3-2019

ODOT Highway Cost Allocation Study Review: Challenges in Including Regional Revenues

Northwest Economic Research Center

Thomas Potiowsky
Portland State University

Emma Willingham
Portland State University

Katelyn Kelley
Portland State University

Devin Bales
Portland State University, dbales@pdx.edu

ODOT Highway Cost Allocation Study Review:
Challenges in Including Regional Revenues

NeRC

March 2019

Portland State UNIVERSITY

ACKNOWLEDGEMENTS

This report was researched and produced by the Northwest Economic Research Center (NERC) with support from the Oregon Department of Transportation.

The Oregon Department of Transportation (ODOT) is the state department in charge of transportation. ODOT's mission is provide a safe and reliable multimodal transportation system that connects people and helps Oregon's communities and economy thrive.

NERC is based at Portland State University in the College of Urban and Public Affairs. The Center focuses on economic research that supports public-policy decision-making, and relates to issues important to Oregon and the Portland Metropolitan Area. NERC serves the public, nonprofit, and private sector community with high quality, unbiased, and credible economic analysis. Dr. Tom Potiowsky is the Senior Advisor of NERC, and also the former Chair of the Department of Economics at Portland State University. Dr. Jenny H. Liu is NERC's Assistant Director and Associate Professor in the Toulan School of Urban Studies and Planning. The report was researched and written by Tom Potiowsky and Emma Willingham, with research and writing support from Katelyn Kelley and Devin Bales.

Northwest Economic Research Center

Portland State University
College of Urban and Public Affairs
PO Box 751
Portland, OR 97207-0751
503-725-8167
nerc@pdx.edu

www.pdx.edu/NERC
@nercpdx

Portland State UNIVERSITY

Contents

Executive Summary

This report, written for the Oregon Department of Transportation (ODOT) by Portland State University's Northwest Economic Research Center, outlines the challenges that regional revenue collection poses for ODOT's biennial Highway Cost Allocation Study (HCAS). The HCAS assesses the relative burdens of light and heavy vehicle classes on state infrastructure, in relation to the amount of revenue that said vehicle classes generate. In other words, it ensures that light vehicles and heavy vehicles are "paying their share" of state transportation expenditures.

Differences in vehicle traffic or differential impacts to vehicle classes are the root cause of most of the problems that local revenue collection mechanisms pose. When revenues from a specific location or mechanism hit one class more heavily than the other, it becomes difficult to determine whether or not the two broad classes are in fact generating revenue that balances out their share of expenditures. If said local revenues are included in the HCAS, then the outcome of the study deviates from the ideal balanced ratio, and if they are not, then the HCAS ratio is incorrect.

One potential solution to this problem is to calculate HCAS ratios for different regions within the state. However, as this would essentially require conducting the HCAS multiple times, there would be additional labor, especially in cases where data would need to be parsed down to the appropriate scale. In some cases, for instance when forecasting revenues, it would be necessary to actually conduct a forecast (if one does not exist), or use assumptions to adjust from the state forecast. Both approaches would introduce another level of uncertainty to the study ratio.

Additionally, there are components to the model that would require reexamination and process adjustments. For instance, the current approach to estimating tax avoidance assumes that a certain flat percent of vehicle miles traveled within the state are fueled by gas purchased out of state (and therefore not subject to the tax). If regions are considered, then different rates in border areas would likely be reasonable. Estimating these rates is distinct separate analytical step, and there are other components of the tax avoidance and evasion protocol that might require similar separate estimations.

The challenges posed to the HCAS process by including local revenues, outlined above, can be summarized as follows:

Differential impacts to vehicle classes due to:

- Regional differences in vehicle class shares
- Revenue collection method
- Road system differences in vehicle class shares

Data challenges related to:

- Parsing data into smaller regional classifications
- Forecasting regional series

Other challenges include:

- Tax avoidance and evasion methodology
- Increased labor required to conduct multiple regional HCASs

Background

This section will provide a comparison of regional revenue collection methods, followed by a brief review of the HCAS report methodology and most recent results.

