



Innovative Finance: Strategic Research Project

Report 6-0700-1
Published: August 2013



INNOVATIVE FINANCE: STRATEGIC RESEARCH PROJECT

David Ellis, Ph.D.
 Research Scientist
 Texas A&M Transportation Institute

Nicolas Norboge
 Assistant Transportation Researcher
 Texas A&M Transportation Institute

Trey Baker
 Assistant Research Scientist
 Texas A&M Transportation Institute

Jason Wagner
 Associate Transportation Researcher
 Texas A&M Transportation Institute

Cinde Weatherby
 Director, Center for Strategic Transportation Solutions

José M. Rocha, JD
 Graduate Research Assistant
 Texas A&M Transportation Institute

Sharada Vadali, Ph.D.
 Associate Research Scientist
 Texas A&M Transportation Institute

Elizabeth Sandefur
 Graduate Research Assistant
 Texas A&M Transportation Institute

Rafael Aldrete, Ph.D.
 Senior Research Scientist
 Texas A&M Transportation Institute

Michael Hardy
 Graduate Research Assistant
 Texas A&M Transportation Institute

Ivan Damnjanovic, Ph.D.
 Associate Professor
 Texas A&M Transportation Institute

Chandra Caldwell
 Graduate Research Assistant
 Texas A&M Transportation Institute

John Mander, Ph.D.
 Research Engineer
 Zachry Department of Civil Engineering

Allison Weldon
 Graduate Research Assistant
 Texas A&M Transportation Institute

Brianne Glover, JD
 Associate Transportation Researcher
 Texas A&M Transportation Institute

Report 6-0700-1
 Project 6-0700
 Project Title: Innovative Finance

Performed in cooperation with the
 Texas Department of Transportation
 and the
 Federal Highway Administration

Published: August 2013

TEXAS A&M TRANSPORTATION INSTITUTE
 College Station, Texas 77843-3135



Disclaimer

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation.

Acknowledgments

This project was conducted in cooperation with TxDOT and FHWA. The authors thank Rick Collins, Project Monitoring Committee Members Frank Espinosa, Gretchen Stoeltje, John Sabala, Ron Hagquist, and Teresa Lemons for their invaluable support for this research effort. The authors would also like to thank John Henry and Chris Pourteau from TTI Communications for their excellent support in drafting the final executive summary brief.

TABLE OF CONTENTS

Disclaimer.....	iv
Acknowledgments.....	v
Introduction And Report Contents.....	1
Transportation Funding Framework	1
<i>How Outputs Become Inputs</i>	1
About This Executive Summary.....	2
Input Philosophies: Monies Coming In	3
Understanding How Revenues Relate To Services	3
<i>Where Revenue Dollars Go</i>	4
<i>Who Administers the Revenue Source?</i>	4
Creating A Matrix Of Funding Philosophies.....	5
Input Philosophy #1: User-Based Funding, Privately Controlled.....	6
Input Philosophy #2: User-Based Funding, Publicly Controlled	11
Input Philosophy #3: Public Good Funding, Privately Controlled	15
Input Philosophy #4: Public Good Funding, Publicly Controlled.....	18
Input Philosophy Currently Practiced In Texas	20
Output Philosophies: Maximizing Return On Investment	23
<i>Build</i>	23
<i>Leverage</i>	23
<i>Loan</i>	23
<i>Pay Down Debt</i>	24
<i>Capitalize</i>	24
Output Philosophy #1: Maximize Economic And Social Return From Transportation Investment.....	24
Constants To Consider With Any Strategy	29
<i>Constant #1: Long-Term Sustainability</i>	29
<i>Constant #2: Communicating Effectively with the Public</i>	29
<i>Constant #3: Matching Strategies to Their Appropriate Jurisdictions</i>	29
Conclusion And Further Research Needs	30
References	30

LIST OF FIGURES

Figure 1. Transportation Funding Framework2
 Figure 2. Funding Continuum.....3
 Figure 3. Facility Control Continuum4
 Figure 4. Input Philosophies Matrix5
 Figure 5. Input Philosophy #1: Possible Strategies to Consider Matrix7
 Figure 6. Input Philosophy #2: Possible Strategies to Consider Matrix 11
 Figure 7. Input Philosophy #3: Possible Strategies to Consider Matrix 15
 Figure 8. Input Philosophy #4: Possible Strategies to Consider Matrix 18
 Figure 9. Current Texas Philosophy: Where Texas Is Heading21

LIST OF TABLES

Table 1. Input Philosophy #1: Possible Strategies to Consider8
 Table 2. Input Philosophy #1: Characteristics.....9
 Table 3. Input Philosophy #1: Examples9
 Table 4. Input Philosophy #1: Benefits and Limitations 10
 Table 5. Input Philosophy #2: Possible Strategies to Consider..... 12
 Table 6. Input Philosophy #2: Characteristics 13
 Table 7. Input Philosophy #2: Examples 13
 Table 8. Input Philosophy #2: Benefits and Limitations..... 14
 Table 9. Input Philosophy #3: Possible Strategies to Consider.....16
 Table 10. Input Philosophy #3: Characteristics 17
 Table 11. Input Philosophy #3: Examples 17
 Table 12. Input Philosophy #3: Benefits and Limitations..... 17
 Table 13. Input Philosophy #4: Possible Strategies to Consider 19
 Table 14. Input Philosophy #4: Characteristics..... 19
 Table 15. Input Philosophy #4: Examples20
 Table 16. Input Philosophy #4: Benefits and Limitations.....20
 Table 17. Current Texas Philosophy Comparison22
 Table 18. Current Texas Philosophy: Characteristics22
 Table 19. Example Leveraging Mechanisms.....23
 Table 20. Output Philosophy #1: Maximize Economic and Social Return from
 Transportation Investment Possible Strategies to Consider25



It's time to rethink how we fund transportation infrastructure because most transportation experts agree: there's a transportation funding and financing crisis looming.

Introduction And Report Contents

It's time to rethink how we fund transportation infrastructure because most transportation experts agree: there's a transportation funding and financing crisis looming. Projected revenues from current sources of transportation funding will amount to only a fraction of projected transportation funding needs. This crisis will affect not only the state's ability to build and maintain new roads, but also its ability to adequately maintain its existing infrastructure. And the problem isn't localized; it's a growing concern across the United States.

While reports published recently provide possible strategies to consider, no readily available strategies exist for Texas transportation policy makers to use. Every year, state and local transportation agencies, academic research institutions, and private consultants develop numerous solutions for meeting Texas' transportation funding needs. Several reports provide interesting context on a host of different funding strategies, but few provide an overarching framework for organizing and understanding them.

This executive summary not only provides a list of possible out-of-the-box transportation revenue strategies, it also provides an overall framework in which to understand them. The authors intend to provide a holistic approach to examining how the state approaches how it funds and finances transportation infrastructure. These processes are part of an overall system with inputs, outputs, and institutional processes that ultimately govern how revenue is collected and allocated. This framework provides a guide to understanding the implications of current and innovative funding and financing strategies and will help Texas identify the preferred path for funding and financing our transportation network in the 21st century.

Historically, Texas has been a leader in transportation innovation. The Lone Star State has an opportunity to lead the nation again in rethinking how it funds transportation investment. Our state has already pioneered such innovative financing and project delivery mechanisms as public-private partnerships and comprehensive development agreements (CDA). However, Texas needs to adopt a new approach to truly transcend traditional strategies for funding, financing, and constructing transportation infrastructure that is both sustainable and acceptable to the public.

Transportation Funding Framework

Consider the method by which Texas pays for transportation infrastructure as a process with inputs and outputs. The inputs for this process are the fees and taxes that Texans pay on a regular basis (i.e., fuel taxes, vehicle registration fees, property taxes, and sales taxes). These dollars can then be used to build infrastructure, issue debt in the form of bonds, pay off debts, make loans to other entities involved in transportation, or capitalize other types of financing instruments such as infrastructure banks.

How Outputs Become Inputs

Many of this system's outputs can become inputs as well. For example, capitalizing infrastructure banks and providing loans to other entities for transportation development can provide more revenues (or inputs).

Meet Jane Texan

Jane represents the average texan. She's a mother of two, active in her community, and operates on a tight budget. She also uses (and pays for) transportation every day.

How Jane pays for transportation is an important concern for her, primarily because these changes directly affect her wallet. As we explain the five funding philosophies, we'll discuss how implementing them might affect Jane's bottom line.

Furthermore, many factors govern this system. System inputs are not necessarily detached from outputs, since in many cases the type of fee or tax collected will influence the way in which that money can be used. For example, legislation might require tolling revenues be spent on the facility from which they were generated. General sales tax revenues, on the other hand, can be used for almost any governmental function. So it's useful to consider the types of inputs that feed this system and how these different types of input ultimately affect system outputs.

Figure 1 shows a high-level conceptualization of this system, which forms the basis for the rest of the executive summary report.

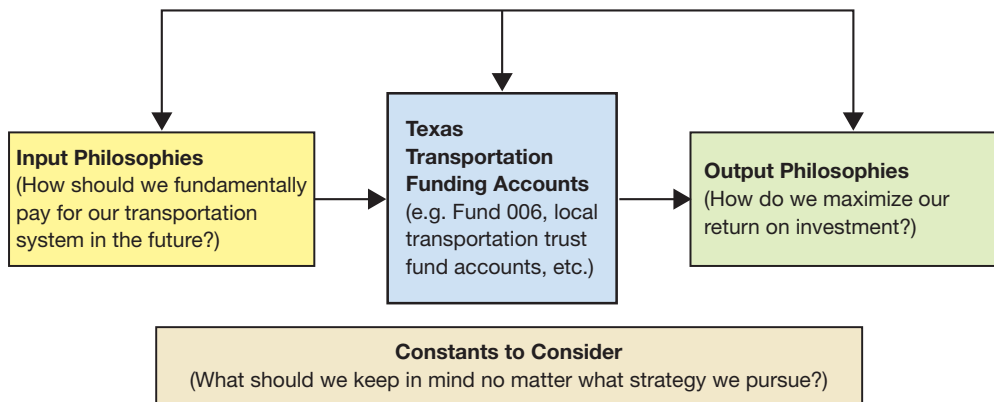


Figure 1. Transportation Funding Framework

About This Executive Summary

Three important areas are covered in the following sections of this executive summary. The first section explores a way of helping decision makers answer the question “How should we pay for our transportation system in the 21st century?” This is a complex question to answer.

We provide a four-quadrant matrix that groups available strategies together. While the authors of this report are not advocating one philosophy over the other, we do want to provide a useful way to better explore possible strategies. Output philosophies are more straightforward, since it was determined the principal goal of any output strategy would be to maximize economic and social return on investment. Finally, we present constants as a way to remind policy makers that no matter which strategy they pursue, they must consider a set of factors in order to be successful.

