Enabling User-Fee Backed Transportation Finance in California

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[1] Unless otherwise indicated, all values are in US dollars.

Abstract

In California, the twin problems of congestion and funding shortages reduce quality of service on the state's highways, arterial streets, bridges, tunnels, and other fixed links. New funding solutions are needed desperately at a time when the purchasing power of the gasoline tax has fallen, construction cost inflation is mounting, and a burgeoning population is putting rising pressure on the surface transportation system. A failure to act could damage the state's competitiveness, quality of life, and global leadership position. These problems, even their contemporaneous occurrence, are not new, but current systems and processes are at or beyond maximum capacity to handle these problems. This paper reviews root cause factors that underlie these problems and puts forward a policy proposal for the establishment of the California Transportation Financing Authority (CTFA) as a method for partially alleviating the prospect of continued infrastructure decline in California and managing infrastructure resources in the future. The CTFA would have the authority to approve requests from local governments to implement user fees and would have resources to engage with local governments in "public-public partnerships" to implement user-fee backed public finance. Local governments would submit proposals to the CTFA only after gaining majority support of local citizens. User-fee backed finance could be a useful tool to finance new transportation corridors, combat congestion through demand pricing, levy fees to logistics companies and other heavy system users, and generally enhance the utilization of infrastructure resources.

Keywords

California, Congestion, Infrastructure Finance, Transportation Financing Authority, Tolling

Introduction

California's system for delivering and funding transportation infrastructure has supported the development of one of the most advanced networks of highways, byways, and thoroughfares in the world. Nonetheless, this system faces choking levels of congestion and limited funding that may constrain future development of the State, its residents, and their businesses in the 21st century. The Golden State has the technology, expertise, and, some say, money to provide superb transportation infrastructure.

Why has congestion been allowed to persist? Why do transportation budgets seem so limited? And how can the state fix these problems so that its global economic leadership position is not eroded? This paper examines these questions and proposes that user fees and user-fee backed public finance be considered as potential solutions to ensure a dedicated revenue source for transportation infrastructure and to provide congestion relief through demand-based pricing. It also proposes that a new state authority—the so-called California Transportation Finance Authority—be established to administer "public-public partnerships" with local governments that decide to charge user fees and seek revenue-backed finance.

The proposed solutions acknowledge the economic reality that California's transportation infrastructure lacks adequate funding for maintenance and improvements (there is enough funding available to do one or the other, but not both). Though politically sensitive, the proposal to introduce user fees has important environmental, public health, and greenhouse gas reduction benefits by providing congestion relief, which is a primary transportation management objective. It would also provide dedicated funding for new transportation corridors (such as freight corridors out of Los Angeles and Long Beach) that could be funded by revenue-backed bonds and would not have to compete for funding with other transportation priorities in the State.

In arriving at these conclusions, this paper examines data from recognized think tanks, the state budget, published articles and commentary specific to California, international studies on user-fee backed finance, and comments and views articulated by state senior government officials.

Here transportation infrastructure is defined as "any fixed physical asset designed for transporting people and goods including highways, arterial streets, bridges, tunnels, and mass transportation systems."[1] An often overlooked aspect of transportation infrastructure, even of the most well constructed type, is that it is a consumable asset: it has a finite life, wears out with use, and needs periodic replacement.

This paper is intended for a wide audience: state assembly members who approve major freeway and mass-transportation projects, public officials at Caltrans and local governments who are involved in project implementation, and other participants in the decision making process, including but not limited to local government agencies (such as local transit authorities), state agencies (such as Business, Transportation and Housing), regional councils (such as the Bay Area Council), nongovernmental organizations (NGOs) (such as environmental and neighborhood groups), infrastructure operators and funds, labor groups, the Treasurer's Office, the Governor's office, and taxpayers and users.

The analysis and conclusions presented in this paper were motivated by a workshop hosted by the Collaboratory for Research on Global Projects at Stanford University on October 26, 2007 entitled "Renewing California's Infrastructure: Finding A Way Forward". Attendees included representatives of Stanford University, industry firms, NGOs, the Treasurer's office, the Governor's office, other State agencies, Canadian PPP coordination agencies, and multilateral financial institutions.[2] This paper draws on the workshop, expands and elaborates some of the ideas expressed there, and adds information and ideas developed afterwards through follow-on conversations among participants.

Plenty of Financing, Insufficient Funding

For the past 25 years—a period during which California's economy and population have nearly doubled—the rate of infrastructure investment in the State has been well below the 50-year average.[3] Meanwhile, patterns of trade and production have shifted.

Before discussing the funding deficit in the context of the transportation sector in California, it is important to introduce the subtle but important distinction between the concepts of *funding* and *financing*. The term *financing* is used to describe large blocks of capital furnished by bond investors, lenders, and/or equity providers to pay for construction (or periodic maintenance) costs of infrastructure assets and that are amortized over time. In contrast *funding* describes the underlying stream of payments allocated to repay the financing provided by initial bond investors, lenders, and/or equity providers usually in recurring increments, typically monthly or quarterly, over the life of the financing arrangement, which extends typically from 5-15 years.

Broadly speaking, *funding* for both the construction and maintenance costs of infrastructure in California comes from residents and businesses. Payments are made in a variety of ways. Public utilities, such as water and power, are typically paid through user fees that support municipal bonds or other financing (including corporate financing, where services are delivered by the private sector) to build, provide, and maintain services. These user fees can be correlated closely with use, measured directly using a utility meter, and priced based on usage. Roads, tunnels, and bridges are paid for the most part through a combination of general income taxes (if paid from the State's general obligation fund), gasoline taxes, sales taxes (State and local), user fees (tolls), federal subsidies, and truck weight fees. Thus there are no free roads in California, but a tangled web of payments that provide funding.

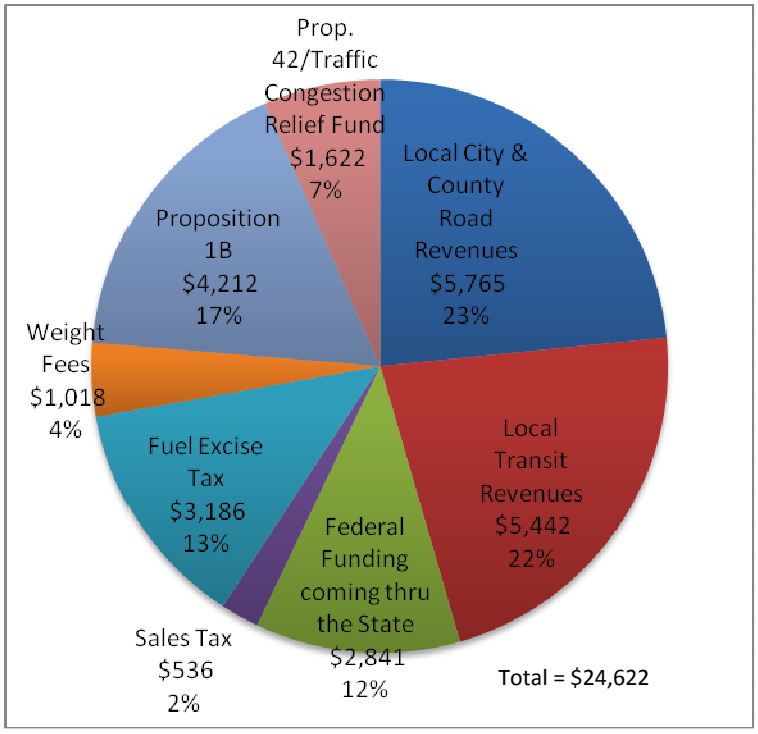
The lion's share of *financing* for California's infrastructure is raised through the sale of two kinds of bond issues. *General obligation bonds* are paid from the General Fund, the main fund for supporting state government programs such as environmental services, education, healthcare, and corrections. The primary sources of revenue for the General Fund are personal income taxes, the statewide sales tax, and bank and corporate taxes. Although issuing general obligation bonds is a very secure type of financing, there is a capacity problem: the state cannot issue too many of them or it must reduce spending on other things that voters value in order to repay the bonds. In 2006 voters approved $43 billion in general obligation bonds for transportation, water, and a variety of other infrastructure projects—a big first step in Governor Schwarzenegger's strategic growth plan for the state's economy.[4]

Revenue bonds make up the second major category of bond issue. If a state or local government has social license—i.e. broad-based support of the general public—to charge user fees, revenue bonds can be issued against those revenue streams and so not cause a reduction in spending for other programs supported by the General Fund. Of the $323 billion in bonds issued in the U.S. municipal bond market in the first nine months of 2007, two-thirds were revenue bonds backed by user fees.[5] California has a long tradition of charging user fees to pay for infrastructure services. User fees for appropriate projects are strong credits; California often uses such fees to finance water systems, wastewater and solid waste systems, airports, ports, toll roads, electric utilities, and a host of other things—with the notable exception of roads (except in a few scenarios where toll-roads have been implemented).

