

**Financing the American Road-Trip:
Value Capture of the Highway System**

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Abstract

Public motorways are deteriorating and currently there is no substantial legislation in place to fund the necessary repairs and improvements. This paper discusses development and current status of roadways along with viable public policy that will enable identifiable, accountable parties to perform required work whom also benefit from Highway maintenance and expansion. Examined policy includes but is not limited to: Highway Trust Fund, fuel tax, land value taxation, value capture, mileage-use taxation, and infrastructure banking.

Introduction and Importance

Invention of the motor vehicle in the late 1800's led to roads becoming vital as people began to travel more than 60 miles in a day. Being able to travel farther and with heavier loads than was possible with horse carriage opened up numerous avenues. Roads began to expand and develop as the motor truck moved around two billion tons of freight annually, meeting a definite need and gaining special importance (Grupp, 1924, p. 15). Railroads at the time were the main method of hauling freight but "requires a relatively larger investment of capital" and many businesses did not have tonnage to be hauled, plus rails were un-adaptive in delivery locations requiring further coordination in order to get material from factory to consumer; trucks offered a middle ground allowing for smaller shipments and less capital investment realizing higher profits thus increasing competitiveness (ibis, p. 274). Development of cheap transportation "permits other goods to be brought in, so that the products of other lands and climes may become as commonplace as the articles produced at home", trucks and roads allowed for additional goods to be delivered across the nation as more companies were able to compete and enter the market place (Locklin, 1960, p. 2). Through further development that decreased transportation costs, markets are able to expand and competition increased generating more accurate pricing and improved supply of goods.

Although today we recognize the popularity of vehicles, production of the motor vehicle had only entered into stride by the beginning of the First World War in 1914 "with a production of about 1,750,000 passenger cars and 125,000 trucks annually", when in 1900 only 4,000 vehicles were manufactured per year and by "1909, 10,000 vehicles were produced by a single company" which is when major legislation began cultivating what is now recognizable as United States highway system (Healy, 1940, p. 16). In modern times the vehicle has become

synonymous with everyday American life, but one major element has begun to fail, the roads and bridges upon which are heavily relied have continued to deteriorate. The Subcommittee on Highways and Transit found that “if no additional investment in our nation’s highways is made, congestion would be more acute in urban areas where delays are projected to grow by more than one-half by 2020, more than double by 2035, and quadruple by 2055”; in 2007 delay estimates equal “an all-time high of 4.2 billion hours of travel delay” (2008, p. 3). Roads are public goods, a privilege that not any one entity is responsible for and yet is available to all. Whom should be expected to develop and maintain an asset which is valued by corporations, small business owners, commuters, and travelers alike? Delays caused by congestion and degradation of roads create market inefficiencies that hamper economic advances in production. Highways, interchanges, and roadways have largely all been developed, primarily leaving upkeep and improvements to be funded. Resources used over the decades of highway use have begun to change dramatically as typical petroleum fueled vehicles such as trucks, busses, and family vehicles alike are becoming more efficient or electric, causing previous methods of raising funds, namely the fuel tax, to be outmoded demanding that legislation change in order to keep motorways in good working order as a public good.

Remaining sections of this paper will address the history and development of the highway system along with the current road conditions. Discussion of road conditions will also describe possible ways to better anticipate breakdown of motorway surfaces. Following analysis will cover current traditional policy along with more progressive use of public transit legislation and finally conclude.

Road Conditions

With the popularization of bicycling in 1890, the first “campaign of education for ‘good roads’” began and was soon joined by farmers that recognized “it might be to their benefit” (Healy, 1940, p. 118). The campaign has since continued and evolved as more entities encouraged use of the best kept roads to increase efficiency of deliveries and travel. In Grupp’s book, *Economics of Motor Transportation*, he suggests to use “the most level and the best-kept roads should be chosen for the route of a vehicle” which can become problematic as distances increase because there is not the same certainty that comes with railway track surfaces, grades, curves, bridges and grade crossings (1924, p. 152). Fostering use of best kept roads then increases the demand on those roads speeding the dilapidation of the good requiring maintenance sooner. Grupp further inspires road construction to not only be built for road traffic of today but for road traffic of the next century (ibis, p. 322). Preparation of building thoroughfares for tomorrow raises the debate of higher initial sunk costs today with lower maintenance costs later or the opposite. In 1940’s dollars, “it may pay to have high first-cost concrete surfaces which require only \$68 per mile per year to maintain, rather than to build low first-cost oil-bound macadam roads which cost, even under light traffic conditions, as much as \$200 per mile per year” in maintenance (Healy, 1940, p. 145). Currently there is debate on how to best estimate future costs and accurately predict when roads will become so decrepit that they must be rejuvenated.