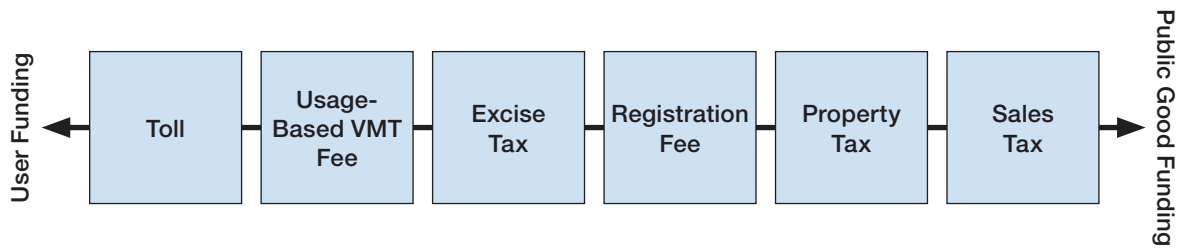


Figure 2. Funding Continuum

Input Philosophies: Monies Coming In

Inputs in this context can be best thought of as fees, taxes, and other revenue sources. The state collects many types of fees and taxes. A helpful way of simplifying the classification of these types of fees is to think about two aspects of the fee collection: how the state determined the amount to collect, and whether the service provided can or should be carried out by either the public sector or private businesses.

One way of thinking about revenue sources is to look at whether the fee paid has any relation to the good or service consumed. Revenue mechanisms can be placed on a continuum. Those sources of revenue with a close relationship to the service being charged for are found at the left of the continuum, while those that have little relationship with the good or service are found on the right. Figure 2 above describes this continuum in greater detail, with one end referring to user-based funding and the other referring to public good funding.

Understanding How Revenues Relate To Services

For example, tolls are charged for the use of a certain roadway. If someone does not use that facility, then they pay nothing, while someone who regularly uses that facility will pay more than an infrequent or occasional user. Thus, tolls are found on the far left of the continuum.

Fuel excise taxes are closer to the user funding concept because, in order to use the roadway system, one must consume fuel and pay the tax. Individuals fund the road network every time they fill up their gas tank and use the roadways. Furthermore, those who drive more will generally need to consume more fuel and, thus, will pay more. However, the rate paid is not perfectly tied to the value of the service. For example, vehicles have different levels of fuel economy, which results in motorists that drive in more fuel inefficient vehicles paying more than drivers of more fuel efficient vehicles. Thus, fuel is taxed less related to efficient pricing than tolls but still more related to use than vehicle registration fees, which do not vary with the number of miles driven. Sales taxes are the transportation funding source furthest removed from the services provided. This type of tax is set at a fixed percentage of the purchase price of a good. The amount of revenue returned corresponds to the value of the good purchased, not the value of the service the tax is being collected to fund.

User-Based Funding refers to how directly a revenue amount correlates to a service's value. The closer a revenue source directly correlates to a service's value (e.g., toll roads), the higher the revenue's "pricing efficiency." Arbitrary fees (e.g., vehicle registration fees) have low pricing efficiency because there is no direct relationship to their amount and the value they represent in funding transportation infrastructure.

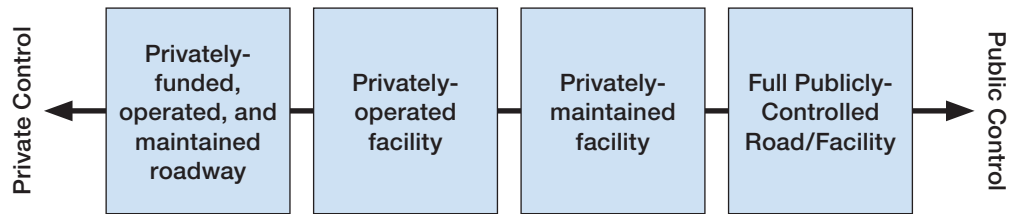


Figure 3. Facility Control Continuum

Where Revenue Dollars Go

Another aspect of this particular continuum is that, traditionally, legislators require usage-based pricing to support the facility from which the revenue was generated. For example, toll revenues often support the toll roads that generated them. Motor fuel tax revenues, on the other hand, often can fund non-roadway projects like transit projects, and motor fuel taxes paid in one state might pay for roadway enhancements in another via federal redistribution formulas. The sales tax paid on soft drinks may go to fund state law enforcement, education services, or any number of governmental uses. Thus, they are at the bottom of the continuum.

Who Administers the Revenue Source?

Another factor to consider in looking at revenue sources is to what extent the good or service being paid for is controlled or otherwise administered by the private or public sector. Again, this can be thought of on a continuum (see [Figure 3](#)).

At the far left of this continuum would be a service, such as a toll facility, that is completely controlled by a private entity. In this case, the private sector sets rates for access to the facility, collects fees, determines how revenues are used, and determines the rules for using the facility. Moving to the right on this continuum results in facilities where the private sector has little control over the facility. As shown in the figure, a move only to the center-right might be a toll facility where a private entity is contracted to perform basic maintenance functions, but the public sector handles the remainder of facility operations and administration, similar to a design-build or comprehensive development agreement contract in Texas.

Creating A Matrix Of Funding Philosophies

Combining these continuums results in a 4 × 4 matrix that serves to illustrate how governmental entities might use various revenue mechanisms to fund transportation programs (see Figure 4). Think of each quadrant as a philosophy of transportation funding, with the types of funding mechanisms deployed by the state reflecting a given philosophy.

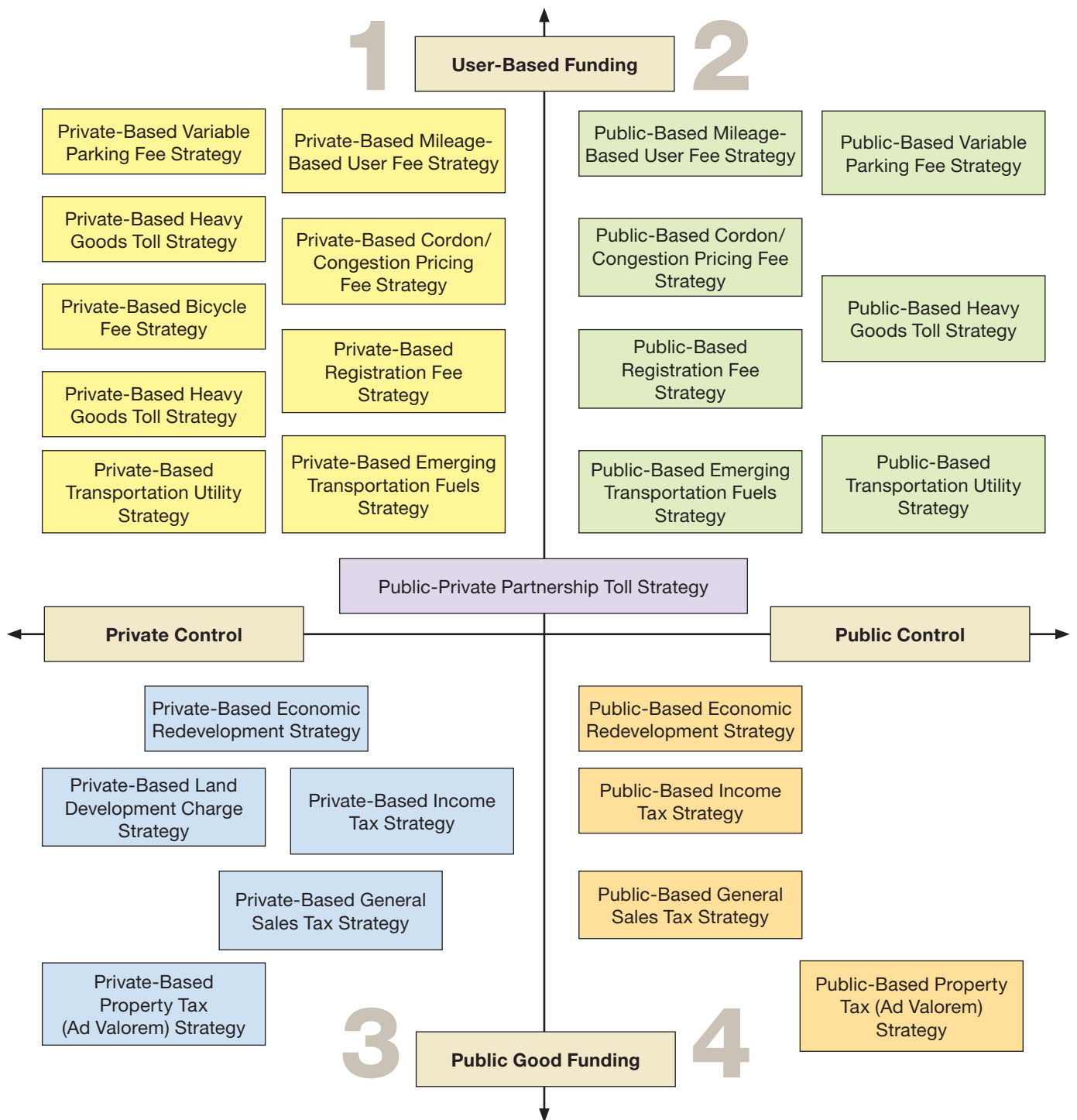


Figure 4. Input Philosophies Matrix



The following sections discuss innovative funding and financing strategies through the lens of these four quadrants. Each section describes the principles of each philosophy, the associated characteristics, and example funding and finance strategies and tactics that Texas could adopt.

What derives from this matrix is a framework for use in thinking about different ways for paying for transportation in the 21st century. Several input strategies based on four fundamental philosophies then emerge, as shown in [Figure 4](#).

**Philosophy #1:
the Impact on Jane
Texan?**

Under this philosophy, Jane pays for the transportation infrastructure that she uses and that's it. She would pay for roads wholly through tolls or an innovative mileage-based user pay system. If Jane drives more, she pays more. If less, then less.

Input Philosophy #1: User-Based Funding, Privately Controlled

The pay-for-use philosophy encompasses several principles. The first principle is that users of transportation services should pay for those services in proportion to their level of use (resulting in a high pricing efficiency rating). This means, for example, that if someone does not drive or otherwise travel on the transportation network, then they should not be charged for that use. And if two people travel on a roadway by the same means, then the individual who travels further or more often should be charged more. The second principle is that the price paid by road users incorporates the full costs associated with that use. This means, for example, that if a certain type of roadway is more expensive to maintain than another, then it should cost more to drive on the more costly facility. Similarly, if certain types of vehicles cause more wear and tear on the roadway, then those types of vehicles should be required to pay more for using the roadway.

A third principle is that the private sector controls the goods or services for which the public is being charged. This does not mean that the private sector necessarily owns that particular asset, but it does mean the private sector controls how that asset is operated and maintained. This also means that the private sector has control over how funding is used to develop that facility. This arrangement is often considered necessary when managing an asset in a dynamic environment. Governmental entities are often restricted by public policy in how they respond to changing conditions.