Most Californians agree that users should pay for water, but not everyone agrees that direct user fees should be charged for roads. The lack of user fee based funding for roads and other transportation links creates problems. Because most roads are not tolled, they cannot be financed by revenue bonds and the general fund is capacity constrained. For 20 years California has been trying to solve its transportation

funding crisis by drawing on a hodgepodge of direct and indirect funding streams. Sources of funds include Federal and state fuel excise tax, sales taxes on gasoline and diesel fuel, and sales taxes collected pursuant to local measures (many counties have voted for higher sales taxes). The state has also financed transportation with general obligation bonds pursuant to Propositions 108, 116, 1B, and for seismic retrofit, but this has not been a regular general purpose funding source. Limited revenue bonding has occurred against future federal gas tax allocations (GARVEE bonds).[6] Despite cobbling together a medley of funding sources, valued at $24,622 billion dollars in 2007-08 (see Figure 1), the staggering needs for road maintenance and rehabilitation are still not fully covered. In the 2008 Ten Year State Highway Operations and Protection Program, Caltrans identified $55 billion in system rehabilitation needs over the next ten years, but only about $25 billion in available funding—a shortfall of $3 billion a year! It is also suspected that the hodge podge based funding system is associated with higher administration costs than would be the case if funding followed a simpler format.

Figure 1. Hodgepodge of Transportation Funding Sources, 2007-08, (Dollars in Millions)



Source: Authors' calculations based on data from Department of Finance, Office of the Governor

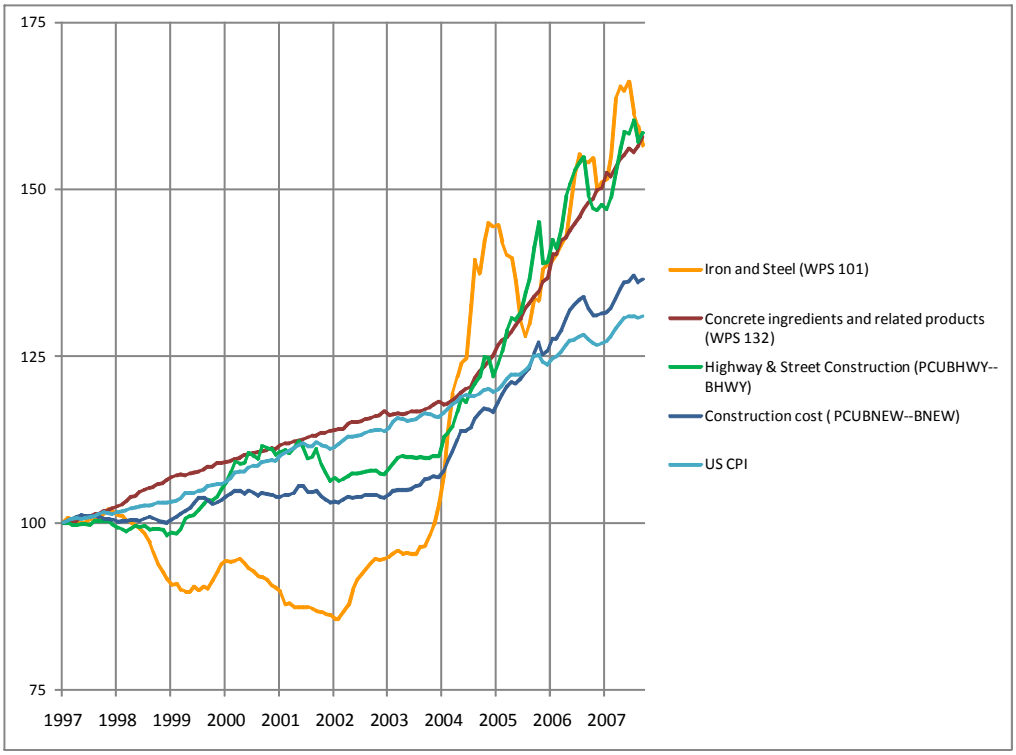
When roads are financed with general obligation bonds, they have had to compete with other General Fund priorities such as health care and education. When the first wave of infrastructure was built in California (and most Western countries), the government did not have these other non-infrastructure social spending responsibilities that it carries now. Today it would be untenable to cut education and health care spending in order to keep water bills below costs and highways free of user fees.

At one time the gas tax was largely sufficient as a funding source, but its buying power has plummeted over the past decade, and it hasn't been raised since 1993 when it went from 14.1 cents a gallon to the current 18.4 cents.[7] Adjusted for inflation, that makes the current tax equivalent to just 12.4 cents a gallon in 1993 dollars. Proponents of increasing the gas tax point to the fact that Belgium, France, Germany, Italy, Netherlands, and United Kingdom have instituted gas taxes that are on average ten times

higher than they are in America![8] But the U.S. Department of Transportation has been actively opposed. "A substantial increase in the nation's gas tax is ill-advised," wrote Secretary of Transportation Mary Peters in a Washington Post editorial last summer, "Of far greater promise than traditional gas taxes is direct pricing of road uses similar to how people pay for other utilities."[9]

As the gas tax has fallen, another major trend facing California infrastructure is that construction costs have climbed dramatically. Over the past decade construction inflation has far outstripped general consumer price inflation. Between January 1997 and September 2007 the cost of highway and street construction jumped 59% due to steep rises in the prices of inputs. Steel costs rose 57%, concrete 58%, and crude oil 280%, while general consumer price inflation increased just 31% (Figure 2).[10] This means that for the state to deliver the same level of service as just five years ago, it would need to increase its capital outlays for infrastructure aggressively just to keep up with the insidious inflation in commodity prices. Or, the other option is to intentionally let service levels decline. The standard economic response to an increase in cost of an economic input is to buy less of it, relative to other inputs.

Figure 2. U.S. Construction Costs, 1997–2007 (Index: 1997 = 100)



Source: Authors' calculations based on data from U.S. Bureau of Labor Statistics.

At the national level, a political contest looms as the 2009 date approaches when the Highway Trust Fund will spend its last penny. In California and across the nation, even though users feel like they have paid the price for transportation from multiple pockets, not enough revenue is being generated to pay both for needed deferred road maintenance and new construction. Financing is not the problem, it is funding that is in short supply and new sources of funding are needed to prevent further maintenance backlogs and congestion problems and to expand transportation capacity.

Direct user fees have been implemented on nine state bridges to pay for construction costs; tolls are still in place on seven to cover operation and maintenance costs.[11] In the case of the Bay Area, voters

authorized the use of bridge tolls to help finance non-tolled capacity on other roadways in the region and ongoing maintenance and operational costs. However, tolling is not yet widely authorized or accepted.

Overall, limited success has come from efforts to secure uncertain revenue streams from a variety of sources and to contain the capital costs of new roads. Moreover, State and local taxes are inadequate to add new capacity and maintain what already exists. Thus a new source of revenue is essential to meet the State's transportation needs. One option might be an increase in the use of direct user fees, which is a proposal that we discuss later on in greater length.

