, 2018).

[28] Porter, "Transportation System Funding: Prepared Food & Beverage Sales Tax" (August 23, 2019).

Simultaneously, TSDCs raise costs on inexpensive housing by a greater percent since the fees generally are calculated without consideration of the housing's market value. The flat fee comprises a greater share of the total housing cost/price when applied to lower-cost housing, thereby increasing low-income household housing cost burdens disproportionately. The city's minimum parking standards work similarly, as we have shown in other comments.[29] Altogether, if VMT fees were to replace the proposed GO bonds and reduce reliance upon TSDCs, overall regressiveness of transportation system funding would be reduced.

Second, it is technologically possible for lower-income households to pay a lower per-mile rate. We believe this would best be done via a "multiple fee" structure linking per-mile fees with vehicle type (see footnote 15 for further discussion) since this would motivate beneficial vehicle substitution. However, a lower fee could also be qualified for on the basis of income proof, in a manner similar to what we have proposed in connection with fuel taxes.[30]

Third, even if the imposition of a uniform VMT fee is regressive, that does not mean the overall construct of VMT fees must be regressive. If lower-income households collectively contribute 10% of VMT revenue but collectively receive more than 10% of the spending, regressiveness is reduced or eliminated. (This line of argument applies to funding tools like VMT fees that tax transportation in order to fund transportation. But it does not apply to taxation of housing via property tax increases and TSDCs since these tools generate regressiveness in housing that cannot be redressed via transportation spending.) A particularly progressive manner in which VMT fees may be implemented would be spending significant VMT fee funds on improving pedestrian, cyclist, and transit capabilities for lower-income households. This approach would reduce those households' future reliance upon driving and thereby moderate their future annual VMT fee responsibilities, while simultaneously enhancing quality of life.

Visitor & Tourist Treatment

Our base case modeling reflects the assumption that all VMTs occurring on Bend's roads are captured by VMT fees. However, only Bend residents, employees, and students would likely have their vehicles outfitted with VMT reporting devices. This leaves unresolved the question of charging visitors and tourists for their VMTs, including - if done - a mechanism for imposing visitor VMT fees not reliant upon direct VMT reporting. We offer two perspectives on this issue.[31]

One possibility is that visitors and tourists are exempted from VMT fees. We do not find this answer especially satisfying, but we note that visitors and tourists do not directly pay Bend property tax or TSDC increases. So it is not without precedent to exempt tourists from direct contribution to transportation system funding tools.

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[29] Porter, "Parking Policy Reforms to Promote Transportation System Improvements" (August 20, 2018).

[30] Porter, "Transportation System Funding: Fuel Tax" (August 8, 2019).

[31] Not all VMTs derive from either local drivers or tourists; some are from pass-through motorists. Detailed VMT data from Aspen, Colorado, indicate this is likely to be a very small share of overall VMTs in Bend. We believe the figure is sufficiently small to be ignored at this point. Charlier Associates, Inc., "Aspen VMT Model" (August 2015).

For purposes of modeling a visitor VMT fee exemption, we would ideally use Bend VMT data that distinguishes between tourists and Bend residents/employees/students. Unfortunately, we do not believe such data exist. As a proxy we have used Bend tourism statistics to estimate the impact of tourist VMT fee exemptions. It was reported for calendar year 2015 that an average of "almost 20,000 people visited Bend every day of the year," while "Bend's resident population is only about 87,000 people."[32] If visitors and residents generated identical daily VMTs, that suggests about 19% of Bend's VMTs are attributable to non-local visitors. We note that significant daily VMTs also would derive from Bend employees and students who do not live in Bend, implying that 19% may overstate the VMT impact of non-local visitors. On the other hand, it is likely that visitors are more active drivers than residents and employees since they are not working or at school during their tours. All factors considered, we view 20% as a reasonable first-pass estimate of non-local visitors' annual VMT contributions.[33] Starting with a baseline of 610.0 million VMTs, this implies that 488.0 million VMTs are generated by local Bend residents and employees.

Our full model of this visitor/tourist VMT fee exemption is found in Appendices 5 through 8. Table 2, below, summarizes our findings if visitors and tourists are exempted from VMT fees in Bend.