Understanding Philosophy #1 In Context

In Texas, transportation infrastructure development has traditionally been funded under the pay-as-you-go philosophy, meaning that infrastructure development could only occur when funds were actually available. However, by turning to alternative financing mechanisms, transportation improvements can be made without having cash on hand.

Private entities have more freedom to issue debt and raise capital through non-traditional means (i.e., they can develop transportation infrastructure in a much shorter time frame than governmental entities operating with a pay-as-you-go approach). Often, the mechanisms employed by these private entities require toll collection over the life of a project in order to recoup the up-front capital costs for construction. Such facilities are, therefore, often the perfect environment to deploy fees where the amount paid is based on use and the price is reflective of the actual cost to develop the project. [Figure 5](#) explores in greater detail Philosophy #1. [Tables 1](#) through [5](#) discuss different characteristics of Philosophy #1.

Philosophy #1: Principles

1. Users of transportation services should pay for those services in proportion to their level of use.
2. The price paid by road users for a service incorporates the full costs associated with that use.
3. The private sector controls the goods or services for which the public is being charged.

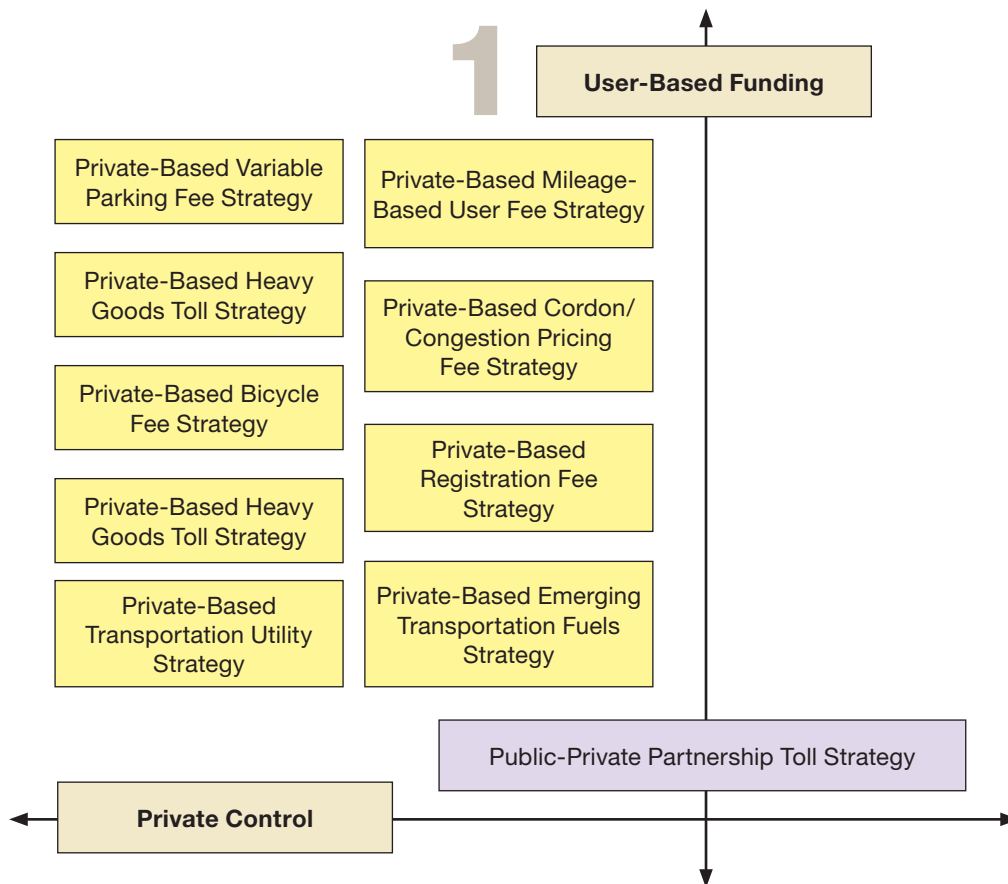


Figure 5. Input Philosophy #1: Possible Strategies to Consider Matrix

Table 1. Input Philosophy #1: Possible Strategies to Consider

Strategy	Brief Description	Resources and Examples
Private-Based, Mileage-Based User-Fee Strategy	A private consortium is responsible for building and maintaining a critically needed transportation facility. In return, that private consortium levies a charge per user on a per-mile basis.	Mileage-Based User Fee Alliance Minnesota Mileage-Based User Fee Task Force Implementing Mileage-Based User Fees in Texas Practical Strategies for More Optimal Vehicle Pricing
Private-Based Cordon/Congestion Pricing-Fee Strategy	Private consortium constructs and maintains infrastructure in a congested urban area. In return, that consortium is allowed to levy a congestion fee on users of that infrastructure.	London Cordon Pricing Program Singapore Area Licensing Scheme Stockholm (Sweden) Congestion Charging
Private-Based Variable Parking-Fee Strategy	Private consortium constructs and maintains parking infrastructure. In return, that consortium is allowed to levy a fee on drivers. This fee can vary by time of day.	Seattle Performance-Based Parking Pricing Study
Private-Based Bicycle-Fee Strategy	Private consortium builds and maintains bike-lane infrastructure. In return, that consortium is allowed to issue permits for bicycle lane use or operate bicycle rental facilities near bike-lane infrastructure.	Washington DC Capital Bikeshare Program Houston B-Cycle Program Minnesota Nice Ride Bike Rental Subscription Program London Barclays Cycle Hire Program
Private-Based Heavy-Goods Toll Strategy	Private consortium builds and maintains infrastructure, particularly for heavy vehicles. In return, that consortium is allowed to charge a toll on heavy vehicles based on factors such as weight and distance traveled.	Germany Heavy Goods Toll Collect Program Poland National Heavy Vehicle Toll System
Private-Based Transportation-Utility Strategy	Private consortium builds and maintains infrastructure in a particular jurisdiction. In return, that consortium is allowed to charge those who benefit in that jurisdiction through a regular (e.g., monthly) utility bill.	Prospects for Transportation Utility Fees Study
Private-Based Registration-Fee Strategy	Private consortium builds and maintains infrastructure in a specific jurisdiction. In return, that consortium is allowed to levy a regular fee on a regular basis (e.g. annually)	
Private-Based Emerging Transportation-Fuels Strategy	Private consortium is responsible for delivering transportation infrastructure to a specific jurisdiction. In return, that consortium levies a fee or toll on an emerging transportation fuel source (e.g., natural gas or electricity).	Monetizing “Vehicle-to-Grid” Network National Petroleum Council Future Transportation Fuels Study
Private-Public Partnership-Toll Strategy	Private consortium, in partnership with the public sector, builds and maintains transportation infrastructure. In return, the private consortium (regulated by the public sector) levies a toll per vehicle use.	

Table 2. Input Philosophy #1: Characteristics

Revenue Streams	Revenue streams are tied directly to infrastructure use. Transportation programs are funded through fees and taxes such as tolls and fuel taxes. Tolling would represent the purest form of charging under this principle, since a road user only pays for the distance they travel on the facility. Tolls that vary by the time of day, such that travel during periods of heavy congestion see the highest tolls, would better fit this philosophy, as the price paid would account for the extra cost associated with lost time due to congestion. Fuel taxes are less than ideal, namely because the amount that a road user pays largely depends on the fuel efficiency of their vehicle. Under this philosophy, transportation programs would not be funded through general revenue sources because tax payers are not paying into those funds based on the amount they travel.
Financing/Institutions	Under this philosophy, financing would likely be tied to generating usage-based revenue such as toll-backed binding instruments. Almost any financing instrument utilized under this philosophy would have to be tied to some metric of use. This would preclude the use of bonding instruments based on future general-fund revenues, and would also likely preclude the use of infrastructure banks. The private sector would be responsible for utilizing these instruments.
How Projects Are Selected	Under this philosophy, transportation projects are initiated, designed and selected wholly by the private sector. This means that investment decisions are based on market conditions. However, accountability to the public could decrease under this approach.
Public-Sector Role	The public sector has a minor role under this philosophy, likely being limited to ensuring that the private sector meets minimal levels of service for the road user.
Private-Sector Role	The private sector has the strongest influence under this philosophy. It is responsible for rate setting, investment decisions, facility operations and facility administration.

Table 3. Input Philosophy #1: Examples

International Examples	In the late 1990s, officials in New Zealand considered turning over control of the national roadway system to a series of commercial companies, with the central government and local authorities as shareholders. These quasi-governmental entities would operate the roadway network and would receive funding from an agency that would itself be funded with road usage fees and taxes (e.g., fuel taxes and vehicle excise duties). These private entities would then be responsible for providing roadway services such as maintenance and bridge replacement. However, the proposal was not acted upon.
U.S. Examples	Texas has in recent years begun to utilize Comprehensive Development Agreements (CDAs) for the provision of roadway infrastructure, mostly in areas experiencing significant population growth. A CDA gives the private sector the authority to plan, construct, maintain, and operate roadway facilities for a given time period. Under a CDA, the private facility owner is able to collect tolls from roadway users for the maintenance and expansion of the facility.
Non-Transportation Examples	Almost all the goods we consume on a regular basis fit this model. Private entities set the price of groceries, automobiles, housing, and other consumer goods according to the costs incurred in manufacturing and delivering these items to the end user.



Table 4. Input Philosophy #1: Benefits and Limitations

Benefits	<ol style="list-style-type: none"> 1. Pay-per-use philosophy means people who use it pay for it. 2. Private financing and project acceleration. 3. Greater ease in monetization of existing assets (NCSL, 2010).
Limitations	<ol style="list-style-type: none"> 1. Could mean subsidized transportation modes (e.g., bike lanes) could lose out. 2. Possible loss of public control and accountability. 3. Possible private profits at public's expense. 4. Risk of toll road pricing controversies. 5. Risk of Bankruptcy or Default (NCSL, 2010).

Input Philosophy #2: User-Based Funding, Publicly Controlled

This philosophy entails two distinct principles: pricing based on usage and the public owning the rights to the transportation system. The construction, maintenance, and operation of our transportation network carry a hefty price tag. Efficient pricing implies that those who use the system should bear the costs, since they receive the benefit of its usage. This principle also implies that costs should vary with usage.

In practice, this would mean that individuals who use the transportation network more will pay more, and those who use it less will pay less. This can be implemented in any number of ways, but the underlying principle is that those who receive benefits from the transportation network should pay in proportion with their usage.

The second principle is that the public should own and maintain the transportation network, as opposed to private ownership and management. This argues that owning, operating, and maintaining the transportation network should be inherently reserved to the government, not be relegated to private businesses. Part of the underlying belief is that the people should own the land and infrastructure, and that the government—which is the direct representative of the people—is responsible for operations and maintenance, and should be responsive to the needs of the people.