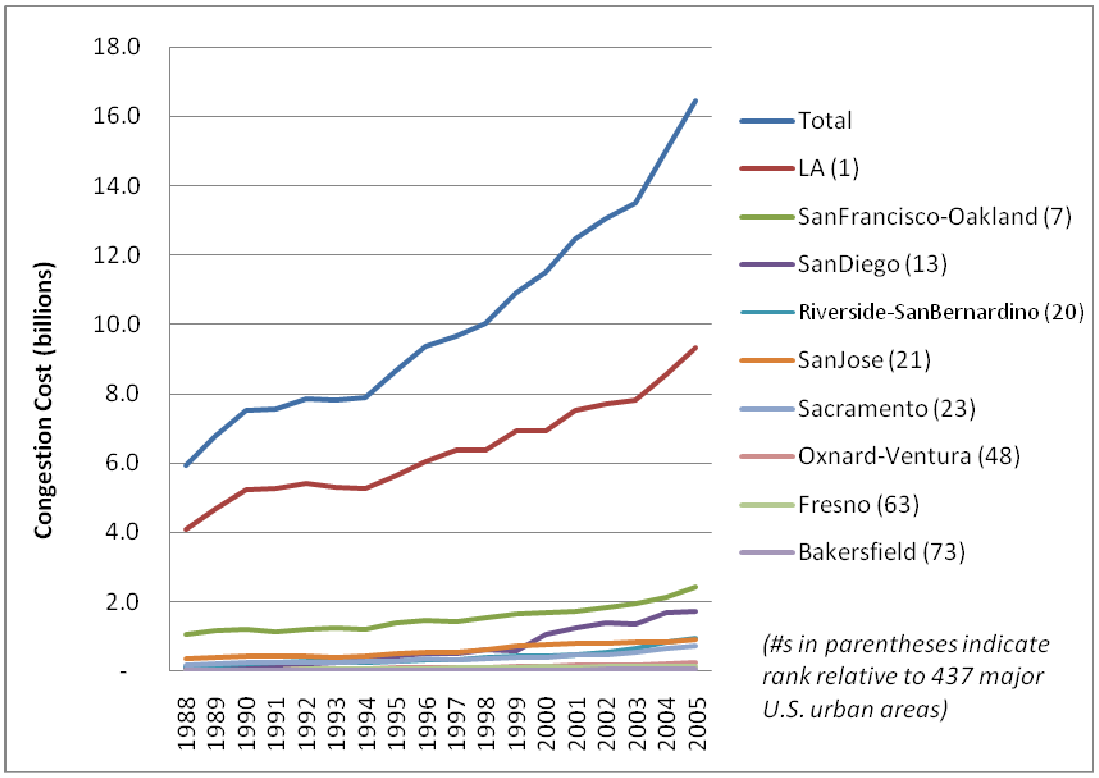
Congestion

Traffic congestion clogs the arteries of California's economy. According to the Texas Transportation Institute, Los Angeles is the nation's most traffic-congested city, and San Francisco and San Diego also sit near the top of the list.[12] And the problem is getting worse. The Texas Transportation Institute's database indicates that over the past two decades congestion has jumped 150% in Los Angeles, 160% in San Francisco, and almost 600% in San Diego. During this period the costs of congestion in the State have risen 180%, reaching nearly $17 billion in 2005 (Figure 3)—including 910 million hours of delays and 630 million gallons of excess fuel wasted. At the national level, the Texas Transportation Institute estimates that aggregate congestion costs across 437 major U.S. urban areas reached $78 billion in 2005. That means that California, with just 12% of the U.S. population, accounted for more than 21% of U.S. congestion costs in 2005.

As congestion worsens, trips take longer and congestion spreads across more of the day, affects weekend and rural travel, slows personal trips and freight shipments, and makes travel times universally unreliable. The negative impact on the State's competitiveness is profound. Congestion costs U.S. commuters an average of 20 cents per urban-peak vehicle mile. Based on *Highway Capacity Manual* speed-flow curves, marginal peak period congestion costs for urban freeways average 37 cents a mile when traffic flows at less than 40 miles an hour—and just 6–9 cents a mile when traffic flows faster than 50 miles an hour.[13]

Moreover, measuring economic costs such as time delays and wasted fuel captures only a fraction of the true costs of traffic congestion. Congestion also has negative effects on air quality, public health, global warming, property values, vehicle wear-and-tear, accident rates, driver stress, labor productivity, and law enforcement.[14] These secondary effects, which are much more difficult to quantify and convert into a monetary cost equivalent, affect all aspects of economic, social, and civic life. Congestion is now so widespread that everyone is suffering—the rich, the poor, and the middle class alike.[15]

Figure 3. Costs of Congestion in Major Urban Areas in California, 1988–2005[16]



Source: Authors' calculations based on data from Texas Transportation Institute.

People are driving more than ever before

The higher incidence of traffic jams in California is not just the result of State population growth outstripping construction of new roads. Figure 4 shows that between 1988 and 2005, while the population in six of the State's major metropolitan areas grew 22%, new roadway capacity increased 23%. Yet these six areas exceeded mean U.S. growth rates both in delay per traveler and total delay.

Figure 4. Growth in Population and Supply of Roadways in Six California Metropolitan Areas[17]

	Population (millions)			Freeway Supply (lane miles)			Arterial Street Supply (lane miles)			Growth in Delay Per Traveler Relative to U.S. Mean	Growth in Total Delay Relative to U.S. Mean
	1988	2005	Change	1988	2005	Change	1988	2005	Change		
LA	11.14	12.54	13%	4,665	5,870	26%	17,410	20,755	19%	Slower	Much Faster
San Francisco-Oakland	3.61	4.14	15%	2,175	2,475	14%	4,375	5,240	20%	Faster	Much Slower
San Diego	2.15	2.91	35%	1,600	1,965	23%	2,610	3,400	30%	Much Faster	Much Faster
Riverside-San Bernardino	1.06	1.80	71%	700	1,125	61%	1,900	2,670	41%	Much Faster	Much Faster
San Jose	1.37	1.68	22%	875	910	4%	2,090	2,500	20%	Faster	Much Faster
Sacramento	1.05	1.75	67%	650	785	21%	1,730	2,345	36%	Average	Faster
Total	20.38	24.81	22%	10,665	13,130	23%	30,115	36,910	23%	Faster	Faster

Source: Authors' calculations based on data from Texas Transportation Institute.

Research by the Surface Policy Transportation Project shows that the growth in congestion comes largely from an exponential increase in driving (measured in vehicle miles traveled), which cannot be

explained by population growth or even the demographic shift to dual-income households. Instead, the trend of people driving more is explained by a multifaceted set of factors: a trend toward lower-density residential and commercial development patterns that forces people to drive more frequently over longer distances, a lack of affordable housing that forces painful hours-long commutes from suburban areas to city centers, an increase in the proportion of parents driving their children to school and then themselves to work (the "double rush hour"), incentives for local governments to promote inefficient highway strip developments in order to maximize sales tax and other revenues, and widespread cultural perceptions among the general public that driving on freeways is free and encouraged, even at peak times.[18]

The many underlying causes of congestion require a sophisticated solution. According to the Surface Policy Transportation Project, "[o]ther states have utilized a diversity of strategies including better real-time traveler information technologies, peak-hour congestion pricing, coordination of transportation and land use goals, telecommuting, staggered work hours, financial incentives promoting ridesharing and vanpooling, and better traffic incident management." Of the many strategies, most economists and transportation planners agree that, although largely untested in the U.S., market-oriented congestion pricing mechanisms offer the most promising tool in the toolkit—and perhaps the only serious one—for rapid, permanent congestion relief.[19] Under typical congestion pricing arrangements, roadway users would pay user fees that would fluctuate throughout the day, dissuading drivers from using roadways at peak times. Congestion pricing is the most effective method for rationing scarce highway capacity.

The "build more" approach is flawed

The dominant logic of California's transportation planners over the past half-century has been to increase the supply of capacity by constructing new roadways and adding new lanes: the "build more" approach. This approach is now considered to have severe limitations. As new roadways reduce time and out-of-pocket costs for drivers, they induce more traffic by satisfying pent up demand and fill up almost as quickly as they are constructed.[20]

The congestion problem cannot be solved solely by building more capacity. In fact, it is ineffective to keep adding expensive new capacity to the system until measures are implemented to increase the efficiency of existing capacity and to find an appropriate method for rationing the existing capacity. More sophisticated approaches—including, potentially, peak congestion pricing and traffic management systems—that address the long-term underlying causes of congestion are badly needed.

System never designed for influx of intermodal freight and global trade[21]

When construction began in the 1950s, the National System of Interstate and Defense Highways envisioned to open the nation to passenger cars, interstate commerce, and military vehicles through design and construction standards that allowed for greatest uniformity, safety and reliability from coast to coast and border to border. But the overwhelmingly dominant vehicle of choice for commercial cargo was still railroads. Over time as the system expanded towards completion, there was a natural shift towards trucking as both an alternative and complement to the railroads. In the past 20 years, with the rise of low-cost Asian manufacturing, the globalization of the U.S. economy, the rise in truck traffic using the "free" roadway system, and the evolution of intermodal transport technologies, California's freeways have become overwhelmed with a volume of heavy transport trucks that the designers of the Interstates could never have thought to predict or address.