TABLE 2: VMT FEE SUMMARY RESULTS (IF VISITORS & TOURISTS ARE EXEMPTED)

VMT Fee ($/Mile)	Revenue ($ Millions)	VMTs (Millions)	CO2 (Millions Lbs.)	Maint. Svgs. ($ Millions)	Wellbeing Gain ($ Millions)
$0.00	$0.0	610.0	564.9	$0.0	$0.0
$0.01	$4.8	588.2	544.7	$0.6	$68.7
$0.02	$9.0	569.0	527.0	$1.2	$129.3
$0.03	$12.9	552.0	511.2	$1.7	$182.8

The outcomes are reasonably good. A $0.03/mile VMT fee would still raise about $12.9 million in revenue each year, and meaningful maintenance savings and wellbeing gains would be realized.

Alternatively, if charges for tourist and visitor VMTs are desired, a second possibility is that a flat VMT surcharge is added on a per-night basis to transient rooms. Continuing with the numbers developed for Table 2, if 488.0 million VMTs occur from Bend locals, then 122.0 million derive from visitors and tourists. As of 2015, it was tabulated that

[32] Trejbal, C., "Too Many Tourists?" *Source Weekly* (July 20, 2016).

[33] Aspen, Colorado, has compiled detailed VMT data that distinguishes between local VMTs and non-local visitor VMTs. Of its reported 147 million VMTs in 2014, approximately 44% (64 million) derived from non-local visitors. Bend, like Aspen, enjoys significant tourist activity, though Bend's tourism rates are proportionately somewhat less than Aspen's. This can be seen in Aspen's cataloguing of several winter months "peak season" in addition to the summertime peak season, while Bend regards the winter months as its low season. Bend's peak season generally is regarded as a summertime occurrence. If 44% of Aspen's VMTs derive from non-local visitors occurring with two peak seasons, then we would view as reasonable an estimate that 20% of Bend's VMTs are generated by non-local visitors during its one peak season. Charlier Associates, Inc., "Aspen VMT Model" (August 2015).

approximately 7 million room nights were consumed in Bend by tourists.[34] Dividing equally, this suggests that each room night corresponds with about 17.4 miles of visitor driving in Bend. Applying the $0.03/mile VMT fee suggests a flat per-night VMT surcharge of approximately $0.52 would be appropriate, on average, to compensate Bend for visitor VMTs.

Such a visitor/tourist fee would lead to revenue outcomes similar to those shown in Table 1, but we would anticipate moderated savings in VMTs, CO2, and maintenance costs, and somewhat reduced wellbeing gains relative to those shown in Table 1 as a byproduct of the differing fee structure.

Fund Usage

It may be suggested that, because VMT fees derive from motorists, it is only fair that VMT revenue be spent on vehicle infrastructure. This is incorrect. We previously were asked about fairness in connection with spending fuel tax revenue on pedestrian and cyclist infrastructure. Our arguments that such spending is fair apply fully to VMT fee spending as well, and we incorporate them here by reference.[35] We also believe these arguments pertain not only to pedestrians and cyclists but to transit spending as well.

Administration Costs

To this point we have ignored administration costs and focused on gross revenue capacity. If administration costs are included in the analysis, we would expect a reduction from gross to net revenue in the range of 15 percent.

"ODOT estimates when the number of road usage charge payers [i.e., OReGO users] reaches about one million, operating costs will drop to below five percent of gross revenues per annum."[36] Until that time, costs will be higher. Such a relationship between cost and program size reflects what is known as "economies of scale." Scale economies are not generally linear with respect to unit growth; typically, the greatest efficiency gains occur when percentage unit/user growth is large (because starting-point units/users are small). At present, OReGO is limited to about 5,000 vehicles.[37] Application of the technology in Bend would encompass roughly 100,000 unique vehicles, including residents, employees, and students. For purposes of estimation, we assume that, at that scale, an administrative cost ratio of about 15% is reasonable and conservative.[38] This is more than three times the cost ratio expected at 1 million users. Actual administration costs could be lower, and, in any event, would be expected to decline over time with organic growth and the maturation of Bend's administrative practices.

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[34] Trejbal, C., "Too Many Tourists?" *Source Weekly* (July 20, 2016).

[35] Porter, "Fuel Tax Arguments & Counterarguments" (August 29, 2019).

[36] "Fixing Funding by the Mile: A Primer and Analysis of Road User Charge Systems," National League of Cities (2018).

[37] OReGO Website, "About" (myorego.org; accessed September 2019).

[38] Most government fee programs target a cost ratio of about 10%. Oregon Department of Transportation, "Oregon's Road Usage Charge: The OReGO Program Final Report" (April 2017).

If a 15% administrative cost ratio is assumed, anticipaple annual revenue from a $0.03 VMT fee would be about $13.7 million, if applied to all Bend VMTs. If visitors and tourists are exempted, net revenue would be about $11.0 million per year.