Revenue Collection Methods: Literature Review

It is useful to start this report with a brief discussion of three transportation funding policies: congestion pricing, local option transportation taxes, and increased vehicle registration fees. In addition to their ability to generate revenue, this paper will also investigate how fairly these policies divide up the share of the costs and if said costs are in rough proportion to how often the individual uses the good. As is the case with most policy, tradeoffs between efficiency and equity for each of these funding options are inevitable. Often the best choice compiles multiple funding strategies that are tailored for the needs of individual regions.

Tolling

The principal cost to the state associated with automobile use, after infrastructure construction, is the wear and subsequent maintenance to said infrastructure. Also associated with vehicle use are implicit, or hidden, costs associated with traffic, such as delayed travel time and pollution. In urban areas, where the bulk of damage is done during peak commute hours, cities have implemented a time-based tax to combat this road overuse and ameliorate traffic by imposing a cost that some commuters will seek to avoid by shifting their travel to non-peak hours or choosing alternative modes of transportation.

The purpose of a congestion tax is to charge more to those who use the roads when it is in highest demand thereby incentivizing a shift to off-peak hours for dispensable trips. Shifting driver behavior to be more aligned with their willingness to pay for road services improves market efficiency, as rush hour drivers will incur a more proportional share of the societal cost they impose through increased commute time.[1] Two cities that have enacted such a tax, Stockholm and London, faced pushback during the inception. However, both polices have now remained in place for over a decade.

Stockholm began its congestion charge in 2006. The tolls are enforced by time-differentiated cameras that charge users 11-30 SEK ($01.18 -$3.76 USD) if driving within the charge zone on weekdays between 6:00am-6:30pm.[2] As a result, these tolls have been regularly reducing traffic by approximately 20%, and yielding roughly 850 million SEK ($91 million) in yearly profit earmarked for road investments.[3]

In London, the Congestion Charging Scheme (LCCS) was first implemented in 2003. Like in Stockholm, the LLCS utilizes a network of cameras, located at every entrance and exit to the congestion charging zones. In its first year the program the LLCS raised £68 million (approximately $90 million USD) in profit, which were subsequently invested in transportation projects. Additionally in its first year the policy saw

[1] Zhong, Shaopeng, Xiantao Xiao, Max Bushell, and Hui Sun. "Optimal road congestion pricing for both traffic efficiency and safety under demand uncertainty." *Journal of Transportation Engineering, Part A: Systems* 143, no. 4 (2017): 04017004

2 Swedish Board of Transportation. “Congestion taxes in Stockholm and Gothenburg.” (2019).

3 Eliasson, J. (2014). The Stockholm congestion charges: an overview. Stockholm: Centre for Transport Studies CTS Working Paper, 7, 42

a reduction in car traffic by 30% and overall traffic by 18%.[4] Today the charge is a flat fee of £11.50 ($15.19) if driving between 7:00am-6:00pm Monday through Friday. The penalty for noncompliance is a £160 ($211) fine that increases by 50% if not paid in the allotted time.[5]

As with most taxes, the concept of congestion charges typically engenders resistance. However, when applied, public support tends to grow as drivers see a substantial decrease in traffic and more reliable commute times.[6] A chief critique of congestion pricing is that it is by definition a regressive tax. The fee is determined by time of day, not level of income, and therefore the congestion tax rate is proportionately higher for those with the least ability to pay. However, according to 2015 five-year estimates from US Census Bureau data, the Portland, OR median family income of those who commute to work by car is 65% percent more than those who get to work by public transit, and 74% more than those who bike or walk.[7] So while the tax remains regressive in nature, the sample of the population most affected by the tax over represents higher income individuals, reducing (but not eliminating) that concern.

A congestion toll is most logical and efficient in regions with large cities, where commute times vary significantly with congestion and pollution is most severe. In Oregon, using ODOT regions for reference, this type of taxation would best lend itself to the Portland Metro area (Region 1) and Willamette Valley (Region 2). These two areas contain the ten largest cities in the state (aside from Bend and Medford).