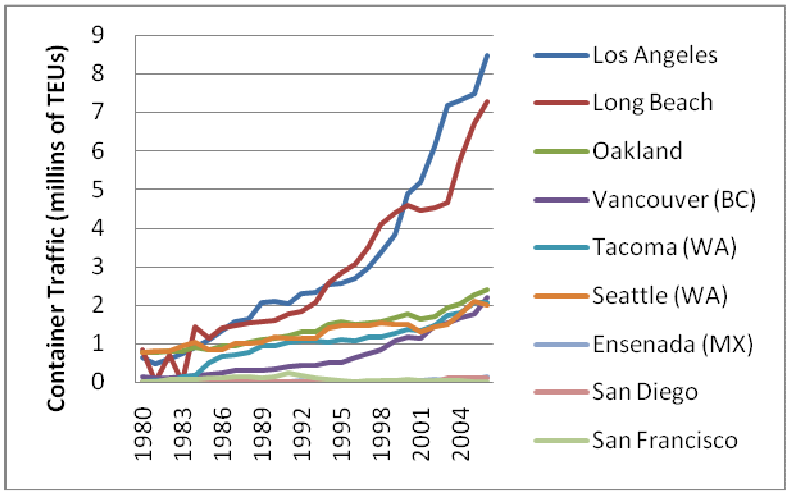
John Wachs, director of the RAND Supply Chain Policy Center, has noted that "[n]early everything we use and consume comes to us from somewhere else—whether from across town, across the

country, or across the world. The prices and availability of all these items depend on how quickly, efficiently, safely and cheaply businesses can move them through the supply chain that connects fields and factories to stores and communities around the world." Globalization exerts massive pressure on all nodes of the global supply chain—ports, storage yards, cross-docks, freeways, railways, and airports.

The challenges are complicated by the fact that California's transportation infrastructure was designed for a regional, agriculture-based economy; but in recent years patterns of trade and production have shifted and California has evolved into a major hub with both heavy volume of east-west shipments from Asia into continental U.S.A and north-south shipments between Canada and Mexico.

Intermodal container traffic through California's two largest ports, at Los Angeles and Long Beach, increased an average of 1,000% between 1980 and 2004 (Figure 5).[22] By 2020, traffic at these two ports is projected to more than double from 15 million to more than 36 million twenty-foot equivalent units (TEUs).[23] When congested freight networks cross through already congested metropolitan areas, the effect is a "congestion double-whammy". In fall 2004, congestion at the Los Angeles and Long Beach ports led to the unplanned diversion of more than 100 container ships to other ports, caused a dire backlog in inland traffic, and dislocated financial arrangements in a supposedly reliable system of trans-shipment.[24] The transportation links carrying freight of the ports and into the rest of America are due for a major overhaul.

Figure 5. Growth in Shipping Volumes at West Coast Ports, 1980–2004



Source: Authors' calculations based on data from American Association of Port Authorities.

Summary

Figure 6 summarizes the challenges facing California's transportation infrastructure system and proposes an overarching solution that could address the underlying causal factors.

Figure 6. Major Challenges Confronting California's Transportation Infrastructure System

Challenge	***Root Cause***	***Description of Cause***	***Proposed Solution***
Insufficient funding—supply of dedicated revenue sources for transportation	Eroding purchasing power of the gas tax, reduced Federal transfers, aging transportation network, escalating construction costs	The State's transport infrastructure is funded from a variety of sources, but these sources lack sufficiency and consistency, and are not allocated permanently to recipient transportation corridors	*Enable transportation financing authority to vet local proposals and*

infrastructure falls short of demand			*approve—on a selective basis—charging user fees so that designated revenues will be available to fund transportation corridors and so that congestion pricing and traffic management systems can be implemented (discussed in next section)*
Congestion—has negative effects on air quality, public health, global warming, property values, economic growth, quality of life, driver health, and so on	People are driving more than ever before	New road construction is keeping up with population growth, but changes in urban growth and lifestyles mean more cars on the road and more vehicle miles travelled	
	The "build more" approach is flawed	The idea that "building more roads" will solve the problem is a myth	
	Interstate system not designed for influx of intermodal freight and global trade	Due to many factors, roadways have become clogged with heavy transport trucks; the volume and size of trucks was not foreseen when the system was designed and contributes to congestion	

Source: Authors' analysis.

Consequences of Inaction

Failure to address the twin problems of congestion and insufficient funding could have serious repercussions for the State and its citizens from the perspectives of economic growth and competitiveness, human living standards, and overall influence and leadership within the global economy.

Slower Economic Growth

Infrastructure's contributions to growth in both per capita and broader measures of GDP have been documented in numerous national, regional, and global studies.[25] For example, a World Bank study found that annual investments of 1% of GDP in infrastructure are needed to support 1% growth in GDP.[26]

While infrastructure is necessary to generate sustained increases in economic growth, rates of infrastructure-driven growth differ greatly over time and across countries.[27] Moreover, infrastructure is insufficient in and of itself for growth to occur—other human, social, economic, resource, and institutional endowments need be present in catalyzing proportions.[28] The influence of infrastructure on growth can be effected non-linear factors such as knowledge spillovers, circular-and-cumulative causation, and agglomeration effects.[29] Accordingly, infrastructure is not something that should be purchased by a State in unlimited quantities—some countries have "overprovided" beyond the growth-maximizing level.[30]

What is clear from the stock of research on the relationship between infrastructure and growth is that when infrastructure becomes a bottleneck or limiting factor—as is the case with California's congestion—new investment can unleash unusually attractive returns.[31] In many cases, "it is more important to improve the *quality* of the existing infrastructure than to engage in further investment."[32] World Bank research has documented that after periods of sustained neglect—as in California at the State level over the past three decades—new infrastructure investment can yield extraordinary returns relative to investments in other types of capital assets.[33] California is currently living on a 30-year-old collection of infrastructure, and obvious problems like road and port congestion, power blackouts, and leaky pipes are creating a drag on the State's economic output. Economic side effects will only worsen if neglect continues.

Reduced Quality of Life

At the household level, definitions and indicators of quality of life often include measures of access to basic infrastructure services such as water supply, sanitation, transportation, and electricity. Moreover, a strong link exists between access to infrastructure and family income.[34] Infrastructure affects almost every aspect of our everyday lives—and where infrastructure regresses, so will the quality of life of Californians.

Loss of Global Leadership Position

A further implication of California's eroding infrastructure is that the State risks losing its position of leadership in the global economy. California is the world's eighth largest economy, making it larger than most independent nations. In the race between states and nations to attract foreign direct investment, infrastructure has critical importance. More than ever before, capital is going to economies with two important features—large economic size and attractive business environment, which together account for 75% of the variance in global foreign direct investment flows.[35] Given that, if California can go beyond mere investing in fixing potholes to developing an advanced infrastructure system unrivaled in Western economies, it could attract a disproportionate share of global capital and achieve amazing returns.

On the flipside, if California slides out of the 10 most attractive global business environments, it could quickly lose hundreds of billions of dollars in new investment flows. Indeed, the 10 economies that topped the business environment rankings published by *The Economist* magazine in 2007 attracted more than half of all global capital flows. Thus the pressure of globalization adds a high-stakes dimension to this game not present in the 1970s or 1980s.

In making facility location decisions companies pay particular attention to the quality and availability of infrastructure. To the extent that companies relocate to states with better transportation infrastructure, the economic benefit to California is lost for the duration. The state of California's infrastructure is becoming a serious weakness it its competition with other jurisdictions.

California has an opportunity to become the gateway of Asian trade and investment in North America, as Asia's share of the global economy is expected to grow 30–40% over the next 20 years.[36] But this privileged position as a portal in the East-West supply chain is by no means secure.[37] In recent months Chinese leaders have raised serious concerns about California's commitment to infrastructure investment, and Chinese planners are said to be actively exploring alternate transportation hubs in Mexico, Canada, and Washington state.[38] If these shifts occur, they would involve long-term infrastructure arrangements that could take a generation to reverse.

Implementing User Fees as a Piece of the Solution

The economic situation for funding new transportation infrastructure in California is relatively straightforward: without additional revenue (funding), there can be no new infrastructure. The additional revenue could come from one or more of the following sources: user fees, tax increases, re-allocations of the General Fund or other funds, sales of existing infrastructure assets (privatization), or at some point in future, perhaps even auctions of carbon credits.[39]

Direct user fees, or tolls, look like an increasingly promising solution to California's problems of insufficient funding and congestion in the transportation sector. Tolling offers a dedicated revenue source that would be usage based, more reliable and, if appropriately structured, less susceptible to political intervention. With a dedicated revenue source in place, it would suddenly become much easier to finance California's roadways through the issuance of revenue bonds.