Administrative costs would partly be redirected into Bend's economy since a portion of costs would go toward local staffing for the program. Of $2.0 to $3.0 million in annual costs, perhaps one-half would fund new administrative positions, thus creating local jobs and income.

Summary

A $0.03 per mile VMT fee would generate significant revenue, decrease pollution, enhance Bend quality of life, and reduce the total quantum of transportation system funding required.

If implemented, VMT fees could replace GO bonds and reduce TSDC rate increases. Both of these latter funding tools cause significant negative effects, including increased VMTs, elevated pollution, diminished Bend quality of life, and escalated total transportation system funding requirements. They also contribute directly to Bend's housing crisis, punish those who walk and cycle or use transit, raise consumer prices on all goods, and are severely regressive.

We estimate VMT fee annual net revenue in the range of $11.0 to $13.7 million per year, depending primarily upon the treatment of tourists and visitors. VMTs would decrease by about 60 to 70 million miles per year, and CO2 pollution would fall by 55 to 65 million pounds. Annual maintenance savings would be in the range of $2 million, while Bend quality of life would increase by a value of around $200 million.

Implementation of VMT fees in Bend can be readily achieved by adopting the technical workings of ODOT's OReGO program. VMT fees would ideally be paired with our proposed $0.144/gallon weighted average fuel tax, implementation of performance parking and related parking reforms, and vehicle registration fees as core transportation system funding tools since all directly link transportation system usage/cost with payment, and all generate beneficial system outcomes.

Thank you for your consideration.

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ABOUT THE AUTHORS

Steve Porter

Steve is a recognized authority on economic analysis and valuation. He has provided expert testimony in high-stakes commercial litigation on topics including economics, valuation, statistics, econometrics, market definition, consumer choice, business strategy, and pricing, among others. He has consulted with Fortune 500 corporations on intellectual property licensing, asset transactions, and valuation issues, and he has conducted economic impact analyses, including work performed on behalf of the Los Angeles Superior Court. His articles have published in the *Journal of Legal Economics*, *les Nouvelles*, the *Patent, Trademark & Copyright Journal*, the *Journal of the Patent and Trademark Office Society*, and *Intellectual Asset Management*, among others. He also is co-author of *IP Strategy, Valuation, and Damages* (LexisNexis), a treatise on intellectual property economics. Some of his work has been cited as authoritative in filings submitted to the Supreme Court and the Federal Trade Commission, and he has been quoted by and featured in the editorials section of the *Wall Street Journal*. He has been an invited speaker before the Chicago Bar Association, the Attorney General's Office of the State of Arizona, and various law firms and corporations, where he has lectured on topics ranging from economic analysis and valuation to econometrics and game theory. He is a recipient of the William J. McKinstry Award in economics, the *Wall Street Journal* Scholar Award, the Micronomics Economic Research Award, and the IE Fund Leadership Scholar Award. He served as a teaching assistant in economics at the Dolibois European Center in Luxembourg, an ad hoc referee for the *Journal of Forensic Economics*, and as Co-Chair and an Executive Committee Member of Young Professionals Advisory Council at the Farmer School of Business. He graduated *summa cum laude* and with University Honors from Miami University in Oxford, Ohio, completing dual majors in economics and marketing. He received his MBA, with honors conferred by the Dean and Board of Academic Affairs, from IE Business School in Madrid, Spain, graduating 5th in a class of more than 400. He holds the Series 65 securities license.

Michelle Porter

Michelle is an expert in valuation, economic analysis, and quantitative methods. She has been engaged by Fortune 500 companies, SMEs, U.S. and international government entities, and leading law firms to provide expertise in high-stakes commercial litigations, negotiations, and asset transactions. Her consulting work has encompassed advisory roles in industries including pharmaceuticals, medical devices, banking, telecommunications, consumer goods, software, and transportation technologies, among many others. Michelle is co-author of the book entitled *IP Strategy, Valuation, and Damages* (LexisNexis). Her articles have appeared in *les Nouvelles*, *Intellectual Asset Management*, *Intellectual Property Magazine*, *Smart Business, Los Angeles Daily Journal*, *The Recorder,* and *China Intellectual Property*, and she has been quoted by *Forbes*. Michelle has spoken before such groups as the Intellectual Property Law Committee of the Chicago Bar Association, Google, and Motorola Mobility. Her work has been recognized with the Accenture International Consulting Competition Top Honors Award, the IE Women Leaders Scholarship Award, the *les Nouvelles* Best Article Award, and the Micronomics Economic Research Award. In addition, Michelle has served as an advisor to the Forte Foundation's MBALaunch for Women, President of the IE Business School Southern California Alumni Association, Co-Chair and Executive Committee Member of Young Professionals Advisory Council at the Farmer School of Business, and an instructor in microeconomics. Michelle graduated *cum laude* from Miami University in Oxford, Ohio, majoring in economics. She received her MBA from IE Business School in Madrid, Spain.