Ahmed et al. is one such group that wished to address the dilemma of appraising the Pavement Distress Index (DI) to accurately determine when the remaining service life of the pavement was nearing zero. They engineered a computation to determine when pavement rehabilitation is necessary, establishing different service lives for the particular types of roadways enabling more accurate predictions for Pavement Management Systems (Ahmed, Abu-

Lebdeh, & Lyles, 2006). Accurate quantitative predictions similar to these are necessary for financial and policy planning which would empower authorities to better allocate need of resources. Per a United States Congress Subcommittee, in an evaluation of vehicle miles traveled “(drawn primarily from 2004 data), only 72.4 percent...was on pavement with acceptable ride quality, while 26.7 percent of urban bridges are deficient” (Subcommittee on Highways and Transit, 2008, p. 2). These data along with the high capital costs of revitalizing the bridges and roadways calls for better management and legislation which would enable competent construction and reparation of this high demand public good.

Chad Shirley’s (2011, p. 6) *Economic and Budget Issue Brief* to the Congressional Budget Office estimates that:

“Passenger vehicles’ contribution to traffic congestion in urban areas imposes estimated costs of about 10 cents per mile, constituting one of the largest sources of external costs of motor vehicle use. Estimates of pavement damage by trucks, the largest per-mile external cost of truck use, range from about 5 to 55 cents per mile depending on the weight of the truck, the number of axles over which its weight is distributed, and where it operates.”

These valuations that determine the effect of different types of vehicles on road conditions along with their negative impact on society caused by congestion, air pollution, and reliance on foreign oil it makes sense that government would choose to deter congestion of roads by taxing fuel. As the population continues to be highly mobile and reliant on economical transportation in order to receive goods and travel, along with motor vehicles evolution of becoming less fuel-reliant, the deterrent of fuel tax is no longer satisfactory in cultivating funding for continual maintenance of

roads and bridges. The cost of highways, although partially tied to the use of the roads, also includes aging and weathering which “are fixed and would accrue regardless of how much a road is used” (Beider, 2011). Otherwise some would recommend a higher taxation on trucks creating motivation to further invest in railways and divest in highways, as rails are more capable of traveling with larger loads and do not cause some of the negative side-effects that semi-trucks have on our highways quality congestion and pollution.

Legislation

“What is needed is reasonable and constructive legislation which will be a benefit to the public at large, and an aid in the development of motor transportation” (Grupp, 1924, p. 322). 1921 saw the creation of the Federal Highway Act which provided for federal funding for improvement of “the most important highways in the state, i.e., the main channels of highway traffic” (Locklin, 1960, p. 614). This initial act allowed for the collection of taxes based on the amount of gas purchased, while limiting the use of the funds. Data and figures from 1938 indicated that “relative to the highway the railroad is still the dominate long-haul carrier” but as production and use of vehicles increased so did the demand for more extensive and well-kept roads that would allow for passengers and freight to travel more easily (Alexander III, 1975, p. 35). Extensions to the Federal-Aid Highway Act occurred in 1944 and 1957 which allowed for additional funding for “principal secondary and feeder roads, including farm-to-market roads, rural free delivery mail and public school bus routes” (Locklin, 1960, p. 615). The Federal-Aid Highway Act of 1944 additionally allowed routes to be created, updated, and maintained in order to increase the national defense by connecting “principal metropolitan areas, cities, and industrial centers”, these routes are now commonly known as the Interstate System and “are the most heavily traveled highways in the country” (p. 615). These supported roads were to be funded singularly through gas taxation at the pump. With the advent of hybrids and electric cars this

funding source is significantly threatened as “hybrids, use the roads at a sharp discount, and electric cars use it for free” (Glazier, 2012).

“Highway-user taxes consist principally of gasoline and other motor-fuel taxes, motor-vehicle registration fees, and ton-mile or some other form of weight-mile tax imposed on motor trucks by a few states”, fuel tax is the most significant form of taxation, raising almost \$2.9 billion in 1957 (Locklin, 1960, p. 619). These general, almost standard across the nation, fundraising tactics are significant as they are not limited to specific counties, but aggregate funds based upon use of the public good. Batt (2001, p. 207) states:

“Over the years, there have been instances when the Highway Trust Fund was overflowing with money; other times, it has failed to cover even basic costs. In recent years, there has been a general recognition that maintenance has not been addressed in a timely way and has led to a general deterioration of the roads and bridges that are part of the system.”

