Texas Department of Transportation

Independent Performance Audit: Transportation Funding

Final Report Appendices

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Appendix A:
Transportation Revenues in Other Jurisdictions

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This is Appendix A to Section II Audit Area A, Fiscal Capacity. It summarizes the results of analysis to determine whether there are other transportation finance approaches applicable to Texas. The AOC directed the audit team to determine whether there are other approaches nationally and internationally that warrant consideration in Texas. Because TxDOT is already a national leader in the application of public-private partnerships, innovative financing, and tolling, the appendix does not address these mechanisms.

Transportation officials in many jurisdictions believe that they have reached the limits of yield from the revenue sources that traditionally fund highway programs: the taxes on motor fuel that are collected as highway user fees. This describes other revenue sources that are being considered, or are already in place, in other jurisdictions.

A. High-Occupancy Toll (HOT) Lanes

Toll roads, pass-through tolls, and private-public partnerships are excluded from the detailed descriptions since they are already in use in Texas. Managed lanes in their various forms—tolled priority lanes, high-occupancy toll (HOT) lanes, and truck-only toll lanes—are briefly summarized here.

HOT lanes aim to reduce congestion and increase revenues by enacting fees or tolls for the use of specified lanes of a highway, the rates of which vary with the level of congestion. HOT lanes have been constructed in several states that allow single-occupant cars to pay a premium to travel in less-congested high-occupancy vehicle (HOV) lanes.

The California Department of Transportation is authorized[1] to solicit proposals and enter into long-term agreements with private enterprises to construct and manage new toll roads and facilities; qualifying projects include HOT lanes, truck-only lanes, and express toll lanes. California has two models of HOT lanes:

- **Sale of excess HOV lane capacity.** The I-15 HOT Lanes in San Diego are operated mainly as HOV lanes and sell any excess capacity to drivers willing to pay a variable toll.
- **Private express toll lanes.** SR 91 in Orange County consists of express toll lanes that provide toll discounts to some kinds of high-occupancy vehicles. SR 91 Express is fully supported by tolling revenues; it was originally built under a public-private partnership, but Orange County subsequently bought out the private sector partner.

[1] "GoCalifornia" Assembly Bill 850, 2005.

B. Distance (VMT) and Weight Charges

Road users are not required to pay the user fee portion of fuel taxes[2]; instead, they pay a rate per mile and/or a rate per ton. Referred to as road-use metering, distance charges and vehicle-miles traveled (VMT) charges.

1. Policy Objectives

Road user charging is not only a way to help fund transportation infrastructure but can also be used as a demand management tool to control congestion, reduce environmental damage, and facilitate private-public partnerships. Officials in some jurisdictions have concluded that the increasing fuel efficiency of engines has made motor fuel taxes a poor proxy for road user charges and that a more direct levy of a road user charge is needed.

Mileage-based fee systems require significant coordination and buy-in from legislators and the public; the American Association of State Highway and Transportation Officials (AASHTO) estimates that it will take more than 20 years to develop and implement a national VMT collection system in the United States.

2. Collection Methods

There are several methods of application of a vehicle miles traveled approach, from the most technologically simple to the most advanced:

- **Odometer reading** – This approach involves a periodic reading of the odometer or hub odometer of registered vehicles and the assessment of a mileage fee based on that reading.
- **Gas efficiency index charge** – This approach involves equipping vehicles with a device attached to the gas tank entrance that identifies the vehicle type and its average miles per gallon fuel consumption and then calculates the miles traveled based on how much gasoline is pumped into the tank.
- **Automatic vehicle identification technology** – Already used extensively on toll roads, this approach involves the establishment of road side "readers" that scan a radio frequency or infrared device that is mounted on or inside the vehicle. The information is collected and vehicle owners are assessed a fee on a regular basis.
- **GPS** – This approach requires the installation of an on-board computerized device in each vehicle that is equipped with a GPS receiver and a geographic information system database, which records vehicle movement and distances traveled and calculates a VMT fee. Uploaded information is sent directly to a central collection agency.

[2] Outside the United States, most jurisdictions do not dedicate all or even any of their taxes on motor fuels to funding transportation expenditures. In many jurisdictions, fuel taxes are regarded as a carbon tax.

3. Examples

Generally, the United States lags behind in consideration of road user fees with its continued reliance on motor fuel taxes as a proxy for directly levied user fees and the limited use of tolls, primarily through point pricing[3]. Oregon leads the states in the implementation of VMT charges.

The Oregon Experience

In 2001, in response to the steady erosion of the state's gas tax and concerns regarding the long-term sustainability of fuel taxes as the primary funding source of revenues for repairing, maintaining, and building Oregon's roads[4], the Oregon State Legislature created the Oregon Road User Fee Task Force (RUFTF) to examine revenue-raising alternatives for replacing Oregon's gas tax. After extensive research and review and evaluation of 28 options, the RUFTF concluded that the replacement to the gas tax should be a road user fee based on vehicle miles traveled[5]. Under the VMT scheme, road users would be assessed a defined fee for each mile driven. The policy basis for this conclusion was that such an approach is a fair, simple, and affordable way to generate revenue for road repair, maintenance, and construction, as it charges a fee based on actual miles traveled in Oregon.

Based on this recommendation, the Oregon Department of Transportation (ODOT) and Oregon State University successfully bench-tested on-board equipment designed to count and communicate mileage in order for gas stations to collect information and deduct taxes while adding the mileage-based charge. This bench test was followed by an initial pilot test using 20 vehicles to test all facets of the program, which was then a larger pilot program involving 260 vehicles that ended in March 2007. Some motorists were placed in a "rush hour" pricing group to test the ability to separately count miles traveled during rush hours in the congested Portland area.

Preliminary conclusions of the pilot program include:

- The project was a success in terms of zone differentiation, mileage-counting accuracy, transaction administration integration with gas tax collections, and mileage data transmission at the fuel pump;
- The technology gained 91% acceptance by participating motorists;
- Certain areas need further development, including improving the speed of cash transaction at the fuel pump, improving mileage data transmission at the fuel pump to a 99.99% accuracy target, and

[3] Tolls are collected on roads, tunnels, and bridges in 33 states, although 38 percent of all tolls paid in 2003 were collected in two states, New York and New Jersey. Publicly controlled special authorities operate nearly all toll facilities in the U.S. states. (Committee for Long-Term Viability of Fuel Taxes for Transportation Finance, 38).

[4] In a 2002 financial study, ODOT predicted that in 2012 state fuel tax would level off and then start to permanently decline over the next decade (Guderian, 34)

[5] Oregon Department of Transportation received three grants from the Federal Highway Administration's Value Pricing Program to fund the Task Force research and pilot projects.

- Retrofitting of existing vehicles with mileage counting technology is problematic because technology applications for various makes and models of vehicles is not standardized, and technical assistance to fuel stations is needed on a continuous basis.

While ODOT's full evaluation of the pilot program is not expected until fall 2007, ODOT plans to draft legislation for consideration by the State Legislature in 2009[6].

In addition to consideration of outstanding technical and administrative issues, several outstanding policy decisions need to be addressed, such as whether to charge a lower rate per mile for vehicles that achieve a certain fuel efficiency, for motorists that avoid rush hour or congestion zones, and for motorists participating in other environmentally sensitive programs.

The 2005 federal SAFEEA-LU legislation authorized a three-year comprehensive field test of a proposal based on the Oregon *New Approach to Road User Charges Study*. Supported by TxDOT and 14 other state departments of transportation, the proposed road use metering system would be designed for national implementation but would provide flexibility so that each state could decide independently to charge mileage fees and establish its own rate structure.

New Zealand

The policy objective of the New Zealand scheme is that all users of New Zealand's roads must contribute to their upkeep. To achieve this, New Zealand has in place a combined system: Most road users pay levies in the prices of their fuel while others, such as users of diesel-powered or electric vehicles that are not taxed at source and vehicles with a manufacturer's gross laden weight of more than 3.5 tonnes (3500 kg), must directly pay a road user charge (RUC).

All vehicles required to pay a RUC must display a RUC distance license. Distance licenses are purchased in units of 1,000 km (621 miles). When the finish distance is reached, a new license is required. Licenses are available for purchase at Land Transport New Zealand agencies, by phone, by fax, by authorized RUC service stations and truck stops, and by direct connects for commercial operators. Distance licenses are calculated according to whether the vehicle is powered or unpowered, the number of axles, and the number of tires per axle. Licenses also vary depending on the weight of the vehicle in operation: The vehicle operator must purchase a license to cover the gross weight of the vehicle while in operation. RUC rates are based on the assumption that a commercial truck, called a heavy goods vehicle (HGV) in this and most other jurisdictions, travels at least 50 percent of the time without a load and this is taken into account in the license calculation cost. All vehicles that operate with distance licenses must be fitted with a distance recorder that is of a specified type with accuracy sufficient to provide a reliable record of the distance traveled; a HGV must be fitted with an approved hubodometer. Licenses must be displayed behind the inside of the windshield on the passenger side of the vehicle[7]. Enforcement is undertaken by the New Zealand police forces.

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[6] www.oregon.gov/ODOT/HWY/RUFPP/ruftf.shtml

[7] Road User Chargers, April 2007, Land Transport New Zealand, http://www.landtransport.govt.nz/commercial/ruc.html

Germany

Introduced in 2005 after several years of development, Germany's scheme dictates that all HGVs must pay road user charges on major roadways. The charges are based on the following measures: distance traveled, which segments of the major roadways are traveled upon, the time of day when traveled, axle class, weight class and emissions class of the vehicle. Revenue from the scheme is to be directed to transportation investment as well anti-congestion initiatives.

Under the German scheme, all major roadways are divided into segments. On-board units in vehicles store the geographical coordinates of these segments, and GPS is used to determine on which segments a vehicle has traveled. A digital tachograph is used as a backup to the GPS and, in those areas where a GPS signal is unreliable, a dedicated radio system beacon provides back-up location information. When a vehicle exits from the German roadway network, the vehicle's on-board unit transmits to a centralized toll operator, through an encrypted cellular link, the details of time, distance and segments of routes traveled.

Toll Collect[8], a separate agency established by the German federal government, administers the system. Users registered with Toll Collect who have on-board units receive a toll statement once a month. Drivers of vehicles without on-board units can register with Toll Collect in advance, then log on over the internet or at one of 3,500 toll station terminals located in Germany or neighboring countries to outline their planned route. The comprehensive system of enforcement includes fixed control bridges, stationary team controls at parking lots in the vicinity of control bridges, mobile enforcement with about 300 vehicles throughout Germany, and company audits.

The German scheme was designed and developed with the intent to one day moving to a single toll system for all of Europe. The German system has also been developed with the flexibility to support future management of road traffic in Germany and Europe with the "satellite based toll system [having] the capability to implement a graduated place and time-dependent road charging system."

Switzerland

Since 2005, HGVs in Switzerland pay a fixed rate per kilometer driven, regardless of the road type, time of day or vehicle weight. Vehicles are outfitted with an on-board unit that is connected to the vehicle's tachograph, with a GPS unit backup. When a vehicle enters the country, the unit is switched on automatically by roadside Dedicated Short Range Communications systems, and the distance traveled in the country is recorded on the unit's smart card. Upon leaving Switzerland, the driver of the HGV inserts the smart card in a roadside terminal and pays the toll due. If a vehicle does not have an on-board unit, the driver must declare mileage on entry and exit to customs authorities.

[8] Toll Collect Web site (English), containing detailed information on German HGV scheme is found at http://www.toll-collect.de/frontend/HomepageVP.do;jsessionid=57AE6BF0EDC44DC73BB7495571A4223B

Other Countries

The Czech Republic and Austria operate a relatively simple distance traveled road user scheme for HGVs based on a charging system that uses gantry-mounted cameras over key roadways. Sweden is developing a HGV charging scheme using a GPS-based on-board unit.

The U.K. government has proposed the adoption of a national road user charging scheme for all vehicles on U.K. roads by 2030. This is based on the analysis that the public has little incentive to be prudent in its driving habits and that the introduction of variable costs (per kilometer charges) are required to "change social attitudes and promote public transportation" (Cottingham, 9). Introduction of such a scheme would be incredibly complex and require a much higher degree of sophistication and technology than is evident even in the existing German scheme.

C. Congestion Charges

Congestion charging, also called zone pricing or cordon pricing, involves the application of variable fees or charges for the right to travel during peak periods or and or around key locations.

1. Policy Objectives

Congestion pricing schemes are designed to reduce congestion on a road network by increasing the cost of travel and thus inhibiting the overall use of congested segments and nodes in the network. Road use charges provide incentives for users to shift some trips to off-peak times, to less congested routes, to other modes, or to cause some lower-valued trips to be combined with other trips or eliminated. A shift in a relatively small number of peak-period trips can lead to substantial reductions in overall congestion.

Congestion charges differ from tolls and user fees in two important aspects: They are set to manage demand rather than to recover costs, and governments do not provide any special assets, e.g., a toll road or a bridge, to those who pay the fee.

2. Collection Methods

Collection methods are similar to those used for road user charges.

3. Examples

New York City is currently considering charging cars that enter central Manhattan between 6 a.m. and 6 p.m. a congestion fee of $8. The revenues collected will be used to fund expansions and improvements to the regional transit system and achieve a state of good repair on city streets and on the transit system. The Puget Sound Regional Council in Washington State is investigating the feasibility of electronic congestion pricing (Noblet, 12-13)

Some international jurisdictions have comprehensive zone or cordon congestion charging schemes in place; they are described below.

Singapore

Singapore has a long history of road user charging, based on a relatively simple form of zone pricing: charging of a set fee for entry into a particular area.

In 1975, Singapore introduced its first zone pricing scheme, the Area Licensing Scheme, as a key measure to reduce congestion in its central business district. Under the scheme, drivers were required to purchase and display a paper-based license to enter and drive within a critical, specified zone during peak periods. The scheme was credited with significantly reducing vehicle traffic during these peak periods and significantly increasing the use of car-pooling (Cottingham, 7).

In 1998, Singapore moved to a more sophisticated system based on Electronic Road Pricing. This scheme requires vehicles to have an on-board prepaid smart card unit that is automatically debited over a short-range radio link every time the vehicle passes under a gantry into a particular zone. The system is dynamic in that the amount charged is based on prevailing traffic conditions at seven pricing points. Early results show a 15% reduction in overall traffic levels (Nash, 13).

Norway and Sweden

Several cities in Norway have established toll rings in which vehicles are charged each time they cross, inbound or outbound, a circular boundary around the city. Vehicles remaining inside or outside the boundary are not charged.

Although primarily used to raise revenues for road improvements[9], the goal of the toll rings has moved from solely revenue generation to reduced congestion[10] increased accessibility, and an improved environment. Toll rings were established in 1986 in Bergen, 1990 in Trondheim, and 1991 in Oslo. Originally set up as 15-year schemes to generate revenue for road improvements, the life of these schemes has been extended in Bergen and Oslo to manage demand, as well as raising highway revenues, and new toll rings have been established in Kristiansand, Stavanger and Namsos.

In 2006, after previously unsuccessful attempts, the City of Stockholm introduced a congestion-charging scheme based on cordon pricing with time-varying prices.

The technology to collect the tolls has graduated from a windshield sticker system to full electronic tolling[11]. The primary technology is a dedicated microwave tag with the option of paying after passage through the zone using automatic license plate recognition cameras for enforcement.

[9] In 2005, 25 percent of the total annual budget for road construction in Norway comes from road pricing schemes currently in place (May, 75).

[10] Various studies report traffic reduction of 5 percent in Oslo to 6 to 7 percent in Bergen (Nash, 13) to 22 percent reduction in inner city congestion during working hours (Cottingham, 5).

[11] http://www.progress- project.org/Progress/tron.html.

London

London pioneered a new approach to time-based zone pricing in 2003 to reduce congestion in its inner city core. Under the scheme, drivers within central London are charged a fixed fee for traveling in a specified region during the working day. Buses and taxis are exempt and residents within the area can obtain a 90% discount. On entering the charging zone, a vehicle's license plate number is photographed by roadside cameras and registration logged against a payment database. Drivers can pay by telephone, in designated stores, at Paypoint outlets, and over the Internet.

The fee has reduced vehicle traffic in the charging zone by about 30%. However, the system is not being considered for broader application in the rest of London due to the resource-intensive image processing requirements, high-capacity network requirements, and the extensive back-end customer billing system. To extend the system to a larger charging zone, the Transport for London organization is assessing and undertaking pilot trials of dedicated radio systems involving tag and beacon technology (Cottingham, 10).

D. Local Option Taxes

Local option transportation taxes are imposed at the county or municipal level as incremental funding for state and local transportation systems within their boundaries.

Local option taxes tend to draw upon four tax bases:

- A surcharge on state fuel tax that is authorized at a local level and earmarked for transportation programs or for a particular transportation project;
- A diversion of some portion of local or state-wide general sales tax dedicated to transportation (twenty-three states have authorized the use of local option sales taxes for transportation funding);
- A diversion of some portion of local property tax; or
- A charge on natural resources, dedicated to funding resource roads in rural areas where the industry the primary user (Noblet, 9).

1. Policy Objectives

State transportation departments welcome local option tax revenues as increased local participation. Where local governments support local option taxes, they appear to do so for two reasons:

- The local option tax is part of an agreement in which the state government cedes decision-making powers to the local government, or
- Tolling is more expensive or less practical than the alternative of local option taxes.

Local option taxes produce significant revenue; in particular, an increment of a general sales tax has powerful leverage. Other benefits include: direct local voter approval, fixed terms with sunset provisions, dedication to specified transportation projects, and local accountability for the revenues raised.

Local option taxes are not equitable however, in that taxpayers do not pay in proportion to how much they use the transportation system. There may be lack of coordination and service delivery when one county has local option sales taxes regimes and its neighbors do not. These schemes may also suffer from lack of flexibility and ability to be responsive to changing conditions or broader developments (Crabbe).

2. Collection Methods

Local option taxes are collected through state or local tax systems.

3. Examples

Three jurisdictions are described below, two of which make extensive use of local option taxes.

California

In the mid-1980s, California authorized sales taxes for transportation projects in individual counties. Since then, local transportation authorities in 20 counties, representing over 80% of the state's population, have introduced local transportation sales taxes (LTSTs) ranging from 0.25% to 1%, for transportation projects on local and state roads. In total, the optional sales taxes levied in these so-called "self help" counties have generated revenue equivalent to the state gasoline excise tax: about $2.5 billion in 2005. (Hanak, 7)

LTSTs in California have supported a large range of projects with a fairly even split between highways, local roads, and public transit. Recently, there has been a trend to provide more funding for new capital projects and less to operations and maintenance. Each county that collects and manages an LTST has a designated transportation authority providing joint oversight by the city and county governments. Often, these transportation authorities also serve as a congestion management agency.

British Columbia

TransLink is a provincial government agency that, separately from the Ministry of Transportation and the British Columbia Transit Authority, is responsible for public transit and major roadways in the Greater Vancouver Region. Translink's Board of Directors is selected from among municipal elected officials from the region.

The province assigned to TransLink several provincial sources of revenue collected within the region:

- About 50 cents per gallon of the 80 cents per gallon provincial motor fuel tax[12];
- All transit revenues;
- The 7% provincial sales tax collected on non-residential parking charges;
- A levy on electricity accounts that was formerly provided to the British Columbia Transit Authority; and
- A portion of the provincial property taxes collected in each municipality.

The rationale for using property tax as one of the ways to pay for the regional transportation system is that the system provides benefits to all residents. Even those who do not use public transit or might not even drive are considered to benefit from the efficient movement of goods and services that is vital to British Columbia's economy, environment, and quality of life.

In 2006, TransLink assessed a property tax surcharge on non-residential parking sites within the Greater Vancouver Regional District as additional source of revenue. The tax rate is based on per square meter of taxable parking area and is paid annually, along with other provincial and municipal property taxes. However, this tax has been criticized as narrowly focused, hobbled by limited revenue potential, expensive to collect, and discriminatory against those property owners who require large parking areas to conduct business.[13]

Florida

The Florida Mobility 2000 Initiative provides for the advanced completion of $6 billion of improvements to the Florida Intrastate Highway system by 2010 without raising taxes. Under the initiative, the advanced completion of these major transportation projects will be funded in part by a recapture of state transportation revenue previously diverted to Florida's General Fund, through a diversion of 75% to 80% of the $2–per-day rental car surcharge that formerly flowed to the General Fund and 30% of a $100 "new wheels on the road fee" collected for initial registration of some vehicles.

E. Land Development Charges

Revenues to support the development of transportation associated with real estate, commercial, or residential development charges paid by real estate developers can include a charge to raise revenues in support of transportation systems.

[12] Converted to U.S. dollars and U.S. gallons. In addition to provincial motor fuel taxes, Canadian motorists also pay a federal fuel excise tax and a value-added tax that totals to about 45 cents per gallon. Thus, a motorist in Vancouver pays motor fuel taxes of about $1.45 per gallon.
[13] TransLink Governance Review: An Independent Review of the Greater Vancouver Transportation Authority by the TransLink Governance Review Panel, January 26, 2007.

1. Policy Objectives

Land development charges serve two policy objectives:

- **Matching of costs and benefits.** Most land developments confer a benefit upon landowners while imposing costs on the transportation system. Some of those costs are direct costs, such as the costs of building and maintaining the roads in and around the development, and some costs are indirect, such as the costs imposed on the entire road network by the added traffic that the development generates. A development charge places some or all of those costs upon the landowners who enjoy the benefit.
- **User fees in sparsely traveled areas.** In rural and other sparsely traveled areas, traffic volumes are so low as to make the direct collection of tolls unfeasible. A charge placed on landowners in such areas can serve as a proxy for user fees.

Since these approvals are in the hands of municipal and county authorities, these fees are most often levied by local governments.

2. Collection Methods

The requirement to pay land development charges is usually linked to the approvals required for changes in land ownership or land use. Local governments need enabling legislation from their states to enact provisions in their subdivision ordinances that require payment by the developer or sub-divider of a parcel of land. The charge must be paid as a condition of receiving the approval.

The charge may be linked to costs. For example, a land developer may be required to pay for specified roadway improvements into and surrounding the development. The charge may be linked to community impacts, e.g., a required contribution into a local fund to mitigate the impact of development overall on local traffic and roadways. Such improvements may not be on the land itself but on roads whose traffic needs are affected by the subdivision or development. These provisions can also provide for the reimbursement of road improvement costs between initial and subsequent developers of a land parcel. Often, developers are required to pay such charges in kind: They may be responsible for providing public parking facilities, curbs, or drive access points.

Other forms of development charges include:

- **Incremental highway capacity charges,** paid by real estate developers for highway capacity above a certain standard (say, more than two-lanes);
- **Industrial development charges,** paid by sole users of industrial access road; and
- **Road impact fees**, a one-time charge determined by a formula applied to properties in the assessment district to offset the impact of pending development.

3. Examples

Several states in the U.S. already authorize agreements between local governments and private land and real estate developers to provide financing for roads and other public facilities needed to complete the development. Development agreements are becoming fairly common in high growth states, including California, Arizona, Florida, Idaho, Nevada, South Carolina, Maryland, Massachusetts and Virginia. Several counties in California[14] have introduced transportation development fees for new homes and other real estate construction, either to fund specific projects or to provide general local matches for local county programs.

Reimbursement Provisions: Virginia

As an example, the Virginia Legislature mandates that all cities and counties enact pro-rata road reimbursement provisions. In most municipalities in Virginia, the initial land developer funds the entire cost of off-site road improvements and is reimbursed proportionately by subsequent developers. Some municipalities, like the City of Chesapeake, have changed their statutes such that individual developers in an area are only required to pay their proportionate share of such improvements, with construction of the road to occur only once sufficient funds have been collected by the city.