We can use a similar framework to think about general highway tolling. This type of user fee is traditionally in the State's jurisdiction to fund inter-city projects, most notably highways. Again, tolls are used as an attempt to ensure that individuals pay a rough proportion of how much they use the public good[8]. Variations of highway tolls have been used since the early 20th century; today you can find toll road projects with any mix of public and private financial backing. Most of these projects are in the Northeast, where a dense population means sufficient traffic to cover the costs associated with constructing, maintaining, and managing the tolls.[9]

Local Option Tax

A Local Option Transportation Tax, broadly defined, is a tax that varies intrastate, whose revenues are controlled at the local level and designated for transportation-related services. Often these taxes are approved by referendum, time-limited, and are attached to narrowly defined projects such as renovating an old bridge[10]. These taxes can be implemented by a variety of fees that are often used in tandem.

4 Santos, G. (2005). Urban congestion charging: a comparison between London and Singapore. Transport Reviews, 25(5), 511-534.
5 Transport For London (TFP) (2019). Congestion Charge. https://tfl.gov.uk/modes/driving/congestion-charge
6 Leape, J. (2006). The London congestion charge. Journal of Economic Perspectives, 20(4), 157-176.
7 U.S. Census Bureau; American Community Survey, 2015 American Community Survey 5-Year Estimates, Table B08121; American FactFinder; https://factfinder.census.gov
8 Goldman, Todd, and Martin Wachs. (2003)."A quiet revolution in transportation finance: The rise of local option transportation taxes." University of California Transportation Center. .
9 Kirk, R. (2016). Tolling U.S. Highways. *Congressional Research Service.*
10 Goldman, T., Corbett, S., & Wachs, M. (2001). Local Option Transportation Taxes in the United States (Part One and Two). University of California Transportation Center.

A fuel tax is an example of a common local transportation tax. This type of taxation has been the chief revenue source for building and operating roads throughout the U.S., and is frequently used due to its ease of administration and its direct connection to road users[11]. Both cities and counties have the power to levy fuel taxes; and in Oregon the constitution dictates that revenues generated by such taxes must be used for the construction and maintenance of highways, roads, and streets[12]. Two counties (Multnomah and Washington) and an additional 27 cities have adopted these taxes with the required voter approval[13]. Local fuel taxes have shown to be a sound long-term source of revenue for routine transportation projects. However, increasing fuel efficiency and stagnant revenues with respect to inflation make it nearly impossible to raise enough revenue for major infrastructure investments through fuel taxes alone[14]. For this reason, local governments tend to employ a range of different local option taxes in order to piece together significant funding for transportation projects. These categories of local option transportation taxes will be discussed briefly in later sections and include, property, sales, and income taxes. A fourth option, a vehicle registration fee, will be discussed in detail in its own section.

Property taxes have long been the primary source of funding for local government in the U.S., and until the 1920's this included transportation services. Much of this rationale came from the idea that property is not worth much if people cannot get to it. It was not until the rise of motor vehicles that states and federal governments began to play a more central role in funding transportation projects[15]. Today many communities, including 19 counties and 16 cities in Oregon, are reversing this trend and adding a line-item property tax for local and county roads[16].

Sales taxes have become the most commonly used local option transportation tax throughout the U.S.. Sales taxes are a non-user fee and are relatively more lucrative for precisely this reason: because they are applied to the general population they have a broader base to generate revenues from, so a small percentage increase contributes more to local projects than a larger increase in, say, a fuel tax[17]. Sales taxes tend to be more palatable to tax payers because, while they are frequent, they remain small and are rarely thought of in aggregate terms. Their popularity (and more generally local option taxes as a whole) as a tool for funding local transportation projects can be attributed to the following characteristics: direct voter support, the finite nature of the tax, explicitly laid out projects, and local control over the revenues. The disadvantages of this kind of tax are the disincentives it places on consumption (and local business growth), and its unequal nature. Like the congestion tax, a sale tax is regressive by definition, as lower income individuals pay a higher percentage of their income toward the tax. Issues of horizontal equity also arise with sales tax for transportation projects because unlike the congestion tax, they are a non-user fee. This disconnect between the consumption of transportation

[11] Wachs, M. (2003). Local option transportation taxes: devolution as revolution. *Institute of Transportation Studies.*
[12] Goldman et al., 2001.
[13] Legislative Policy and Research Office (LPRO). (2016). Funding Transportation: Background Brief. Oregon Legislature.
[14] Schweitzer, L., & Taylor, B. D. (2008). Just pricing: the distributional effects of congestion pricing and sales taxes. Transportation, 35(6), 797-
[15] Wachs, 2003.
[16] Goldman, et al., 2001.
[17] Wachs, 2003.

services from the prices paid for travel discourages travelers from considering the full cost of driving, including road wear but also less palpable costs like congestion and emissions.