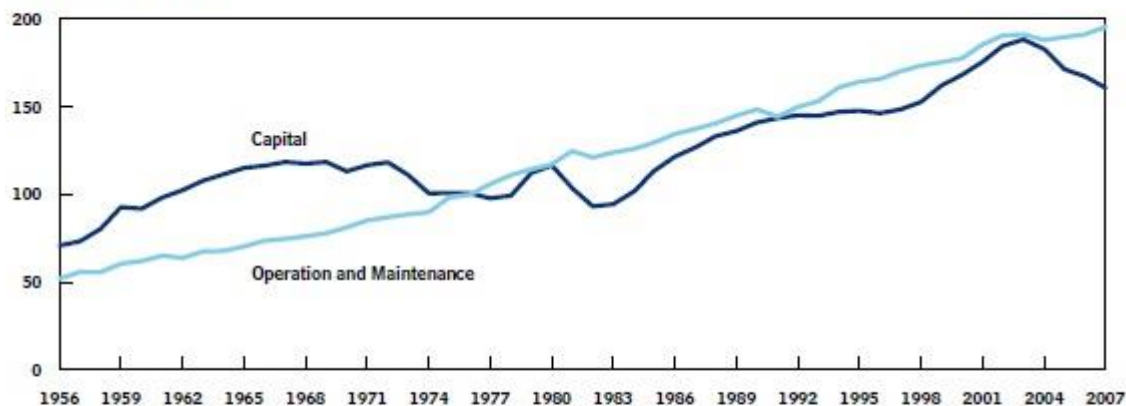
Meaning that the nation has either overextended its' capital expenditures and can no longer offer roads as a public good or that as a nation we need to restructure how to fund and manage the road system. In the period between 2003 and 2007 public spending on transportation and water infrastructure declined by 6%, where spending on highways “accounted for 43 percent of expenditures for transportation and water infrastructure in 2007” (Musick, 2010, pp. ix-x). The decrease in spending in this area is mainly due to a “sharp increase in prices for materials used to build such infrastructure...that outpaced the growth of nominal spending on those types of infrastructure” (ibis, pp. ix).

Traditional Taxation and Funding

America's historic Federal Highway Act, which initially set up the Highway Trust Fund where the majority of the fuel sales tax is deposited, created a tradition of how to fund our public roads for future generations. As supplementary acts, which helped restore the Fund to significant financial levels ended due to time constraints placed on them, Congress and agencies nationwide have been scrambling to develop programs that would restore financing to manage highways. One such act that has since expired was a measure in 2005 where Wilson [President and CEO of National Stone, Sand and Gravel Association notes it "would require local grant recipients to provide matching funds and protects the Highway Trust Fund from raids, has the potential of generating more than \$171 billion in economic activity across the country" (Hernan). The raids mentioned by Wilson reflect the fact that some money is malapportioned to unessential projects or sequestrations by other departments in need of emergency funding. Recently the

Total Public Spending for Transportation and Water Infrastructure: Expenditures for Capital and Related Operation and Maintenance, 1956 to 2007

(Billions of 2009 dollars)



Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Capital spending includes the purchase, construction, rehabilitation, or improvement of physical assets, such as land, facilities, and equipment. The remaining portion of public expenditures consists of noncapital outlays—primarily for the operation and maintenance of physical assets. When calculating spending for operation and maintenance, CBO also includes spending on investment in intangible assets (for instance, for research and development), as well as expenditures for administrative activities and public outreach (such as educational and safety programs).