Appendix 1
Bend VMT Fee Analysis: Indicative Long-Run VMT Fee Revenue, VMT, and CO2 Estimates
Applied Demand Elasticity Value of -0.70

VMT Fee ($/Mile)	VMTs (Miles)	Fee Revenue ($)	CO2 (Pounds)	VMT Reduction (Miles)	VMT Change (%)	CO2 Reduction (Pounds)	CO2 Change (%)
[A]	[B]	[C] = [A] * [B]	[D] = ([B]/21.5973)*20	[E]	[F]	[G]	[H]
Baseline ($0.00)	610,000,000		564,885,425				
$0.010	582,777,303	$5,950,781	539,676,073	27,222,697	-4.5%	25,209,352	-4.5%
$0.020	558,725,020	$11,308,229	517,402,657	51,274,980	-8.4%	47,482,768	-8.4%
$0.030	537,546,834	$16,110,667	497,790,773	72,453,166	-11.9%	67,094,652	-11.9%

Appendix 2
Bend Estimated Fiscal Savings with $0.03 VMT Fee
Transportation System Annual Maintenance Savings

		Low Estimate	High Estimate	Average
Annual Bend Street Maintenance Savings Per 1% VMT Reduction	[A]	$138,878	$218,878	$178,878
Estimated VMT % Reduction with $0.03 VMT Fee	[B]	11.9	11.9	11.9
Estimated Annual Street Maintenance Savings with $0.03 VMT Fee	**[C] = [A] * [B]**	**$1,649,531**	**$2,599,736**	**$2,124,633**

Source: For further information on Bend Street Maintenance Savings and the relationship between VMTs and maintenance costs, see: Porter, "Evidence Demonstrating the Efficiency, Safety & Economic Benefits of 20mph Speed Limits," Public Comment (July 13, 2018).

Appendix 3
Bend Estimated Hedonic Gains with $0.03 VMT Fee
Particulate Matter (PM) Pollution Abatement

Estimated Bend Housing Stock Value	[A]	$16,797,360,000
Hedonic Gain Rate Per 1% PM Reduction	[B]	0.10%
Estimated Hedonic Gain Per 1% PM Reduction	[C] = [A] * [B]	$16,797,360
Estimated PM % Reduction with $0.03 VMT Fee	[D]	11.9
Estimated PM-Related Hedonic Gain with $0.03 VMT Fee	**[E] = [C] * [D]**	**$199,511,790**

Note: PM-related hedonic gains are tethered to housing values for computational convenience.
Hedonic gains would manifest more generally in Bend living standards regardless of PM dispersion patterns.

Source: For further information on estimated Bend housing stock value and the relationship between hedonic gains and particulate matter pollution, see: Porter, "Evidence Demonstrating the Efficiency, Safety & Economic Benefits of 20mph Speed Limits," Public Comment (July 13, 2018).

Appendix 4
Bend Estimated Hedonic Gains with $0.03 VMT Fee
Noise Pollution Abatement

Estimated Bend Housing Stock Value	[A]	$16,797,360,000
Hedonic Gain Rate Per 1 Decibel (dB) Noise Reduction	[B]	0.29%
Estimated Hedonic Gain Per 1 dB Noise Reduction	[C] = [A] * [B]	$48,712,344
Estimated dB Reduction Per 1% VMT Reduction (0.25 dB / 5% VMT)	[D] = 0.25 / 5.0	0.05
Estimated Hedonic Gain Per 1% VMT Reduction	[E] = [C] * [D]	$2,435,617
Estimated VMT % Reduction with $0.03 VMT Fee	[F]	11.9
Estimated Noise-Related Hedonic Gain with $0.03 VMT Fee	**[G] = [E] * [F]**	**$28,929,210**

Note: Noise-related hedonic gains are tethered to housing values for computational convenience.
Hedonic gains would manifest more generally in Bend living standards regardless of noise dispersion patterns.

Source: For further information on estimated Bend housing stock value and the relationship between hedonic gains and noise pollution, see: Porter, "Evidence Demonstrating the Efficiency, Safety & Economic Benefits of 20mph Speed Limits," Public Comment (July 13, 2018).