Figure 6 shows possible funding strategies to consider consistent with this philosophy. Table 5 provides a brief description of these philosophies and resources for additional information. Table 6 provides important characteristics associated with this philosophy; Table 7 provides examples and Table 8 provides benefits and limitations to this philosophy that are important to consider.

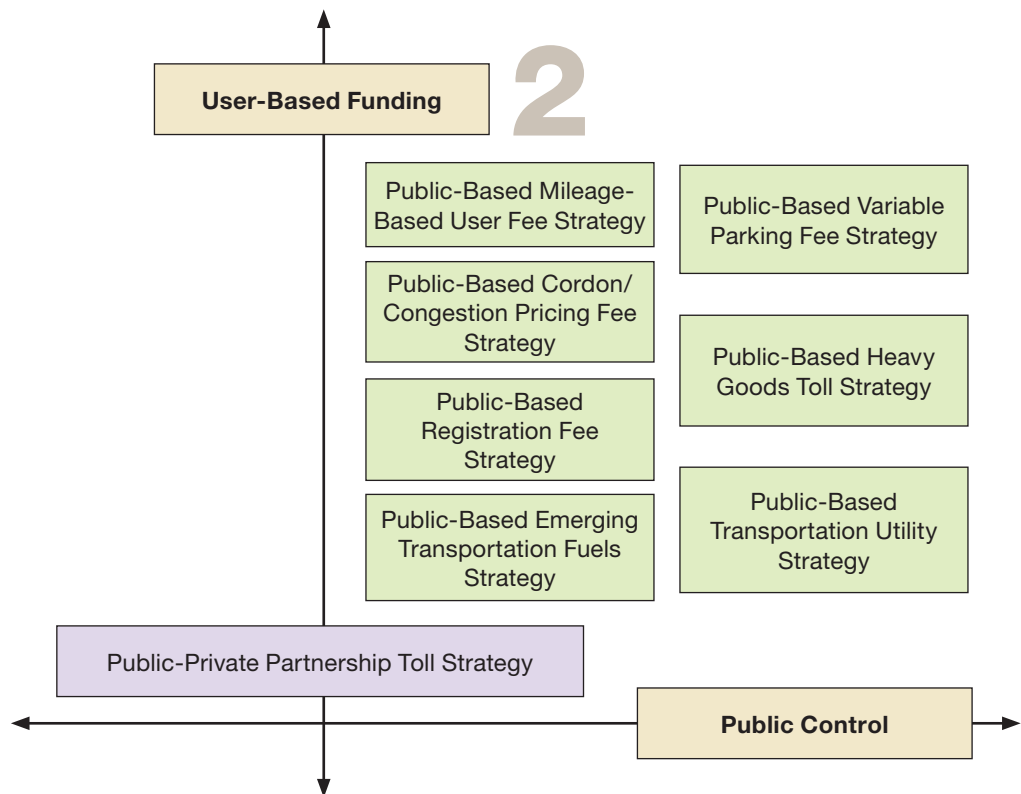


Figure 6. Input Philosophy #2: Possible Strategies to Consider Matrix

Philosophy #2: What's the Impact on Jane Texan?

As under Philosophy #1, under this philosophy, Jane Texan would still pay for transportation infrastructure through a user-fee based system. However, the public sector would retain significant control over available transportation infrastructure.

Jane would see public agencies (e.g., TxDOT), not a private company, handle much of the work associated with constructing and maintaining transportation infrastructure projects.

Philosophy #2: Principles

1. Pricing is based on level of usage.
2. The public sector controls the goods or services for which the public is being charged.

Table 5. Input Philosophy #2: Possible Strategies to Consider

Strategy	Brief Description	Resources and Examples
Public-Based Mileage-Based User-Fee Strategy	Public agencies (not the private sector) are responsible for building and maintaining critically needed transportation infrastructure. In order to pay for these improvements, the government levies a charge on a distance basis on users.	Mileage-Based User Fee Alliance Minnesota Mileage-Based User Fee Task Force Implementing Mileage-Based User Fees in Texas Practical Strategies for More Optimal Vehicle Pricing
Public-Based Cordon/Congestion Pricing-Fee Strategy	Public-sector agencies are responsible for maintaining infrastructure in a congested urban area. In order to pay for those improvements, the government levies a cordon-priced fee on users.	London Cordon Pricing Program Singapore Area Licensing Scheme Stockholm (Sweden) Congestion Charging
Public-Based Variable Parking-Fee Strategy	Public-sector agencies are responsible for maintaining parking infrastructure. In order to pay for those improvements, agencies levy a fee on drivers. This fee can vary by time of day, location, and other factors.	Seattle Performance-Based Parking Pricing Study
Public-Based Bicycle-Fee Strategy	Public-sector agencies are responsible for building and maintaining bike lane infrastructure. In order to pay for bike infrastructure, the government can require permits for bicycle lane use or operate bicycle rental facilities near bike lane infrastructure.	Washington DC Capital Bikeshare Program Houston B-Cycle Program Minnesota Nice Ride Bike Rental Subscription Program London Barclays Cycle Hire Program
Public-Based Heavy Goods-Toll Strategy	Public-sector agencies are responsible for building and maintaining infrastructure, particularly for heavy goods vehicles. In order to pay for this infrastructure, the government is allowed to charge a toll to heavy vehicles based factors such as weight or distance traveled.	Germany Heavy Goods Toll Collect Program Poland National Heavy Vehicle Toll System
Public-Based Transportation-Utility Strategy	Public-sector agencies are responsible for building and maintaining infrastructure in a particular jurisdiction. In return, the government charges those who benefit in that jurisdiction through a regular (e.g., monthly) utility bill.	Prospects for Transportation Utility Fees Study
Public-Based Registration-Fee Strategy	Public-sector agencies build and maintain infrastructure in a specific jurisdiction. In order to pay for this infrastructure, residents pay a regular fee (e.g., monthly or annually) in that jurisdiction.	
Public-Based Emerging Transportation-Fuels Strategy	Public-sector agencies are responsible for delivering transportation infrastructure to a specific jurisdiction. In order to pay for this infrastructure, the government levies a fee on an emerging transportation fuel source (e.g., natural gas or electricity).	Monetizing “Vehicle-to-Grid” Network National Petroleum Council Future Transportation Fuels Study
Public-Private Partnership-Toll Strategy	Private consortium (with greater public oversight) builds and maintains transportation infrastructure. In return, the public sector levies a toll per vehicle use.	Lessons Learned from Public-Private Transportation Projects in Texas

Table 6. Input Philosophy #2: Characteristics

Revenue Streams	Revenue streams come through sources directly related to transportation infrastructure use. Funding relies on sources like tolls, fuel taxes, vehicle mileages fees, or other usage-based charges. Under the purest form of the efficient pricing principle, all funding sources tie directly to how much an individual uses the transportation network, without any distortions, loopholes, or ways to evade taxation. Additionally, the transportation network does not receive funds from general revenue sources, like sales taxes or property taxes.
Financing/Institutions	Institutions and financing methods are designed to help advance revenue from sources directly related to transportation. The public sector develops or uses most financing tools, since it has principal control over the transportation asset. This could provide significant benefits because the public sector has access to cheaper capital, ensuring that a public transportation facility is owned and operated effectively and efficiently.
How Projects Are Selected	The public sector initiates, designs, and selects transportation projects wholly. This is beneficial because government is directly accountable to voters, and, therefore, has strong incentives to deliver only projects that are popular and preferred by the public.
Public-Sector Role	The public sector has a significant role, since it is responsible for funding, financing, designing, managing, operating, and maintaining transportation infrastructure. All strategies easily capture revenue from usage of the network, which directly fund the transportation system.
Private-Sector Role	Little to no private participation in transportation infrastructure design or construction is needed. Under the belief that transportation should be paid for under user-based principles and publicly controlled, the private sector would have a minimal role in the development of Texas transportation infrastructure.

Table 7. Input Philosophy #2: Examples

International Examples	There are several international schemes set up that fit closely with this philosophy. Many European countries generate revenue from tolling and fuel taxes that directly charge users for the amount they use. In London, motorists entering parts of the city must pay for their access of the transportation system through the use of toll collection. Singapore, perhaps the most noteworthy example of this strategy, funds their transportation network by charging users for any use of the transportation network via distance-based tolls, user fees on transit, and other methods.
U.S. Examples	The United States has several examples of usage-based funding, notably the gas tax and the use of publicly owned tolling authorities. These revenue streams charge users based on their usage, although the gas tax is not an optimal strategy since it allows distortions related to high-mileage vehicles and electric vehicles do not pay this tax.
Non-Transportation Examples	There are several clear examples of this strategy in non-transportation sectors. Publicly-owned utility companies provide services to the general population that charge individuals based (at least partly) on the amount they consume. Individuals who use electricity, water, and other publicly provided services pay for their usage based on the amount they consume. These revenues fund the service provider and enable them to continue operating.



Revenue streams come through sources directly related to transportation infrastructure use. Funding relies on sources like tolls, fuel taxes, vehicle mileages fees, or other usage-based charges.

Table 8. Input Philosophy #2: Benefits and Limitations

Benefits	<ol style="list-style-type: none"> 1. Pay-per-use philosophy means people who use it pay for it. 2. Facility control remains within the public sector. 3. Future public revenues (through tolling or other methods) stay within the public sector. 4. There exists less risk of negotiating a contract where a company profits at the expense of the public.
Limitations	<ol style="list-style-type: none"> 1. User-pay belief may mean subsidized transportation modes (e.g., bike lanes) could lose out. 2. Equity concerns (could disproportionately hurt low-income households, since a greater percentage of their income is spent on transportation). 3. Inability to use private financing and project acceleration due to capital vehicles available in the private sector. 4. There exist fewer opportunities to transfer risk to the private sector.

Input Philosophy #3: Public Good Funding, Privately Controlled

This philosophy entails two distinct principles: infrastructure is funded through general revenues and the private sector is responsible for operating and maintaining the transportation system. This is based on the belief that since everyone benefits directly or indirectly benefit from having a functioning transportation network, all should pay collectively regardless of use. The principle of public good funding implies that since all individuals benefit, everyone should pay a share of the burden for funding the transportation network. This principle argues that funding should be taken from general revenues, and should not be related to the amount one uses in the transportation network.

The principle of private ownership and operation argues that the private sector can often do things more efficiently or effectively than the public sector and, as such, should be the entity that owns and operates the transportation network. This principle, like the others, operates along a continuum. At the furthest point out on the continuum is where the private sector has full ownership and control over the transportation network. In this area, they make decisions about how the network should be managed and operated, and have complete ownership of the network. Moving closer to the axis on the continuum reduces the role that the private sector plays, and the government begins to take a stronger role. For example, the government might own the network, and set the rules for how private industries can operate.