Of all the variants of local option transportation taxes, the use of income or payroll taxes is the most limited. Oregon is one of four states to have adopted this method specifically for transportation purposes and the scope remains small, with just two areas implementing a local payroll and self-employment tax. Lane County and Tri-Met Transit Districts use their respective revenues for transit capital and operating expenses and for funding a light rail extension. Most local income taxes have a flat rate but can be adjusted to a graduated structure, rising with income, if issues of inequality arise. Closely related to the income tax is the payroll tax, which still taxes income but from the employers side. This type of tax is particularly useful for transportation projects since it ensures that commuters into a city are paying for the services they use getting to and from work.

Registration Fee

Vehicle registration fees (VRF) are the last category of transport tax examined. Every state requires vehicles to be registered and titled, what differs is how these fees are assessed. While most states use a flat or weight-based fee, there are others that calculate the tax based on value, age, or (in Missouri's case), taxable horsepower.[18] Similarly to a fuel tax or tolling system, a registration fee is a user fee in that the tax is only applied to vehicle owners (it can also be considered a form of personal property taxation).[19]

An increase in VRFs is a common way for states to raise revenues for transportation projects due to their reliability and low cost of implementation. In 2017 California passed a $52-billion transportation plan which included an increase to the flat VRF and the addition of a graduated Transportation Improvement Fee determined by vehicle market value. Over ten years these two fees are estimated to bring in $16.43 billion, to be split between state and local transportation projects.[20] While VRFs are typically mandated at the state level, they can also be used as a local option. Washington County, Oregon attempted this in 2014 with Measure 34-221 which was ultimately voted down at the ballot box. The Measure proposed a $30 per year fee for most passenger cars and trucks, and a $17 fee for motorcycles; this would have generated an estimated $12.8 million for the county and its incorporated cities.[21] Many other counties throughout the U.S. have successfully implemented local option VRFs; some states identify this fee as a county "wheel tax."

Depending on how the VRFs are determined, their fairness varies case by case. Where a flat fee is applied, these taxes are like their sales tax and tolling counterparts, vertically inequitable – meaning individuals in different economic situations pay the same amount. To make this type of tax more progressive some states increase the amount of tax with the value of the vehicle, the assumption being wealthier individuals tend to have more valuable cars. A general issue with VRFs is that they do not take into consideration marginal costs of driving. This means all drivers, no matter how frequently they use their vehicles and add to overall road damage, pay the same amount—some individuals shoulder a

[18] National Conference of State Legislatures (NCSL) (2017). Vehicle Registration Fees By State. State-by-State Table.
[19] Wachs, 2003.
[20] McGreevy, P., & Kim, K. (2017). What Californians need to know about the state's $52-billion transportation plan. Los Angeles Times.
[21] Land Use and Transportation (LUT) (2014). *Ballot Measure 34-221.* Washington County, Oregon.

greater burden than their vehicle use entails, while others do not pay enough. Another concern with increasing the fee is the potential for more users to go unregistered.[22]

Comparison

Each of these tax options are unique in what advantages and disadvantages they bring to the table. The most common concerns encompass how efficient and equitable these fees are. Are the taxes incentivizing the desired behavior without too much distortion? Do they treat individuals with different level of income proportionally and those with similar levels of income similarly? Does transportation spending in each jurisdiction match the revenues collected by that area?