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

Figure 1: source: (Musick, 2010, p. 12)

United States government has been working through many fiscal measures that have been extended over the short-term while trying to find long-term solutions. Politicians and citizens have been wading through these issues. Mr. Simonson, managing director of corporate and government ratings at Standard & Poor's mentioned that "so many entities have put these projects on hold; and you can only put infrastructure on hold for so long' The size of infrastructure transactions typically starts at \$150m and goes up quickly from there" (as seen in Figure 1) (Miller, 2010). Large financing is necessary in order to address many of the smaller projects; when States are trying to fill the funding gap created by weakening federal fuel tax revenues they end up leaning more on "public-private partnerships or 'P3' deals where by private firms invest in transportation projects alongside state and local governments, using tolls to collect a return" directly charging drivers for the use and thus removing the road as a public good by limiting admittance (Kilcarr, 2013). One of Fitch's directors, Emma Griffith stated that "Federal funding to state DOTs is down 22%, including a 7% cut due to sequestration" which is a significant dip in the funding previously provided for such projects as road upkeep and forcing local governments to find and utilize other financing options not at the federal level (Kilcarr, 2013). As seen in Figure 1, the cost of capital investment, that is the building of roads, has varied quite significantly due to changing costs of materials, need and motivation to build new motorways. On the other hand, the costs of maintaining the roads we already have has steadily increased over time developing a consistent demand of financing to ensure quality of the shared good. Responsibility of the civic benefit can be said from "the point of view of economic

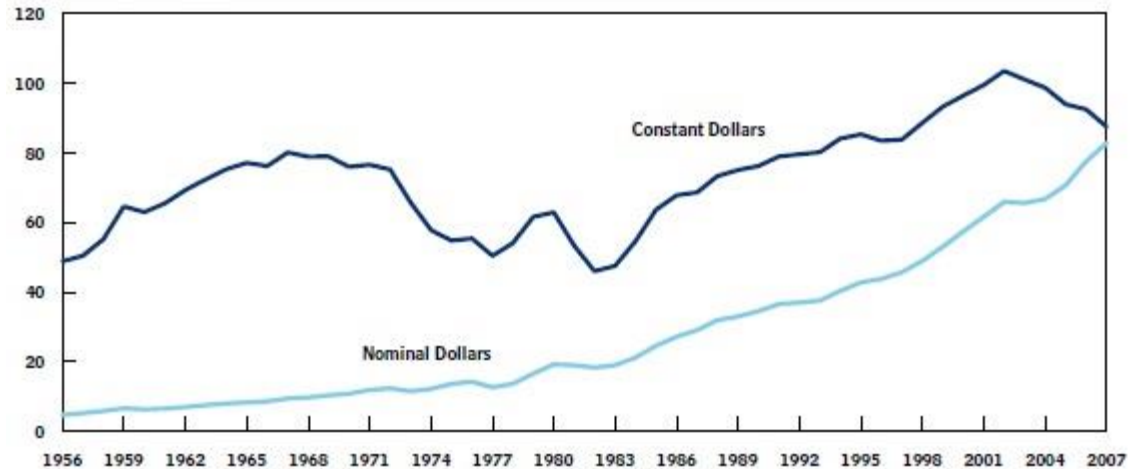
efficiency, decision-making authority is best placed with those who have the incentive (along with the information) to weigh all of the costs and benefits of the decisions” (Shirley, 2011, p. 1).

Propositions that deviate away from increasing the current fuel tax suggest re-allocating previously promised infrastructure funds, leveraging private funds through a federal infrastructure bank, through oil drilling, and mileage-based taxation. The American Energy and Infrastructure Jobs Act would “draw mainly from the beleaguered highway trust fund, which is supported by federal gas tax revenues ... [while] also looking to come up with additional funding through expanded domestic oil drilling” (Glazier & Hume, 2012). It would continue the current fund while trying to gain funding from a dis-incentivized drilling of oil, as many vehicle manufactures are being urged to develop more fuel-efficient, green, and electric modes of transportation reducing reliance on the non-renewable oil resource. By continuing to cling to waning taxation of oil to help fund dilapidated roads the inevitable is only pushed off a couple

years and not fully addressing the larger issue. President Obama’s proposed transportation

Total Public Spending for Highway Capital, in Constant and Nominal Dollars, 1956 to 2007

(Billions of 2009 dollars)



Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

Capital spending includes the purchase, construction, rehabilitation, or improvement of physical assets, such as land, facilities, and equipment.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009. Spending expressed in nominal dollars indicates the amount of spending over a given period without an adjustment for inflation.