An important collateral benefit to rationing highway space with direct user-fees is the potential to relieve congestion, keep the transportation system operating at higher speeds and efficiencies, and achieve environmental benefits through dynamic, demand-based pricing. Tolls would be set to rise and fall dynamically throughout the day, varying with fluctuations in user demand. For example, at midnight when the road is not heavily used, it may very well be possible to make all lanes free. On the contrary, at 8am in morning rush-hour when traffic is at its worst, the toll may rise to $20 or higher. At 3pm, when traffic is relatively light, the toll might fall to $2. Toll structures could vary across lanes, so that there was always a "free" lane for low-income groups that valued money over time and always an "open" lane for business travelers who valued time over money. Mixed speeds do present safety concerns, however.

Economists such as Larry Goulder use the term "double-dividend" to describe the benefits of implementing a tax, such as a toll, to reduce a widespread social ill, such as congestion. The first dividend results from eliminating the inefficiencies of congestion and the harmful effects of environmental pollution. The second dividend arises in the form of a revenue stream that the State could use to improve other parts of the transportation system. If a toll fluctuates dynamically as a congestion relieving measure, it could actually generate much more revenue than necessary to merely pay for capitalized costs and maintenance on the roadway. In such cases, the additional revenue could be applied to cross-subsidize other local roadways or important State services.[40]

One of the main arguments against implementing tolling is that it can be cumbersome for drivers to have to stop at a toll booth and fish a fistful of quarters out of their pocket. However, rapid innovations in global positioning systems (GPS), satellite transponders, automated toll collections systems, digital mapping, wireless networking, and mobile computing are now enabling the development of "smarter" technical solutions that previously did not exist. All of the technological elements are in place, and the global transportation industry is on the cusp of major revolution. An major milestone in the revolution will occur when automobile manufacturers start to ship new models with a built-in transponder. As the revolution unfolds, the individual user experience will continue to improve on tolled facilities and opposition based on inconvenience should subside.

The idea of charging tolls on existing roads may also run into some opposition from voters who feel that they are already paying enough taxes for roads. It may be more politically feasible to propose tolls for new roads—especially if it could be argued that such new capacity would otherwise not be funded. Moreover, the fact that the passage of sales tax measures in specific counties has been successful underscores that, contrary to conventional wisdom, taxpayers are willing to tax themselves for increased investment when direct benefits can be demonstrated.

It should be noted that although trucking and logistics firms indirectly fund some of the construction and maintenance of U.S. roadways, they also face the irony of contending with the costs of congestion.[41] One recent proposal is to create designated "truck only" lanes on corridors in and out of major ports and airports and along other key trucking routes; in return for paying user fees truckers would enjoy less congestion and increased speed, reliability and payload.[42] Designated single-purpose heavy freight transit corridors have been proposed as another solution. Direct user-fees levied against trucking companies would arguably be the best approach to fund such a major improvement.

Government provided incentives could meaningfully accelerate the process of innovation and commercialization of new technologies for tolling and congestion relief. In California, one obstacle to considering and deploying congestion pricing, for example, is not technological; it is that local and regional transportation authorities are not legally authorized to impose direct user fees. According to Richard Little, Director of the Keston Institute for Infrastructure, "California was an early leader in the modern movement toward "value pricing" and high-occupancy toll (HOT) lanes, with several successful

experiments in Southern California since the mid-1990s, but has not followed up with this early pioneering work."[43]

In the present environment, the user fee proposal may be quite palatable amongst members of the California Legislature. A diverse array of special interests recognize the escalating importance of mitigating deleterious effects of congestion—*environmental NGOs* are concerned with pollution levels; *climate change experts* are attentive to global warming issues; *asthmatics*, *elderly*, *insurance companies*, and *medical professionals* are sensitive to air quality; *industrialists* are concerned with predictability of freight transportation; *landowners* are interested in land valuations; and *daily commuters* are constantly battling with congestion on a daily basis. The gradual convergence of this broad group of stakeholders in support of user fees will not go unnoticed in Sacramento.

Administering User Fees via California Transportation Financing Authority

The California Transportation Financing Authority does not yet exist but was first conceived in the Treasurer's 2007 Debt Affordability Report as a potential model to administer user fees and user-fee backed finance on a wider basis in California's transportation sector. Its purpose would be to create a new dedicated funding source for transportation and ameliorate congestion on heavily trafficked routes. The report provides excellent background on methods—from the Treasurer's viewpoint—for using State resources, including its credit, to provide new infrastructure. As to the California Transportation Financing Authority, it says:

> To address the need for innovative public transportation and transit financing options, the Treasurer believes the Legislature should create a California Transportation Financing Authority (CTFA) to permit the issuance of bonds to support publicly-owned and operated highways that may be backed by a variety of revenue sources, including tolls. The Treasurer believes there is a huge potential for 'public-public partnerships' (partnerships between different levels of government such as the State and a local transportation agency) to deliver essential projects without relying on the private sector for direct financing and operation.
>
> The CTFA would be authorized to issue revenue bonds for State-owned highways, including those built through public-public partnership. Membership on the Authority would include, at a minimum, the Treasurer, the Director of Finance and the Director of Caltrans. The Treasurer would serve as agent for sale for the CTFA's bonds. Over the next few months, the Treasurer intends to develop details for the CTFA and seek its creation from the Legislature.

The revenue streams that the Treasurer envisions seem largely to be tolls on new roads, though there is a possibility of select excise taxes (such as transportation or gas taxes). The proposal implies the authorization of tolling for transportation corridors. That power now resides solely with the Legislature and would need to be delegated to the CTFA. Further details of the scope of the Authority will likely be defined in the Treasurer's proposal being prepared for the Legislature over the next several months.

The CTFA would not be authorized to approve or plan the construction of new roads. This decision would follow existing State rules and regulations, as presently administered by the California Transportation Commission.

Envisioning CTFA Set-Up and Implementation Options

Going beyond what the Treasurer has described in the Debt Affordability Report, it is possible to conceptualize other aspects of the CTFA, which we propose below, to potentially augment what the Treasurer is planning to suggest.

In terms of process, it is envisioned that State and local transportation authorities would submit proposals to the CTFA to request approvals to charge user fees and to employ user-fee backed finance. Proposals would include whatever items the CTFA deemed necessary to constitute a complete submission including but not necessarily limited to traffic studies, toll rate increase forecasts, and local government endorsements, etc. The merit of proposals could be determined against a range of screening criteria:

- *Financial Feasibility*—Do the project revenue projections cover repayment of construction costs, operating expenditures, capital improvements, and bonds? Is the project cash positive or positive enough?
- *Presence of trucking companies and free riders*—Is the road heavily trafficked by long-haul trucking companies that would value and pay for reliability in support of "just in time" business models? Is the road being designed as a designated heavy freight corridor (say, out of Los Angeles, Long Beach, or Oakland)?
- *Fairness of toll rates and increases*—Is the proposed toll rate and schedule of increases consistent with other areas of the State and other similar facilities?
- *Likelihood of solving congestion*—Does the road have problems with or is it likely to have problems with congestion? Could demand pricing reduce high-levels of congestion, carbon emissions, air quality concerns, and public health problems? Could demand pricing improve efficiency by increasing overall throughput?
- *Need for designated funding source*—Do State budgetary constraints eliminate the possibility of building the road without user-fee backed finance?
- *Unutilized state bond funding*—Does the State have pre-authorized bond funding sitting unused that could be applied to the project?
- *Presence of low-income neighborhoods*—Does the road cut through low-income neighborhoods where continued use of the network might be sensitive to toll rates? Do low-income groups have access to other public transport options? Could they be subsidized?
- *Technological best practice*—Does the proposal draw on the best technological options, taking into account the full range of congestion pricing and traffic management systems and given the experiences of other localities within the State and internationally with various options?
- *Consistency of user experience*—Are the proposed toll collection technologies and the physical locations of the toll collection booths going to create problems of discontinuity at the network level? Probably not a concern over the first 10 years, but would eventually be problematic if a large share of roadways were to switch to tolling.
- *Feasibility of success*—Based on a holistic assessment of quantitative and qualitative factors and contextual conditions, is it likely that user-fee backed financing will be successful?

- *Local support*—Does local and regional support exist for the project package including concept, delivery method, user fees, and/or finance methods?