Road Impact Fees: Illinois

In Kane County, Illinois, the county government charges road impact fees on new and replacement residential and non-residential development. Developers enter into an impact fee agreement with the county that specifies a proposed plan of specific road improvements and their projected cost. The developer must pay in full before the project begins, unless they enter into an installment agreement with the county. Building permits may not be issued unless the impact fee has been paid.

Value Capture: United Kingdom

Land value capture programs seek to capitalize on the increase in property values associated with increasing access through transportation infrastructure. Proximity to transit positively affects property values by giving one location a relative advantage over other locations, and can increase overall productivity by reducing total transportation costs. By taxing a portion of the additional value of properties adjacent to transportation infrastructure, cities can fund transit system development and operating costs. The properties typically most affected by transportation infrastructure are within 500 meters or the distance people are willing to walk. It is important to note that significant increases in property values are likely to occur only if there is a demand for proximity to transit.

[14] As an example, Contra Costa, Riverside, San Bernardino, and Santa Clara all have general purpose transportation developer fees. Orange County has used them to help finance specific toll road projects. According to data from the State Controller's Office, these fees raised roughly $40 milllion in 2002 and 2003. (Hanak, 7)

In the U.K., construction of new railways is being partly funded by the consequent increase in land values. The Docklands Light Railway in London was partially funded by the sale of newly accessible land to developers once the railway was constructed.

F. Illustration of Alternative Governance Models

Alternative revenues are often associated with changes in governance. In California, for example, counties that charge local option taxes for transportation projects often create transportation authorities have self-defined mandates and their governing bodies see themselves as solely accountable to the county voters for implementing their transportation expenditure plan. This can inhibit broader regional planning and co-operation with other jurisdictions.

One of the solutions to the tension between state and local interests is to combine them into a single regional authority that controls state highway, local roads, transit, and other transportation modes. Two long-functioning examples are described below.

1. British Columbia

In 1999, the government of British Columbia created a Crown agency, TransLink, with overall responsibility for public transit as well as major arterial roads that join the 21 municipalities that form the Greater Vancouver Regional District. TransLink is responsible for transportation planning, administration of service contracts with subsidiary companies and contractors (including four bus lines, two light rail rapid transit lines, and one inland ferry), the management of capital projects, financial management and planning, public affairs, and community consultation. The priority of TransLink is creation of an "integrated transportation system that is "forward-thinking, proactive in building infrastructure, fiscally accountable, and supported by sustainable funding."[15]

A review panel recommended the establishment of a three-part planning framework designed to ensure that economic, social, and environmental goals are considered and that provincial and regional interests are integrated:

- A 30-year provincial vision for transportation in the region;
- A 10-year TransLink strategic plan consistent with the provincial vision; and
- A 3-year operating plan based on the 10-year strategic plan.

With respect to governance, the review panel recommended a three-part governance structure composed of:

- A Council of Mayors responsible for approving TransLink's 10-year strategic plan and the revenue measures needed to accomplish it;

[15] ibid.

- A Board of Directors appointed by the provincial government from the ranks of transportation and business experts that is responsible for planning, constructing and operating the regional transportation system; and
- An independent TransLink Commissioner responsible for approving fare increases, assessing the consistency of TransLink's 10-year strategic plans with the provincial government's long-range transportation plan, assessing the reason of the financial assumptions included in the plans and measuring TransLink customers' levels of satisfaction.

A final key recommendation of the panel was that the provincial government provide TransLink with a sustainable funding framework to support the expected growth in the region's transportation needs. The new framework subsequently approved by the provincial government included:

- Elimination of the unpopular property tax charge on parking spaces and the levy on electricity bills.
- Re-balance of the three main sources of revenues—property taxes, motor fuel taxes and tolls—into equal one-third portions.
- An increase in the regional motor fuel tax surcharge of about 10 cents per gallon.
- Transit fare increases equal to the rate of inflation for the foreseeable future.

2. New Zealand

In the government of New Zealand, responsibility for funding for land transport infrastructure and services, including highways and roads, is separated from the responsibility for highway and roads operations.

Land Transport New Zealand[16] is the government entity responsible for allocating and managing funding for land transport infrastructure through the National Land Transport Programme. This includes working with and assisting "approved organizations" who are responsible for implementing transport projects and services and other transport-related activities. Approved organizations include Transit New Zealand, a Crown entity that since 1986 has been responsible for the operation of the national highway system in New Zealand, as well as regional councils and territorial local authorities that are responsible for regional and local roadways.

The Ministry of Transport is left with the responsibility for leading the development of the government's transport policy.

[16] In 1996, funding and operations was separated from policy and funding allocation responsibility of Translink with the creation of Transfund New Zealand. In 2006, Transfund was merged with the Land Transport Safety Authority to create Land Transport New Zealand, a single authority responsible for all highway and roads management and funding; this change is intended to ensure that funding of state highways is considered on the same basis as funding of local roads and regional council subsidized public transport.

Transit New Zealand operates New Zealand's state highway network, including maintenance, construction, safety, and traffic management. It holds responsibility for state highway strategies and design guidelines, economic and environmental planning for state highways, technical standards, and quality assurance systems. Transit New Zealand's approach to planning involves all transport and funding options, including developer contributions and measures to manage travel demand both actively, via tolling and road pricing, and passively, through the application of design principles.

With respect to tolling, the *Land Transport Management Act* enables Transit New Zealand to toll certain new roads; Transit New Zealand has plans for two new toll roads and is developing a national toll management system in conjunction with Ministry of Transport and Land Transport New Zealand.

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Appendix B:
OLS Regressions of State and Federal Revenues

■

This is an Appendix B to Section II, Audit Area A, Fiscal Capacity.

A. State Motor Fuel Taxes

This appendix contains a forecast of motor fuel tax revenues that can be expected from sales of gasoline and diesel fuel for highway use. Texas collects sales tax on all motor fuels[17] sold in the state, with gasoline and diesel at 20 cents per gallon and liquefied natural gas at 15 cents per gallon. There are exceptions[18] for some users, such as state public school use and federal agencies.

Motor Fuel Taxes in the Context of Texas State Revenues

In the fiscal year 2006, the State of Texas received $72.4 billion in revenue from state and federal sources. Tax collections made up 46% of total revenues, with almost $3 billion (or 4.1%) from motor fuel taxes. Exhibit 1 on the next page provides a breakdown of Texas revenues for fiscal year 2006.

[17] Texas Comptroller of Public Accounts. Fuel Tax Index, http://www.cpa.state.tx.us/taxinfo/fuels/index.html
[18] Texas Comptroller of Public Accounts, Statute (Sec. 162.102)
http://www.window.state.tx.us/taxinfo/fuels/gasoline.html

Exhibit 1: Texas Net Revenue by Source (All Funds, Excluding Trust) – Fiscal 2006

Tax Collections By Major Tax

Tax	Revenue $	Percent of Total	Percent Change from Previous Year
Sales Tax	$18,275,209,754	25.2	12
Motor Vehicle Sales/Rental, Mfg Housing Sale	3,075,153,783	4.2	8
Motor Fuels Taxes	2,993,569,575	4.1	2
Franchise Tax	2,605,447,409	3.6	20.1
Insurance Occupation Taxes	1,233,493,584	1.7	2
Natural Gas Production Tax	2,339,147,491	3.2	41.2
Cigarette and Tobacco Taxes	545,904,191	0.8	-8.9
Alcoholic Beverages Taxes	680,748,138	0.9	8.7
Oil Production Tax	862,360,868	1.2	26.5
Inheritance Tax	13,360,123	0	-86.9
Utility Taxes	480,792,722	0.7	26.5
Hotel and Motel Tax	308,018,897	0.4	17.5
Other Taxes	131,291,012	0.2	134.9
Total Tax Collections	$33,544,497,547	46.3	12.4

Revenue by Source

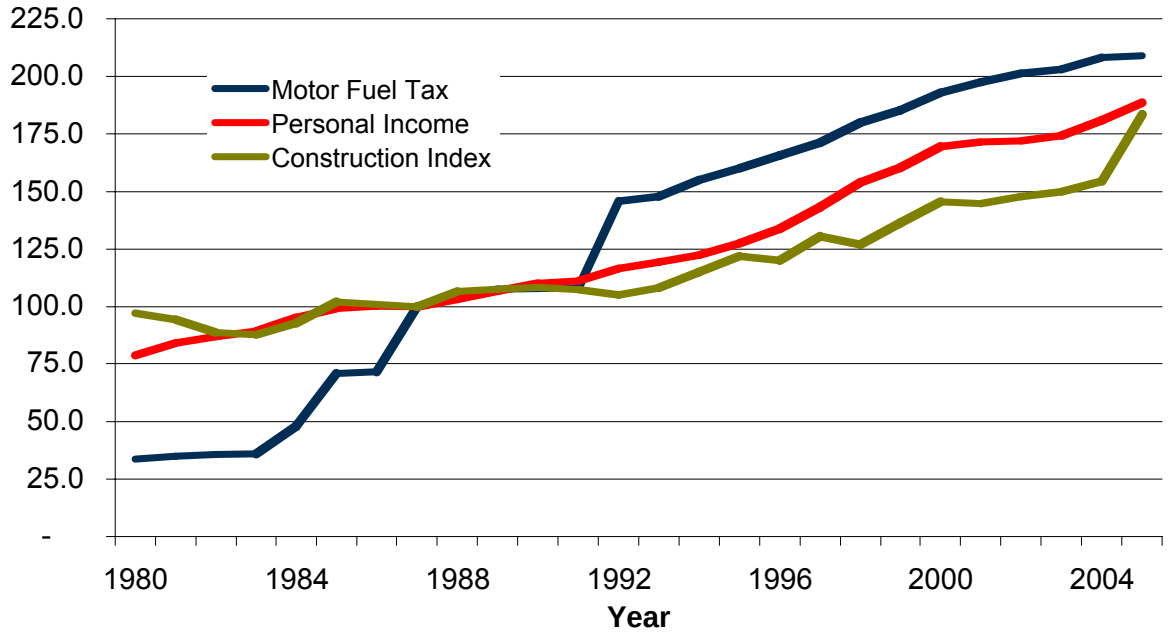
Source	Revenue by Source	Percent of Total	Percent Change from Previous Year
Total Tax Collections	$33,544,497,547	46.3	12.4
Federal Income	$24,726,453,940	34.1	8.4
Licenses,Fees,Permits,Fines and Penalties	5,999,063,646	8.3	-2.5
Interest and investment Income	1,949,502,792	2.7	27.5
Net Lottery Proceeds	1,585,180,718	2.2	0
Sales of Goods and Services	492,439,009	0.7	43.1
Settlements of Claims	545,573,929	0.8	-1.1
Land Income	860,755,135	1.2	31.6
Contributions to Employee Benefits	220,923,679	0.3	12
Other revenue sources	2,496,559,098	3.4	16.4
Total Net Revenue	$72,420,949,493	100	10

As seen in Exhibit 2, there are large year-over-year percent changes after 1984, 1987, and 1991, reflecting increases in motor fuel tax rates. In 1985, the fuel tax rate increased from 5 cents to 10 cents per gallon; in 1987, from 10 to 15 cents per gallons; and in 1991, gasoline and diesel tax rates increased from 15 to 20 cents per gallon. In July 2006, the average U.S. tax rate on gasoline was $0.2130 per gallon, slightly higher than Texas[19]. Over the last ten years, motor fuel tax revenues have averaged an annual percentage change of 2.7%.

[19] Energy Information Administration. State Energy Profiles, Texas April 2007 http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=TX

Motor fuel revenues have continued to rise in nominal dollars since 1982, however, the percentage of total revenues has declined from a high of 7.3% in fiscal year 1987 to 4.1% in fiscal year 2006.

Exhibit 2: Texas Motor Fuel Tax Revenues, Personal Income and Construction Indices 1980 - 2005



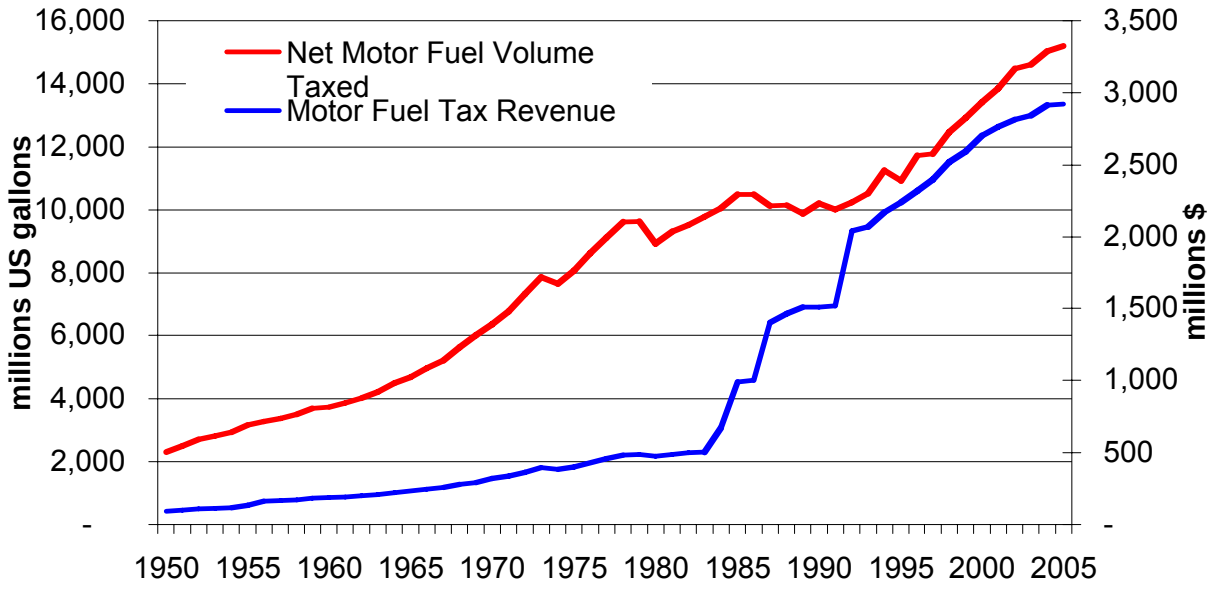
An historical assessment may be better understood by calculating indices for motor fuel tax and personal income and comparing these indices to the construction index, as seen in Exhibit 2 above. The motor fuel tax revenue index has increased at the same rate as the personal income index since 1992, therefore reflecting a consistent tax burden since the last tax rate increase. With respect to purchasing power, the comparison of the motor fuel tax index to the construction index reflects a similar pattern as personal income. However, the rapid increase in construction costs since 2003 has resulted in a significant reduction in the purchasing power of state motor fuel taxes.

Historical Values of the Relevant Variables

Both Texas and the United States collect taxes on gasoline and diesel fuel sold for highway use. Since the last tax rate increase in 1991, motor fuel tax revenues and taxed volumes have coincided with an average annual increase of 2.8% for revenues and 3.1% for volumes. However, year-over-year changes range from 0.4% to 5% for revenues and from -2.8% to 7.2% for volume. Historical motor fuel tax revenues[20] and taxable gallons sold are shown in Exhibit 3.

[20] U.S. Department of Transportation. Federal Highway Administration, Office of Highway Policy Information, Highway Statistics Publications. http://www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.htm

Exhibit 3: Taxable Gallons and Tax Revenues



When motor fuel tax rates are held constant, motor fuel tax revenues and taxed volumes coincide with one another; however, the year-over-year fluctuations reflect additional behavioral changes. That is, by simply modeling gallons taxed and then multiplying that estimate by the tax rate, one does not take into account other behavioral changes that may occur in the future. The volumes of gallons taxed are influenced by other economic and demographic factors. This section explores each of these factors in turn.

Taxable gallons sold are not only influenced by the tax rate but also by the retail price of fuel, the purchase price of new vehicles, population, household income, and gross domestic product.

Therefore:

GAL = *f*(GPR, CPR, POP, HIS, GDP)

Wherein:

GAL = Taxable gallons of fuel sold

GPR = Retail price of fuel, including taxes

CPR = Purchase price of a new vehicle, including interest

POP = Population

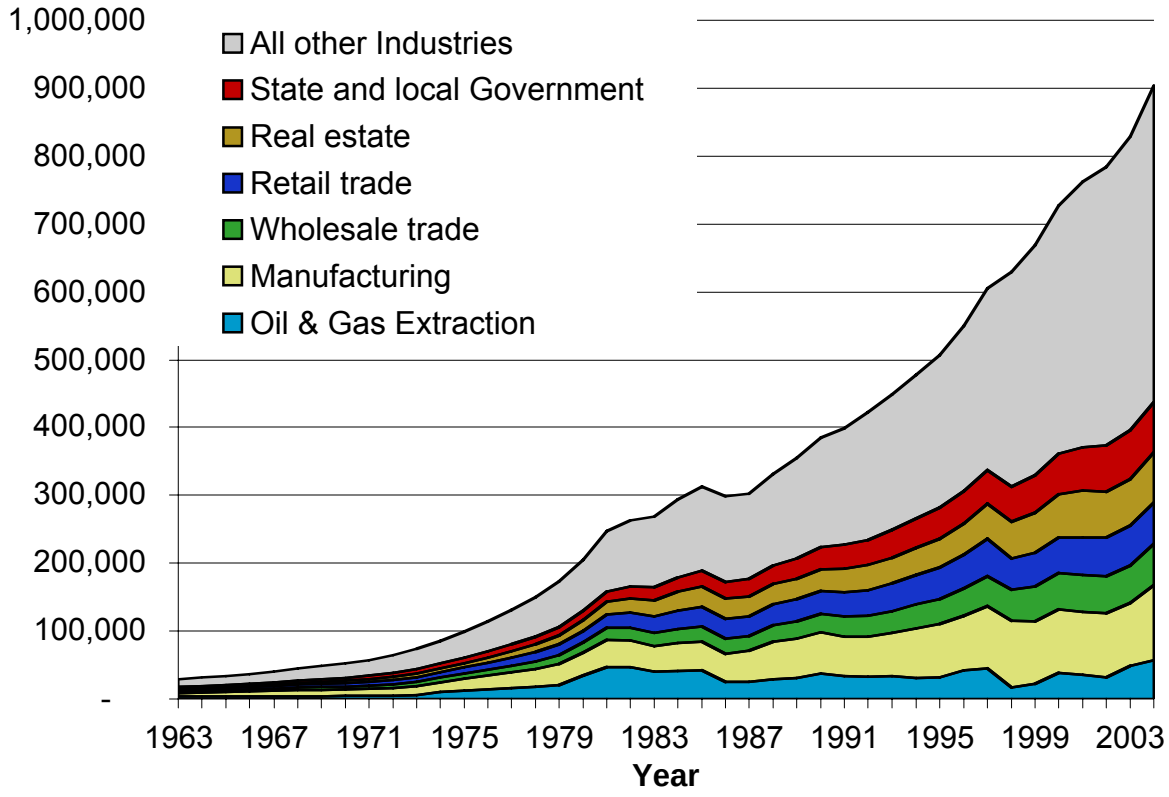
HIS = Household income

GDP = Gross Domestic Product

1. Gross Domestic Product (GDP)

Economic history in Texas does not reflect a dependency on any one industry; however, the largest contributors are oil and gas extraction, manufacturing, wholesale trade, retail trade, real estate, and state and local governments. These are represented in Exhibit 4 on the following page.

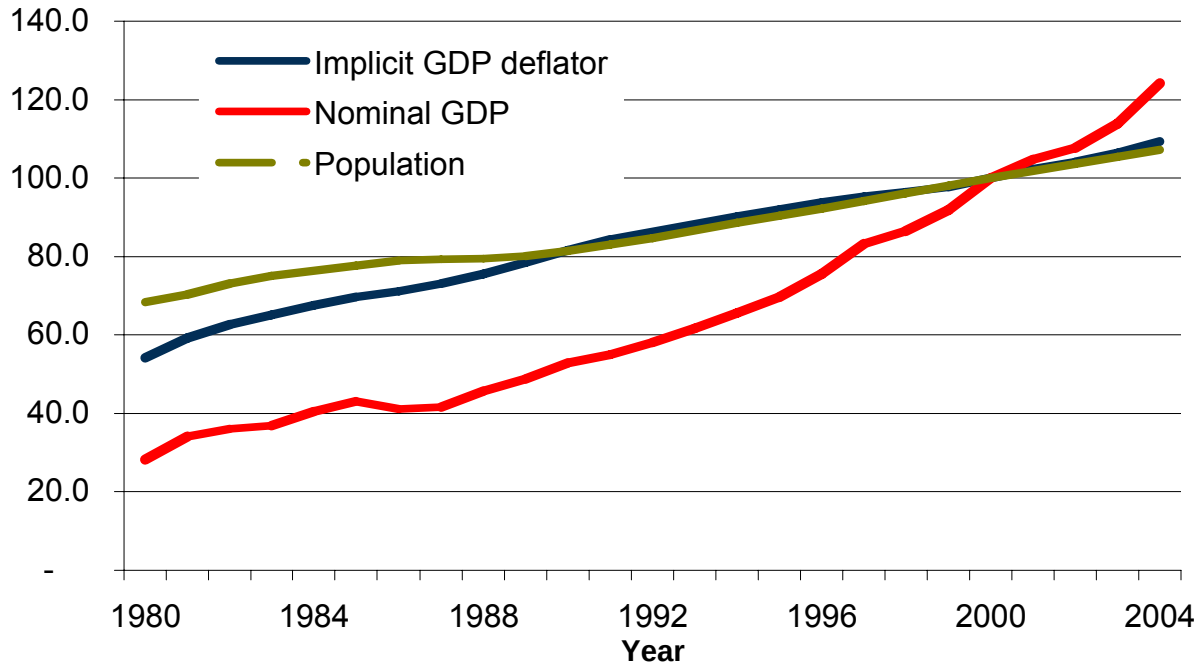
Exhibit 4: Texas State Gross Domestic Product, current dollars



Nominal GDP in Texas has had an average annual growth rate of 6.0% since 1984, which is consistent with the average annual growth rate of the nation at 5.9% during that time period. When GDP is adjusted for inflation, Texas has realized an average annual growth rate of 3.3% since 1984 and 4.3% since 1963.

As seen in Exhibit 5 on the next page, comparisons of the GDP deflator, nominal GDP, and population indices reflect an increasing gross national product compared to the population. This implies that GDP is increasing faster than population, indicating increasing wealth. The increasing wealth of the nation over the last 25 years when compared to the GDP deflator indicates that these are real increases in wealth.