Figure 7 below provides a close-up examination of possible funding strategies to consider that are consistent with this philosophy. Table 9 provides a brief description of these philosophies and resources for additional information. Table 10 provides important characteristics associated with this philosophy; Table 11 provides examples and Table 12 provides benefits and limitations to this philosophy that are important to consider.

Philosophy #3: What's the Impact on Jane Texan?

Under this philosophy, Jane Texan wouldn't pay for her transportation access through a user-fee based system. Instead, she would pay for transportation infrastructure similar to how she pays for public education—everyone pays in and everyone benefits.

Regardless of how much or little she drives, she would pay the same amount annually. Those funds would be managed and controlled by the private sector.

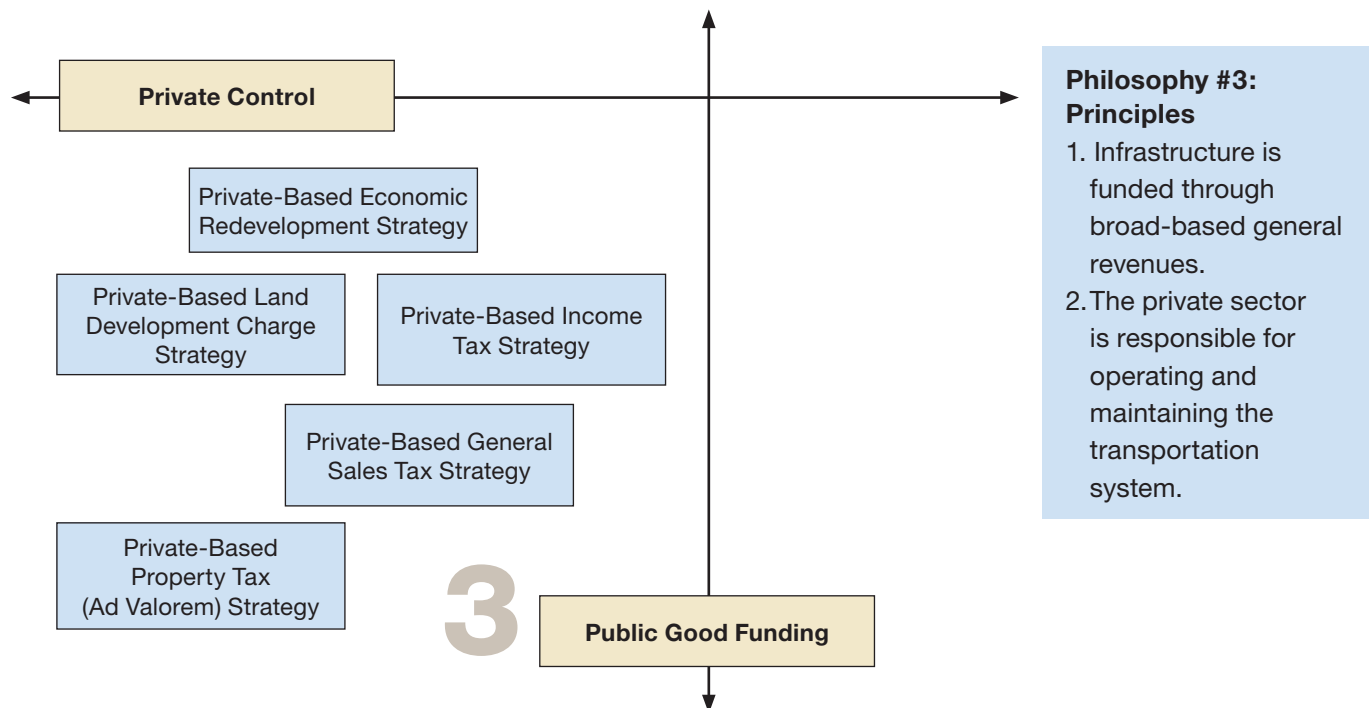


Figure 7. Input Philosophy #3: Possible Strategies to Consider Matrix



Table 9. Input Philosophy #3: Possible Strategies to Consider

Strategy	Brief Description	Resources and Examples
Private-Based General Sales-Tax Strategy	Private consortium is responsible for building and maintaining transportation infrastructure in a jurisdiction. In return, the private consortium is authorized to receive a general lump-sum payment from sales tax revenue collected from citizens in that jurisdiction.	CT News Junkie: Tolls or Taxes? How to Fund Transportation Infrastructure
Private-Based Property-Tax (Ad Valorem) Strategy	Private consortium is responsible for building and maintaining transportation infrastructure in specific jurisdiction. In return, the private consortium is authorized to receive a lump-sum payment from property-tax revenue collected from citizens in that jurisdiction.	IAAO.ORG: Building Market-based (Ad Valorem) Property Assessment Capacity—International Challenges and Opportunities in Developing Countries
Private-Based Income-Tax Strategy	Private consortium is responsible for building and maintaining transportation infrastructure in specific jurisdiction. In return, the private consortium is authorized to receive a lump-sum payment from federal, state, or local income-tax revenue collected from citizens in that jurisdiction.	NGA Center for Best Practices: How States and Territories Fund Transportation
Private-Based Land Development-Charge Strategy	Private consortium is responsible for building and maintaining transportation infrastructure in specific jurisdiction. In return, the private consortium is authorized to receive a lump-sum payment from general land-development charge revenue collected in that jurisdiction.	NGA Center for Best Practices: How States and Territories Fund Transportation
Private-Based Economic-Redevelopment Strategy	Many economic redevelopment programs serve as a surrogate for this approach.	NGA Center for Best Practices: How States and Territories Fund Transportation

Table 10. Input Philosophy #3: Characteristics

Revenue Streams	Revenue streams come through sources not directly related to transportation infrastructure use. Instead of relying mainly on revenue coming through tolls, gas taxes, or other methods based on a pay-per-use approach, funding comes through general sales taxes, property taxes, or other fees levied generally (i.e., not directly related to a specific mode of transportation) on a specific jurisdiction.
Financing/Institutions	Institutions and financing methods are designed to help advance revenue from sources not directly related to transportation. However, private industry promotes most of the financing tools, since the private business sector retains principal control over the transportation asset.
How Projects Are Selected	The private sector initiates, designs, and selects transportation projects. This is beneficial because the private sector might be more efficient or effective at selecting projects in which to invest. All projects should turn a profit, however. Otherwise, the private sector is unlikely to operate or manage these. Projects unlikely to turn a profit would not be funded, or the government would have to pay private businesses to operate these.
Public-Sector Role	The public sector has a limited role, raising funds for projects through general revenues not tied to transportation usage, funding the projects, and then turning the project over to the private sector for management and operation.
Private-Sector Role	The private sector is responsible for much of the infrastructure design, construction, operation, and maintenance. The private sector owns, operates, and maintains the infrastructure, but does not finance or fund its development. The public sector funds projects and then turns over the rights to the private sector for operation and maintenance. Any revenues the private sector generated are not returned to the general revenue pool.

Table 11. Input Philosophy #3: Examples

International Examples	There are limited international examples that fit well within this approach. A hypothetical example would be the construction of a bridge or road, paid for from general funds, and then turned over to the private sector to run and collect tolls.
U.S. Examples	It's difficult to find examples of this principle being applied in the United States for transportation-related purposes for roadway services. However, a possible example of this philosophy might be found in the leveraging of an incremental property tax increase to pay for roadway development within a private subdivision, commercial development, mixed-use development, or other privately owned and maintained property. The levying of this tax for development on private property might be justified if the transportation investment provided economic benefits in the form of jobs or increased sales tax revenues.
Non-Transportation Examples	One example of this strategy is the construction of sports stadiums and other private venues with tax dollars or bonds. The local government uses revenues unrelated to usage of the facility to construct the stadium, and then turns over the stadium to the private sector to own and manage. The decision to construct these types of facilities is usually made with the intention of increasing economic activity in the locality.

Table 12. Input Philosophy #3: Benefits and Limitations

Benefits	<ol style="list-style-type: none"> 1. Private financing and project acceleration 2. Greater ease in monetization of existing assets (NCSL, 2010)
Limitations	<ol style="list-style-type: none"> 3. Possible loss of public control and accountability 4. Possible private profits at public's expense

**Philosophy #4:
What's the Impact on
Jane Texan?**

Not much would change for Jane Texan. Transportation leaders would move away from user fee-based funding and toward a public good funding model, where everyone pays and everyone benefits. The public sector would continue to own, manage, and operate transportation infrastructure.

**Philosophy #4:
Principles**

1. Government should control transportation assets.
2. The people should pay collectively (not based on use) for transportation because they benefit collectively.
3. The people should pay for transportation because a healthy transportation system serves the public interest.

Input Philosophy #4: Public Good Funding, Publicly Controlled

This philosophy is founded on the notions that government should control a transportation asset and people should pay collectively for transportation because they benefit collectively. This philosophy also embraces the belief that people should pay for transportation because a healthy transportation system is in the public interest. In other words, transportation is treated as a purely public good, and it is, therefore, best if the government retains stewardship of the transportation asset.

People collectively pay for (and benefit from) transportation, and payment is not directly tied to the amount of transportation one consumes. This is based on the belief that everyone benefits (personally, economically, developmentally, etc.) from an efficient and effective transportation network, whether someone drives 1,000 miles or 1 mile per month. They still consume goods, access services, or otherwise meet a need via the transportation network.

An efficient network would allow people to travel as much as they want, when they want, and how they want. Ultimately, transportation is owned, operated, maintained, and managed by the government which is essentially an organization directly accountable to the public for delivering efficient, effective, and responsive service. [Figure 8](#) below provides a close-up examination of possible funding strategies to consider that are consistent with this philosophy. [Table 13](#) provides a brief description of these philosophies and resources for additional information. [Table 14](#) provides important characteristics associated with this philosophy, while [Table 15](#) provides examples.