Nearly all transportation funding debates concern equity, yet equity is defined differently for different situations, and in general equity is considered a question of degree rather than an absolute[23]. From the categories discussed earlier, local option income taxes are the most progressive, as the highest earners pay the biggest share of the aggregate tax. Income taxes are also by definition equitable across households with similar levels of income. However in terms of transportation these taxes could be deemed unfair as they tax all earners regardless of their road use. All other tax options discussed are regressive, with VRF increases based on value being only moderately regressive[24]. Congestion and general tolling, while still regressive with respect to income, are desirable because of their direct correlation to road use. This ties the cost of road maintenance directly to the user in proportion to how often they actually use the commodity. It is arguable that tolling is the optimal choice if the objective is to internalize the social cost of driving, but regardless, it is important to prioritize equity criterions to justify inevitable tradeoffs from one policy to another.

ODOT HCAS

The Oregon Department of Transportation conducts biennial cost allocation studies that determine the relative burdens of light (10,000 pounds or less) and heavy (greater than 10,000 pounds) vehicle traffic and subsequently matches those values to taxes and fees assessed on said vehicle categories. The purpose of this exercise is to determine whether or not each vehicle type is taxed in accordance with the wear and tear that it imposes on the state highway system, and secondly, to make recommendations to correct any imbalance in cost responsibility and assessed taxes and fees.

Methodology

The Oregon Highway Cost Allocation Study (HCAS) uses the cost-occasioned approach, described above: vehicles are taxed in accordance with imposed wear and tear rather than the alternative benefits approach, which would seek to quantify benefits enjoyed by each class. The latter requires broad assumptions that might prove inappropriate (given the potentially differing utility values of a mile traveled even within vehicle weight classes), and does not directly address the way that fees can be used to optimize resource allocation. When considering these costs, said reports use expenditures by the state rather than estimated costs, as expenditures are clearly verifiable and do not entail the same

[22] Texas A&M Transportation Institute (TAMU) (2013). State Vehicle Registration Fees. *Mobility Investment Priorities.*
[23] Levinson, D. (2010). Equity effects of road pricing: A review. Transport Reviews, 30(1), 33-57
[24] Goldman, et al., 2001.

quantifying challenges that a "total cost" approach would require. Data is collected for a base year (in the most recent report, this was 2015) and projected forwards to obtain values for the forecast year (in the same report, that year is 2018).

Five types of data are required for this study, listed below and accompanied by base year source:

1. Traffic data: how many vehicle miles are traveled by each vehicle class on each road system considered. (Oregon Department of Transportation [base year], Oregon Office of Economic Analysis [forecast modifiers])
2. Expenditure data: Projected spending on construction by work type, road system, and funding source (and in other categories by funding source only). (ODOT)
3. Revenue data: Predicted revenues by tax or other revenue source. (ODOT)
4. Allocation factors: Various attributes used to determine what share of an expenditure should be borne by which vehicle class. (NAPCOM model)
5. Conversion factors and distributions: methods for converting measures as required. (Various)

Expenditures imposed by various vehicles weights are estimated using Roger Mingo's National Pavement Cost model (NAPCOM), which has been modified for use in Oregon. (Unlike in other states, Oregon uses weight increments of 2,000 rather than the standard 5,000 pounds.) Said expenditures are considered on an incremental basis: additional increments of infrastructure or improvement are allocated only to the vehicle class predicted to require the additional use, on the basis of vehicle miles traveled by that class (for the most part; exceptions exist where practical).

The purpose of this report, as previously described, is to explore the challenges that introducing a local revenue source would pose with respect the revenue-expenditure ratio created in the HCAS. See *Local Revenue and the HCAS* below for a detailed description of how local revenues are included and used in the calculation.

2017-2019 Biennium Results

The most recent HCAS, conducted by private economic consulting firm EcoNorthwest, finds that full-fee-paying light vehicles will contribute 64.46% of state highway user revenues under the current tax structure, with the remaining 35.54% falling to heavy vehicles. In contrast, estimates of wear and tear over that period indicate that light vehicles should pay 63.98% of highway costs, while heavy vehicles should shoulder the remaining 36.02%. In other words, heavy vehicles as a class are projected to underpay their fair share by 1.35%, while light vehicles overpay by 0.76%. In order for vehicle classes to pay commensurate to highway wear and tear, an adjustment will be necessary, in order to bring the ratio of costs to paid revenues (defined as the equity ratio) back toward the desired value of one (meaning that costs imposed and taxes paid are equivalent). Closer examination shows that within the heavy vehicle class, some weights overpay and some underpay, and alternative fee schedules to correct this "cross-subsidization" are explored.