Exhibit 5: Texas, Implicit GDP deflator, Nominal GDP, and Population Indices, 1970 - 2004

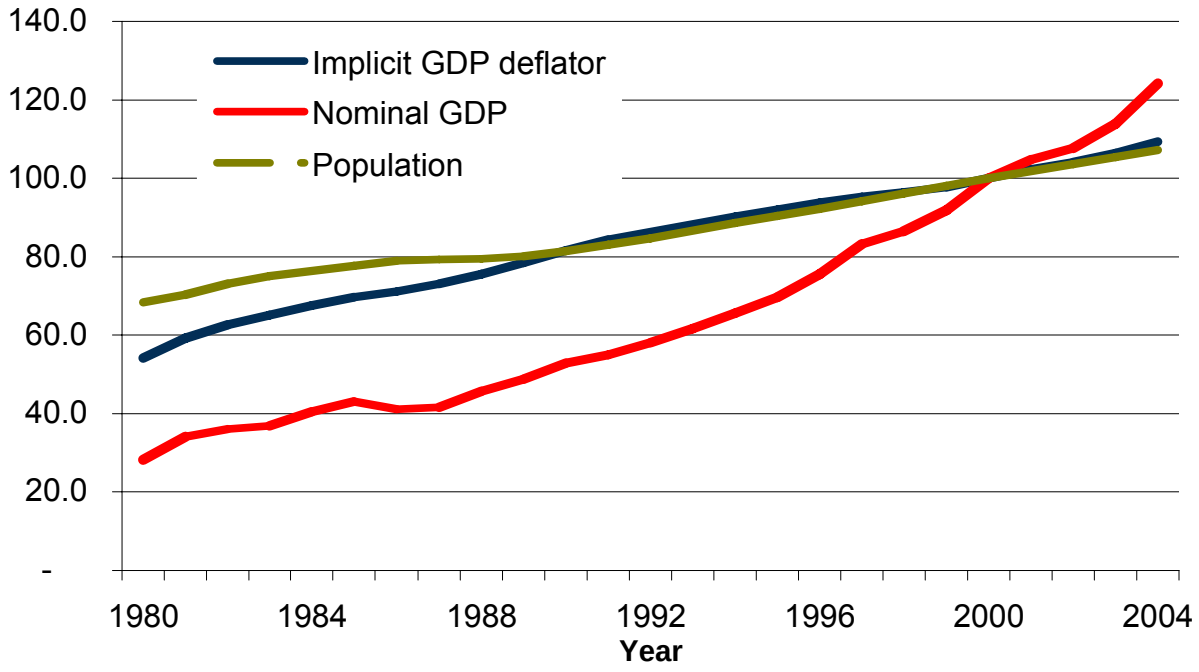


2. Population

Texas' population currently resides at approximately 23 million people, with an average annual growth rate since 1983 of 1.7%. This rate of growth has outpaced the nation, which averages 1.1% during the same time period.

The composition of households within Texas' population is not significantly different from the average across the nation, as shown in Exhibit 6 on the following page.

Exhibit 6: Households in Texas and the U.S., 2000[21]



3. Household Income

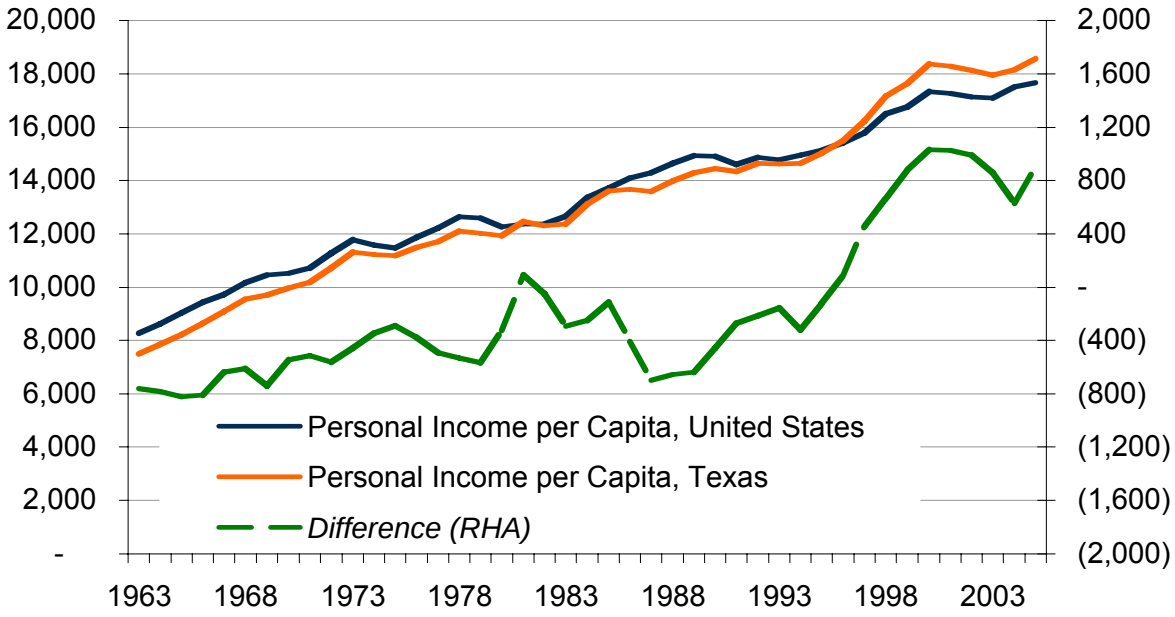
Household income is a more difficult statistic to compile than personal income, represented as income per working person. Because the growth and composition of population and households in Texas are not significantly different from the national averages, personal income can serve as a substitute for household income.

Personal income in Texas and the United States since 1970 is shown in Exhibit 7 on the following page. When expressed in 1982 dollars[22], personal income in Texas has risen from almost $10,000 in 1970 to $18,500 in 2005. This equates to an average increase of 1.8% for Texas, while the nation experienced a slightly slower growth rate of 1.5% for the same time period.

[21] United States Census: http://www.census.gov/prod/2001pubs/c2kbr01-8.pdf

[22] Computed by dividing personal income in current dollars as reports in the regional economic accounts of Bureau of Economic Analysis http://www.bea.gov/regional/spi/SA1-3fn.cfm by the average consumer price index of Dallas-Fort Worth and Houston- Galveston – Brazoria as measured by the Bureau of Labor Statistics, http://data.bls.gov/PDQ/outside.jsp?survey=cu

Exhibit 7: Personal Income per Capita, United States and Texas, Constant 1982$



Since 1995, personal income in Texas has risen higher than the national average, with a gap of more than $900 in 2005.

4. Registered Vehicles, Vehicle Prices and Fuel Prices

In 2005, Texas had nearly equal shares of light and heavy registered vehicles, with 8,911,818 light registered vehicles, and 8,557,729 heavy registered vehicles[23]. However, in 1984, light vehicles outnumbered heavy vehicles by almost 4.7 million. Light vehicle automobile registrations have increased in Texas, at an average rate of 0.5% since 1984, which is consistent with the national average of 0.4%. Heavy vehicle truck and bus registrations have increased much faster in Texas and the entire nation, with an average annual rate of 4.2% and 4.8% respectively.

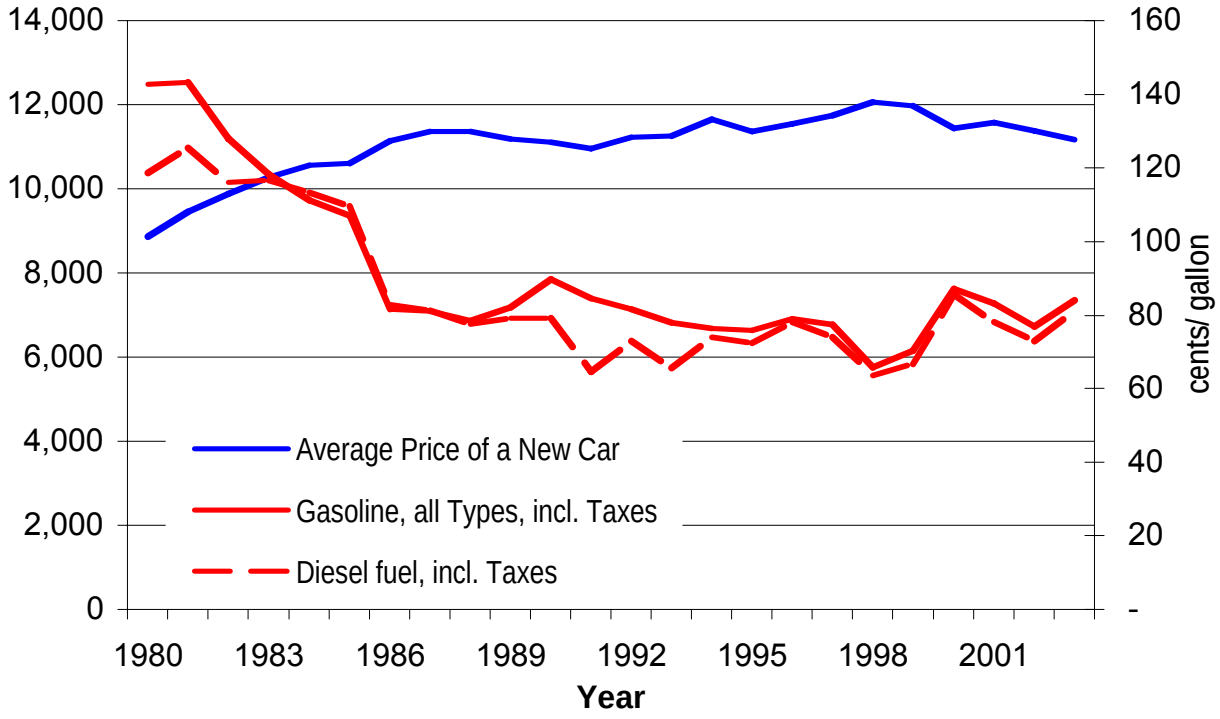
Fuel prices are not significantly lower in Texas than in other American states and do not induce Texans to alter their travel decisions. The average retail price for regular grade unleaded gasoline in February 2007 was $2.23 per gallon, while the national average during the same time period was $2.39 per gallon[24].

[23] U.S. Department of Transportation, Federal Highway Administration http://www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.htm motor vehicles, light registered vehicles “automobiles”, heavy vehicles "trucks" and "buses" annual table MV1

[24] Energy Information Administration. U.S. Retail Gasoline Prices, Weekly U.S. Retail Gasoline Prices, Regular Grade http://www.eia.doe.gov/oil_gas/petroleum/data_publications/wrgp/mogas_home_page.html

New car efficiency standards became effective in 1978, stimulating the development of smaller cars and more efficient engines[25]. The average horsepower of cars and light trucks decreased from 137 horsepower in 1975 to a low of 102 in the 1981/82 period, then rose again 63% by 1996 (light trucks include minivans, sport utility vehicles, and small pick-up trucks)[26]. Since 1982, the average horsepower of new vehicles has increased steadily, as sales for high-powered cars and light trucks dominate over the sales for lower horsepower. However, corporate average fleet efficiencies continue to meet the standard of 27.5 mpg for passenger cars[27].

Exhibit 8: Cost of Vehicles and Fuel, Constant 1982$

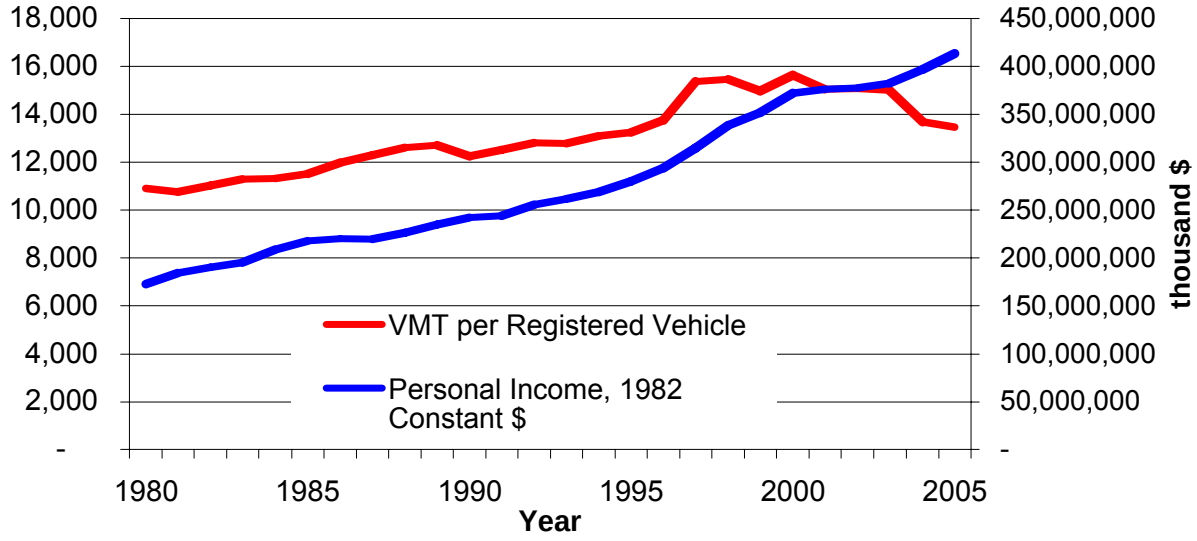


[25] The Energy Information Administration. 25th Anniversary of the 1973 Oil Embargo http://www.eia.doe.gov/emeu/25opec/sld012.htm
[26] The Energy Information Administration. 25th Anniversary of the 1973 Oil Embargo http://www.eia.doe.gov/emeu/25opec/sld012.htm
[27] The Energy Information Administration. 25th Anniversary of the 1973 Oil Embargo http://www.eia.doe.gov/emeu/25opec/sld012.htm

5. Vehicle Miles Traveled (VMT)

Vehicle miles traveled on all functional classes of highway in Texas have doubled since 1980, from 114,478 million miles to 235,170 million miles in 2005[28]. Total lane miles have only increased by 16% during the same time period, from 561,408 lane-miles in 1980 to 648,625 lane-miles in 2005. Across the United States, however, total lane miles have increased by less than half of Texas', at 6%[29]. Growth rates for vehicle miles traveled and light vehicle registrations decreased during the 1980's and 1990's while heavy vehicle registrations decreased in the 1980's and then increased again in the 1990s.

Exhibit 9: Texas, Vehicle Miles Traveled per Registered Vehicle and Personal Income, 1982 Constant Dollars



By expressing total vehicle miles traveled as a function of total vehicle registration, as shown in Exhibit 9 above, we can see that between 1980 and 2000, Texans who owned vehicles began driving longer distances, reflecting the increase in real personal income and relatively low retail fuel prices (as seen in Exhibit 8). Since 2000, vehicle miles traveled per registered vehicle has remained relatively flat. However, in 2004, light vehicle registrations increased by 11% and heavy vehicle registrations increased by 16%; because total miles traveled only increased by 3%, reductions in per vehicle distances traveled resulted.

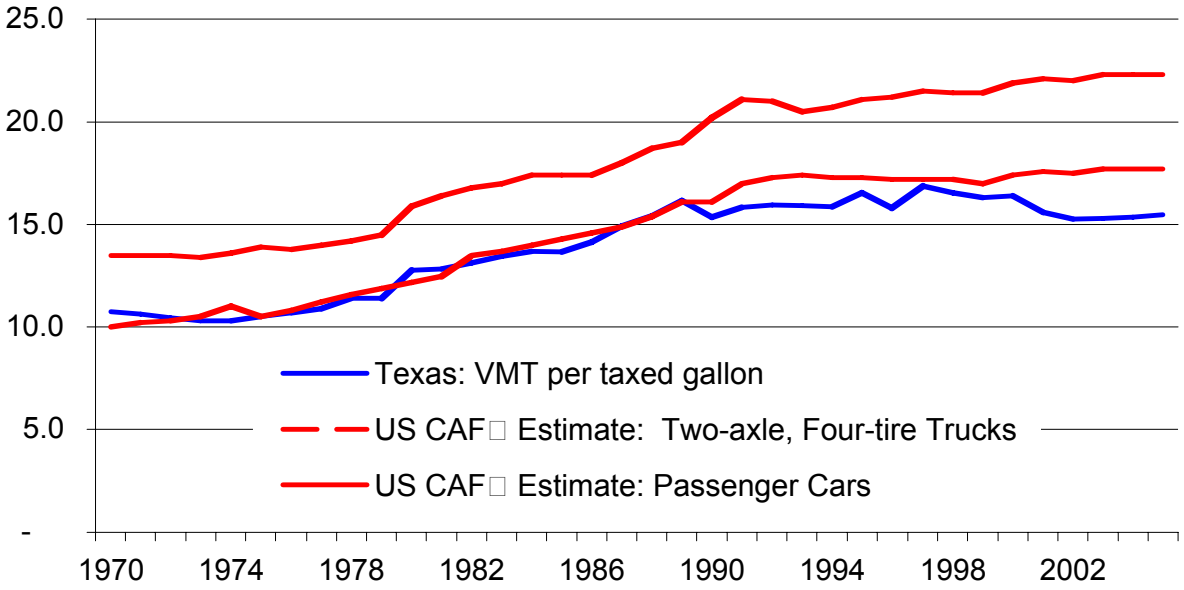
[28] U.S. Department of Transportation. Federal Highway Administration, Office of Highway Policy Information http://www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.htm. Highway Statistics; Historical Table VM202 & VM203; from 1995 forward: Annual Table VM2

[29] U.S. Department of Transportation. Federal Highway Administration, Office of Highway Policy Information http://www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.htm. Highway Statistics; Table HM60

6. Miles per Gallon (MPG)

Texas has not realized the same fuel efficiency as U.S. national estimates (as seen in Exhibit 10 below). There are several differences in the data that require some caution in making direct comparisons of the Texas data with the CAFE estimates. The state data is estimated by dividing VMT by taxed fuel, thus excluding exempt fuel that is included in the VMT estimates. Also, CAFE estimates are based on tests of sample vehicles rather than fuel consumption for the U.S. vehicle fleet as a whole.

Exhibit 10: Fuel Efficiency in Texas and the U.S., 1970 - 2005



Estimate of the Model with Historical Values

To use forecasts of the independent variables, e.g., population and economic activity, to forecast future values of the dependent variable, i.e., sales of motor fuel, the relationships among these variables must be estimated from the historical values summarized in the section above. To estimate those relationships, ordinary least squares (OLS) regressions were made on the data for each year from 1984 to 2005.

Two specifications were tested. The first included all the behavioral variables described in section I-B above:

$$\mathbf{GAL = a + b_1LMN + b_2GDP + b_3POP + b_4MPG + b_5GPR + b_6CPR + b_7HSI}$$

Wherein:

GAL =	Taxable gallons of fuel sold
LNM =	Lane miles of all functional highway classes
GDP =	Gross domestic product
POP =	Population
MPG =	Miles per gallon of the Texas vehicle fleet
GPR =	Retail price of fuel, including taxes.
CPR =	Purchase price of a new vehicle, including interest.
HSI =	Household income

The results of this regression are summarized in Exhibit 11 below:

Exhibit 11: Regression Results, First Specification

	Estimated Coefficient	*T- Statistic*	*Evaluation*
Intercept a	2,506,592.97	0.72	intercept, statistically insignificant
LNM b_1	10.20	2.95	statistically significant
GDP b_2	1.53	0.47	statistically insignificant
POP b_3	0.63	2.70	statistically significant
MPG b_4	-576,276.34	-5.99	statistically significant
GPR b_5	-12,485.48	-3.09	statistically significant
CPR b_6	-162.41	-1.74	statistically significant
HSI b_7	159.40	1.81	statistically significant

The adjusted R^2 of this regression was 0.99 and the mean absolute percentage error (MAPE) was 0.8%.

In the second model specification, the independent variable that returned an insignificant value, GDP, was removed. The results of this regression provided statistically significant coefficient estimates with smaller variances for all independent variables (the constant term remained statistically insignificant), and an adjusted R^2 of 0.99 and mean absolute percentage error (MAPE) equal to 0.8%, which was the same as model specification 1 above.

While retail fuel prices and new car prices are significant and therefore influence future taxable gallons sold, these variables are extremely problematic to model or predict as you move further into the future. As a result, we removed these variables also (ie. GPR and CPR) leaving LNM, POP, MPG, and HSI as independent variables:

$$GAL = a + b_1LMN + b_2POP + b_3MPG + b_4HSI$$

When this model was run, HSI also became insignificant; therefore, the final model specification was:

$$GAL = a + b_1LMN + b_2POP + b_3MPG$$

The results of this regression are summarized in the exhibit below:

Exhibit 12: Regression Results, Third Specification

	Estimated Coefficient	*T- Statistic*	*Evaluation*
Intercept a	-2,084,739.15	-1.44	intercept, statistically insignificant
LNM b_1	13.06	3.29	statistically significant
POP b_2	0.84	29.61	statistically significant
MPG b_3	-658,502.57	-10.16	statistically significant

The adjusted R^2 of this regression was 0.99 and the mean absolute percentage error (MAPE) was 1.2%.

Elasticity

An elasticity estimate gives the percentage change in the probability of a success in response to a 1% change in the explanatory variable. Therefore, the elasticity refers to the percentage change in the dependent variable (GAL) that results from a 1% change in one explanatory variable (LNM, POP, or MGP), holding all other explanatory variables constant.

Elasticities can be calculated by taking the double-log functional form of the above model yielding:

$$Ln(GAL) = a + b_1Ln(LNM) + b_2Ln(POP) + b_3Ln(MPG)$$

The resulting coefficients provide constant elasticity estimates of the independent variables included in the regression; these are summarized in Exhibit 13:

Exhibit 13: Regression Results, Second Specification in Double-Log Form

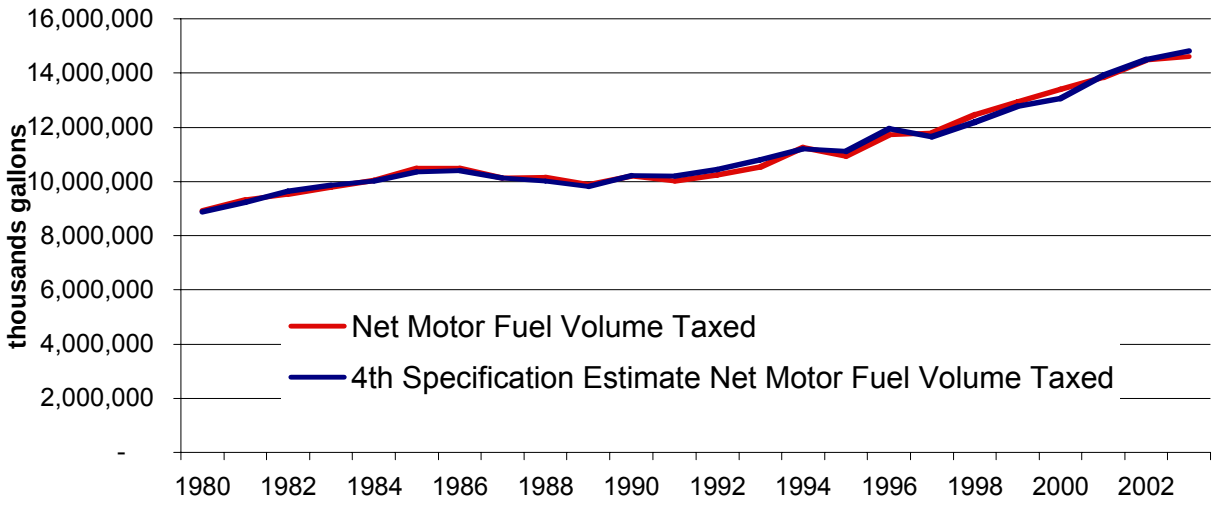
	Estimated Coefficient	*T- Statistic*	*Evaluation*
Intercept a	1,541,916.67	0.56	intercept, statistically insignificant
LNM b_1	10.09	2.99	statistically significant
POP b_2	0.71	4.13	statistically significant
MPG b_3	-576,468.55	-6.14	statistically significant
GPR b_4	-11,634.54	-3.29	statistically significant
CPR b_5	-181.24	-2.20	statistically significant
HSI b_6	190.72	3.35	statistically significant

These elasticity estimates provide useful information about how the independent variables impact taxable gallons sold and therefore motor fuel tax revenues. The above output indicates that a 1% increase in total lane miles results in an increase of approximately 0.67% in taxable gallons. Alternatively, a 1% increase in fuel efficiency results in a decrease of approximately 0.87 percent in taxable gallons. Population changes have a much greater impact on motor fuel gallons, or alternatively, motor fuel gallons are very responsive to population changes. Therefore, a 1% increase in population results in approximately 1.34% increase in taxable gallons.