The last two criteria on the list are especially important because a string of early successes would be crucial to gain broad public support for the CTFA concept. Early failures could be detrimental.

There are several outstanding questions that would need to be addressed during formation of the CTFA. First, how much deference should be given to the locality in the decision to approve user fees for projects submitted by a local government? Should the locality be required to undertake a countywide or citywide referendum to establish public acceptance? Second, what process does the locality use in soliciting and responding to stakeholder comments, grievances, and objections, and does this happen before or after the locality sends the proposal to the Authority for approval? Third, what criteria and process does the CTFA apply when deciding to approve or reject local proposals? Is the list of screening criteria proposed above sufficient? Or are additional criteria necessary? Finally, should the two criteria labeled "Technological best practice" and "Consistency of user experience" be on the list of screening criteria, or should they be considered at the time of project approval, by the relevant planning authorities, long before the CTFA is involved? An argument for including them in the CTFA's review is to ensure that tolling is done in a sensible way, according to international best practice, and with the maximum likelihood of success, which would affect how the CTFA's reputation would develop.

The social equity concern is one that the CTFA would need to carefully consider and monitor closely. Low-income groups able to afford a car but unable to afford a toll could be disadvantaged and shut out from the system. Social equity concerns could be especially worrisome in situations where proposed toll lanes cut through low-income neighborhoods and locals lacked other transportation options. In these situations it could be possible to leave un-tolled lanes, to provide lower prices at different off-peak times of the day, or to subsidize low-income persons directly using technology or expanded transit options. A governance approach to counter this concern could involve requiring local proposals to have embedded within them local political input in order to eliminate the most potentially troubling situations; and the CTFA would be able to solicit expert advice when social equity concerns became apparent and to summarily reject proposals on that basis. [44] On the other side of the coin, it is not at all clear that congestion is beneficial to the poor. It can be argued that many of the poorest citizens cannot even afford a car. It can also be argued that congestion's impact on gasoline consumption, housing prices, and reduced ability to access labor markets is regressive to all citizens of the State, including those at the lower-end of the income scale. Polling data confirm that low-income people like choices and reliability just like everyone else.[45]

Implementation Options

Two distinct approaches could be envisioned to the establishment of the proposed authority. Proponents of the "big bang approach" would seek direct approval from the Legislature for the establishment of the CTFA.[46] However, if it were deemed unrealistic to obtain Legislature approval to establish the CTFA, an "incremental approach" might also be feasible. Independent jurisdictions, such as Orange County, Riverside County, Santa Clara County, and so on, could seek approval from the Legislature to charge user fees within their jurisdiction, independently one at a time. The Legislature tends to look favorably on proposals that do not affect other constituencies, viewing them as local matters.[47] Proponents of an

incremental approach would create an informal steering committee of representatives of those local agencies admitted to the privileged club permitted to charge user fees. At first, this informal steering committee would compare notes and share lessons learned. But once a substantial group of jurisdictions had won approval, the arrangement could be institutionalized through an entity similar to the CTFA. Proposing a CTFA type entity to the Legislature at a later stage would probably improve its chances of being supported, as it would not necessitate the Legislature granting blanket approval on tolling.

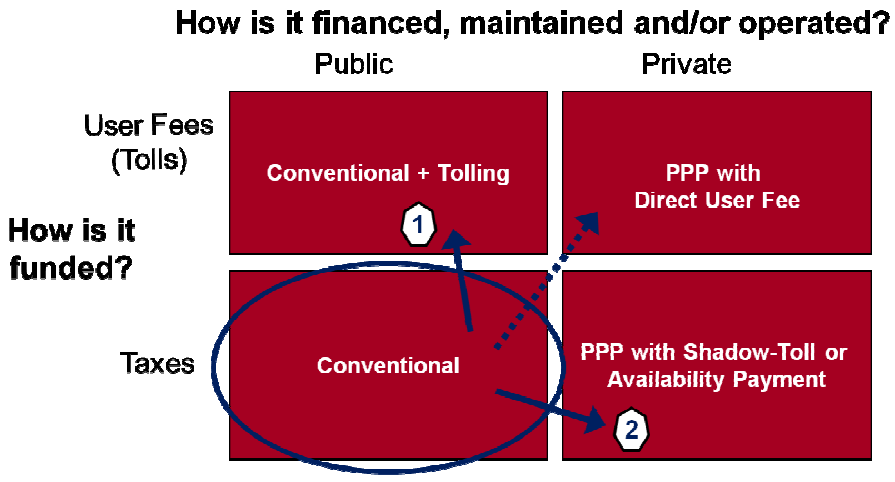
Unbundling User Fees from Public-Private Partnerships

Under the Treasurer's CTFA proposal, the question of whether tolls for roads are appropriate for public-private partnerships is left open. This is important, because proposals to enable public-private partnerships have been circulating in California with overall leadership from the Governor's Office under the auspices of a program called Performance Based Infrastructure (PBI), which would build on successes of Canadian and UK PPP programs.[48]

User fees and public private partnerships are often discussed synonymously. They are different and independent concepts. User fees are a funding concept. Public private partnerships are a procurement method. It is natural for discussions of modernizing the system of infrastructure finance and delivery to include references to both concepts, as both are key building blocks in the development of "a more entrepreneurial, market-oriented system, in which direct user fees in the form of tolls, variable (congestion) pricing, long-term operating concessions, and private equity capital are allowed to play a major role in funding and managing new transportation infrastructure."[49]

However, from a public policy standpoint, it is important to distinguish the user fee proposal from the public private partnership proposal. This distinction is important, because there is substantial variation across the two proposals in terms of the politics of gaining public and legislative support.

Figure 7. Two Proposals: (1) From Taxes to Tolling, (2) From Public to Private Service Provision



Source: Authors' analysis.

The two proposals are summarized in the two-by-two matrix shown in Figure 7. The intent of the diagram is to illustrate how the user fee and private participation proposals relate to one another

conceptually and to show a road-map illustrating the major policy directions available in the state. The bottom left quadrant of the matrix characterizes the conventional system of infrastructure delivery in California: public entities design, finance and operate infrastructure that is funded by tax revenue transfers from the state. The top left quadrant depicts the user fee proposal: under this option Public Tolling Authorities would be established to collect tolls that would provide funding to pay-back revenue bonds issued by state agencies. The bottom right quadrant captures the public-private partnership proposal: private operators would be paid out of tax revenues according to a contractually agreed pricing system between the private party and the state—commonly called a "shadow-toll," "availability payment," or "PFI-credit" scheme—but the private operator would not be authorized to charge user fees. The top right quadrant shows the case where both proposals are enabled, creating the possibility for public-private partnership schemes with private financing, maintenance and/or operations supported by user fees that would be collected by the private operator. As with any two-by-two matrix, the figure is somewhat of an oversimplification as it ignores the great variety and complexity of different public-private partnership modalities—i.e. leases, concessions, build-operate-transfer schemes, etc.—that exist within the two quadrants on the right hand side of the diagram and which permit greater or lesser degrees of risk transfer.

The ultimate goal would be to have all four quadrants of the diagram available as options for the delivery of transportation infrastructure in California. However, political realities may make it impossible to enable both the user fee and public-private partnership proposals at once. The public-private partnership proposal has fewer advocates, aside from primarily just construction companies, investment banks, and consultants, and the proposal is opposed by a powerful coalition of labor unions; its success would likely require strong support from state executive offices. Thus, differences in public and political support make it advantageous to analytically disentangle the two proposals.

Sequencing the Implementation of User Fees and Public-Private Partnerships

Taking a broader view of the evolution of the system of finance for California transportation infrastructure, it appears to be on a trajectory towards greater utilization of user fees and public-private partnerships (the latter of which often entails private equity financing). In terms of sequence of implementation, it may well be prudent to start out with state financing backed by user-fee funding before moving on to full-blown public private partnerships for two main reasons. First, the former could be more politically feasible to move through the Legislature given the broad coalition of stakeholders who have a vested interest in reducing congestion. Second, ongoing research at Stanford University shows that in many countries where widespread social objections to private participation in infrastructure have arisen (especially in the water and transportation sectors), the objections are ill-informed and are created not by the enactment of private financing and operation in and of itself (which is often the target of opposition groups) but by the imposition of user fees or the raising of user fees above historical levels or before service improvements are implemented.