Figure 2: source: (Musick, 2010, p. 6)

funding comes from “a six-year highway-transit bill jump-started with \$50 billion and proposes an infrastructure bank to leverage private funds. Promis[ing] that all work will be ‘fully paid for’” (Ichniowski, 2011). While this promise sounds dreamy, previous attempts to induce demand of private funding creates indebtedness that places a larger strain on the nation’s looming deficit. Difficulty with leveraging private funds is that they must offer returns in order to incentivize purchase, thus they are provided with “expectation of future returns, which must be paid later by highway users or taxpayers” (Shirley, 2011, p. 5). In short, private funds only solve the short term problem of financing and do not create a long-term solution of backing our public roads. Another typical proposition to garnish more funding for infrastructure suggests that “states should turn to a nationally interoperable mileage-based tax system, utilizing GPS technology to determine how much tax drivers should pay at the pump. The system should allow

the machines to read the mileage, but not obtain detailed information about drivers' habits" (Glazier, 2012). Again relying on drivers to eventually making it to a pump, but with the emergence of electric car the inevitability of operators ending up at a fuel pump is less likely as that pump can now be located in their garage making it more difficult for taxes to be collected based on mileage. Bill Graves, American Trucking Associations President and CEO stated that "the fuel tax is the most direct and sustainable way of addressing this shortfall [in funding the Highway Trust Fund] rather than other, less traditional financing schemes" (Cullen, 2013). Looping back to the previously effective Highway Trust Fund, the financing of our motorway's needs to become more adaptive as metropolises continue to merge, change, and vehicular economies change.

Value Capture

“Although the interstate highway system is essentially complete and the only further costs involved for the most part are in its maintenance, value capture offers a convincing approach in ensuring that the highway system will remain adequate to serve motor vehicle needs for the indefinite future” (Batt, 2001, p. 196). Value capture would allow for the parcels of land surrounding highways to be rented by the authorities in order to invest in projects to compliment transit or fix problems that arose and regain finances to fund the highway system. “Were owners to relinquish these unearned value increments, they would incur no loss on their original capital investment. But retaining this speculative gain is actually receiving a publicly created benefit” (Smith & Gihring, 2006, p. 752). Renting the land that appreciates due to its easy accessibility created by the additional infrastructure allows the rent or tax to increase as the land value increases allowing for further debt to be paid off and the upkeep of the road to continue. Land values within walking distance or within a quarter of a mile have been seen to increase by up to “25 percent as a direct result of public investment in transit” (Batt, 2001, p. 209). Rent is similar

Implications of Fuel Taxes and VMT Taxes

	Equity			Efficiency			
	User Pays	Larger Relative Burden on Low-Income People ^a	Larger Relative Burden on People in Rural Areas	Address Fuel-Related Costs ^b	Address Mileage-Related Costs ^c	Collection Costs	Privacy Issues
Fuel Taxes	Yes	Generally, yes	Yes	Yes	Somewhat ^d	Low	No
VMT Taxes	Yes	Generally, yes, but perhaps less than fuel taxes	Yes, but less than fuel taxes	Significantly ^e	Yes	High	Yes

Note: VMT = vehicle-miles traveled.

- Some low-income people do not own motor vehicles; however, they pay fuel taxes indirectly because the prices of goods they buy reflect the goods' transportation costs.
- Fuel-related costs include greenhouse gas emissions, dependence on foreign oil, and local air pollution from trucks.
- Mileage-related costs include road wear, congestion, accidents, local air pollution from passenger vehicles, and noise.
- Fuel taxes would have proportionately less effect on miles driven than on fuel use and provide minimal incentive for users to avoid congestion or increase the number of axles on trucks they purchase.
- VMT taxes would have a proportionately equal effect on fuel use and mileage but provide no incentive for users to increase fuel efficiency.

Figure 3: source: (Beider, 2011, p. ix)

to “an unearned increment tax, and is based on the premise that property owners benefiting from

a government-conferred locational advantage should pay some portion of the cost of public improvements from which the added value is originally derived” (Smith & Gihring, 2006, p. 753). By placing a land-value tax (LVT) which creates a “higher tax rate on land values, it would become more costly to hold onto vacant or under-utilised (sic) sites” and decreasing “the tax rate on improvement values would engender private capital investment in building improvements” (Gihring, 2001, p. 309). Authorities capture the increased public-good value while encouraging utilization of land with increased accessibility.

Two things are necessary for value capture to be effective in funding or backing public works projects; (1) increased use or visitation to areas surrounding access points to the public good and (2) significant density of retail, parks, and other points of interest (in other words non-residential areas) (United States Government Accountability Office, 2010). As public highways connect major metropolitan centers along with areas of lower density an overall value capture taxation would allow for all influenced areas to fund and maintain the project. This is especially important as metropolises continue to develop, expand, and evolve all of which would incentivize further use of roadways and thus provides a positive feedback loop increasing surrounding parcel values.