Local Revenue and the HCAS

The purpose of this report is to explore the challenges that enacting one of the revenue collection mechanisms described in the *Revenue Collection* section above would pose in calculating an accurate

HCAS ratio. This section will describe when such revenues are included, and how regionally-generated local revenues might pose either explicit or implicit problems for the HCAS model and process

While not all local revenues are included in the HCAS calculations, those which are fungible with state revenues do enter the revenue-expenditure ratio. Federal revenues are likewise included when fungible with state revenues. Additionally, some local restricted funds that free up unrestricted funds are included. The data for such local expenditures are derived from the Local Roads and Streets Survey (LRSS), and projected forwards for use in the HCAS.

Challenges in Including Local Revenues

Under the current methodology for the HCAS, there are a number of issues that including local revenues will pose by either resulting in a biased ratio, or by altering the value of said ratio away from the goal of equity (a value close to one). These are briefly summarized below, and expanded upon in the following section

1. Regional Challenges: Some regional collection methods, like registration fee increases or some forms of tax, are assessed to different vehicle classes. Others, like tolling, will impact different vehicle classes because the mix varies on different road types, and, for example, in urban vs. rural areas. These types of concerns are the most significant, and therefore we dedicate the most time to them.
2. Additional Challenges
    a. Tax Avoidance: While this is currently recognized and dealt with under the current HCAS methodology, it will remain an issue under regional approaches, and assessing avoidance on a regional level (especially considering the challenges mentioned above) will pose different challenges.
    b. Forecasting: Revenues and Expenditures are prospective measures and thus forecasted for upcoming bienniums. Local revenues are often forecast, but not always, so assessing and creating projections will require additional labor.

There are two ways that a regional tax or fee could impact the HCAS, depending on whether or not they are included: either explicitly, by altering the ratio's value and tilting the balance between light and heavy vehicle revenues and expenditures; or implicitly, by changing the real revenue-expenditure balance while leaving the ratio calculation untouched.

Revenues are attributed in the HCAS model using vehicle miles traveled (VMT) by weight class and number of axles-- meaning that the ratio is vulnerable to bias whenever impacts differ in their local intensity. For instance, a change in registration fees within a single county would enter the model as an increase in revenues from each vehicle class, split proportionately across the state according to the previously-discussed factors. If that county had a different proportion of a certain vehicle class, the new revenue would not show up as an increase in revenues to that vehicle class, but would rather be distributed according to the proportions recorded in the state as a whole. This is the core issue with the HCAS methodology and institution of local transportation revenue collection options: the current methodology attributes revenues across the state, rather than for different localities.

Generally speaking, if funds are collected in a certain area, for example in a metropolitan region, then the vehicle mix from which they are collected might be biased—for example, light vehicles make up 90.9% of urban interstate vehicle miles traveled but 80.1% of rural interstate travel. A policy that charges for urban interstate use would draw more revenue from light vehicles, without necessarily allocating said revenue appropriately. Under current policy, this would result in a biased ratio, where revenues not included in the HCAS calculation and collected mainly from light vehicles are missing from the equation (meaning that the value of expenditures to revenues is artificially low, as there are revenues missing from the light vehicle share).

Similarly, the mechanism used to collect revenue can be biased with respect to vehicle class as well, whether by design (e.g., an increased registration fee for either light or heavy vehicles) or by default (in the case of a local option tax on certain users, which differentially impacts vehicle classes).

If revenues are in fact included, then the value of the ratio itself is altered.[25] In order to bring it back into alignment, it is necessary to either increase revenue collections from the other vehicle class (obviously not a sensible solution), or increase expenditures related to that vehicle class (also not reasonable).