A test of overall variance shows that the robustness and precision of the third model specification, with only three independent variables, is not significantly different than the first and second model specified. The third model specification is used to forecast the volumes of taxable motor fuel in future years.

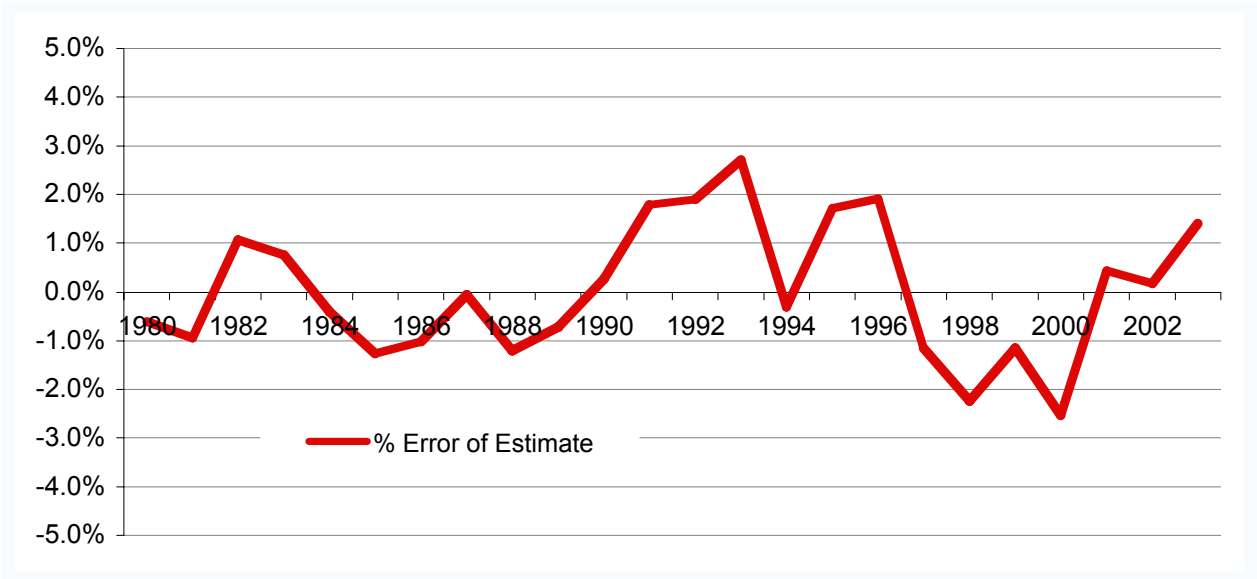
The fit of the third model to the historical data is shown in Exhibit 14. The annual difference between the estimated and actual volume of gallons taxed is called the residual error. If the fit of the model to actual data were perfect, the residual data would be zero in each year. To the extent that the error is large when expressed as a percent of the actual value, or if there is any systematic pattern in the residual errors, the model is imperfect.

Exhibit 14: Estimated and Actual Net Gallons Taxed, 1980 - 2003



The residual errors in the third specification are shown in Exhibit 15 below. The percentage errors are small, within +/- 3% for any given year, and do not appear to have any systematic pattern. To be sure, we can calculate the Durbin-Watson statistic (*d*), compare these values to the upper and lower critical values (d_L *and* d_U), and test for first-order serial correlation in the residuals.

Exhibit 15: Residual Errors, Percent Error of the Estimate



A value of 2 for the Durbin-Watson statistic indicates that there appears to be no autocorrelation. Small values of *d* indicate successive error terms are, on average, close in value to one another or positively correlated. Large values of *d* indicate successive error terms are, on average, much different in value to one another or negatively correlated. Autocorrelated deviations may be caused by left-out variables of incorrect function form.

The Durbin-Watson statistics are displayed below for all linear models described above:

Exhibit 16: Durbin-Watson Statistic – test for serial correlation

Durbin-Watson Statistic - test for serial correlation						
Level of Significance = .05						
	Specification 1		Specification 2		Specification 3	
n = 24	***k* = 7**		***k* = 6**		***k* = 3**	
	d_L	d_U	d_L	d_U	d_L	d_U
Critical Value	0.75	2.17	0.84	2.04	1.1	1.66
Estimate	2.06		2.07		1.14	
Evaluation	no autocorrelation		no autocorrelation		inconclusive	
Where ***n*** = number of observations and ***k*** = number of independent variables						

As seen in the table above, each of the Durbin-Watson statistics are within the upper and lower bound of the critical value, otherwise known as the inconclusive region. Both model specification 1 and 2 have *d* values close to two, therefore suggesting that there is no first-order autocorrelation. The third model, which will be used to forecast future taxable gallons, removed two variables—new car price and retail fuel price—therefore lowering the *d* statistic and creating more autocorrelation. However, this values still lies within the upper and lower critical values or inconclusive region.

Estimates of Future Values of the Independent Variables

This section contains forecasts and assumptions for future values of the variables that affect gallons of fuel sold for highway use.

$$GAL = a + b_1LMN + b_2POP + b_3MPG$$

1. Texas Lane Miles (LMN)

The number of lanes is calculated using the Highway Performance Monitoring system (HPMS) database compiled by the Texas Department of Transportation and submitted to the Federal Highway Administration. These lane mile increases are obtained from the projects in the Metropolitan Transportation Plan (MTP),

characterized by area type and functional class[30]. Total lane miles are equal to the number of lanes multiplied by the number of miles for each road section. Total lane mile projections were stated for 2030 and were estimated to be 734,574. In 2005, there were 648,625. Therefore, annual projections for the years between were estimated using an exponential functional form of $y = Ae^t$, wherein y = the number of lane miles, A = 645,405, and t = 0.005x; therefore $y = 645{,}405e^{0.005x}$.

2. Population

According to the most recent population projections from the Texas State Data Center, Texas' population was at 23,047,143 in January 2006 and is expected to reach 35.76 million by 2040[31]. This is based on a statewide annual rate of growth of approximately 1.5%, which is slower than 1990 – 2000 but still substantial growth, given the 2000 population base of 20.85 million. In 2005, Texas became the fourth "majority minority" state, with a minority population comprising 50.2% of its total population, according to U.S. Census Bureau population estimates[32] [33]. The revenue projections in this model use the population forecasts stated in the TxDOT Draft Model 2V162 model, under tab '*Veh Reg Model A-2'*.

3. MPG

Historically, the average efficiency of new automobiles has increased from 15.8 miles per gallon in 1975 to 27.9 miles per gallon in 1986, and then stabilized over the next decade. The efficiency of new light trucks has also improved from 13.7 miles per gallon in 1975 to 21.4 miles per gallon in 1986, and then remaining at about 21 miles per gallon for the next decade.[34] While the average efficiency of all new light-duty vehicles is expected to increase from 24.2 miles per gallon in 1999 to 28.0 miles per gallon in 2020, improvements in the average efficiency of the fleet is slowed by stock turnover. Therefore, the average stock efficiency of all light-duty vehicles is expected to increase from 20.5 to 21.5 miles per gallon by 2020[35].

[30] Bryan/ College Station MPO, Texas Urban Mobility Plan http://www.bcsmpo.org/pdffiles%20on%20www.bcsmpo.org/08-02-06%20Final%20TUMP.pdf
[31] Texas State Data Center and Office of the State Demographer http://txsdc.utsa.edu/tpepp/2006projections/
[32] U.S. Census Bureau. Press release August 11, 2005. http://www.census.gov/Press-Release/www/releases/archives/population/005514.html
[33] Business and Industry Data Center. Overview of the Texas Economy http://www.bidc.state.tx.us/overview/2-2te.htm
[34] Department of Energy. Energy Information Administration, February 28, 2001 http://tonto.eia.doe.gov/FTPROOT/presentations/oiaf/speeches/228eia.html
[35] Department of Energy, Energy Information Administration, February 28, 2001 http://tonto.eia.doe.gov/FTPROOT/presentations/oiaf/speeches/228eia.html

The amount of taxable fuel burned per vehicle mile driven is influenced by the continuing evolution of fuel efficiency through the design of gasoline and diesel-powered vehicles as well as by the use of 'alternative fuels' that may not be taxed. Alternative fuels are non-petroleum based fuels that include liquefied natural gas (LNG), compressed natural gas (CNG), liquefied petroleum gas (propane), electricity, hydrogen, ethanol, and biodiesel. In 2001, Texas ranked 19th in the nation with 1.987 alternative fueled vehicles per 1,000 people, while the nation averaged 1.7 alternative fueled vehicles per 1,000 people [36].

Each of the influences affecting miles per gallon are discussed below:

Power Output and Fuel Efficiency of Vehicle Engines

With fuel efficiency standards for light-duty vehicles remaining at current levels, fuel efficiency is projected to improve at a slower rate through 2020 than it did in the 1980s. This is due to projected low fuel prices and higher personal income, which are expected to increase the demand for larger, more powerful vehicles. Average horsepower for new cars in 2020 is projected to be about 55% above the 1999 average, but advanced technologies and materials are expected to keep new vehicle fuel economy from declining[37].

Automotive technologies that use alternative fuels or require advanced engine technology are projected to reach nearly 2.7 million in vehicle sales (16.7 percent of total projected light-duty vehicle sales) by 2020. The leading technologies are gasoline hybrid electric vehicles, followed by turbo direct injection diesels and alcohol flexible-fueled vehicles[38].

Within the forecast model TxDOT Draft Model 2V162, the '*Fuel Efficiency_Price Adj*' tab, contains a table with the adjustments for future fuel efficiency from the Energy Information Administration. This adjustment allows for the model to account for the impact of fuel efficiency to fuel consumption. The model currently uses the EIA defaults (column B), but the user could provide their own adjustment to test different scenarios. These adjustments are provided for each year beginning in 2005 and running out to 2030. The EIA defaults assume that there will be approximately 10.5% efficiency gains over the next 25 years or equivalently a gain of 1.7 mpg.

To model the changes in future fuel economy for the entire Texas' vehicle stock, best practices would be to build a cohort model which aims at connecting the dynamics of the passenger car market with the adoption of new technologies in the sector. This simulation model incorporates the demand for

[36] StateMaster.com. Energy Statistics, Alternative Fuel Vehicles (per capita) by State, http://www.statemaster.com/graph/ene_alt_fue_veh_percap-alternative-fuel-vehicles-per-capita
[37] Department of Energy. Energy Information Administration, February 28, 2001 http://tonto.eia.doe.gov/FTPROOT/presentations/oiaf/speeches/228eia.html
[38] Department of Energy, Energy Information Administration, February 28, 2001 http://tonto.eia.doe.gov/FTPROOT/presentations/oiaf/speeches/228eia.html

passenger transport, the selection of transportation equipment (the car fleet and its relative characteristics), as well as the estimation of the potential impacts in terms of fuel consumption.

Also included in such a model would be current vehicle stock, estimated scrappage levels or rates, and estimated new vehicle purchases, with the latter being derived from forecasts of personal income, population changes in different age groups, and customer segment behavior. Customer segment behavior would include the vehicle purchase habits of different age groups. The object of the modeling exercise is to create a tool capable of capturing and predicting the process of technology substitution in the sector.

The historical stock of cars in different categories is used to determine the existing fleet. Vehicle stock data is available through Texas' vehicle registration data and can be grouped into several assigned categories, based on a number of factors affecting overall fuel efficiency. These factors include but are not limited to make, model and year, body-type/size, engine size, fuel type, high and low purchase price, and domestic and import.

The decision to buy, substitute, or scrap a passenger car is a choice made by each individual on the basis of financial, socio-economic, and technological parameters. At the individual level, the decision to buy a car depends on their household income and utility and can be compared to the purchasing behavior demonstrated for typical durable goods. The main determinant for purchasing a car is household income; therefore, the chances of buying a car increase when income increases. Alternatively, the price of a car as well as the cost of using and maintaining it acts as an inhibiting factor.

Scrappage levels or scrappage rates may be estimated for both fuel types, varying weights of vehicles, and assigned groups of vehicle ages. Scrappage levels may be estimated based on historic levels, whereas scrappage rates may be estimated based on individual decisions to keep or scrap a vehicle based on the repair costs and age associated with the vehicle. That is, if the vehicle repair costs exceed its market value minus its scrap value, then the individual would scrap the vehicle.

With respect to new car purchases, the type of car purchased depends on numerous variables, including input prices and income. However, there are also a number of variables that are not quantifiable. These may include prestige associated with certain brands or car size, lifestyle trends, advertising and marketing, and the technological progress itself. The type of engine and/or fuel used seems to be a secondary decision. Because only two real alternatives exist today— gasoline or diesel-fueled internal combustion engines—the individual's choice depends largely on price, performance, and use costs. Gasoline and diesel are established fuels, and the internal combustion engine is a proven technology. With respect to new emerging technologies such as electric cars, fuel cells, or cars fueled by natural gas or biofuels, these emerging alternatives still lag in terms of

maturity, infrastructure and fuel availability, safety, and public perception, and they are not yet considered as alternatives by the majority of consumers[39]. Whether they will eventually become such, when their costs fall to competitive levels, remains an open question.

Ethanol-Based Fuels

Ethanol fuel is a biofuel alternative to gasoline and is the most widely used renewable biofuel today. It can be combined with gasoline in any concentration up to pure ethanol (E100). Worldwide automotive ethanol capabilities vary widely, and most spark-ignited gasoline style engines will operate well with mixtures of 10% ethanol (E10). Ethanol is projected to increase at an average rate of 3.6 % per year until 2020. All alternative fuels are projected to displace about 203,000 barrels of oil equivalent per day by 2020, or 2.1% of light-duty vehicle fuel consumption[40].

In 2004, Texas consumed about 333 million gallons of gasohol,[41] a blend of over 90% gasoline and less than 10% ethanol. This represents about 2% of the combined use of gasoline and gasohol in Texas. This usage is significantly lower than the national average of about 24%[42]. In 2006, Texas had 23 fueling stations for ethanol, which is about 2.4% of the National total[43].

In 2006, to encourage the production of biofuel in Texas, the Texas Department of Agriculture created the Texas Biofuel Incentive Program. The program allows for Texas biofuel producers to register with the department to become eligible to receive grants based on the amount of biofuel produced by their facilities[44].

With respect to fuel efficiency, some sources have reported a minor decrease in fuel economy of between 1-3%, (i.e., a vehicle currently getting 25 mpg might go down to 24.25 mpg).[45] Ethanol contains approximately 34% less energy per gallon than gasoline,[46] and therefore for vehicles running on E10 (10% ethanol and 90% gasoline), the effect is small (~3%) when compared to conventional

[39] Institute for Prospective Technological studies. Dynamics of the introduction of new passenger car technologies, June 2003. ftp://ftp.jrc.es/pub/EURdoc/eur20762en.pdf
[40] Department of Energy. Energy Information Administration, February 28, 2001 http://tonto.eia.doe.gov/FTPROOT/presentations/oiaf/speeches/228eia.html
[41] U.S. Department of Transportation. Federal Highway Administration, Office of Highway Policy Information, Highway Statistics Publications. http://www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.htm Motor Fuel Statistics, 2004, Table MF-33E.
[42] U.S. Department of Transportation. Federal Highway Administration, Office of Highway Policy Information, Highway Statistics Publications. http://www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.htm Motor Fuel Statistics, 2004, Table MF-27. The states that are significantly higher than the national average tend to be agriculture-intensive states in the mid-West.
[43] Energy Information Administration, Texas State Energy Profile http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=TX
[44] Texas State Energy Conservation Office http://www.seco.cpa.state.tx.us/re_ethanol_incentives.htm
[45] http://www.dem.ri.gov/programs/benviron/waste/pdf/usteth.pdf. April 2006
[46] http://en.wikipedia.org/wiki/Ethanol_fuel

gasoline, and even smaller (1 – 2%) when compared to oxygenated and reformulated blends. Texas does not currently tax ethanol-based fuels differently from gasoline; therefore, the impact of any increasing substitution from gasoline to ethanol-based fuels on motor fuel tax revenues would be insignificant.

Propane, Kerosene, and Natural Gas

Motor vehicles licensed in Texas and equipped with a liquefied gas system (i.e., butane, propane, compressed natural gas) are required to prepay the tax by purchasing a liquefied gas tax decal. Motor fuel taxes are therefore collected through annual sticker permit fees, which are based on the registered gross vehicle weight rating and the mileage driven in the previous year. Motor vehicles licensed in other states pay the tax at the retail pump at a rate of 15 cents per gallon[47].

In 2005, Texas had 2,697 vehicles that operated on natural gas, which accounted for 12.11% of the national total[48]. In 2001, Texas had approximately 22,000 vehicles that were propane-powered (or 0.1% of all vehicles registered), which accounts for about 6% of the national total of 350,000 vehicles[49].

There are no significant differences in the fuel efficiency of cars and light trucks that operate on gasoline and those that operate with LPG or CNG; these alternative fuels reduce vehicle operating costs by virtue of their lower price-per-gallon equivalent[50]. While Texas currently taxes these fuels at a lower rate than diesel or gasoline, vehicle registrations are not sufficient to induce reductions in motor fuel tax revenues, and current projected numbers should remain insignificant throughout the forecast period.

Fuel Cells and Other Sources of Energy

Texas currently has a number of tax incentives for hybrid vehicles: Texas Hybrid vehicle purchase Tax Incentive, Austin Hybrid Parking Discount, Austin Plug-In Hybrid Incentive, Hybrid Sales and Use Tax, and San Antonio Hybrid Free Parking. In 2005, Texans registered 9,632 new hybrid vehicles, ranking third in the nation behind California and Florida.[51] In all states, almost 200,000 new hybrid vehicles were registered, still only slightly more than 1% of the 17 million new vehicles sold. By 2006, Texas had over 20 million

[47] Texas Comptroller of Public Accounts. Due Dates and Tax Rates for Taxes Administered by the Comptroller, February, 2002 http://www.cpa.state.tx.us/taxinfo/taxtypes.html
[48] Energy Information Administration. Official Energy Statistics from the U.S. Government, Natural Gas 2005. http://www.eia.doe.gov/pub/oil_gas/natural_gas/data_publications/natural_gas_annual/current/pdf/table_069.pdf
[49] Propane Education and research Council. Propane-Powered Pick-up Makes its Debut at the Bush Ranch, 2001. http://www.propanecouncil.org/newsroom/press_releaseDetail.cfv?id=124
[50] U.S. Department of Energy. Energy Efficiency and Renewable Energy, 2003 http://www.fueleconomy.gov/feg/FEG2003_AltFuelVehicles.pdf
[51] Travelers Insurance http://www.hybridtravelers.com/press_09_25.html

registered motor vehicles, according to the Texas Department of Transportation, and the number of hybrid vehicles registered in Texas increased approximately 64%, from 13,516 in 2005 to 21,212 in 2006[52].

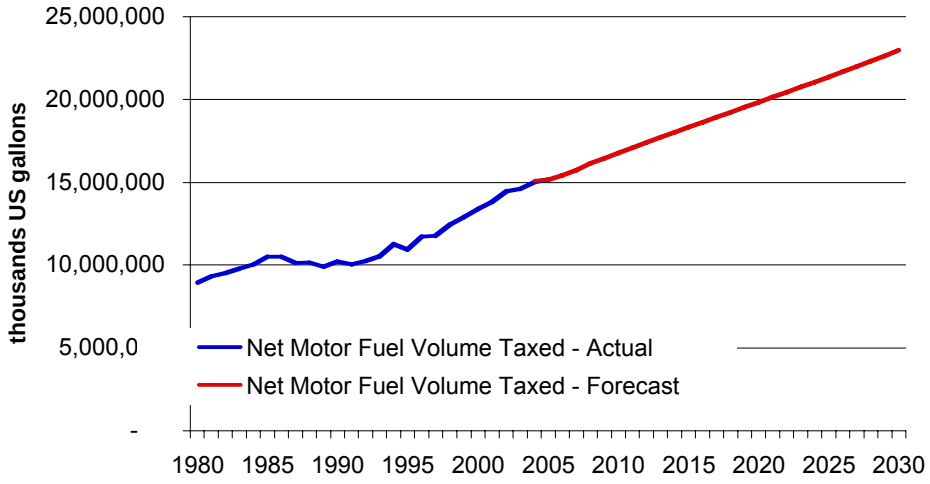
According to MIT transportation experts, it will be some two decades before even moderately improved technology vehicles will be on the roads in sufficient numbers to make a dent in America's staggering consumption of petroleum for transportation. Hydrogen fuel cell hybrid vehicles are unlikely to be a common on-road sight for more than 50 years[53]. Any significant jump in the number of hybrid vehicles in Texas will most likely come from a federal or state government decision to re-profile their fleets, which are exempt from motor fuel tax in any event. Hybrid vehicles are not likely to make a significant impact on the average MPG of Texas-registered vehicles within the forecasted time frame.

Revenue Forecasts

1. Forecast of Motor Fuel Tax Revenues

Applying the third model specification detailed earlier to the forecasts of independent variables LNM, POP, and MPG above yields the following forecast of taxable gallons sold.

Exhibit 17: Forecasts of Taxable Gallons Sold, to 2030



[52] The State of Texas, Office of the Governor, Economic Development and Tourism. Texas Automotive Manufacturing Industry Report, February 2007
http://www.bidc.state.tx.us/Industry%20Reports/2007TXAutoRpt.pdf
[53] MIT Engineering System. New Vehicle Technologies: How soon can they make a difference? 2005
http://esd.mit.edu/esd_reports/summer2005/new_vehicle_technologies.html

The forecasts for taxable gallons average an annual growth rate of 1.7% per year; however, year-over-year growth rates range from a high of 2.5% in 2008 to a low of 1.4% in 2029. Annual revenues are computed from multiplying the taxable gallons projected by the state tax rate of 20 cents per gallon. The historical average revenue tax yield[54] indicates that there are annual fluctuations between the tax rate applied and the tax rate received. Since the last tax rate increase in 1991, annual revenue tax yields vary from 19.23 cents per gallon to 20.49 cents per gallon. While there have been continuous reductions since 2000, beginning at 20.14 cents per gallon and ending at 19.23 cents per gallon, these fluctuations are more likely to be a result of administrative anomalies rather than as a result of increasing market penetration of alternative fueled vehicles, because the current number of alternative vehicles is still too small to create such a decrease. Therefore, for this forecast, a rate of 20 cents per gallon will be used to forecast the future motor fuel tax revenues.

Exhibit 18: Forecasts of Motor Fuel Tax Receipts, to 2030

Year	Taxable Gallons (*billions*)	Revenue (*billions*)	*% change year-over-year*
2005	15.2	3.0	
2006	15.4	3.1	1.9%
2007	15.8	3.2	2.1%
2008	16.1	3.2	2.5%
2009	16.5	3.3	2.0%
2010	16.8	3.4	1.9%
2011	17.1	3.4	1.9%
2012	17.4	3.5	1.8%
2013	17.7	3.5	1.8%
2014	18.0	3.6	1.7%
2015	18.3	3.7	1.7%
2016	18.6	3.7	1.7%
2017	18.9	3.8	1.6%
2018	19.2	3.8	1.6%
2019	19.5	3.9	1.6%
2020	19.8	4.0	1.5%
2021	20.1	4.0	1.5%
2022	20.4	4.1	1.5%
2023	20.8	4.2	1.5%

[54] The average revenue tax yield is calculated by dividing the taxable gallons sold by the motor fuel tax revenue realized, for each year.