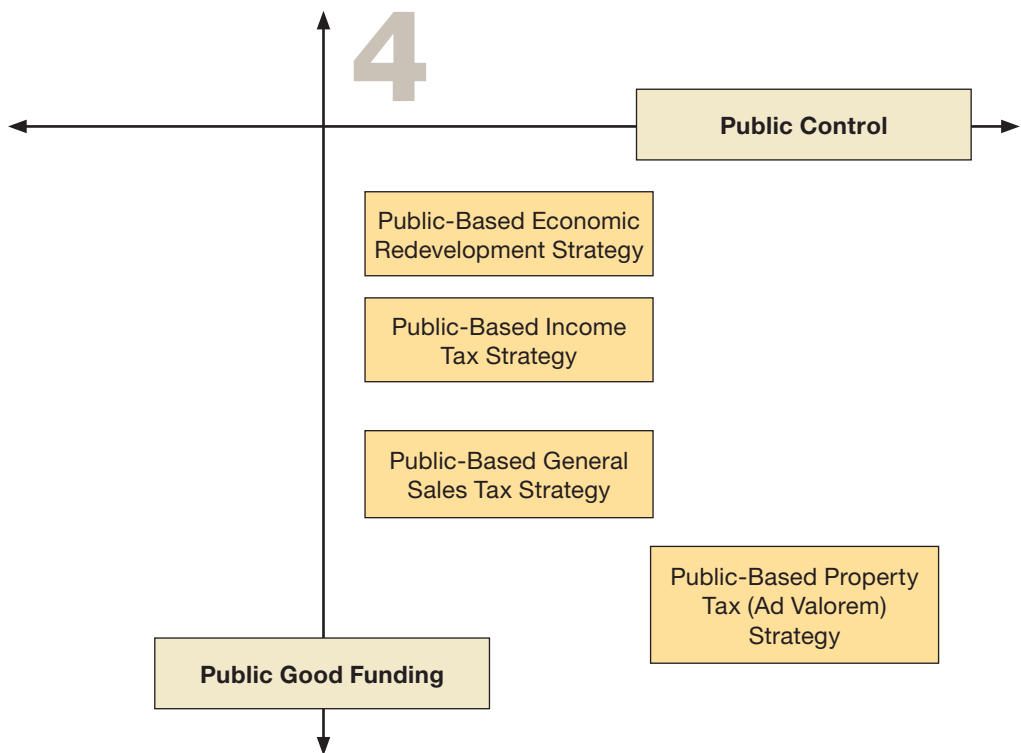


Figure 8. Input Philosophy #4: Possible Strategies to Consider Matrix

Table 13. Input Philosophy #4: Possible Strategies to Consider

Strategy	Brief Description	Resources and Examples
Public-Based Sales Tax for Transportation Strategy	Public sector is responsible for building and maintaining transportation infrastructure in a jurisdiction. In return, the public sector can levy general sales tax revenue from citizens in that jurisdiction.	Dye Management: Moving Texas to the 21st Century: A Report on Transportation Demand, Estimated Investment Needs and Funding Options for Texas Dye Management: Findings and Analysis
Public-Based Property Tax for Transportation Strategy	Public sector is responsible for building and maintaining transportation infrastructure in a specific jurisdiction. In return, the public sector can levy property tax revenue from citizens in that jurisdiction.	Dye Management: Moving Texas to the 21st Century: A Report on Transportation Demand, Estimated Investment Needs and Funding Options for Texas Dye Management: Findings and Analysis
Public-Based Income Tax for Transportation Strategy	Public sector is responsible for building and maintaining transportation infrastructure in a specific jurisdiction. In return, the public sector can levy income tax revenue from citizens in that jurisdiction.	Dye Management: Moving Texas to the 21st Century: A Report on Transportation Demand, Estimated Investment Needs and Funding Options for Texas Dye Management: Findings and Analysis

Table 14. Input Philosophy #4: Characteristics

Revenue Streams	Revenue streams come through sources not directly related to transportation infrastructure use. Instead of relying mainly on revenue coming through tolls, gas taxes, or other methods based on a pay-per-use approach, funding comes through general sales taxes, property taxes, or other fees levied generally (i.e., not directly related to a specific mode of transportation) on a specific jurisdiction.
Financing/Institutions	Institutions and financing methods are designed to help advance revenue from sources not directly related to transportation. However, most financing tools assist or derive from the public sector, since the public sector would have principal control over the transportation asset. This could provide significant benefits because the public sector would have access to cheaper capital, ensuring that a public transportation facility is owned and operated effectively.
How Projects Are Selected	The public sector initiates, designs and selects transportation projects wholly. This is beneficial because government is directly accountable to voters, and therefore has strong incentives to deliver only projects that are popular and preferred by the public.
Public-Sector Role	The public sector has a significant role under this guiding philosophy. It is responsible for funding, financing, designing, managing, operating, and maintaining transportation infrastructure. All strategies are geared toward supporting a general fund of revenue that helps fund transportation investment.
Private-Sector Role	Little to no private participation in transportation infrastructure design or construction is needed. Under the belief that transportation should be publicly funded and controlled, the private sector has a minimal role in the development of transportation infrastructure.

Table 15. Input Philosophy #4: Examples

International Examples	There are several international models that fit closely with this philosophy. In some countries, 100 percent of funds used for financing the construction of transportation infrastructure come through general revenue funds.
U.S. Examples	Many states have pursued several strategies for funding transportation through general funding. For example, Colorado recently explored the possibility of increasing the state sales and use tax and dedicate the increase in revenue to transportation-related purposes (Michigan.gov). Georgia has also recently pursued an initiative to increase its statewide sales tax by 1 cent to be used for transportation-related projects selected by the public sector. For both initiatives, the public sector controls the project selection process.
Non-Transportation Examples	There are several non-transportation examples of this model. Funding for Texas' public schools comes from three main sources: local property taxes, state sales tax revenues, and federal funding (Finance, 2010). The government is responsible for constructing the schools. Generally, parents of children who attend these schools are not required to pay a fee for doing so because the financial burden for operating schools resides with state sales tax payers and local property tax payers. The public sector (e.g., school personnel, state and federal policy makers, the community) is responsible for influencing how much money is raised for education and how those funds are used (Association).

Table 16. Input Philosophy #4: Benefits and Limitations

Benefits	<ol style="list-style-type: none"> 1. Facility control remains within the public sector. 2. Future public revenues (through tolling or other methods) stay within the public sector. 3. There exists less risk of negotiating a contract where a company profits at the expense of the public. <p>Modes that provide mobility but that do not generate revenue (e.g., bike 4. infrastructure) won't lose out</p>
Limitations	<ol style="list-style-type: none"> 1. Possibility for some modes to subsidize others 2. Inability to use private financing and project acceleration due to capital vehicles available in the private sector. 3. There exist fewer opportunities to transfer risk to the private sector.

Input Philosophy Currently Practiced In Texas

The Texas approach to funding transportation has evolved over the years, starting with a philosophy emphasizing public good based funding and public ownership, but also sampling some strategies from other quadrants. Notably, in recent years, the Texas system has moved further toward efficient pricing but more toward private management. Historically, Texas has relied heavily on the motor fuels tax, registration fees, licensing, and other fees. These strategies align with the public ownership side of the continuum, and include elements of both the efficient pricing and public good principles. The motor fuels tax is usage based, but more accurately reflects use of gasoline, not the transportation network. The fuel tax charges motorists indirectly for their use of the transportation network, the assumption being that if you're buying gasoline, you're driving on the roads. In recent years, this strategy has become less accurate and effective as a mechanism for charging users for using the network, however, since average fuel economy has increased and certain vehicles (i.e., electric vehicles) will pay much less, if anything at all, under this strategy.

Motor-vehicle registration fees are another funding mechanism that indirectly charges for using the transportation network, since all vehicle owners must pay registration fees each year. This funding strategy does not vary with usage, and as such, incorporates some aspects of the public good principle. Fees associated with licensing motorists occupy a similar position on the transportation funding grid. Motorists must pay to access the road network, but the price does not vary with usage.

Tolling is a funding strategy that Texas has used increasingly in recent years. Tolling is a usage-based funding strategy high on the user based funding continuum. Its place along the public/private ownership continuum depends on the implementation specifics, as private or public entities can operate toll roads. Traditionally in Texas, public agencies have operated toll roads. Figure 9 illustrates this shift in policy direction away from Philosophy #4 (public control/public-good funding) and toward Philosophy #2 (public control/user-based funding). Table 16 maps current Texas funding practice to the philosophical principles described in this report. Table 17 describes characteristics of current Texas practice.

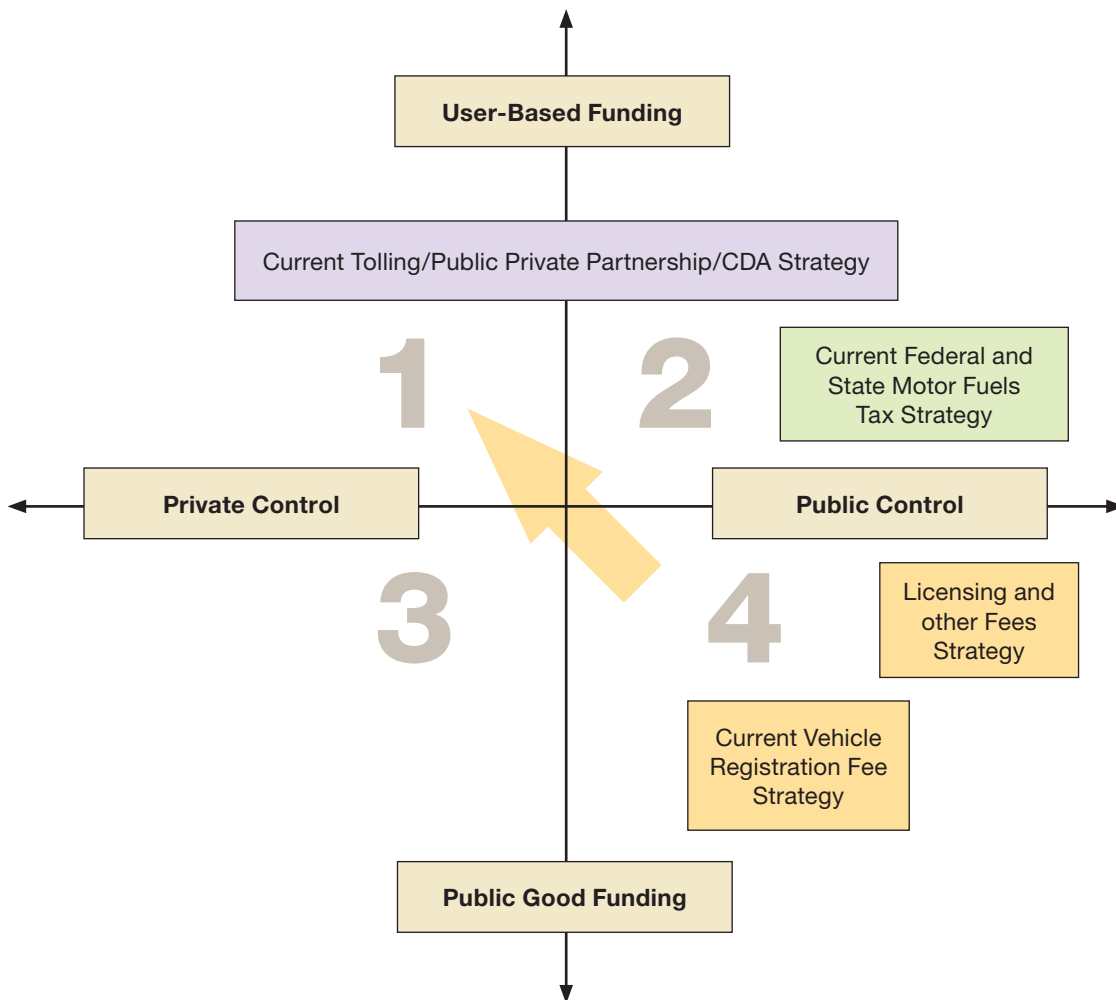


Figure 9. Current Texas Philosophy: Where Texas Is Heading

Table 17. Current Texas Philosophy: Comparison

Strategy	Philosophy Quadrant	Principles
Current Federal and State Motor Fuels Tax Strategy	2	Efficient pricing and public ownership
Current Motor-Vehicle Registration Fee Strategy	2 and 4	Efficient pricing, public ownership, elements of public good
Licensing and Other Fee Strategy	2 and 4	Efficient pricing, public ownership, elements of public good
Tolling Strategy	1 and 2	Efficient pricing, elements of both private and public ownership