Looking backwards on the development of a nine mile long section of highway in Albany, New York, William Batt calculated the value capture amount that could have been seen of the 307.4 affected acres compared to the total projected costs of the Northway; estimating that the land would have paid for the project over eleven times if the value capture method was used in this instance (2001, p. 217). Batt’s approximations used the cost paid to acquire the land, current value of the land using nominal dollars, and then the total cost including interest. This analysis made evident the citizens of Albany would no longer be paying the debt created by the

construction of this motorway if they had been taxed differently on the land surrounding the highway. Using the value capture taxation method funding could have been collected for this project, Northway upkeep, along with possible redistribution of funds for snow-removal, and emergency funding to other similar roadways would have been fully funded through LVT.

Forward examining approaches have endeavored to evaluate the profitability of using this method. Based upon Gihring’s tax forecast to encourage the advancement of public transit in the Greater Puget Sound area, namely Seattle; he used a LVT of 95%; “that is, 95% of the total tax rate is applied to the land assessment and 5% to the improvement assessment” and determined that “owners of intensively used parcels... would be rewarded with lower taxes” while under-utilized parcels “would see a positive tax shift of about 93%” (2001, p. 310). Land value would increase less under a two-rate tax but the tax would be able to capture more of the increase in

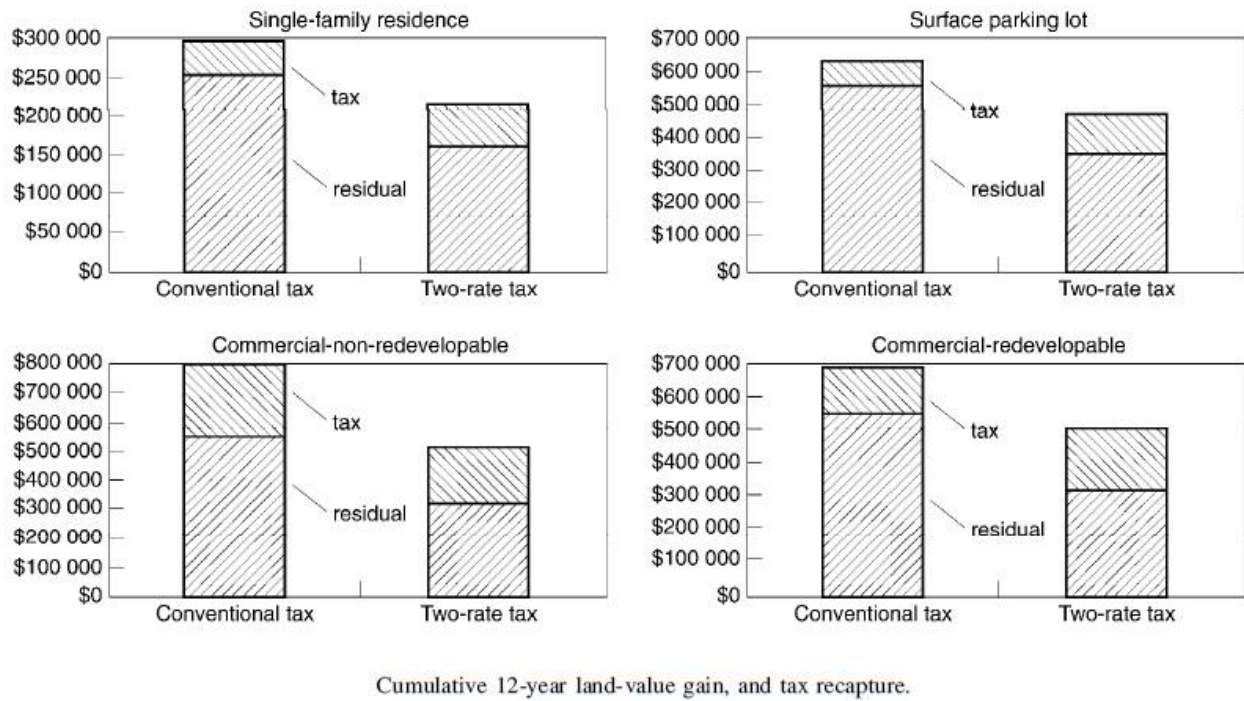


Figure 4: source: (Gihring, 2001, p. 314)

contributed worth due to location to the new infrastructure improvement project (as seen in 4,

above). Gihring’s measurement also determined that this form of land taxation would provide enticements for citizens to not speculate on land as much but encourage productive developments on the parcels.