2024	21.1	4.2	1.5%
2025	21.4	4.3	1.5%
2026	21.7	4.3	1.5%
2027	22.0	4.4	1.5%
2028	22.3	4.5	1.4%
2029	22.6	4.5	1.4%
2030	23.0	4.6	1.5%
			1.7%

B. Federal Aid Highway Funds

First, an OLS regression estimated receipts to the Federal Highway Trust Fund. Highway account outlays were then derived from this estimate.

1. Estimates of Highway Trust Fund Receipts, Nationwide

The federal Highway Trust Fund receives revenues from several sources that are subject to several adjustments, as are illustrated below.

Exhibit 19: Status of the Federal Highway Trust Fund, 2004[55]

	Highway Account	*Mass Transit Account*	*Total Highway Trust Fund*
Excise taxes (transferred General Fund receipts)			
Gasoline	15,392,886,000	2,851,272,000	18,244,158,000
Gasohol	4,535,969,000	1,180,158,000	5,716,127,000
Diesel, special fuels	7,883,289,000	1,052,176,000	8,935,465,000
Tires	445,841,000	0	445,841,000
Trucks and trailers	1,846,613,000	0	1,846,613,000
Federal use tax	944,563,000	0	944,563,000
Total excise taxes	31,049,161,000	5,083,606,000	36,132,767,000
Deduct - reimbursement to General Fund receipts (refunds and tax credits)			
Diesel vehicle rebate	0	0	0
Diesel in buses	31,423,000	0	31,423,000
Diesel fuel-other	564,665,000	61,156,000	625,821,000
Gasohol	27,751,000	0	27,751,000
Gasoline in gasohol	22,865,000	0	22,865,000

[55] FHWA Highway Statistics, Table FE-10

Gasoline-other	260,002,960	45,283,000	305,285,960
Special fuel	1,342,000		1,342,000
Total Deductions	908,048,960	106,439,000	1,014,487,960
Transfers To:			
Land and Water Conservation Fund	844,000	156,000	1,000,000
Aquatic Resources Trust Fund	273,861,000	37,778,000	311,639,000
General Fund	97,862,000	13,488,000	111,350,000
Total Transfers	372,567,000	51,422,000	423,989,000
Net Excise Taxes	29,768,545,040	4,925,745,000	34,694,290,040
	Highway Account	*Mass Transit Account*	*Total Highway Trust Fund*
Other income			
Safety fines and penalties	16,456,644	0	16,456,644
Interest under CMIA (net)	0	0	0
IMTP Revenue	0	25,000	25,000
Total Other Income	16,456,644	25,000	16,481,644
Total Receipts	**29,785,001,684**	**4,925,770,000**	**34,710,771,684**

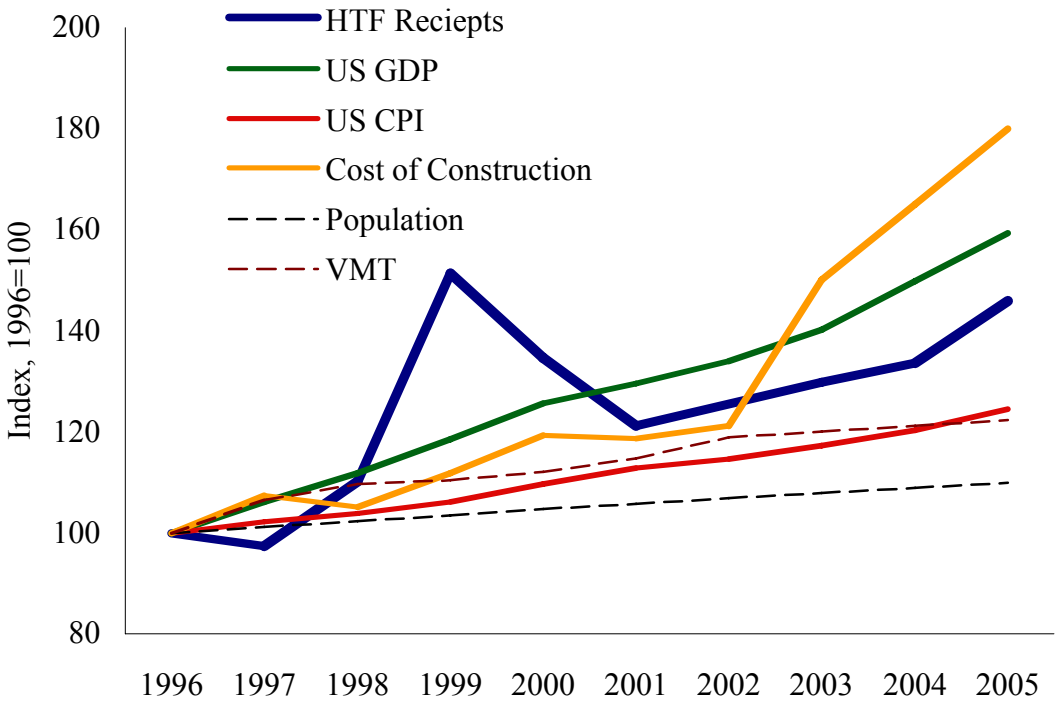
Of the $36.1 billion in gross receipts in 2004, about $32.9 billion or 91% were derived from excise taxes on gasoline, gasohol, diesel and special fuels – motor fuel taxes, broadly defined. All gross receipts are subjected to numerous deductions, transfers and additions of other income to arrive at the total receipts of the the Highway Trust Fund, i.e. $34.7 billion in the exhibit above.

Total receipts of the highway trust fund was chosen as the dependent variable for the regression since it is the bottom-line amount available from Highway Trust Fund revenues and it is amount used in programming and predicting federal aid apportionments.

Historical Values of the Relevant Variables

The federal excise tax rate on gasoline was last changed in 1997. In the decade since, the growth of total Highway Trust Fund receipts has not kept pace with the US Gross Domestic Product, with the national average consumer price index or the national average cost construction index. It's growth has, however, exceeded growth in both the US population and total vehicle-miles traveled in the nation.

Exhibit 20: HTF Receipts and Selected Economic Indices 1996 - 2005



Following the same initial hypothesis as was posed for state motor fuel taxes, we initially hypothesize that Highway Trust Fund Receipts are a function of fuel prices, population, GDP and household income.

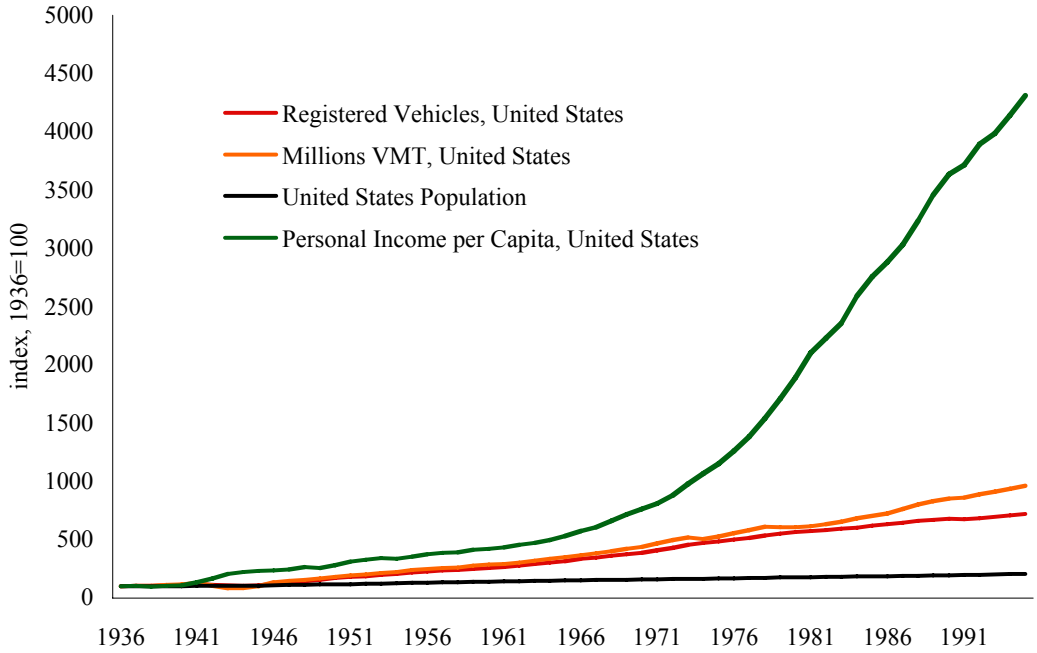
Therefore:

HTF = *f*(GPR, POP, HIS, GDP)

Wherein:
HTF = Net receipts of the federal Highway Trust Fund
GPR = Retail price of fuel, including taxes
POP = Population
HIS = Household income
GDP = Gross Domestic Product

Long-term trends in these basic economic and demographic variables are illustrated in the exhibit below.

Exhibit 21: Economic and Demographic Trends in the United States



In the modern era after the Second World War, both vehicle-miles driven and the number of registered vehicles in the United States have more closely followed growth in the population, which has grown geometrically: while population has doubled over the 60-year period, VMT have grown about 11-fold and the number of registered vehicles has grown about 7-fold. Personal income in the United States over the same period has grown to about 45 times its level in 1936.

Estimate of the Model with Historical Values

Estimates were generated for each of the years in the sample population from 1980 to 2005. The test for equal means, specifically a t-test for two-samples assuming equal variances, was calculated, because only two populations were being tested. If three or more series were being examined, ANOVA, or analysis of variance, would need to be calculated.

Each model was run with the same variables that were used to forecast Motor Fuel Tax Revenues for Texas. Therefore, the models were:

Total Excise Taxes = $a + b_1LMN + b_2POP + b_3MPG$

Total Receipts = $a + b_1LMN + b_2POP + b_3MPG$

The original specification described above, when run for the Federal Highway Trust Funds, produced insignificant coefficients for both lane miles and miles per gallon.

Additional variables examined in the Motor Fuel Tax Revenue forecast were also tested, i.e., GDP, Household Income, Fuel Price, New Car Prices, however as with the Motor Fuel Tax Revenue forecast, none of these variables produced significant coefficients. Therefore, the only variable statistically significant in the estimation of both Total Excise Taxes and Total Receipts was population. Because none of the national economic indicators were significant in the model, the model suggests that the major contributing factor to future motor fuel revenues at the national level is population. However, since the intercept was also significant, this would suggest that the current model specification may be missing minor relevant variables.

The results of these two models were tested using the t-test method described above. Results indicated that while the means or the two samples differed, the difference was not statistically significant, and therefore, we can assume the means are equal, and hence modeling "Total Receipts" is sufficient for the purpose of this audit.

Therefore, the final model specification was:

Total Receipts = $a + b_1 POP$

***or* Total Receipts = -75,291,217,163 + 362.0 * POP**

The adjusted R^2 of this regression was 0.92 and the mean absolute percentage error (MAPE) was 8.8%.

Forecasted Values of the Independent Variables

While it provides an adequate statistical fit, a simple regression of receipts against population does not take into account two known factors that affect gallons of fuel sold: engine efficiency and the age of the driving population. Both of these factors are added as adjustments to the forecast.

We adopted the forecast of US vehicle fleet efficiency prepared by the U.S. Energy Information Administration.[56] This forecast predicts year-by-year changes, shown below, such that the average fuel efficiency of the national light vehicle fleet has improved by about 10% by the year 2030. No adjustment for vehicle fleet as this is national data.

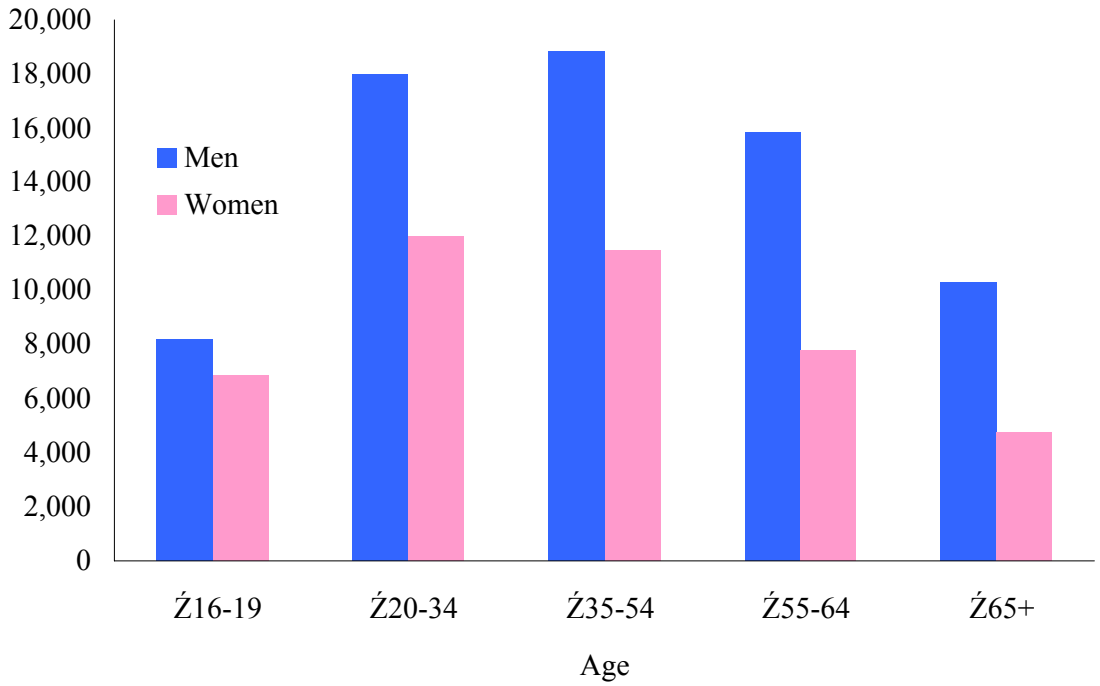
The forecast of state motor fuel taxes in Texas, outlined in the section above, did not require an exogenous adjustment for the age of drivers. The model was calibrated with 15 years of data and regressed gallons sold directly onto population. The resulting coefficient for population includes shifts in VMT due to changes in the age proportions in the Texas population.

There was little confidence that the model for national data would capture that relationship: less than 10 years' of data, since the last changes in the federal excise tax rate, were available to calibrate the model and the dependent variable was only indirectly linked to gallons sold and VMT. In other words, there were insufficient degrees of freedom.

[56] U.S. Department of Energy, Energy Information Administration. Annual Energy Outlook, 2007.

The impact of age and gender on VMT is very pronounced in the United States, as the data below illustrates. Elderly women, for example, drive about $^{1}/_{4}$ the distances each year that are driven by younger men.

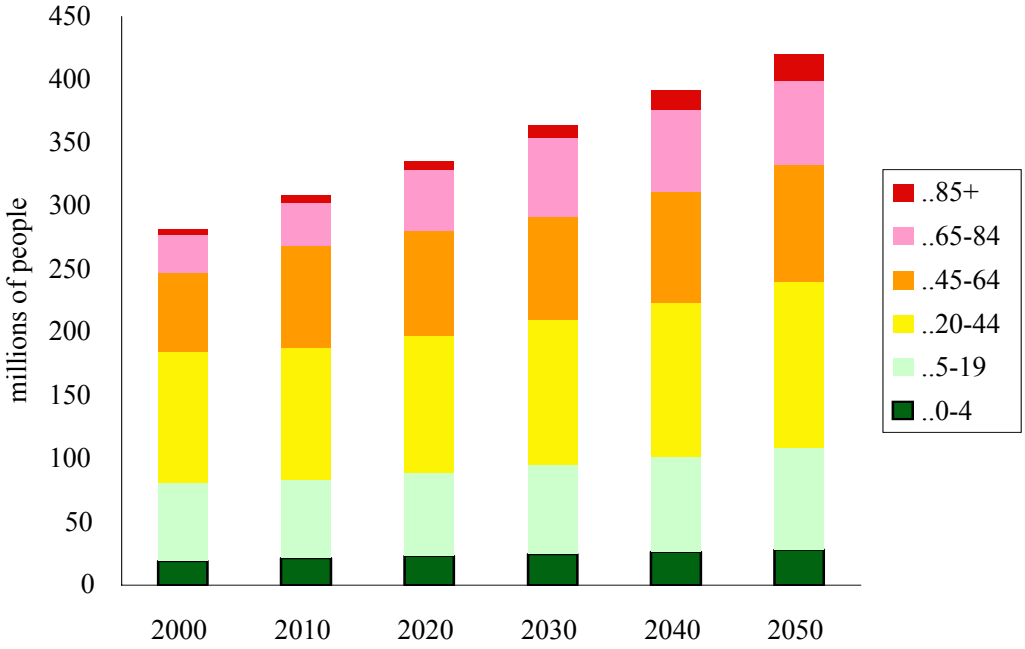
Exhibit 22: Vehicle-Miles Traveled by Age and Gender[57]



These different intensities were applied to the following forecasted shifts in the age and gender of the United States population. Those forecasts, shown in the exhibit below, indicate that the United States population that is 65 years of age and older is expected to be almost 20% in 2030, where as it was about 12.5% in the year 2000 census. Also, women made up about almost 60% of all people aged 65 years and older.

[57] 1995 National Personal Transportation Survey, as reported in 1998 by the FHWA Office of Information Management.

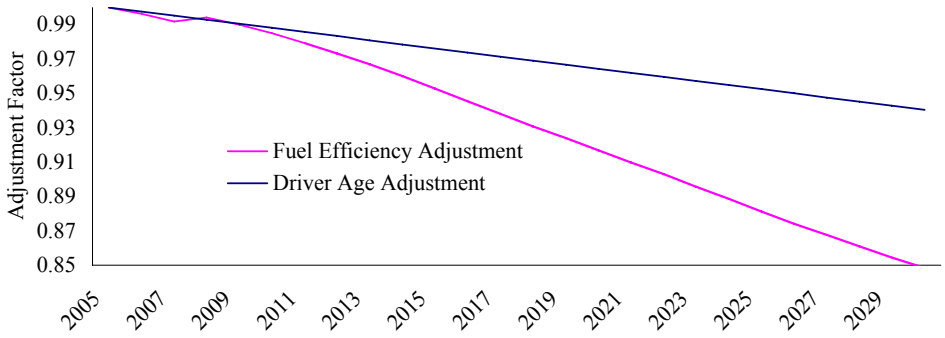
Exhibit 23: National Population Projection[58]



The year-by-year adjustments to forecast receipts for driver age are shown in the forecast detail section below are estimated to decrease vehicle-miles traveled in the United State by 6% below what they would have been in 2030 had there been no demographic shifts in the population.

Both the fuel efficiency adjustment factor and the driver age adjustment factor summed and shown in the exhibit below.

Exhibit 24: Combined Fuel Efficiency and Driver Age Adjustment Factors



[58] U.S. Census Bureau, 2004, "U.S. Interim Projections by Age, Sex, Race, and Hispanic Origin," http://www.census.gov/ipc/www/usinterimproj/

Forecast of the Dependent Variable

The following table details the forecasts of the independent variable, the dependent variable and the adjustment factor.

Exhibit 25: Forecast of Federal Highway Trust Fund Receipts

	US Population	*HTF Receipts before Adjustment*	*Fuel Efficiency and Driver Age Adjustment Factor*	*Cumulative Adjustment*	*HTF Receipts after Adjustment*
	millions	*$ billions*		*$ billions*	*$ billions*
2006	298	35.0	1.00	0.1	34.9
2007	301	36.2	0.99	0.3	35.9
2008	304	37.2	0.99	0.2	37.0
2009	306	38.4	0.99	0.4	38.0
2010	309	39.7	0.99	0.6	39.1
2011	312	41.1	0.98	0.8	40.3
2012	314	42.5	0.97	1.1	41.4
2013	317	44.0	0.97	1.4	42.6
2014	320	45.6	0.96	1.7	43.9
2015	322	47.3	0.95	2.1	45.1
2016	325	49.0	0.95	2.5	46.4
2017	328	50.7	0.94	2.9	47.8
2018	330	52.6	0.93	3.4	49.2
2019	333	54.5	0.92	3.8	50.6
2020	336	56.4	0.92	4.3	52.1
2021	339	58.4	0.91	4.8	53.6
2022	341	60.5	0.90	5.4	55.1
2023	344	62.7	0.90	5.9	56.7
2024	347	64.9	0.89	6.5	58.4
2025	350	67.2	0.88	7.1	60.1
2026	352	69.6	0.87	7.8	61.8
2027	355	72.0	0.87	8.4	63.6
2028	358	74.6	0.86	9.1	65.5
2029	361	77.2	0.85	9.8	67.4
2030	364	79.8	0.85	10.5	69.3

2. Estimates of Highway Account Outlays, Nationwide

The following table details the conversion of forecast Highway Trust Fund nationwide, to Texas apportionments.

Exhibit 26: Forecast of Texas Apportionments and Outlays

	HTF Receipts after Adjustment	*National Apportionments = National Outlays*	*Cumulative Difference Between Receipts and Apportionments*	*Texas Apportionments*
	$ billions			
2006	34.9	34.9	0.0	2.90
2007	35.9	37.9	-2.0	2.98
2008	37.0	40.5	-5.5	3.06
2009	38.0	41.7	-9.2	3.14
2010	39.1	40.7	-10.8	3.22
2011	40.3	41.8	-12.3	3.30
2012	41.4	39.4	-10.3	3.39
2013	42.6	40.6	-8.3	3.48
2014	43.9	40.9	-5.3	3.56
2015	45.1	42.1	-2.3	3.65
2016	46.4	43.4	0.7	3.73
2017	47.8	43.8	4.7	3.82
2018	49.2	45.2	8.7	3.90
2019	50.6	46.6	12.7	3.99
2020	52.1	47.1	17.7	4.08
2021	53.6	49.3	22.0	4.16
2022	55.1	50.7	26.4	4.25
2023	56.7	52.2	30.9	4.34
2024	58.4	53.7	35.6	4.43
2025	60.1	55.3	40.4	4.52
2026	61.8	56.9	45.3	4.61
2027	63.6	58.5	50.4	4.70
2028	65.5	60.2	55.7	4.78
2029	67.4	62.0	61.1	4.87
2030	69.3	63.8	66.6	4.96

This forecast is not a statistical estimate but a calculation that follows several steps, starting with the statistical forecast of nationwide HTF receipts.

The first step is a translation from Highway Trust Fund receipts to apportionments made available to all states and territories. From 2006 to 2009, we use the forecast of federal-aid highway outlays that was developed between the Congressional Budget Office and the FHWA during the 2006 budget cycle.[59] From 2010 onwards, we make the following deductions each year:

- Receipts that are not apportioned in order to ensure that the cash balance of the Highway Trust Fund does not fall below $0; and
- Receipts that are not apportioned but are transferred to the General Fund for the purposes of reducing the U.S. government's deficit.

[59] Congressional Budget Office. The Budget and Economic Outlook: Fiscal Years 2008 to 2017. January 2007.

Exhibit 27: Assumed Annual Reductions from the Highway Trust Fund

	HTF Receipts retained to preserve cash balance	*HTF Receipts transferred to General Fund for deficit reduction*
	$ billions	
2010	2	
2011	2	
2012		2
2013		2
2014		3
2015		3
2016		3
2017		4
2018		4
2019		4
2020		5
2021		3
2022		3
2023		3
2024		3
2025		3
2026		3
2027		3
2028		3
2029		3
2030		3

To derive Texas' share of national appropriations, we assume that the current share – about 8.5% - remains constant in future years.