Table 18. Current Texas Philosophy: Characteristics

Revenue Streams	Texas generates revenues from strategies across the philosophical spectrum. The majority of funding comes from the fuel tax, which is usage based and publicly controlled. Other mechanisms, like toll roads, are properly priced with aspects of both public and private control. Currently, Texas uses several strategies without a clear overriding philosophy; although there has been a gradual progression toward more user-based funding and private control.
Financing/ Institutions	Texas has traditionally used a pay-as-you-go approach to financing projects. This means that projects must have preexisting funding sources available, and projects cannot begin without funding. Recently, Texas has increasingly relied upon toll roads and CDAs to finance infrastructure construction. This shift has moved Texas closer to relying on the private sector and away from the public as the sole source for financing.
How Projects Are Selected	Under the current philosophy, the public sector has largely initiated, designed, and selected transportation projects. The private sector plays a role in design, various analysis components, and construction.
Public-Sector Role	Historically, Texas relied upon the public sector exclusively for the majority of transportation needs.
Private-Sector Role	More recently, Texas has gradually made greater use of private-sector dollars to finance new projects.

Output Philosophies: Maximizing Return On Investment

In addition to input philosophies that deal with how to best fund transportation, several strategies can also help to maximize those revenue streams discussed earlier, as well as preserve existing infrastructure assets.

The five strategies detailed below constitute ways in which transportation agencies can most efficiently use moneys levied from the public. Regardless of the strategy employed, however, there is, in general, one unifying theme that guides decision making: maximizing economic and social return from the investment of the public funds in transportation. By exploring strategies consistent with the belief that *transportation agencies should maximize the economic and social return from transportation investment* (as discussed in greater detail below), Texas could better position itself to take full advantage of the transportation assets now and into the future.

Table 19. Example Leveraging Mechanisms

Leveraging Mechanism	Description
General Obligation Bonds	Backed by the full faith and credit of the government, these bonds usually have the highest credit rating.
Revenue Bonds	Backed by a specific revenue source, such as toll revenue, each type bond has its own risk profile, benefits, and limitations. Bonds need not be tied to tolls, however.
Grant Anticipation Revenue Vehicle (GARVEE)	A debt-financing instrument issued by governmental entities where the principle and interest is repaid primarily through federal-aid funds, meaning that the bonds are paid back through the receipt of federal-fuel tax revenue disbursements.
Grant Anticipation Note (GAN)	Similar to a GARVEE, a GAN is repaid primarily through Federal Transit Administration grants.

Build

This is perhaps the most traditional use of transportation funding and includes building transportation facilities (e.g., new roads and bridges), maintaining those facilities, and developing other transportation-related enhancements such as sidewalks and bike paths. This action involves developing transportation infrastructure in a strategic way so that it promotes mobility, economic growth, and other priorities.

Leverage

When it comes to revenue, there are two types of leveraging: financial and physical. *Financial leveraging* involves techniques such as using future collected funds to generate near-term revenue in order to build a transportation infrastructure project (e.g., issuing bonds). [Table 18](#) lists some examples of leveraging mechanisms.

In *physical asset leveraging*, techniques such as right-of-way acquisition or signage or other physical assets of the transportation system are used to generate future revenue. Existing assets may be leveraged to create new revenue streams.

Loan

Governmental entities can loan resources to other entities, most often a subordinate entity such as a county or city. Loaning the money to other entities will result in increased revenues through interest returned on the loan.

Pay Down Debt

Debt is often incurred in the leveraging of funds for bonds, credit, or loans. Paying down or off this debt is an output of the transportation funding and financing system. Transportation agencies borrow an increasing amount of capital up-front to help pay for transportation infrastructure improvements. Paying down that debt is one way to reduce the burden of transportation funding on the final consumer.

Capitalize

Funding can also be used to capitalize other funds, such as state infrastructure banks. These funds often use similar tactics (such as lending and leveraging) in order to achieve very specific transportation-related goals. However, they require a source of funding to achieve this. This strategy involves using funds to develop other transportation-related funding sources.

For example, many states are looking to or have already developed State Infrastructure Banks (SIBs), essentially a revolving infrastructure investment fund that provides loans and various forms of credit assistance to governmental and private entities for infrastructure development. Credit assistance can take the form of a direct loan, a loan guarantee or a line of credit. An SIB can be capitalized from any number of sources including federal-aid highway apportionments and state funds. The Texas Mobility Fund is an example of using state revenues for capitalization. The fund receives revenues from various state fees and taxes, which allows it to issue bonds backed by those resources.

Output Philosophy #1: Maximize Economic And Social Return From Transportation Investment

Maximizing the economic and social return from transportation investment is the only output philosophy. Consider again the five strategies for using existing transportation dollars:

- **Build:** In terms of building infrastructure, transportation policy makers fight to ensure that physical infrastructure is developed in a manner that serves the public need and meets the highest standards of the state. In many ways, this already is occurring.
- **Leverage:** Policy makers ensure that assets held in the public trust are utilized to their fullest extent while minimizing risk.
- **Pay Down Debt:** Policy makers ensure that the state meets its financial obligations in a manner that instills faith in those seeking to invest.
- **Loan:** Policy makers ensure that state resources are used for purposes that serve the public good.
- **Capitalize:** Policy makers ensure that resources for innovative and dynamic infrastructure investment are available in the long term.

As is the case with the input philosophies discussed earlier, maximizing economic and social return from transportation investment leads to different strategies and tactics within each activity. As shown in [Table 19](#), policy makers can pursue several different strategies for maximizing the economic and social return from transportation investment.

Table 20. Output Philosophy #1: Maximize Economic and Social Return from Transportation Investment Possible Strategies to Consider

Strategy	Brief Description	Resources and Examples
Transportation Reinvestment Zones	Allows cities and counties to capture future property-tax gains to pay for road projects. The governing body of a city or county determines the area within its jurisdiction (Dye Management Group, Inc., 2009, pp. ES-6).	Transportation Reinvestment Zone Handbook
Collect and Sell Electricity through Convection Technology	Method to collect and sell electricity along surface transportation infrastructure through convection technology embedded in the roads. While there are several technical challenges that remain, recent engineering advancements could make it more feasible in the future.	Buildipedia: Asphalt Solar Collectors - The Future is Now
Encapsulate Solar Panels in High-Strength Glass	Method to harvest solar energy by encapsulating solar panels in high-strength glass that is capable of standing up to thousands of cars and trucks passing by each day.	Watch "Solar Roadways: The Prototype" Here Wired Magazine: Solar Roads Fix the Grid and Crumbling Pavement Scientific America: Driving on Glass? Inventor Hopes to Lay Down Solar Roads
Collect and Sell Energy from Solar Bridges	Method to collect and sell energy through solar panels placed on bridges.	The Guardian: World's Largest Solar Bridge Engineering News: Big London Train Station Solar Array Project Advances SolarCentury: About Us Lawrence Berkeley Nat'l Laboratory: The Installed Cost of Photovoltaics in the U.S. from 1998-2007
Collect and Sell Energy from Solar Wind Turbines	Method to embed wind large turbines on the bottom of large bridges to help generate electricity. This electricity could then be sold to local electric companies.	Autoblog Green: Italian Designers Envision Solar Wind Bridge Ubergizmo: Solar Wind Bridge Concept Aims to Harvest Energy
Collect and Sell Rainwater on Right-of-Way	Collecting rainwater along existing right-of-way could help solve Texas' water problems and help provide funding for Texas infrastructure.	Daily Courier: Large-Scale Rainwater Harvesting - Is it Worthwhile? Granite Environmental: HyDRO Rainwater Collection Systems
Harvest and Sell Switch Grass on Right-of-Way for Biofuel Production	This strategy involves using existing ROW to produce and harvest switch grass for biofuel production. This biofuel would be sold and money earned from the production of this product would help go to fund transportation investment.	Scientific American: Grass Makes Better Ethanol than Corn Does Greentechmedia: Can biofuel be economically coaxed from a modest plant? Environment News Service: Switchgrass Ethanol Yields Large Net Energy Gain Past Peak: Switchgrass to Ethanol

Sell/Lease Land for Wind Farms along Right-of-Way	Selling or leasing land for wind farms along highway medians could be a way to raise additional revenue for critically-needed infrastructure.	Parallel Infrastructure, INC: Right-of-Way Value Maximization and Communications Infrastructure Development
Sell/Lease Transportation Facility "Naming Rights"	This strategy involves generating additional revenue through selling "naming rights" of a transportation asset. A transportation agency could allow a private or non-profit organization to "sponsor" a facility.	Washington Examiner: Virginia Drafting Rules for Highway Naming
Sell/Lease Right-of-Way to Electric Utility/ Communications Market	Monetize right-of-way by leasing out large sections of land to utility companies and telecommunications providers. Use revenue from lease agreements to help fund future infrastructure investment.	Parallel Infrastructure, INC: Right-of-Way Value Maximization and Communications Infrastructure Development
Sell/Lease Right-of-Way for Natural Gas Pipeline Infrastructure	Texas has experienced a boom in the production of natural gas in recent years. Transportation agencies could sell or lease right-of-way to natural gas pipeline companies in order to generate additional revenues.	Parallel Infrastructure, INC: Right-of-Way Value Maximization and Communications Infrastructure Development
Roadway Vibration Harvest	This strategy seeks to turn stress, strain, vibrations, and noise into electrical energy. This electrical energy can then be sold to electric companies to generate revenue to help fund new transportation infrastructure investments.	USDOT Alternative Uses of Highway Right-of-Way Innowatech Energy Harvesting Systems Green Prophet: Innwatech Proves it can Collect Energy from Highways and Byways Turn Weight, Motion, Vibration and Temperature into Electricity, Courtesy Innwatech Green Prophet: Innwatech's Coming to Sidewalks and Electric Avenues Near You Highways in California Could Actually Produce Energy
Sell/Lease Right-of-Way for Construction Material Storage	Allow construction companies to lease land along roadways to store aggregates or other material.	Long Island Business News: Audit shows NYDOT Holding Millions in Unused Property
Sell/Lease Right-of-Way for Mineral Rights	In recent years, Texas has experienced a boom in natural gas and other energy development. TxDOT (or another transportation agency) could lease and sell mineral rights underneath currently owned lands to generate additional revenues.	Stacey Lyle: Ownership of Mineral Rights within Texas Right-of-Way State of Texas Policy Paper: TxDOT Should Expand the Leasing of Right-of-Way and Other Real Estate Assets to Private Enterprise
Grow and Sell Crops on Right-of-Way	Much of the land in Texas is arable and fertile, allowing the production of a variety of crops. TxDOT has adequate land available that sits unused; this land could be used to grow crops. TxDOT could contract with local farmers or other companies to grow and tend the crops, and then sell the crops as a source of additional revenue.	USDOT Alternative Uses of Highway Right-of-Way