Even if a revenue collection mechanism does not target a particular geographic area, other classifications pose the same issues: vehicle mix differs in urban vs. rural areas, on highways vs. roads, and on interstate vs. intrastate routes. See Table 1, below, for shares of vehicle miles traveled by road system, as projected for 2018 in the 2017-2019 HCAS.

Table 1: Projected 2018 VMT by Road System

Road system	Total VMT (millions)	Percent Light Vehicle	Percent Heavy Vehicle
State Roads	22,739	89.6%	10.4%
Urban Interstate	5,984	90.9%	9.1%
Rural Interstate	4,066	80.1%	19.9%
Urban Other	6,628	94.1%	5.9%
Rural Other	6,060	89.8%	10.2%
Local Roads	15,796	95.7%	4.3%
Country Roads	8,424	94.8%	5.2%
City Streets	7,372	96.7%	3.3%
Total All Roads	**38,771**	**92.1%**	**7.9%**

Regional Issues Case Study

The following example serve to illustrate how including the regional fees would impact the equity ratios in the HCAS. It is assumed that there are no measurement errors, and all local revenues are included (avoiding implicit bias); therefore the purpose of this exercise is to demonstrate that even in a case where all data can be obtained and the equity ratio approach is faithfully followed, said ratios are still impacted. (The spreadsheet used in Tables 2-5 is available from NERC as an addendum to this report.)

[25] Dan Porter paper

We start with a set of amounts to reflect revenues and expenditures from a hypothetical HCAS. It is assumed that light vehicles are attributed twice the revenues and expenditures of heavy vehicles. (These dollar amounts do somewhat reflect the actual numbers from the most recent HCAS, in that light vehicles are attributed more revenues and expenditures than heavy vehicles, and the total revenue amount is less than the total expenditure amount). The first example does not include additional regional fees and the equity ratios are the ideal value of 1.0 for both light and heavy vehicles.

Table 2: Base Case Scenario

Category	Light Vehicles (≤ 10K lbs)	Heavy Vehicles (>10K lbs)	Totals
HCAS revenue	$400	$200	$600
HCAS expenditures	$600	$300	$900
HCAS revenue share	66.67%	33.33%	100%
HCAS expenditure share	66.67%	33.33%	100%
Equity ratio	**1.00**	**1.00**	**--**

The next table introduces additional regional fees of $200 million. For our example, we assume this is in an urban region. As such, we assume that all the $200 million is collected from light vehicles, possibly from an increase in fuel taxes. Also, unlike the state-wide distribution of expenditures at 66.67% light vehicles and 33.33% heavy vehicles, we assume the greater VMT of light vehicles in the urban area produces a regional expenditure mix of 80% light vehicles and 20% heavy vehicles. All the additional regional revenue is expended in the region. The example illustrates that light vehicles will now be overpaying their share while heavy vehicles are underpaying their share, as evidenced by a value of 1.09 for light vehicles, and 0.81 for heavy vehicles.

Table 3: Regional Revenue Added to Light Vehicle Revenue

Category	Light Vehicles (≤ 10K lbs)	Heavy Vehicles (>10K lbs)	Totals
Regional revenue	$200.00		$200.00
Adjusted total revenue	$600.00	$200.00	$800.00
Adjusted total expenditures	$760.00	$340.00	$1,100.00
Adjusted revenue share	75.00%	25.00%	100%
Adjusted expenditure share	69.09%	30.91%	100%
Equity ratio	**1.09**	**0.81**	--

There are various ways in which to bring the equity ratios back towards a value of 1.0. In our example above, additional regional fees could be assessed to heavy vehicles: in Table 4, note that $68.42 million in additional regional fees on heavy vehicles will bring the equity ratios back to 1.0. Of course, the ability to find that right amount of heavy vehicle fees is dependent on accurate measurements of expenditure and revenue shares. The obvious problem with this approach to rectification is that if the intent of legislative action is to raise $200 million in regional fees, there is no reason to raise an additional $68.42 million aside from balancing the ratio (which itself is not a policy goal).