Appendix C:
Estimates of Cost Savings from Comprehensive Development Agreements

■

This appendix contains the calculations that underlie the estimates of the relative costs of financing toll facilities through municipal bonds versus comprehensive development agreements that are summarized in Section IV. B.2.3 of the audit report.

In these estimates, the two financings of a toll facility with a construction and development cost of $500 million, an initial annual operating income of $15 million and a life of 50 years are compared:

- In the public option, the project is financed 80% with municipal bonds of 20 years' duration and 20% toll equity from the Texas Mobility Fund.
- In the private option, the project is financed 80% with private activity bonds of 20 years' duration and 20% with private equity.

This project is barely toll viable, i.e. the annual operating income is close to being just sufficient to cover the financing costs of the project. The two financings are therefore compared on their:

- **Costs of capital**, i.e. the present value of the operating income that must be used to provide the required debt service payments and the required return to equity; and
- **Financing costs**, i.e. the costs of capital plus the present value of the toll equity that is required to make the project viable.

The following assumptions are used in the analysis:

Assumptions	Public Option	Private Option
% of Project Financed with Bonds	80%	80%
Bond Interest Rate	5%	5%
Discount Rate	4%	
Revenue Growth Rate	3%	
Required Pre-tax Return on Equity	5%	12%
Corporate Tax Rate	n/a	35%
Depreciation	n/a	50 years, straight line

The results are compared on a present value basis, i.e. with all cash flows discounted at the rate assumed above.

Exhibit 28: Capital and Financing Cost Schedule: Municipal Bonds and Toll Equity

Period	Revenues Net of O/M Costs	Debt service costs	PV Cost of Capital	Net Income	PV Net Income
			$ millions		
1	15.00	(40.12)	(38.58)	(25.12)	(24.16)
2	15.45	(40.12)	(37.09)	(24.67)	(22.81)
3	15.91	(40.12)	(35.67)	(24.21)	(21.52)
4	16.39	(40.12)	(34.30)	(23.73)	(20.28)
5	16.88	(40.12)	(32.98)	(23.24)	(19.10)
6	17.39	(40.12)	(31.71)	(22.73)	(17.97)
7	17.91	(40.12)	(30.49)	(22.21)	(16.88)
8	18.45	(40.12)	(29.32)	(21.67)	(15.84)
9	19.00	(40.12)	(28.19)	(21.12)	(14.84)
10	19.57	(40.12)	(27.10)	(20.55)	(13.88)
11	20.16	(40.12)	(26.06)	(19.96)	(12.97)
12	20.76	(40.12)	(25.06)	(19.36)	(12.09)
13	21.39	(40.12)	(24.10)	(18.73)	(11.25)
14	22.03	(40.12)	(23.17)	(18.09)	(10.45)
15	22.69	(40.12)	(22.28)	(17.43)	(9.68)
16	23.37	(40.12)	(21.42)	(16.75)	(8.94)
17	24.07	(40.12)	(20.60)	(16.05)	(8.24)
18	24.79	(40.12)	(19.80)	(15.33)	(7.57)
19	25.54	(40.12)	(19.04)	(14.58)	(6.92)
20	26.30	(40.12)	(18.31)	(13.82)	(6.31)
21	27.09			27.09	11.89
22	27.90			27.90	11.77
23	28.74			28.74	11.66
24	29.60			29.60	11.55
25	30.49			30.49	11.44
26	31.41			31.41	11.33
27	32.35			32.35	11.22
28	33.32			33.32	11.11
29	34.32			34.32	11.00
30	35.35			35.35	10.90
31	36.41			36.41	10.79
32	37.50			37.50	10.69
33	38.63			38.63	10.59
34	39.79			39.79	10.49
35	40.98			40.98	10.38
36	42.21			42.21	10.28
37	43.47			43.47	10.19
38	44.78			44.78	10.09
39	46.12			46.12	9.99
40	47.51			47.51	9.89
41	48.93			48.93	9.80
42	50.40			50.40	9.71
43	51.91			51.91	9.61
44	53.47			53.47	9.52
45	55.07			55.07	9.43
46	56.72			56.72	9.34
47	58.43			58.43	9.25
48	60.18			60.18	9.16
49	61.98			61.98	9.07
50	63.84			63.84	8.98
	1,691.95	(802.43)	(545.26)	889.53	29.43

In the municipal bond version, the present value of the bond debt service costs, i.e. the cost of capital, is about $545 million. The project generates an operating surplus of about $29 million, present value, making the overall financing cost about $516 million.

Exhibit 29: Capital and Financing Cost Schedule: Private Activity Bonds and Private Equity

Period	Revenues Net of O/M Costs	Interest	Earnings before Depreciation and Taxes	Depreciation	Before Tax Income	Income Tax	After Tax Income	PV After Tax Income	Required ROE	PV Required ROE	Internally Generated ROE	ROE above (below) requirement	PV ROE above (below) requirement
						$ millions							
1	15.00	(22.10)	(7.10)	(10.00)	(17.10)	5.98	(11.11)	(10.69)	(9.00)	(8.65)	3.50	(5.50)	(5.29)
2	15.45	(22.10)	(6.65)	(10.00)	(16.65)	5.83	(10.82)	(10.00)	(9.00)	(8.32)	3.50	(5.50)	(5.09)
3	15.91	(22.10)	(6.18)	(10.00)	(16.18)	5.66	(10.52)	(9.35)	(9.00)	(8.00)	3.50	(5.50)	(4.89)
4	16.39	(22.10)	(5.71)	(10.00)	(15.71)	5.50	(10.21)	(8.73)	(9.00)	(7.69)	3.50	(5.50)	(4.70)
5	16.88	(22.10)	(5.21)	(10.00)	(15.21)	5.33	(9.89)	(8.13)	(9.00)	(7.40)	3.50	(5.50)	(4.52)
6	17.39	(22.10)	(4.71)	(10.00)	(14.71)	5.15	(9.56)	(7.56)	(9.00)	(7.11)	3.50	(5.50)	(4.35)
7	17.91	(22.10)	(4.19)	(10.00)	(14.19)	4.97	(9.22)	(7.01)	(9.00)	(6.84)	3.50	(5.50)	(4.18)
8	18.45	(22.10)	(3.65)	(10.00)	(13.65)	4.78	(8.87)	(6.48)	(9.00)	(6.58)	3.50	(5.50)	(4.02)
9	19.00	(22.10)	(3.10)	(10.00)	(13.10)	4.58	(8.51)	(5.98)	(9.00)	(6.32)	3.50	(5.50)	(3.86)
10	19.57	(22.10)	(2.53)	(10.00)	(12.53)	4.38	(8.14)	(5.50)	(9.00)	(6.08)	3.50	(5.50)	(3.72)
11	20.16	(22.10)	(1.94)	(10.00)	(11.94)	4.18	(7.76)	(5.04)	(9.00)	(5.85)	3.50	(5.50)	(3.57)
12	20.76	(22.10)	(1.33)	(10.00)	(11.33)	3.97	(7.37)	(4.60)	(9.00)	(5.62)	3.50	(5.50)	(3.44)
13	21.39	(22.10)	(0.71)	(10.00)	(10.71)	3.75	(6.96)	(4.18)	(9.00)	(5.41)	3.50	(5.50)	(3.30)
14	22.03	(22.10)	(0.07)	(10.00)	(10.07)	3.52	(6.54)	(3.78)	(9.00)	(5.20)	3.50	(5.50)	(3.18)
15	22.69	(22.10)	0.59	(10.00)	(9.41)	3.29	(6.12)	(3.40)	(9.00)	(5.00)	3.50	(5.50)	(3.05)
16	23.37	(22.10)	1.27	(10.00)	(8.73)	3.05	(5.67)	(3.03)	(9.00)	(4.81)	3.50	(5.50)	(2.94)
17	24.07	(22.10)	1.97	(10.00)	(8.03)	2.81	(5.22)	(2.68)	(9.00)	(4.62)	3.50	(5.50)	(2.82)
18	24.79	(22.10)	2.70	(10.00)	(7.30)	2.56	(4.75)	(2.34)	(9.00)	(4.44)	3.50	(5.50)	(2.71)
19	25.54	(22.10)	3.44	(10.00)	(6.56)	2.30	(4.26)	(2.02)	(9.00)	(4.27)	3.50	(5.50)	(2.61)
20	26.30	(22.10)	4.21	(10.00)	(5.79)	2.03	(3.77)	(1.72)	(9.00)	(4.11)	3.50	(5.50)	(2.51)
21	27.09		27.09	(10.00)	17.09	(5.98)	11.11	4.88	(9.00)	(3.95)	11.11	2.11	0.93
22	27.90		27.90	(10.00)	17.90	(6.27)	11.64	4.91	(9.00)	(3.80)	11.64	2.64	1.11
23	28.74		28.74	(10.00)	18.74	(6.56)	12.18	4.94	(9.00)	(3.65)	12.18	3.18	1.29
24	29.60		29.60	(10.00)	19.60	(6.86)	12.74	4.97	(9.00)	(3.51)	12.74	3.74	1.46
25	30.49		30.49	(10.00)	20.49	(7.17)	13.32	5.00	(9.00)	(3.38)	13.32	4.32	1.62
26	31.41		31.41	(10.00)	21.41	(7.49)	13.91	5.02	(9.00)	(3.25)	13.91	4.91	1.77
27	32.35		32.35	(10.00)	22.35	(7.82)	14.53	5.04	(9.00)	(3.12)	14.53	5.53	1.92
28	33.32		33.32	(10.00)	23.32	(8.16)	15.16	5.05	(9.00)	(3.00)	15.16	6.16	2.05
29	34.32		34.32	(10.00)	24.32	(8.51)	15.81	5.07	(9.00)	(2.89)	15.81	6.81	2.18
30	35.35		35.35	(10.00)	25.35	(8.87)	16.48	5.08	(9.00)	(2.77)	16.48	7.48	2.31
31	36.41		36.41	(10.00)	26.41	(9.24)	17.17	5.09	(9.00)	(2.67)	17.17	8.17	2.42
32	37.50		37.50	(10.00)	27.50	(9.63)	17.88	5.10	(9.00)	(2.57)	17.88	8.88	2.53
33	38.63		38.63	(10.00)	28.63	(10.02)	18.61	5.10	(9.00)	(2.47)	18.61	9.61	2.63
34	39.79		39.79	(10.00)	29.79	(10.42)	19.36	5.10	(9.00)	(2.37)	19.36	10.36	2.73
35	40.98		40.98	(10.00)	30.98	(10.84)	20.14	5.10	(9.00)	(2.28)	20.14	11.14	2.82
36	42.21		42.21	(10.00)	32.21	(11.27)	20.94	5.10	(9.00)	(2.19)	20.94	11.94	2.91
37	43.47		43.47	(10.00)	33.47	(11.72)	21.76	5.10	(9.00)	(2.11)	21.76	12.76	2.99
38	44.78		44.78	(10.00)	34.78	(12.17)	22.61	5.09	(9.00)	(2.03)	22.61	13.61	3.07
39	46.12		46.12	(10.00)	36.12	(12.64)	23.48	5.09	(9.00)	(1.95)	23.48	14.48	3.14
40	47.51		47.51	(10.00)	37.51	(13.13)	24.38	5.08	(9.00)	(1.87)	24.38	15.38	3.20
41	48.93		48.93	(10.00)	38.93	(13.63)	25.30	5.07	(9.00)	(1.80)	25.30	16.30	3.27
42	50.40		50.40	(10.00)	40.40	(14.14)	26.26	5.06	(9.00)	(1.73)	26.26	17.26	3.32
43	51.91		51.91	(10.00)	41.91	(14.67)	27.24	5.04	(9.00)	(1.67)	27.24	18.24	3.38
44	53.47		53.47	(10.00)	43.47	(15.21)	28.25	5.03	(9.00)	(1.60)	28.25	19.25	3.43
45	55.07		55.07	(10.00)	45.07	(15.78)	29.30	5.02	(9.00)	(1.54)	29.30	20.30	3.47
46	56.72		56.72	(10.00)	46.72	(16.35)	30.37	5.00	(9.00)	(1.48)	30.37	21.37	3.52
47	58.43		58.43	(10.00)	48.43	(16.95)	31.48	4.98	(9.00)	(1.42)	31.48	22.48	3.56
48	60.18		60.18	(10.00)	50.18	(17.56)	32.62	4.96	(9.00)	(1.37)	32.62	23.62	3.59
49	61.98		61.98	(10.00)	51.98	(18.19)	33.79	4.94	(9.00)	(1.32)	33.79	24.79	3.63
50	63.84		63.84	(10.00)	53.84	(18.85)	35.00	4.92	(9.00)	(1.27)	35.00	26.00	3.66
	1,691.95	(441.94)	1,250.01	(500.00)	750.01	(262.50)	487.51	38.72	(450.00)	(193.34)	712.78	262.78	5.16

In the Comprehensive Development Agreement the cost of capital is higher, a present value of $635 million comprised of the interest costs on the bond plus the required return on equity. However, the tax credits available from depreciation supply a significant part of the return on equity that is required by the private sector investor. As a result, the overall financing cost is $437 million, present value, consisting of the interest costs on the bond less the return on equity in excess of the required 12% pre-tax return on equity.

Exhibit 30: Cost Comparison Summary on a Hypothetical $500 million Toll Project

	Public Option	Private Option	Difference
		$ millions	
PV Cost of Capital	545	635	
PV Financing Cost	516	437	79

The difference between the present value financing costs is approximated as $75 million in Section IV. B.2.3. of the audit report.

Following the categories of cost savings identified in Section B.2.3 and Section of the report, the savings estimated for each $1 billion of capital spent on toll projects are:

Exhibit 31: Summary of Comprehensive Development Agreement Cost Savings

	$ millions savings per $1 billion of project cost	
PV Financing Cost	150	estimated above
Design-Build Deliver	60	2% of lifecycle costs%

With savings of about $200 million per $1 billion of toll project cost, we assume that about $25 billion of toll projects will be built using Comprehensive Development Agreements over the next 25 years to achieve total savings of about $5 billion.

Appendix D:
Risk-Based Analysis of Cash Balances

■

This is Appendix D to Section VII Audit Area C.2. Cash Management. This appendix outlines the statistical estimates of risk that were used to define the risk-based target balances in the audit report.

A. The Data

These analyses are completed with several sets of data, all supplied by the TxDOT Finance Division[60]:

- "Beg. Balance", "Dep/Transfers In", Exp/Transfers Out" and "Ending Balance". 1 December 2000 to 22 June 2007;
- "Daily Payments" 1 September 2004 to 25 August 2006;
- "Daily Receipts", "Vehicle Registration", "Daily Receipts, Dept of Public Safety" 1 September 2003 to 31 August 2006.[61]
- "Monthly Payroll", January 2002 to August 2006.
- "Payments to Contractors" (Monthly), September 2004 to May 2007.

B. Cash Inflows and Outflows as Time Series

Seasonal and daily patterns observed in these data can be instructive in making predictions about future revenues and expenditures.

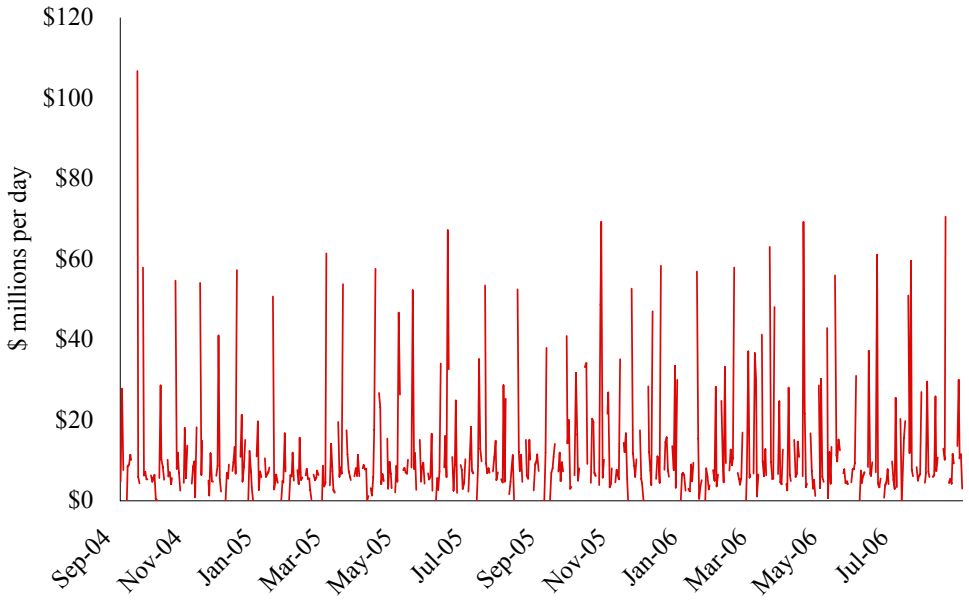
1. Daily Total Payments and Cash Outflows

Daily payment data have been captured and summed on a daily payment total basis for the last two fiscal years, as shown in the Exhibit 32 below:

[60] Diana Napier, Manager, Revenue Accounting and Budgets, Finance Division, TxDOT. Final data runs include data up to 22 June 2007.

[61] Major changes to business processes in the Department of Public Safety in October 2005 required that data prior to that month be excluded from the time series analysis.

Exhibit 32: Total Daily Payments from the State Highway Fund



These date exclude payments to contractors and TxDOT payroll.

The average, or mean[62], of the daily total payments over from September 2004 to August 2006 is $20.4 million. The dispersion of the data around that mean is very high, from $0 to $107 million, and the wide dispersion makes an analysis of trends over two years to be insignificant.

TxDOT makes payments through checks and electronic funds transfers, which are dated as of their posted date. Payment transactions are not, therefore, cash transactions. Associated cash transactions are captured in the cash outflow data, shown in the Exhibit 33 below.

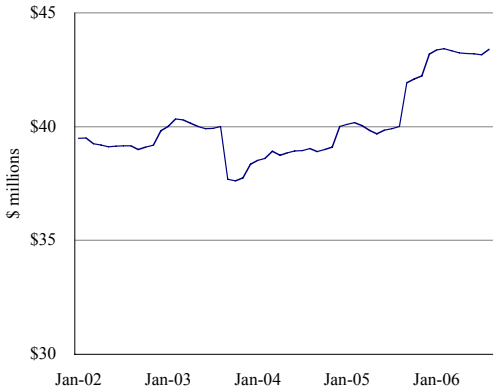
Along with these total daily payments are two series of payments that are made once per month: payments to contractors, made on or about the 8th day of the month, and payrolls, made on or about the 20th day of the month. The serial patterns in these data are shown in the exhibits below.

[62] To keep the text easily read, technical discussion is kept to a minimum. For example, "average" is used here, where "mean" is the correct technical term for what is reported here. Some footnote references are made throughout for the benefit of those who are familiar with descriptive and inferential statistics.

Exhibit 33: Monthly Payments to Contractors

These monthly payments follow a distinct seasonal pattern, following summer peaks in construction activity. This is typical of the patterns found in most states.

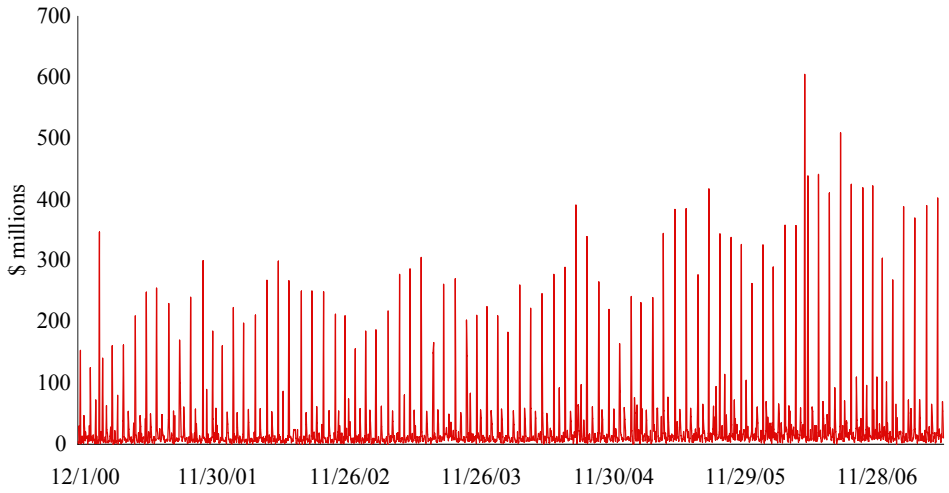
Exhibit 34: Monthly Payroll



These monthly payments do not follow a distinct seasonal variation or trend.

Review of the three payment exhibits above suggests that the two series of monthly payment make distinctive contributions to the serial patterns of the daily cash outflows, shown in the Exhibit 35.

Exhibit 35: Daily Total Cash Outflows



This impression that is confirmed in the moderately high covariances among daily payments, monthly payments and daily cash outflows.

Exhibit 36: Covariance between Cash Outflows and Payments

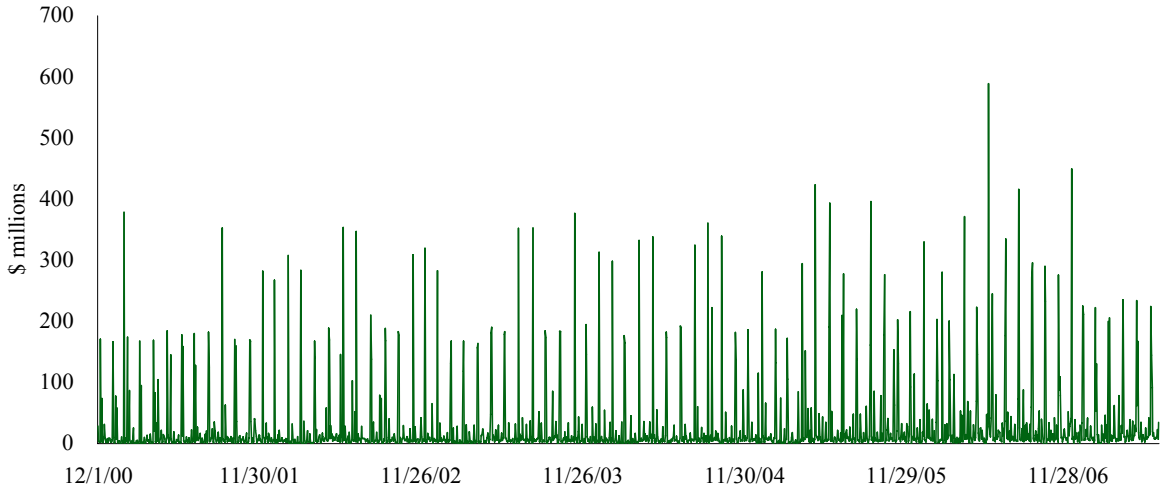
	Cash Outflow - Expenses/ Transfers Out	*Construction & Contract Payments*	*Monthly Payroll*
Cash Outflow - Expenses/ Transfers Out	*1.00*		
Construction & Contract Payments	(0.65)	*1.00*	
Monthly Payroll	(0.37)	0.26	*1.00*

In summary, the serial patterns in the monthly payment data are not good predictors of the peak points in the serial patterns in the cash outflow data. The cash outflow data demonstrates seasonal and monthly patterns but no significant long-term trends.