Public authorities in other jurisdictions have sometimes preferred to connect the user fee and private participation proposals because it allows them to "pass the buck" and have the private entities "do the dirty work" of informing the public of new or increased "tariffs" and of playing the role of "tariff collectors." But passing the buck can create serious problems on many levels, especially on the political

level. An example is the Cochabamba water project in Bolivia. Water was a governmental service not historically associated with user fees based on full cost recovery. A private concession to process and distribute water was granted, along with the authority to charge user fees. The government did not prepare the population for the change. The private sector was blamed. Increases in user fees led to protests, social uprisings, and other pressures on the national government that contributed to its weakening.[50]

For water projects that we have studied where the government undertook the onus to first raise rates to market levels, before bringing in the private sector, social opposition was largely eliminated. Accordingly, it may be politically beneficial for California to disconnect the user-fee and public-private partnership proposals in time and space, so that the public does not conflate these two steps and attribute new fees or fee increases to being caused by "greedy, corrupt, profit-seeking" private entities. The strategy would be to first institute user fees through the CTFA, and then—after the passage of an appropriate period of time—to introduce public-private partnerships to involve private firms in a broader set of design, build, finance, operate, and maintenance functions as value is added. In the interim public tolling authorities could be established to collect user fees.

Conclusions

The environment for transportation infrastructure seems to be deteriorating due to the lack of a sufficient, dedicated funding source. With respect to congestion, people are driving more than ever, road systems were not designed for intermodal freight, and a "build more" approach to the problem dominates even though new capacity is instantly absorbed. These problems threaten economic growth, quality of life, and the Golden State's global leadership position.

Few people would disagree that now is the time for a major initiative to renew California's transportation infrastructure. But proposals on exactly what to do or how to do it are less obvious.

Building on ideas developed at a Roundtable held at Stanford University, this paper presents a proposal for expanding the menu of options available to the State for funding transportation infrastructure and managing overcrowded highways and trucking lanes. The proposal is relatively straight forward: local jurisdictions would have an option to charge user fees, which could be an important tool to help solve the transportation funding shortfall and combat congestion with demand pricing. The California Transportation Financing Authority would be established to approve requests from local governments to implement user fees and to assist in the issuance of revenue bonds on tolled projects.

Despite many obvious benefits, imposing user fees for maintenance on existing roads strikes many users as unfair: the dual costs of construction and thereafter maintenance have theoretically already been calculated into the funding web, and adding a user fee after the fact seems like a "double tax". Imposing user fees on new infrastructure is also complicated, given existing transportation taxes and a widely held view that roads should be free, but it is probably more feasible if the new road could not otherwise be funded without the imposition of the toll. These are long term issues, that will not go away easily. But what makes the user fee proposal suddenly exciting is that a multifarious set of stakeholders are beginning to coalesce around the recognition that the "congestion problem" negatively impacts all aspects of the state's social, environmental, and economic fabric across all classes of society.

Eventually, user fees and public-private partnerships could lead to a new system of transportation finance and management in California. However, proposals for user fees should not be confused with proposals for public private partnerships. The two proposals are distinct. Public private partnerships can be implemented without user fees (with private operators paid out of government funds via shadow tolls

or availability payments). And user fees can be collected without having public private partnerships (through Public Tolling Authorities). Emerging research suggests that social opposition and backlash will be more severe if public-private partnerships that rely on direct user fees are put into place before a government has gained social license to charge user fees.

Looking to the future, opportunities and threats that will influence California's infrastructure include continuing globalization, population growth, energy costs, resource depletion, earthquakes, trade with Asia, baby boomer retirement, and a shift toward a service-based economy.[51] Based on these trends and based on the strengths and weaknesses of California's existing infrastructure, the areas that seem to represent "low hanging fruit" for state investment over the next 10–20 years include designated intermodal freight corridors, smart roads within urban areas that employ dynamic congestion pricing, and transportation links that integrate multiple communities and jurisdictions. Successful implementation will require inter-governmental and inter-community planning, coordination and harmonization of jurisdictionally segmented procedures in order to avoid unnecessary delays.

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[1] Definition of *infrastructure* adapted from M. Garvin, "America's Infrastructure Strategy," Report by KPMG and Stanford University, (2007): 1-48.

[2] Participation in the Workshop was by invitation only, with carefully selected representation from the California Governor's Office, Treasurer's Office, Caltrans, Partnerships BC, Infrastructure Ontario, regional transportation authorities, labor unions, business groups, and relevant sectors of industry, with a particular emphasis on maximizing the diversity of viewpoints at the table. Numbers were limited to a small and select few to encourage real discussion and debate. All comments made during the Workshop were not for attribution. The Workshop program is available on the Collaboratory's website under the section "Events" sub-section "Roundtables".

[3] Crane, D. "California's Infrastructure Deficit", *Public Works Management & Policy*, (2008), Vol. 12, No. 3, pg. 476-478. See also, P. Luchetti, "Investing in California's Infrastructure," Bay Area Economic Forum, June (2006): 1-67, <http://www.bayeconfor.org/media/files/pdf/CAinfrastructureJune06.pdf>. And also,

[4] Mendel, E. "Public Works Bonds Approved", *The San Diego Union-Tribune*, November 8, 2006. See: <http://www.signonsandiego.com/uniontrib/20061108/news_7n8props.html>

[5] There are also bonds classified as revenue bonds that are backed by specific revenues, specific sales tax, gas tax, and so on—California does not issue bonds backed by gas tax, but many other states do.

[6] Based on conversation with Fred Klass, Director of Finance, Office of the Governor, Jan. 2, 2008.

[7] Buechner, W., "History of the Gasoline Tax," American Road and Transportation Builders Association, (2008), <http://www.artba.org/economics_research/reports/gas_tax_history.htm>.

[8] Miller, J., "Infrastructure 2008: A Competitive Advantage", Ernst and Young and Urban Land Institute, (2008), <http://www.marketwire.com/mw/release.do?id=849759>.

[9] Peters, M. "The folly of higher gas taxes." *The Washington Post*, (August, 2007), pg. A15.

[10] U.S. Bureau of Labor Statistics, Producer Price Index for Highway and Street Construction.

[11] See Bay Area Toll Authority website: "BATA administers, programs and allocates revenues from all tolls levied on the seven state-owned toll bridges: Antioch, Benicia-Martinez, Carquinez, Dumbarton, Richmond-San Rafael, San Francisco-Oakland Bay and San Mateo-Hayward. As part of these activities, BATA funds the day-to-day operations, facilities maintenance, and administration of the bridges. BATA also funds the long-term capital improvement and rehabilitation of the bridges, including the projects mandated by Regional Measure 1 (RM 1) and the Toll Bridge Seismic Retrofit Program." <http://bata.mtc.ca.gov/about.htm>

[12] D. Schrank and T. Lomax, "Urban Mobility Study," Texas Transportation Institute (2005), <http://mobility.tamu.edu/ums>.

[13] H. Levinson, "Freeway Congestion Pricing: Another Look," TRR 1450, (1995): 8-12.

[14] See generally Chapter 3 of "Transportation Cost and Benefit Analysis: Techniques, Estimates and Implication," Victoria Transport Policy Institute, (2006), <http://www.vtpi.org/tca/>

[15] For guidelines on implementing congestion pricing, see: E. Deakin and G. Harvey, "The STEP Analysis Package: Description and Application Examples," Appendix B in USEPA, Technical Methods for Analyzing Pricing Measures to Reduce Transportation Emissions, USEPA Report #231-R-98-006, (1998), <www.epa.gov/clariton>; Also, T. Hau, "Economic Fundamentals of Road Pricing," Working Paper, World Bank (1992), <www.worldbank.org>; Also, P. Goodwin, "The Economic Cost of Congestion when Road Capacity is Constrained: Lessons from Congestion Charging in London," 16th International Symposium on Theory and Practice in Transport Economics, (2003), <www1.oecd.org/cem>.

[16] Texas Transport Institute Database, <http://mobility.tamu.edu/>.

[17] Texas Transport Institute Database, <http://mobility.tamu.edu/>.

[18] J. Corless, "Beyond Gridlock: Meeting California's Transportation Needs in the Twenty-First Century," The Surface Transportation Policy Project, (2000): 1-35; <http://www.transact.org/ca>.