Table 4: Additional Revenue Collected from Heavy Vehicles

Category	Light Vehicles (≤ 10K lbs)	Heavy Vehicles (>10K lbs)	Totals
Regional revenue	$200.00	$68.42	$268.42
Adjusted total revenue	$600.00	$268.42	$868.42
Adjusted total expenditures	$760.00	$340.00	$1,100.00
Adjusted revenue share	69.09%	30.91%	100%
Adjusted expenditure share	69.09%	30.91%	100%
Equity ratio	**1.00**	**1.00**	--

While not illustrated, rather than raise the heavy vehicle regional fees the light vehicle fees could be reduced in order to bring the equity ratios back to 1.0; clearly not a valid solution to the issue at hand.

Rather than assessing the entire additional regional fee balance to light vehicles, the $200 million could be split between light and heavy vehicles. Table 5 shows that if the $200 million is split in order to match the revenue and expenditure shares for each vehicle class, the resulting values are $152.73 million to light vehicles and $47.27 million to heavy vehicles, and the equity ratios are maintained at 1.0.

Table 5: Regional Revenue Split According to Vehicle Class Share

Category	Light Vehicles (≤ 10K lbs)	Heavy Vehicles (>10K lbs)	Totals
Regional revenue	$152.73	$47.27	$200.00
Adjusted total revenue	$552.73	$247.27	$800.00
Adjusted total expenditures	$760.00	$340.00	$1,100.00
Adjusted revenue share	69.09%	30.91%	100%
Adjusted expenditure share	69.09%	30.91%	100%
Equity ratio	**1.00**	**1.00**	--

Additional Challenges

While most of the challenges related to the calculation of the HCAS ratio under regional revenue collection schemes can be summed up as differential impacts to vehicle class (either by location or design), there are some which cannot. These are summarized below.

Tax avoidance

Oregon has a fuel tax paid at the pump, and the HCAS accounts for tax evasion via out-of-state gas purchases at a uniform 3.5% of vehicles miles traveled within the state. If regional HCAS values are calculated, it may be most reasonable to alter this flat rate, assuming increased avoidance in border regions and perhaps regions that draw a higher number of out-of-state visitors. If these evasion rates need to be estimated separately, that constitutes a new challenge.

Additionally, the International Fuels Tax Agreement dictates how to ensure that fuel taxes are appropriately allocated by interstate trucking companies when they buy fuel in one state and then travel to another, by either collecting or disbursing relevant funds. This process occurs on a statewide rather than regional basis, posing another issue for regional HCAS collection.

Forecasting

One potential solution to the problems posed by different vehicle mixes across regions is to calculate regional HCAS values, in order to ensure that expenditures and revenues for light and heavy vehicles are in balance. However, this would be difficult, as revenues are currently included in the model on a state basis, rather than locally. Much of the necessary expenditure data is already available on a more granular level, but the revenue forecast is not. Each local revenue source included would require a projection, and if the locality in question does not forecast these values, it would fall to ODOT to do so. In fact, even the data which is available at a more local level (for example, local revenues from the Local Road and Street Survey) would require parsing, entailing increased labor. Similarly, vehicle miles traveled (VMT) by road system and vehicle class, while collected on an extremely granular level using Automatic Traffic Recorders (ATRs), are processed within the model on a statewide basis.

Conclusion

This report outlines the challenges that instituting local revenue collection mechanisms poses for the Oregon Department of Transportation's Highway Cost Allocation Study. According to the state's constitution, revenues collected from light and heavy vehicle classes must be in proportion to the expenditures imposed by each. When local revenues are introduced, differentials in the impacts to either vehicle class can create distortions in the ratio that require novel approaches to remedy. The preferred approach, which ensures that the spirit of the HCAS is embodied by the revenue-expenditure ratio that it provides, is to calculate values on a regional, rather than state, basis. However, this approach poses its own problems, which range from increased labor to insufficient data. While recommendations are beyond the scope of this report, challenges are summarized below.

Differential impacts to vehicle classes due to:

- Regional differences in vehicle class shares
- Revenue collection method
- Road system differences in vehicle class shares

Data challenges related to:

- Parsing data into smaller regional classifications
- Forecasting regional series

Other challenges include:

- Tax avoidance and evasion methodology
- Increased labor required to conduct multiple regional HCASs

NeRC