2. Cash Inflows

Similar to the monthly peak patterns in cash outflows, cash inflows show two peaks each month, caused by deposits of state motor fuel tax and other major receipts. Also similar to cash outflows, there is no significant long-term trend in cash inflows.

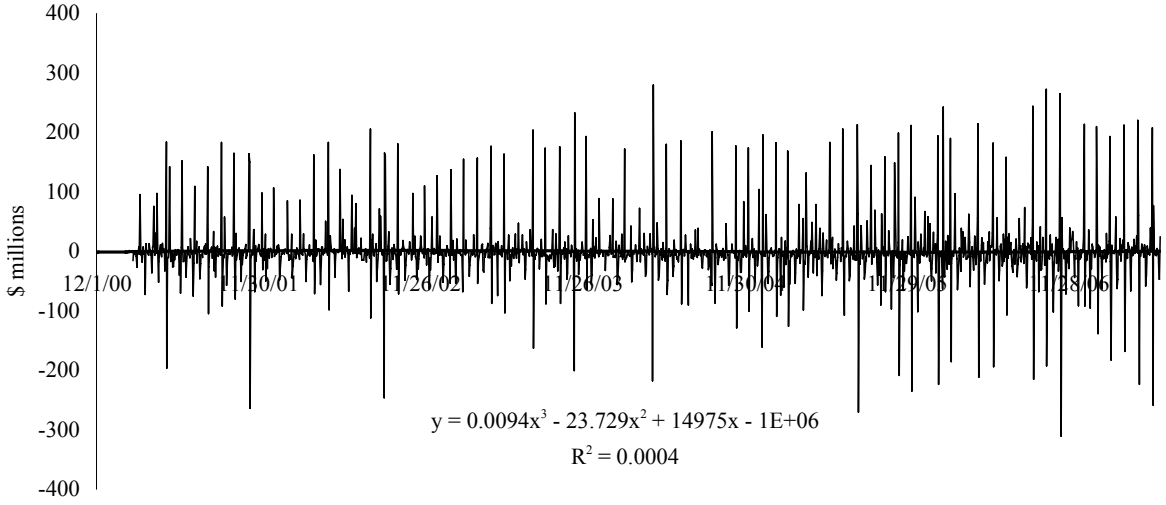
Exhibit 37: Daily Total Cash Inflows



The net cash flows, i.e., the difference between cash inflows and cash outflows each day, shown in the Exhibit 38 below.

3. Net Cash Flows

Exhibit 38: Daily Net Cash Flows



These data bear closer examination, as they are the changes in cash during a day. Fitting a curve that allows two "bends" to the data 63 yields a function that is not significantly different than a straight line through the mean of the data. The mean net cash flow is a $60,000 inflow, which is not significantly different than a mean net cash flow of $0.

Serial patterns over periods of several days are important in the net cash flow data. If periods of net flows or net inflows persist over several days then the cash balances required to offset them will be larger. These show evidence of persistence: period of net inflows lasted, on average, two working days and periods of net outflows lasted, on average, three working days. These periods of persistence are important in the estimate of the probabilities of an overdraft over a period of several days, outlined below.

4. Lumpiness of Cash Flows

These time series distributions supply the parameters that are necessary to estimate the cash balances that must be retained to provide for the *lumpiness* of cash flows, i.e., disbursements that are made in such large amounts that cash must be accumulated in the days and weeks before those disbursements to ensure sufficient cash is on hand. Lumpiness is indicated by the pronounced saw-tooth patterns that large cash inflows and outflows cause in the time series illustrated in the exhibits above.

The net flows that TxDOT must accommodate are slightly over $525 million in single day: the EFT component of payments to highway contractors in the late summer or early fall of each year. The lowest expected value of those payments is about $325 million, in the early spring of each year. As sufficient funds must be accumulated for these payments each month, the minimum average monthly balance available should be about $275 million in the summer and about $175 million in the winter.

C. Frequency Distributions

In this section, the frequency distributions of daily total cash flows are estimated. From these distributions, the probability of large and infrequent payments occurring can be estimated.

In this section, the principal graphic for illustrating frequency distributions is a histogram. In each histogram, the daily total amounts are distributed into bins:

- Each of the first 50 bins span a $2 million range; i.e., the first bin contains all daily flows between $0 and $2 million, the second bin contains all daily flows between $2 million and $4 million, and so on up to $100 million;
- After which the last three bins contain all daily flows from $100 million to $200 million, then $200 million to $300 million, then all flows over $300 million.

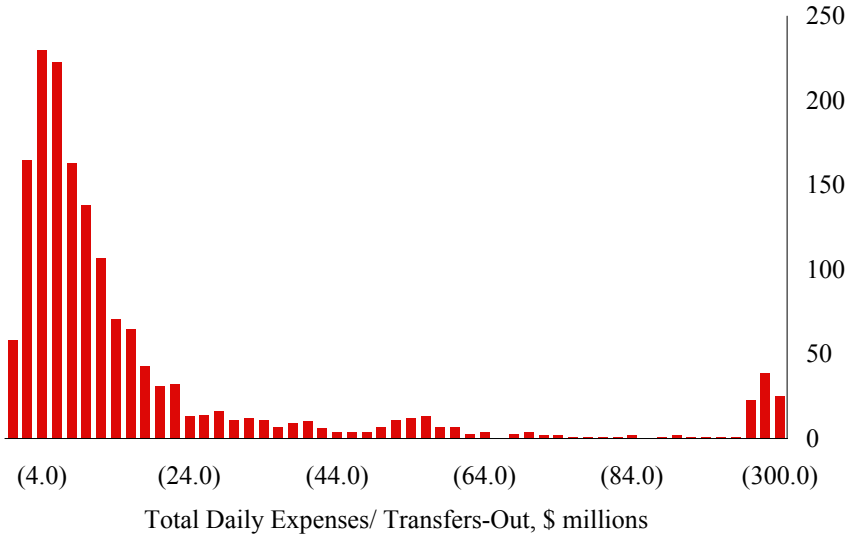
[63] i.e., fitting a third-order polynomial function to the data using ordinary least-squares regression.

The vertical axes show the number of days of flows that are sorted into each bin, such that the higher number of days that had total flows within the range of that bin, the higher the bar in the histogram for that bin. Summed together, the number of days in all of the bins equals 1621 days, the number of working days between 1 December 2000 and 22 June 2007 that are contained in the data.

1. Cash Outflows

The histogram for the frequency distribution of daily cash outflows is shown in the Exhibit 39 below:

Exhibit 39: Frequency Distribution of Cash Outflows



This illustrates the expected distribution: it is not symmetric around its mode but has a long tail, comprised of a smaller number of days with higher total outflows. This is confirmed in the descriptive statistics for the distribution:

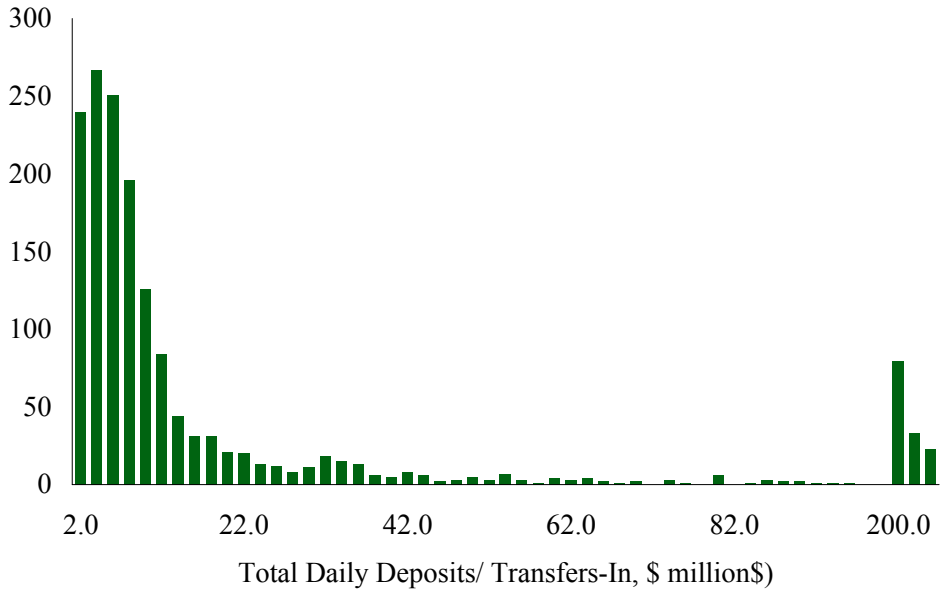
Exhibit 40: Descriptive Statistics: Cash Outflows

	Exp/Transfers out
Mean	(27.33)
Standard Error	1.52
Median	(9.60)
Mode (bin)	(24) to (22)
Standard Deviation	61.36
Sample Variance	3,765.02
Kurtosis[64]	20.91
Skewness[65]	(4.43)

2. Cash Inflows

The histogram and descriptive statistics of daily cash inflows a similar distribution but somewhat tighter, in that the distribution of payments is more tightly clustered around the mean daily inflow of about $27 million.

Exhibit 41: Frequency Distribution of Cash Outflows



[64] Explained in the last section of this appendix.
[65] Explained in the last section of this appendix.

Exhibit 42: Descriptive Statistics: Cash Outflows

	Dep/Transfers In
Mean	27.33
Standard Error	1.55
Median	6.40
Mode (bin)	24 to 26
Standard Deviation	62.50
Sample Variance	3,905.72
Kurtosis	13.60
Skewness	3.55

3. Net Cash Flows

The difference between these cash inflows and cash outflows, the daily net cash flows, follow the frequency distribution illustrated and described below.

Exhibit 43: Frequency Distribution of Net Cash Flows

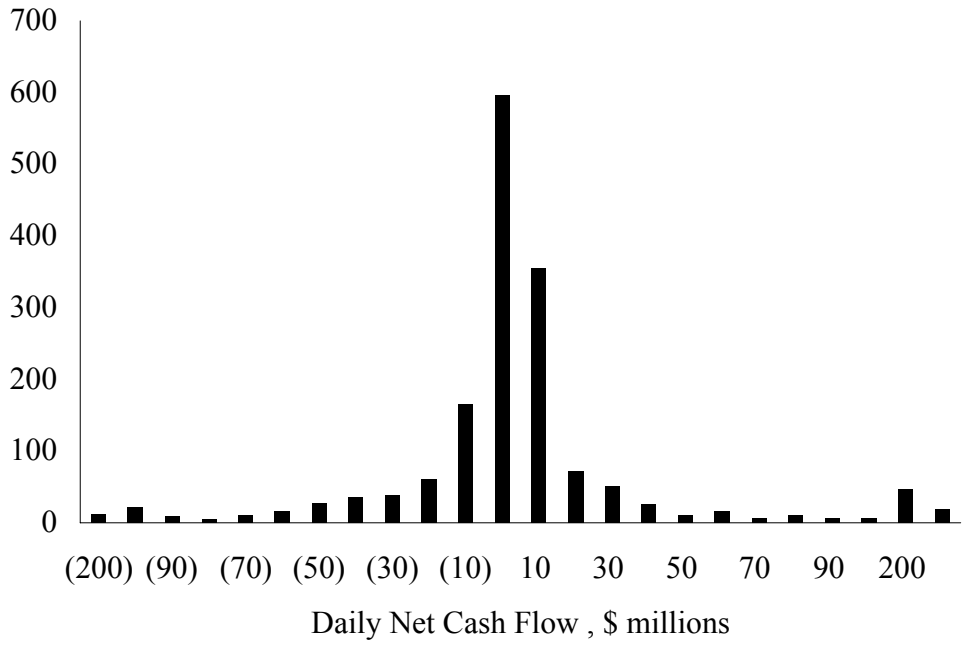


Exhibit 44: Descriptive Statistics, Net Cash Flows

	Net Cash Flow
Mean	0.12
Standard Error	1.27
Median	(2.66)
Mode (bin)	(10) to 10
Standard Deviation	51.24
Sample Variance	2,625.34
Kurtosis	10.18
Skewness	0.78

This frequency distribution shows a marked tri-polar pattern: a large and tightly clustered number of days on which there are relatively small net cash flows, flanked by a significant number of days on which there are large outflows and large inflows. This shows that the large inflows and outflows of cash are not timed to coincide with each other.

4. Uncertainty of Expenditures

These frequency distributions supply the parameters that are necessary to estimate the cash balances that must be retained to provide for the *uncertainty* of cash flows, i.e., deposits and disbursements that do not occur when expected, or are a different amount than expected. The general approach in this section is to determine the probabilities of different values cash flows occurring on one day or on a series of days.

Uncertainties in a Single Day

Estimates are made for two levels of probability, i.e, two levels of risk:

- A "1 in 100" level: the probability of a cash flow being larger than expected once every 100 working days;
- A "1 in 1000" level: the probability of a cash flow being larger than expected once every 1000 working days.

Using the frequency distributions outlined above as probability distributions, the following table shows the values of cash flows at which the probability of a larger flow is less than 1%, i.e., the "1 in 100" level; and less than 0.1%, i.e. the "1 in 1000" level when regular monthly deposits and disbursements are eliminated.

Exhibit 45: Values of Cash Flows at Two Levels of Probability, $ millions

	"1 in 100" level	"1 in 1000" level
Cash Inflow	120	150
Cash Outflow	80	110
Net Flow, Positive	70	150
Net Flow, Negative	70	100

To maintain a risk of an overdraft that is less than 1 in 100 single days, TxDOT would maintain a minimum daily cash balance of $70 million. To maintain a risk of an overdraft that is less than 1 in 1000 single days, TxDOT would maintain a minimum daily cash balance of $100 million.

Uncertainties over Several Days

The risk-based estimates of minimum daily cash balances are based on probabilities of occurrences on a single day, and represent target daily balances on if TxDOT can borrow overnight. If TxDOT could not borrow overnight then the calculation of probabilities from daily total payments must take into account the persistence of negative cash flows over periods of several days. The two periods of persistence considered are:

- The mean time over which negative cash flows tend to persist, which is estimated above to be 3 days; and
- The time required for TxDOT to have proceeds from a short-term borrowing in place, which we assume to be 5 days.

The estimates below are made at both the 1 in 100 and the 1 in 1000 levels of risk, and they assume that a day of very large cash flow are followed by a second day of maximum outflow, then third and subsequent days at a mean net outflow of about $25 million.

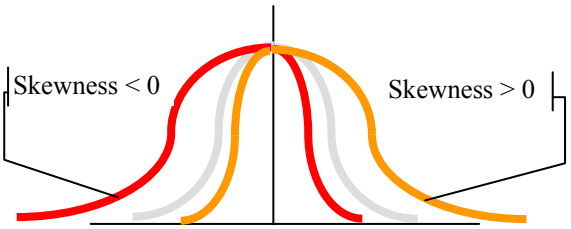
Exhibit 46: Values of Negative Net Cash Flows over Periods of Several Days, $ millions

Negative Net Flow	"1 in 100" level	"1 in 1000" level
over 3 days	165	225
over 5 days, i.e. 1 week	215	275

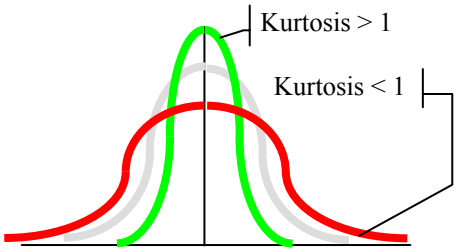
To maintain a risk of an overdraft that is less than 1 in 100 weeks, TxDOT would maintain a minimum daily cash balance of $215 million. To maintain a risk of an overdraft that is less than 1 in 1000 weeks, TxDOT would maintain a minimum daily cash balance of $275 million.

D. Descriptive Statistics Used in Estimating Frequency Distributions

Skewness is a measure of the asymmetry of the data around the mean. If the data is skewed to the right, with a tail of high values at the upper end, the value is positive. If the data is skewed to the left, with a tail of low values at the lower end, the value is negative.



Kurtosis measures how closely bunched the data is around the mean. If the bell curve is narrow and high, kurtosis is greater than 1. If the bell curve is low and spread-out, kurtosis is less than 1.



Appendix E:
RMA Accounting and Financial Management

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This is Appendix E to Section VII Audit Area D: Controls, Accountability Mechanisms, and Oversight of the audit report that examined controls and accountabilities for the new finance mechanisms. TxDOT neither has the authority nor should it have the authority for RMA oversight. However, the audit finds there is a state interest in RMAs having best practice and consistent controls and accountabilities.

The appendix provides detail on the general standards of best practice for accounting, financial management, and budgeting that are applicable to RMAs. Standardized guidelines that address these would be beneficial for RMAs and institutionalize accountabilities and controls.

A. Guidance for RMA Budgeting

During their start-up phases, RMAs have operated on limited and sometimes uncertain funding from sponsoring governmental entities such as counties and TxDOT. As the RMA program matures and transportation projects and systems are implemented, funding sources will grow and become more diversified. It is important at all stages that RMAs have a budget that proposes to expend no more than can be made available during a specified period and the monitoring capabilities connected with accounting and reporting to assure this result.

At a minimum, the board of each RMA should adopt an annual budget that details all the funds it expects to receive and all expenditures it authorizes to be made during the year. The proposed budget for the RMA, including all its components, fund sources by type and proposed expenditures by category and type, should be formally presented to and approved by the RMA board. Significant adjustments to the approved budget should also be handled in this way.

Budgets approved by the RMA board should govern financial activity in the RMA. Staff should adhere to the budget and seek approval from the RMA board for any significant variances. The RMA board may wish to grant staff leeway to make minor budget adjustments (as defined by the board) without prior approval but with full timely reporting to the board. All this is standard procedure in most state and local governments but as the RMAs are new entities in Texas it will be important that they follow this important budget control procedure. Monthly and annual financial reports on the budget should be made to the RMA board by key staff.

Initially, RMAs' budget processes will be simple with a few costs for contractors, staff and board expenses. During the initial period it will be necessary to plan expenditures carefully because, if recent experience is a guide, gaining annual recurring funding is not likely.

Rather, lump sums in the form of loans or grants have been made available to RMAs that must carry them through the start up period lasting several years.

As the RMAs' programs mature, a more complex budget process and structure must emerge. Public management principles will encourage this development and bond indentures will likely require it as is the case with the Central Texas RMA bond indenture[66].

The broad features of such a budget process and structure should require separate budgets for major categories of expense: administrative and general expense, operations of projects and systems, maintenance of projects and systems, and a capital budget specifying capital investments to be made. Budgets for operations, maintenance, and capital outlay should be disaggregated to the project level.

Experience from toll authorities, which have a different governance structure, and the Central Texas RMA indicate the xxx? Of cost accounting investors will require the Central Texas RMA bond indenture requires monthly as well as annual budgets. For example, [67]

In addition, public budgets generally specify the type of expense for which funds may be expended, such as: salaries, benefits, supplies, travel, equipment, contractual services, and the like. Specific types of funding are also specified, such as: revenue by source, grants, loans, and bond proceeds. Although this level of detail can be overly emphasized it is necessary to build competent budgets and can be helpful to analyze proposed variances from approved amounts.

B. Guidance for RMA Accounting and Financial Reporting

In their early stages of development, RMAs usually depend on a sponsoring agency to perform their accounting and financial reporting. Sponsors vary from county governments to regional agencies. This approach is cost effective because new RMAs do not have, or need, financial processing staff. Even in the case of the Central Texas RMA, which has opened a toll road project, internal accounting processes are not highly complex because most operations are out-sourced and its bond indenture requires funds to be managed by a designated trustee. This approach leaves relatively few internal accounting transactions to be processed by the Central Texas RMA. Nevertheless, there are important accounting and reporting standards that RMAs should meet.

[66] Official Statement dated February 16, 2005 for Central Texas Regional Mobility Authority published by UBS Financial Services, Inc., et al. This document sets forth a budget and reporting structure on pages 37 and 38. The structure parallels the financial reporting structure recommended by the American Association of State Highway and Transportation Officials over 40 years ago that provided for separate reporting of transportation operations, maintenance, and construction.

[67] Recently, the Harris County Toll Road Authority (HCTRA) was encouraged to implement a multi-year capital outlay plan to assure the investor community that it would not overextend itself financially. Such a plan was developed and implemented by the Harris County Court which contributed to improved credit ratings for HCTRA securities.

Accounting and financial reporting for RMAs should be conducted in accordance with governmental accounting standards for governmentally operated commercial entities known as "enterprise funds" as promulgated by the Governmental Accounting Standards Board (GASB) and its predecessor the NCGA. The standards, which require these entities to use the full accrual basis of accounting and the flow of economic resources measurement focus, follow closely standards applied to private sector accounting and financial reporting. Under these standards, revenues are recognized when earned and expenses when incurred regardless of when actual cash payments related to those transactions are made. Capital assets are depreciated over time rather than charged at the time of purchase as in normal governmental accounting. Revenues may be recognized when customers receive service for which they are billed regardless of when they pay. So, if electronic toll accounts with prepaid cash balances are maintained for customers, the balance of these accounts constitute a liability of the RMA until the customers actually use the system.

In addition, accounting should be performed in way that permits compliance to the United States Office of Management and Budget (OMB) circular A-87 entitled, "Cost Principles for State, Local and Tribal Governments". This circular is located in the Code of Federal Regulations Part 225.

Monthly financial reports should be presented to the RMA board first comparing actual to budget and second addressing key issues such as changes in assets, liabilities, net worth or fund balance, flow of funds, status of reserves and restricted funds, and other standard measures ratios. These monthly reports, which are unaudited, should show financial activity for the month and for the year to date. An annual financial report should also be presented. Initially, an unaudited report following the format of the monthly reports should be presented followed in due course by an audited report. The audited report is prepared by RMA staff and management but attested as to its fairness of presentation by a certified public accountant. Texas Transportation Code 370.182 requires such an audit. The bond indenture of the Central Texas RMA is more explicit on this requirement and so we may suppose will all future bond indentures into which RMAs may enter require it. The Central Texas RMA has published audited financial statements in conformity with these requirements for each year of its existence.

Specific accounting procedures for processing transactions will vary with complexity. To date, as noted, RMAs have had relatively simple internal accounting procedures because of their small size and limited internally operated activities. This picture could change if RMAs elect to operate their own toll collections systems or maintain their facilities with in house staff. Certainly, if the direct operation of a transit, ferry, or other transportation related service emerges the complexity will grow. Whether simple or complex, however, RMA management must be sure to establish sufficient internal accounting controls to assure the integrity of financial transactions to give reasonable assurance to all interested parties that RMA funds are being used in accordance with legal requirements (law, bond indentures) and public probity. Some examples of these controls include proper authorization of transactions, separation of duties to assure no single individual has total control over a single transaction, maintenance of an audit trail on all transactions, bonding of cash handling personnel, and time goals for processing transactions.

The accounting systems and procedures of the RMA should support financial reporting that enables the organization to identify the revenue it receives by source and activity from which it was generated. For example, toll revenues should be identified to the transportation project for which they were collected. This assignment is required by law (Texas Transportation Code 320.172) and will certainly be required in any bond indenture to assure that revenues collected on a bonded project are handled in a way to secure the bond holders' interests.

Similarly, expenses should be assigned to the transportation project and system on which they were incurred. If operations are outsourced the contractor should be required to differentiate among the projects for which charges are submitted. If operations are internal a cost accounting process should be followed. Allocation of appropriate overhead costs should be a part of this cost allocation process. The matching of revenue and costs so determined by project and system will, at minimum, be necessary to identify any surplus in accordance with the provisions of Texas Transportation Code 370.174. (This will address findings noted in section D.1.2 and recommendation D.1.1). As the RMA systems grow it will also be desirable to identify and compare costs both within RMAs and across the Texas toll way systems.