Lease/Sell Right-of-Way for Oil or Natural Gas Storage	Texas has undergone an energy production boom in recent years, and many traditional storage facilities are nearing capacity. If TxDOT purchased land for right-of-way with access to naturally occurring storage (like salt domes), this land could be leased to energy production companies to store oil, natural gas, or other liquefied materials.	USDOT Alternative Uses of Highway Right-of-Way
Lease/Sell Right-of-Way for Air Rights Use	Lease air rights above or below transportation infrastructure to fund transportation construction or maintenance.	City of Tampa Leases Area Underneath Bridge to Developers, Gains Additional Revenue
Lease/Sell Right-of-Way for Custom Landscaping and Advertising Use	Employ customized landscaping as an environmentally-conscious way to bring in revenue for the DOT.	TCRP Report 133: Practical Measures to Increase Transit Advertising Revenues
Lease Unused Right-of-Way for Land Development	This strategy calls for auctioning off unused pieces of DOT land to finance roads.	USDOT Alternative Uses of Highway Right-of-Way NYDOT Auctions off Land
Lease Right-of-Way for More Efficient Freight Movement	Strategies include leasing land in the median for rail or other innovative freight corridors and taking those funds to help pay for the development of transportation investment.	Freight Shuttle International: Moving Freight into the Future
Sell/Trade Traffic-Backed Securities	Based on the establishment of public-private partnerships to finance transportation infrastructure through Traffic Backed Securities. This concept is based on pooling cash flows from traffic receivables.	World Conference on Transportation Research: Traffic-Backed Securities A New Approach to Project Finance
Incentivize Investments through E-2 Visas	This strategy Calls for streamlining the E-2 “treaty investor” visa process to allow for greater foreign investment in transportation.	U.S. Citizenship and Immigration Services: E-2 Treaty Investors
Utilize Pension Funds to Finance Transportation Improvements	Increasing attention has been paid to the private sector, specifically the revenue available through public pension funds.	Transportation Nation: Private Pension Funds Could Invest in Tappan Zee Bridge America 2050: Recommendations for Funding Transportation Harvard Law Capital Matters: Pension Fund Investment in Infrastructure A Resource Paper
Call for Re-initiating Federal Build America Bond Program	In 2010, the Build America Bond Program was ended. Texas transportation agencies could request the federal government to reopen the program for financing transportation infrastructure.	Bloomberg News: Fix a Bond, Build a Bridge, Help Taxpayers and Investors
Promote Concrete Pavement Preservation	Pavement preservation serves to decrease the amount of maintenance needed on roads and highways. Preservation can be approached from several construction aspects, one of the more successful techniques is known as diamond grinding, which involves the smoothing of the pavement surface in order to improve the quality of pavement texture as well as improving joint faulting. As a side benefit, diamond grinding improves skid resistance, noise levels, increases the longevity of the live of the pavement, as well as improving fuel economy due to the improved pavement texture.	Shatnawi et al.: California's Perspective on Concrete Pavement Preservation

Promote Transportation-Efficient Development	Traditionally, cities in the United States have developed using a sprawl method: land is less expensive on the peripheries of cities, so development progressively moves away from a city center. This creates a transportation problem, as additional roadway infrastructure must continually be built and maintained to keep pace with demand. Transportation-efficient developments would place mixed-use developments in close proximity to each other, and in close proximity to existing transportation and transit facilities. This sort of development minimizes the need for additional infrastructure and maximizes the usage of existing systems. It enables many people to use the network with minimal additional costs to society.	Washington State Transportation Center: Implementing Transportation-Efficient Development
Use Recycled-Materials to Make Longer Lasting Infrastructure	Utilizing recycled materials as a way to improve the lifespan of infrastructure is a newer development that has been gaining ground as interest in environmental preservation continues to be an important consideration. Recycled material usage not only increases the service life of infrastructure projects, it also reduces the consumption of non-renewable resources, harmful emissions, and overall energy consumption during infrastructure projects.	University of Wisconsin-Madison: Recycled Materials and Sustainable Infrastructure
Promote/Incentivize Demand Leveling through Employer-Based Transportation Demand Management	“Employer-Based Transportation Demand Management strategies reduce vehicle trips by providing employees with incentives, information, and additional transportation options to commute via modes other than the single occupant vehicle (SOV), to commute during off-peak times of day, or even to eliminate certain work trips altogether. This transportation market is largely responsible for peak period congestion conditions twice each weekday. As such, modal shifts for these trips can significantly reduce regional vehicle miles traveled and carbon emissions, alleviate congestion during peak periods and improve air quality, all while making better use of the existing transportation infrastructure throughout the day.”	Seattle Urban Mobility Plan: 7 Best Practices in Transportation Demand Management
Performance-Based Contracting	Calls for using performance-based maintenance contracts in order to reduce maintenance costs and reduce transportation agency risk.	TTI: Performance Measures for Performance-Based Maintenance Contracts
Level Demand through Intelligent Transportation Systems (ITS)	Congress passed the Transportation Equity Act for the 21st century (TEA-21) providing that the secretary of transportation develop a “National ITS Program Plan.” TEA-21 called for the establishment of a “National Architecture and Standards” to “promote interoperability amount, and efficiency of, intelligent transportation system technologies implemented throughout the United States.” Development of ITS architectures, however, occurs at the regional level.	Seattle Urban Mobility Plan: 7 Best Practices in Transportation Demand Management
Machine-to-Machine (M2M) Platforms, Applications, and Standards as a way to Reduce Congestion	Involves promoting machine-to-machine platforms (otherwise known as connected vehicle technology) as a way to reduce congestion and level demand in the 21st century.	ITS America: Connected Vehicle Recording ITS America: Connected Vehicle Insights

Constants To Consider With Any Strategy

Regardless what activity transportation funding is ultimately used for, several additional constants must be considered.

- Any strategy must be sustainable for the long term and have elements of flexibility.
- The benefits of the activity must be clearly communicated to the public.
- Proper analysis must be done to assess for what level of jurisdiction that strategy is most appropriate. For example, some strategies are most appropriate at the federal level, while others are best implemented at the local level.

Constant #1: Long-Term Sustainability

Any strategy that's pursued by policy makers must be sustainable for the long-term. Current strategies employed today (e.g., federal and state motor fuels tax) are showing their inability to keep up with growing transportation consumption. For example, an NGA Center for Best Practices found in its report *Innovative State Transportation Funding and Financing*, over the last half century, vehicle miles traveled have dramatically increased due to increased population growth and income, yet revenues for transportation have not kept pace. Based on the trends already seen, usage rates of roads will only increase, and states will not have the necessary money to fund all the repairs and projects necessary if they rely on traditional funding and financing strategies. It will be vital that whatever projects are designed and implemented must be created to withstand political change and ideology and planned with an eye toward future development.

Constant #2: Communicating Effectively with the Public

No matter which strategy that policy makers pursue, it is imperative to communicate to the public important components of that strategy constantly. Taking time to communicate clearly, concisely, and in terms that the public can understand can be used to help the public understand the need for increasing transportation tax and fee rates. Effectively informing the public regarding the reasons for increased funding needs and the value that a properly maintained transportation has will also help to prevent public discontentment and the passing of misinformation, which can have adverse effects in other sectors. No matter which philosophy is pursued, ensuring that effective and responsive communication takes place will go a long way toward building grassroots support for a particular strategy.

Constant #3: Matching Strategies to Their Appropriate Jurisdictions

Finally, the third constant is that any strategy should be properly matched to its best jurisdictional fit. Some revenue stream strategies are most appropriate at the local level, while some can be best applied at a higher, network level (e.g., the state level). Proper due diligence should be done to make sure that each strategy is evaluated and designed to fit the proper level of jurisdiction.

Conclusion And Further Research Needs

It's time to fundamentally rethink how we fund transportation infrastructure.

While this executive summary did not provide an exhaustive list of all possible revenue strategies to consider, it provides a useful framework for thinking beyond traditional funding and financing strategies. Some ideas contained herein have been adopted before in Texas and in other places. However, there are other strategies that might not even be technically feasible for another 10 years. Why, then, mention them at all? The authors found it valuable to take a holistic approach to funding and financing issues associated with transportation infrastructure development and focus on common themes that should be addressed whatever course is taken.

Texas has always led the way in innovative transportation funding and financing, which is what has made this project somewhat difficult to pursue. Texans maintain a stellar reputation as a people who continually innovate their way out of serious problems. Our hope is that this research can help provide decision-makers with a framework for looking at new ways to fund transportation in Texas.

As so often happens with research, while this effort has answered some questions, it has also raised others needing further investigation. First and foremost, there's a critical need to explore some of the more innovative strategies listed in this document. Minimal research exists regarding the revenue potential of some of the more advanced technologies mentioned herein, such as the extra-strength solar collector roads. A more in-depth study can also facilitate further development of the four philosophies detailed here. While this project was only a scan of currently available options, it would be beneficial to explore in more detail different scenarios in which the private sector managed public infrastructure in other areas, such as the electric grid or telecommunications network. Also, numerous strategies could be developed, explored, and simulated using this fundamental framework. Finally, a developing web-based clearinghouse of innovative funding and financing ideas where stakeholders and experts could proffer, share, and refine ideas could be a useful tool for Texas policy makers and the public alike.

References

Association, I. D. (n.d.). How your schools are funded.

Dye Management Group, Inc. (2009). Findings and Analysis: Texas Transportation Funding Challenge. Austin: Texas Department of Transportation.

Excellence, C. f. (2012). Center for Transportation Excellence.

Finance, S. o. (2010). School Finance 101: Funding of Texas Schools. Texas Education Agency.

Michigan.gov. (n.d.). National Scan of State Transportation Revenue Studies and Actions.

NCSL. (2010). Public-Private Partnerships for Transportation A Toolkit for Legislators. Retrieved from <http://www.ncsl.org/documents/transportation/PPPTOOLKIT.pdf>.





David Ellis, Ph.D.

Research Scientist

Texas A&M Transportation Institute

3135 TAMU

College Station, TX 77843-3135

979-845-6165

d-ellis@tamu.edu