Value capture strategies have been used to fund the development of infrastructure within metropolitan areas, where parcels are more numerous and have a higher probability of appreciation. “Special assessments, tax increment financing, and development impact fees (other value capture strategies) have not been widely used as a source of funding for transit”, only 19 of the interviewed 55 transit agencies reported using one or more of the strategies (United States Government Accountability Office, 2010, p. 17). The nineteen organizations that have used the strategies have recovered anywhere from 4% to 61% of the cost of the project (shown in Figure 5, below); these numbers are subject to increase as they are continually to collecting taxes and special assessment district funds to offset the expenditures. Seattle South Lake Union streetcar infrastructure improvement was partially funded by a special assessment district which (as of

Summary of Select Major Transit Infrastructure Projects Funded in Part Using Other Value Capture Strategies				
(Dollars in millions)				
Project name (status)	Value capture strategy(ies)	Amount of revenue generated through use of value capture strategy(ies)	Total project cost	Value capture revenue as a percentage of project costs
Atlanta Beltline (planned)	Tax increment financing	\$1,700	\$2,800	61%
Seattle South Lake Union streetcar (completed)	Special assessment district	\$25	\$53	47%
Portland streetcar (completed)	Tax increment financing and special assessment district	\$41	\$103	40%
San Francisco Transbay Transit Center (in progress)	Tax increment financing and special assessment district	\$1,400	\$4,185	33%
Washington Metro’s NY Avenue Station (completed)	Special assessment district	\$25	\$110	23%
Dulles Corridor extension (in progress)	Special assessment districts	\$730	\$5,250	14%
Los Angeles Metro Red Line, Segment One (completed)	Special assessment districts	\$130	\$1,420	9%
Seattle Bus Tunnel (completed)	Special assessment district	\$20	\$500	4%

Figure 5: source: (United States Government Accountability Office, 2010, p. 20)

2010) had recovered 47% of the total project cost. Ability for the Seattle Municipal to identify

districts in order raise funds for this improvement demonstrates that there is plausibility and effectiveness in the leveeing value capture strategies.

Use of different taxation other than fuel tax is promising as the creation and upkeep of infrastructure adds value to citizens and society by decreasing transportation costs of goods and people. Decreasing movement costs increases market efficiencies, competitiveness, and versatility. Officials report that “revenue generated from other value capture strategies varies – and typically represents one of multiple sources used to fund a transit project... – this revenue can be critical to the financial feasibility of these projects and developments” (United States Government Accountability Office, 2010, p. 21). Viability of constructing and protecting our infrastructure is necessary for the continual advance of our nation’s welfare, by ensuring lower barriers to market development and progression through lower freight and travel costs.

“Carefully selected highway infrastructure projects can enhance the economy’s performance, but realizing potential gains depends crucially on identifying economically justifiable projects” leading politicians and citizens alike to debt what is necessary to ensure continued productivity without spending in excess of the viable return (Shirley, 2011, p. 4).

Conclusion

Financing U.S. thoroughfares and increasing incentives to productively develop land as part of the public good surrounding motorways demands further utilization of value capture rents. This method is demonstrated as profitable through both hypothetical situations and actual transit infrastructure projects that employed this method. Albany, New York’s Northway would have theoretically paid for itself over eleven times in the twenty years between completion and the time of the study, rather than continually being in debt. Actual projects have been at least partially funded over the years through value capture strategies. Many of these projects were

public transit projects, such as streetcars or metro stations; in all of them the transit authorities that used the strategies stated that they were essential in funding their respective undertakings. Currently there are a limited number of agencies that use value capture strategies to help fund infrastructure projects. Implementing land base tax strategies across the country, the infrastructure of highways and roadways could be maintained in good condition without burdening citizens with more debt.

Further study, analysis, and use of value capture strategies should be continued in order to evaluate total effectiveness and other means in which to disperse more evenly the burden of financing the construction and maintenance of the large public good of highways. These studies and analyses should include forecasting models such as those performed for the Greater Puget Sound area expansion of public transportation and then compare actual outcomes that were experienced. Hypothetical analysis that look back on growth of land value to estimate the possible captured value are important in promoting the strategies but are unable to fully measure the actual improvement of the land development and its increased value due to proximity of highways by further incentivizing public usefulness of the land rather than private capital gains.

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