Appendix 5
Bend VMT Fee Analysis: Indicative Long-Run VMT Fee Revenue, VMT, and CO2 Estimates (Excluding Visitors & Tourists)
Applied Demand Elasticity Value of -0.70

VMT Fee ($/Mile)	Local VMTs (Miles)	Total VMTs (Miles)	Fee Revenue ($)	Local CO2 (Pounds)	Total CO2 (Pounds)	VMT Reduction (Miles)	VMT Change (%)	CO2 Reduction (Pounds)	CO2 Change (%)
[A]	[B]	[B1]	[C] = [A] * [B]	[D] = ([B]/21.5973)*20	[D1]	[E]	[F]	[G]	[H]
Baseline ($0.00)	488,000,000	610,000,000		451,908,340	564,885,425				
$0.010	466,221,842	588,221,842	$4,760,625	431,740,858	544,717,944	21,778,158	-3.6%	20,167,482	-3.6%
$0.020	446,980,016	568,980,016	$9,046,583	413,922,126	526,899,211	41,019,984	-6.7%	37,986,215	-6.7%
$0.030	430,037,467	552,037,467	$12,888,533	398,232,619	511,209,704	57,962,533	-9.5%	53,675,722	-9.5%

Appendix 6
Bend Estimated Fiscal Savings with $0.03 VMT Fee (Excluding Visitors & Tourists)
Transportation System Annual Maintenance Savings

		Low Estimate	High Estimate	Average
Annual Bend Street Maintenance Savings Per 1% VMT Reduction	[A]	$138,878	$218,878	$178,878
Estimated VMT % Reduction with $0.03 VMT Fee	[B]	9.5	9.5	9.5
Estimated Annual Street Maintenance Savings with $0.03 VMT Fee	**[C] = [A] * [B]**	**$1,319,624**	**$2,079,789**	**$1,699,707**

Source: For further information on Bend Street Maintenance Savings and the relationship between VMTs and maintenance costs, see: Porter, "Evidence Demonstrating the Efficiency, Safety & Economic Benefits of 20mph Speed Limits," Public Comment (July 13, 2018).

Appendix 7
Bend Estimated Hedonic Gains with $0.03 VMT Fee (Excluding Visitors & Tourists)
Particulate Matter (PM) Pollution Abatement

Estimated Bend Housing Stock Value	[A]	$16,797,360,000
Hedonic Gain Rate Per 1% PM Reduction	[B]	0.10%
Estimated Hedonic Gain Per 1% PM Reduction	[C] = [A] * [B]	$16,797,360
Estimated PM % Reduction with $0.03 VMT Fee	[D]	9.5
Estimated PM-Related Hedonic Gain with $0.03 VMT Fee	**[E] = [C] * [D]**	**$159,609,432**

Note: PM-related hedonic gains are tethered to housing values for computational convenience.
Hedonic gains would manifest more generally in Bend living standards regardless of PM dispersion patterns.

Source: For further information on estimated Bend housing stock value and the relationship between hedonic gains and particulate matter pollution, see: Porter, "Evidence Demonstrating the Efficiency, Safety & Economic Benefits of 20mph Speed Limits," Public Comment (July 13, 2018).

Appendix 8
Bend Estimated Hedonic Gains with $0.03 VMT Fee (Excluding Visitors & Tourists)
Noise Pollution Abatement

Estimated Bend Housing Stock Value	[A]	$16,797,360,000
Hedonic Gain Rate Per 1 Decibel (dB) Noise Reduction	[B]	0.29%
Estimated Hedonic Gain Per 1 dB Noise Reduction	[C] = [A] * [B]	$48,712,344
Estimated dB Reduction Per 1% VMT Reduction (0.25 dB / 5% VMT)	[D] = 0.25 / 5.0	0.05
Estimated Hedonic Gain Per 1% VMT Reduction	[E] = [C] * [D]	$2,435,617
Estimated VMT % Reduction with $0.03 VMT Fee	[F]	9.5
Estimated Noise-Related Hedonic Gain with $0.03 VMT Fee	**[G] = [E] * [F]**	**$23,143,368**

Note: Noise-related hedonic gains are tethered to housing values for computational convenience.
Hedonic gains would manifest more generally in Bend living standards regardless of noise dispersion patterns.

Source: For further information on estimated Bend housing stock value and the relationship between hedonic gains and noise pollution, see: Porter, "Evidence Demonstrating the Efficiency, Safety & Economic Benefits of 20mph Speed Limits," Public Comment (July 13, 2018).