[19] See for example: D. King, M. Manville and D. Shoup, "The political calculus of congestion pricing," *Transport Policy* 14 (2007), 111-123; Also, B.D. Taylor, "Rethinking Traffic Congestion", *Access*, Number 21, University of California Transportation Center Fall (2002), p. 8-16, <www.uctc.net>; Also, K.A. Small, C. Winston and C.A. Evans, "Road Work: A New Highway Pricing and Investment Policy." The Brookings Institution, (1989); Also, A. Downs, "Stuck in Traffic: Coping with Peak-Hour Traffic Congestion," The Brookings Institution, (1992).

[20] Some studies have presented empirical evidence supporting the "induced demand" concept, eg. P. Parthasarathi , "Induced Demand: A Microscopic Perspective", *Urban Studies*, 40/7 (2003) 1335-1351. Other studies do not find conclusive evidence, eg. P. Mokhtarian, F.J. Samaniego, R.H. Shumway, and N.H. Willits, "Revisiting the notion of induced traffic through a matched-pairs study", *Transportation,* 29/2 (2002) 193-220. For a review of this concept, see; U.S. Federal Highway Admin, < http://www.fhwa.dot.gov/planning/itfaq.htm>.

[21] U.S. DOT Strategic Plan, Fiscal Years 2006-2011, <http://www.dot.gov/stratplan2011/index.htm>.

[22] American Association of Port Authorities, Port Industry Statistics, <http://www.aapa-ports.org/Industry/content.cfm?ItemNumber=900&navItemNumber=551>.

[23] TEU = 20 foot equivalent units; the standard unit of measurement in the global shipping industry.

[24] B. Mongelluzzo, "LA–Long Beach Volume Overwhelms Inland Traffic," *The Journal of Commerce*, 6 Dec 2004.

[25] J. Antle, "Infrastructure and aggregate agricultural productivity: International evidence," *Economic Dev't and Cultural Change* 31, (1983); Also, C. Kessides, "The Contributions of Infrastructure to Economic Dev't: A Review of Experience and Policy Implications," World Bank Discussion Paper #213, (1993); See also, B. Sanchez-Robles, "Infrastructure investment and growth: Some empirical evidence." *Contemporary Economic Policy* (1998) 16, 98-108.

[26] World Bank, *World Development Report 1994: infrastructure for development*. (New York: Oxford University Press, 1994).

[27] D. Canning and E. Bennathan, "The Social Rate of Return on Infrastructure Investments." Part of a World Bank research project "Infrastructure and Growth: A Multicountry Panel Study" (RPO 680-89), sponsored by the Public Economics Division of the Development Research Group and by the Transport, Water, and Urban Development Department (2005).

[28] World Bank, *World Development Report 1994: infrastructure for development*. (New York: Oxford University Press, 1994, p. 17).

[29] K. Button, "Infrastructure investment, endogenous growth and economic convergence. *The Annals of Regional Science*, 32 (1998): 145-162. Also P.M. Romer, "Increasing Returns and Long-Run Growth," *Journal of Political Economy*, 1986, 94(5), 1002-37.

[30] D. Canning and P. Pedroni, "The Effect of Infrastructure on Long Run Economic Growth," Working paper, (2004).

[31] Canning and Bennathan, op. cit.

[32] P.R. Agénor, M.K. Nabli and T.M. Yousef, "Public Infrastructure and Private Investment in the Middle East and North Africa," World Bank Policy Research Working Paper No. 3661, July (2005).

[33] Canning and Bennathan, op. cit.

[34] K. Komives, D. Whittington and X. Wu, "Infrastructure Coverage and the Poor: A Global Perspective," World Bank Policy Research Working Paper No. 2551, (2001); Also, J.L. Guasch, *Granting and Renegotiating Infrastructure Concessions: Doing it Right*, (Washington, D.C.: The World Bank, 2004).

[35] *World Investment Prospects to 2011*, co-written by Columbia Program on International Investment and the EIU, (2007) < http://www.cpii.columbia.edu/pubs/documents/WorldInvestmentProspectsto2011.pdf>, provides evidence that with globalization the handful of states with the best business environments attract a disproportionate share of the world's capital. The report shows that in 2006, across a panel of 80+ countries, fewer than 10 countries attracted more than 50% of the FDI inflows and that two-thirds of the variation in FDI inflows across all countries was explained by two factors: the business environment score and the size of the market (pg. 60). The business environment score consists of an aggregation of more than 100 factors across 10 key areas (political environment, macroeconomic environment, market opportunities, policy towards private enterprise and competition, policy towards foreign investment, foreign trade and exchange controls, taxes, financing, labor market, and infrastructure). This leads us to the conclusion that California, being the world's fifth largest market, has an opportunity to absorb an increasingly disproportionate share of the world's FDI inflows, so long as it can continue to offer an attractive business environment, of which infrastructure could well be a gating factor.

[36] The Asian Development Bank has estimated that with continued peace Asia's share of global GDP could climb up to 40% by 2020-25. The IMF has estimated that the Asian share of the world economy could be as high as 45% by 2030. See also, P. Dicken, Global Shift, (London: Sage, 2007).

[37] The Challenge of Mexico's Ports, 2nd Annual Port Technologies Conference, Mario Cordero, July 31 (2007). <http://www.polb.com/civica/filebank/blobdload.asp?BlobID=4312>

[38] One of the participants at the Stanford Workshop noted having sat-in on meetings in China in the past three months where "top 10" Chinese companies and government agencies expressed grave concerns about the present capacity and efficiency of California's transportation infrastructure and suggested that Washington, Canada, and Mexico may offer more robust transportation nodes to support expected future volumes of Chinese exports.

[39] A proposal worthy of further study involves allocating a percentage of revenues from sales of carbon credits to general infrastructure renewal. California recently adopted a State policy that will return the State to 1990 in terms of permissible carbon emissions. If the State were to implement this program by auctioning carbon credits (auction is not the only scheme being discussed), the projected revenues could be 5% of GDP in coming years—a windfall that could go a long way toward rebuilding and expanding the State's infrastructure. Furthermore, it is possible some projects could help reduce greenhouse emissions in the State and count toward State commitments to their reduction, allowing other projects to buy the credits generated if and when the State institutes a cap and trade system.

[40] L. Goulder, "Environmental Taxation and the 'Double Dividend': A Reader's Guide" (1994-10-01). NBER Working Paper No. W4896. Available at SSRN, <http://ssrn.com/abstract=227957>

[41] J.R. Njord, and M.D. Meyer, "*Critical Issues in Transportation*," Transportation Research Board of the National Academies, 20 Jan (2006), <http://onlinepubs.trb.org/onlinepubs/general/CriticalIssues06.pdf>.

[42] Poole, R. "The Case for Truck-Only Lanes, *Public Works Management & Policy*, Vol 11, No 4, (2007) 244-249.

[43] Little, R. "Expanding the Infrastructure Tent: Crafting an Inclusive Strategy for Infrastructure Funding," *Public Works Policy and Management*, Vol 11, No 2, (2006), pg. 84-88.

[44] Recommendations based on discussions with U.S. Assistant Secretary of Transportation Tyler Duvall, November 6, 2007.

[45] Generally, approval ratings of HOT lanes for low-income groups have been not very different than for high income groups -- about 60-70% for, 25-30% opposed. For example, see the page 75 of 228 of the PDF version of San Diego Association of Government's report available at, <http://fastrak.sandag.org/pdfs/concept_plan_vol2.pdf>.

[46] After the drafting of this paper, Assembly member Nava introduced AB 3021, an embodiment of the "big bang" approach. The full bill can be accessed at: <http://www.aroundthecapitol.com/Bills/AB_3021>.

[47] Watts, M., "For Whom the Road Should Toll: The Future of Toll Roads and Road Pricing in California", California Strategies LLC, (May 2, 2008), <http://leonard.csusb.edu/news/documents/Watts-May2forum.pdf>.

[48] Governor's Strategic Growth Plan: Performance Based Infrastructure, Jan. 9, 2008. *See:* < http://gov.ca.gov/issue/performance-based-infrastructure/>

[49] Need to chase this reference down, it was either Poole or Orski, from a newsletter. *See also,* Brown, K. "Are Public-Private Partnership Transactions the Future of Infrastructure Finance", *Public Works Management & Policy*, Vol 12, No 1, (2007), pg. 320-324.

[50] Nickson, A. and Vargas, C., "The Limitations of Water Regulation: The Failure of the Cochabamba Concession in Bolivia", Bulletin of Latin American Research, Vol 21, Issue 1, (2002), pg. 99-120.

[51] D. Neumark, "California's Economic Future and Infrastructure Challenges," Occasional Paper Series of the Public Policy Institute of California, June (2005).