C. RMA Auditing and Compliance Assurance

An audit program will be necessary to assure all interested parties that financial processing and management and certain other key performance requirements are being met by the RMAs. The law, Texas Transportation Code 370.182, explicitly requires it and also empowers the Texas Transportation Commission to initiate an audit of an RMA independent of the RMA's consent. The Central Texas RMA's bond indenture provides more specific guidance concerning the qualifications of the auditor and the audit methods to be employed. The Central Texas RMA's audits since the bond issuance in February of 2005 have been conducted in conformity with the requirements of the bond indenture.

Audits should be performed by a competent independent auditor. This function should be performed by a certified public accountant, as required in the Central Texas RMA's bond indenture as well as financial assistance agreement rules (TAC Part 43, Chapter 25, Rule 25.55). The audit should address at minimum the fairness of presentation of the information in the financial statement and compliance with any applicable laws and rules concerning use and management of funds. The audit should be performed in accordance with generally accepted auditing standards (GAAS) as promulgated by the American Institute of Public Accountants' Auditing Standards Board. In addition it should be conducted in accordance with the standards set forth in Governmental Audit Standards published by the General Accounting Office of the United States (GAO), a document known because of the color of its cover as the "Yellow Book." These two sets of standards are complementary.

The selection and supervision of the auditor is a key decision in assuring financial integrity. The RMA board should form an audit committee of its members to solicit proposals from potential auditors and make a selection based on qualifications and experience. This process should be repeated periodically, not necessarily annually, to assure that the RMA is getting best value for its audit investments.

The auditor must determine whether he can express an opinion as to whether the annual financial statement of the RMA fairly presents the financial position of the entity in accordance with generally accepted accounting principles for governmental enterprise funds. If so, the auditor will place his opinion on the annual financial statement. If not, the RMA management and board should obtain the advice of the auditor as to what corrective measures must be taken to make it possible for the auditor to express an unqualified opinion and then implement those procedures that secure this result for subsequent financial reports.

In the course of auditing the financial statement, the auditor may find weaknesses in financial processing and control that, while not significant enough to impair the ability to express an opinion on the document, may, nevertheless, need improvement. The auditor should be required to submit a management letter with these findings and suggestions regarding corrective action.

D. Compliance Auditing Regarding Grants and Loans From Local, State, and Federal Agencies

RMAs receive grants and loans from local, state and Federal agencies. They borrow funds from private investors. All these financial relationships are made pursuant to specific agreements, contracts, or indentures. The auditor who performs the financial audit should also audit for RMA compliance to the terms of these agreements. To do so successfully, the auditor must have sufficiently trained staff and guidance from the entities that are party to the agreements regarding what tests to apply to assure compliance. Further, it may be desirable to audit for compliance with certain aspects of the laws applying to the RMA.

The compliance portion of the audit is often referred to as “single audit”. This term derives from the fact that the financial auditor is also given the task to review compliance even though the compliance review is not required to express an opinion on the financial statement and could be performed by another outside auditor. For efficiency, the financial auditor performs both functions in a single audit. These single audits are standard throughout all states and jurisdictions that receive financial assistance from the state and Federal governments. Audit guides are usually issued to the auditors to focus their efforts on key issues in the compliance audit process. The State of Texas through TxDOT or some other audit agency should develop and issue a guide for Texas RMA auditors. This guide should conform to the provisions of the OMB Circular A-133 entitled Audits of States, Local Governments, and Nonprofit Organizations. The RMA management could also include compliance tests in its agreement with the auditor to enable it to show the interested parties and the public that it is fulfilling its responsibilities to the law and agreements.

E. RMA Procurement

RMAs can turn to their sponsoring institutions, counties and municipalities, the state, or fellow RMAs for guidance in creating their procurement rules. However, in the long run it would be more efficient for TxDOT to issue some statewide guidelines on this matter and make compliance thereto a subject for annual audit review.

The RMA law at 370.184 charges each RMA to adopt rules governing procurement of goods and services while restricting the procurement of professional services to compliance to chapter 2254 of the governmental code. These rules should be aimed at assuring that goods and services are acquired at the optimal mix of quality and price to obtain efficient use of RMA funds. However, in a public entity such as an RMA these rules must serve another important purpose: to assure the public that the RMA is making its acquisitions in a fair and openly competitive manner that is free of political or other favoritism. Ideally, of course, these two objectives are complementary. Fair and open competition should render the best quality/price combination.

Appendix F: The Federal Aid Highway Program

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This is Appendix F to the audit report and provides background on the Federal Aid Highway Program.

A. Federal Aid Funding

The Federal-Aid Highway Program is a reimbursement program. The state must first spend its own funds on a specific federal-aid project then invoice the FHWA for the portion of those expenditures that can be funded by federal aid.[68] The complex reimbursement process imposes a significant administrative load on departments of transportation in all states and requires those departments to advance sufficient cash to fund federal-aid expenditures until they are reimbursed. State funds are at risk if federal-aid funds are not closely managed: if federal-aid funds are over-committed then more state funds are required to complete a particular project; if federal-aid funds are under-committed then the uncommitted funds may lapse and the opportunity to spend them will be lost.

Many conditions at each of three stages must be met before the FHWA will reimburse funds on any particular project:

1. The US Government must have completed the necessary steps to ensure that sufficient federal-aid funds are available to meet the reimbursement requirements for all projects.

2. The project must be eligible for funding from at least one of the many federal-aid highway programs that restrict the purposes and types of expenditures that are allowed.

3. The FHWA must approve each project at several different stages of project delivery.

For the audit, the availability of funds is the principal interest. All three stages are described here in very simplified terms.[69]

[68] The other portion, i.e. the funds that expended by the state on the project that will not be reimbursed by the federal-aid program is the *state match* requirement.

[69] The FHWA's most basic financial manual, Financing Federal-Aid Highways (FHWA-PL-99-015, 1999) runs to about 75 pages.

1. Availability of Funds

Before funds are available under the Federal-Aid Highway Program, itself a collection of the individual programs[70]:

1) Their purposes of expenditure are authorized.
2) Budget authority is established through appropriations or contract authority.
3) Authorizations and budget authorities are combined in apportionments.
4) The apportionments are subjected to limitations on obligations.

Each of these concepts is reflected in the legislation and regulations that enable the program.

Authorization

Before any U.S. government program can receive a budget, it must be established or continued by authorizing legislation that defines the public policy objectives of a program and the purposes of expenditure to which any funds budgeted to the program can be put.

The authorizing legislation for the Federal-Aid Highway Program is broken into two parts:

- **US Code Section 23 – Highways,**[71] which contains the highway law that Congress considers to permanent; in legal terms, to be continuing and not requiring reenactment every time that a major surface transportation bill is passed.

- The most recent major surface transportation bill, 72 which introduces amendments into US Code Section 23 and defines the financial parameters that, traditionally, Congress does not codify. These financial parameters include the upper limits of funding made available to most of the individual programs within the Federal-Aid Highway Program. These upper limits, together, are the formulae for the distribution of funds among the individual programs.

[70] The FHWA uses the word "program" in two ways: [1] the Federal-Aid Highway Program, which is all of the highway funding activities administered by FWHA, and [2] any one of the separately funded categories that make up the Federal-Aid Highway Program, for example the Rural Transportation Assistance Program or the Surface Transportation Program.

[71] United States Code Title 23 – Highways – Chapter 1 – Federal Aid Highways.

[72] The current surface transportation act is the *Safe, Accountable, Flexible, Efficient Transportation Equity Act - Legacy for Users* (SAFETEA-LU) which was passed by Congress on July 29, 2005. It was preceded by: the *Transportation Equity Act for the 21st Century* (TEA-21), passed in 1998: and the *Intermodal Surface Transportation Efficiency Act* (ISTEA), passed in 1991.

Budget Authority, or Obligation Authority

Authorizing legislation is not sufficient authority for the U.S. government to pay out money. The government must also have budget authority, or obligation authority.

Obligation authority is made available through one of two forms: an annual appropriations act passed by Congress or contract authority, under which the government can obligate authorized funds without further congressional action. Individual programs with contract authority receive increments of obligation authority from the authorizing surface transportation act, prorated annually over the life of the act.[73] More than 90% of surface transportation programs receive their obligation authority as contract authority.

With some exceptions, obligation authority is generally available only for the fiscal year in which it is appropriated, so states manage their highway programs to fully utilize all federal-aid obligation authority in the year in which it is first available. As a result, obligation authority is the principal control over the size of the states' federal-aid highway construction programs from year to year.

Obligation authority itself is not tied to any individual program such as Interstate Maintenance, National Highways, or the Surface Transportation Program, but it is used to commit federal distribution formula into apportionments that are program-specific.[74] Without program-specific apportionment, funds cannot be obligated to projects.

Both appropriations and contract authorities are subject to the *Budget Enforcement Act* (1990), which established deficit reduction goals for the U.S. government. This act divides all federal spending into two categories, based on the ability of Congress to control the spending through the annual appropriations process:

- **Mandatory programs**, which are subject to binding legal obligation of the U.S. Government to provide funding. Mandatory spending accounts for about two-thirds of all U.S. government spending and includes food stamps, social security, Medicare, veterans' benefits and interest on the national debt. Congress cannot alter spending for these programs in a given year without changing their authorizing legislation. Only two surface transportation programs are mandatory: Emergency Relief and part of the Minimum Guarantee program.

[73] In SAFETEA-LU, which applies from 2005 to 2009, obligation and contract authority can be borrowed between almost all named high-priority projects. Obligation authority cannot, however, be borrowed by the core construction programs (except in 2005). Given the magnitude of named high-priority projects and the need to advance these projects as quickly as possible, special handling of contract and obligation authority through the life of SAFETEA-LU will be needed.

[74] This subtle distinction is often lost in discussions of the Federal-Aid Highway Program, and the distribution formulas in the authorizing legislation are referred to as apportionments.

- **Discretionary programs**, which are subject to annual funding decisions in the appropriations process. The Congress may reduce spending for a discretionary program by reducing its annual appropriation or, in the case of a contract authority program, by imposing an obligation limitation upon it. Discretionary spending includes defense, the Federal Bureau of Investigation, the Internal Revenue Service, the Environmental Protection Agency, and transportation programs.

Since most discretionary programs receive their budget authority through appropriations, which are the means by which Congress exercises annual expenditure control over those programs. The Federal-Aid Highway Program is an exception: more than 90% of its individual programs are discretionary programs with contract authority. Congress achieves annual expenditure control such programs with obligation limitations: ceilings on the total obligations that can be incurred in each program during a fiscal year. Obligation limitations are only applied to the Federal-Aid Highway Program after it has been apportioned.

Apportionment

The federal distribution formulae in the authorizing legislation and the obligation authority in the annual appropriations act combine together to define apportionments: the amounts available for each state, in each individual program, in each of the current fiscal year and three years following.

The distribution formulae are applied after deducting specific amounts from the appropriated funds for some activities and programs that are specified in the authorizing act. These deductions or takedowns include: administration of FHWA and some other federal agencies; the activities of MPOs and some safety and education programs.

After the distribution formulae are applied, other adjustments are made to determine the final apportionments:

- The authorizing legislation requires states to maintain safety programs, such as DUI and seatbelt programs. States that fail to meet the program requirements in a year must pay penalties in the next year, in which funds are held back or transferred to other programs.

- Certain amounts are earmarked to specified programs, such as planning, research and safety enhancements.

- Other amounts are earmarked to high-priority projects, named in the authorizing legislation, that may have been chosen for their special status notwithstanding their place in a state's transportation improvement plan.

Again, there is an exception to the rule; not all funds are distributed to states and programs through apportionments. The definitions of some programs in the authorizing legislation, such as the Interstate Maintenance Discretionary Program and Bridge Discretionary Program, do not include distribution formulae. Funds are allocated to these programs from appropriations, in some cases according to criteria specified in some other legislation and in some cases at the discretion of the US Secretary of Transportation.

The total apportionments and allocations to each state are subjected to yet another adjustment: the minimum guarantees for each state, of which there are two:

- The total shall not be less than a percentage for each state of the total appropriation that is specified in the authorizing legislation.

- The total shall not be less than 90.5% of the federal excise taxes collected in that state and deposited into the Highway Account of the federal Highway Trust Fund.

Apportionments are subject to a rule, defined in the Byrd Amendment, that there is enough cash in the Highway Trust Fund (HTF) to make reimbursements: unfunded authorizations, i.e. unpaid commitments in excess of amounts available in the HTF at the end of the fiscal year in which the apportionment is to be made, must be less than the revenues anticipated to be earned in the following 24 month period. This rule translates approximately to a three-year rule: obligations at the beginning of a fiscal year should not be more than three-years' worth of apportionments. If unfunded authorizations exceed the limit then all apportionments are reduced in the current year to make sufficient funds available for the unfunded authorizations of prior years.

Obligation Limitation

At the beginning of each fiscal year, FHWA:

- Applies the distribution formulae to the amounts covered by that year's appropriations act to determine apportionments.

- Makes all of the adjustments to that year's funding as outlined above to determine funds available from that fiscal year.

- Adds funds that from prior years that were available for obligation, not obligated but have not yet lapsed.

- Then issues certificates to each state to define the total funds available for obligation in that year in each individual program.

As outlined above, obligation limitations are the means by which Congress controls annual expenditures in discretionary programs that draw their budget authority from contract authority. Almost all federal aid highway programs fall into this category.

An obligation limitation restricts the amount that can be obligated in a given year within an individual program to an amount less than what is available for obligation for that year in that program. Since the Federal-Aid Highway program is a multi-year program, limitations on obligations in a given year do not affect the apportionment or allocation of funds to federal aid highway programs but they do control the rates at which these funds can be obligated to projects. The limitation is applies to all funds available for obligation during a certain fiscal year, regardless of the year in which the funds were apportioned or allocated. Also, unused obligation authority within the obligation limitation lapses at the end of the fiscal year; any limitation unused at the close of a fiscal year cannot be carried over into the next fiscal year.

Among all discretionary expenditures across government, spending for certain programs is protected by budgetary firewalls: separate spending caps for the programs they protect that prevent the obligation limitations for those programs being reduced in order to increase spending for other discretionary programs. The effect is that any reductions in a firewall-protected program for a particular year must go towards deficit reduction. Such firewalls exist among five separate categories for discretionary spending: [1] defense, [2] violent crime reduction, [3] highways, [4] mass transit, and [5] all other discretionary programs.

The firewall amount for highways is related to the projected receipts to the Highway Account of the Highway Trust Fund (HTF). Those projections will, likely, differ from actual receipts so the firewall amount in the next year must be adjusted as new receipt projections are made and actual receipts for earlier years are known. The adjustment is called Revenue Aligned Budget Authority (RABA).

Program Eligibility

The Federal-Aid Highway Program consists of many individual programs, each one of which is restricted as to the types of projects that they can fund. There are, for example, programs for bridge projects, safety projects and each functional class of highway. Some individual states impose additional eligibility requirements on their projects, usually to ensure some equitable distribution of highway expenditures across different regions of the state.

Each state must ensure that the projects they propose for funding under any one of these individual programs is eligible, i.e., meets all of the restrictions, for that the program. State departments of transportation often design a project that meets the eligibility requirements for more than one program, e.g., a corridor upgrade that may rehabilitate existing bridges and install new safety provisions. Such a project can draw funds across several programs to fund the components of the project that are eligible for each program.

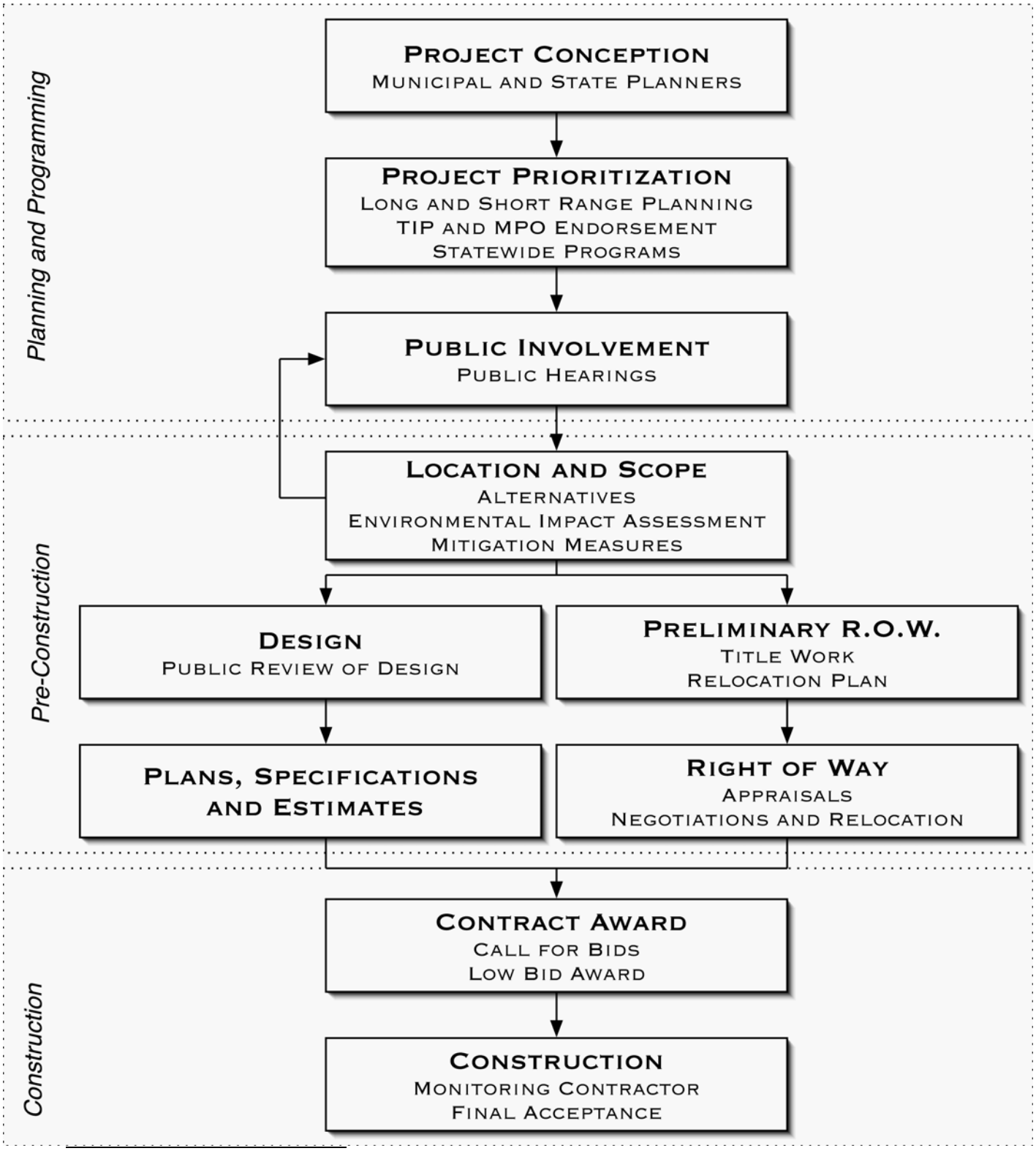
The process by which eligible projects are married up to funds available for obligation under each program is the programming process. To ensure that states have an adequate supply of eligible projects under development, the legislation that authorizes federal aid requires the regular production of planning and programming documents,

notably Metropolitan Transportation Plans (MTPs) and Transportation Improvement Plans (TIPs) from which the eligible projects are drawn for obligation. Since the programming process does not affect the availability of funds, it is not described in detail here.

Project Approvals

In addition to the restrictions on the funding of program categories and systems that are found in apportionment and distribution, Federal-Aid funds may only be obligated to approve projects as shown in Exhibit 47.

Exhibit 47: Stages of Federal-Aid Approval on Projects[75]



[75] Adapted from United States Code Title 23 – Highways, Chapter 1 – Federal Aid Highways and from Code of Federal Regulations, Title 23 Highways.

Federal approvals for the expenditure of federal funds are obtained at the time a project enters the Statewide Transportation Improvement Program (STIP) and at various stages of project development, including environmental approval. These various state and federal approvals can have significant impacts on the efficient obligation of federal funds. Each step is an opportunity for the scope, schedule, and budget of the project to change. Therefore, each step introduces more uncertainty about the costs and schedules for project delivery.

2. Innovative Financing

FHWA offers the following list of debt instruments and credit assistance to state DOTs for funding highway programs.

Grant anticipation revenue vehicles (GARVEEs)

When states issue bonds, they must pledge revenues towards their repayment. If more revenues are available to be pledged, then more bonds can be sold.

Up to 1995, the federal funds received by states for federal-aid eligible projects could only be pledged towards bonds in very limited ways. Now, the same rules that allow for advance construction with federal funds over long periods also allow the future federal appropriations that are expected over those longer periods to be pledged as revenues to bonds.

GARVEEs take the forward commitment of federal appropriations to bonds one step further: once the FHWA has approved a project or program for a GARVEE, and the state has issued a bond with those future appropriations pledged against it, the state may elect to bill the FHWA for the federal portion of the debt service payments on the bond rather than the federal portion of cash payouts on the project or program.

A GARVEE is still a state-issued bond and is classified by the issuing state as “on-book” debt, i.e. as direct debt. Because federal aid receipts are among those revenues included in the debt service/revenue ratio, GARVEE bonds fall inside the Commonwealth’s cap of a maximum 6 percent debt service/revenue ratio.

A GARVEE may be issued on a non-recourse basis with the issuer pledging only future federal-aid funding as security. However, states may also choose to pledge additional revenues, such as state motor fuel taxes, thereby enlarging the revenue base from which the bond is to be repaid. This reduces the risk of default and, as a result, usually is recognized with higher bond ratings and lower interest rates.

GARVEES are used to their best advantage in two situations:

- When a very large federal-aid project or program has cash flows so voracious that borrowing is necessary to prevent other programs from being starved of revenues. Without a GARVEE, the large project or program would have to be funded with a state bond backed by state revenues; the federal funds for that

project or program would only be forthcoming after the FHWA had been billed for project expenditures. When a GARVEE is used, state funds no longer need to be advanced to initially fund the entire project or program cost. Starting in 1998, Ohio issued $130 million in GARVEE bonds for such projects and, by applying toll credits to meet the state match requirements, did not encumber any state revenues to fund them.

- When legislative authority exists to issue highway-related bonds but a subsequent vote of the people has denied the state the authority that it needs to pledge state revenues to those bonds. Such a denial in 1995 sparked a $375 million GARVEE-based borrowing program in Arkansas.

State infrastructure banks (SIBs)

A state infrastructure bank is a revolving fund whose initial capital was funded from federal apportionments. The FWHA provides credit assistance, through that initial endowment, to any highway projects that draw all or part of their funding from the state infrastructure bank.

Many governments and large corporations use revolving funds for ongoing generations of capital projects. The government or large corporation provides its revolving fund with an initial endowment of capital as its opening balance. Thereafter, it operates as an internal bank within the organization and loans out funds to a generation of projects; as that generation repays the borrowed funds to the internal bank, the funds are loaned to succeeding generations of projects. The internal bank often charges an internal interest rate to cover its administrative expenses and, in some cases, to build earnings that might offset losses on failed projects that cannot repay their loans.

States have used revolving funds for their highway programs for many years but, prior to 1995, they could not use federal funds as part of the initial capital provided to a revolving fund. States could only use federal funds that were received on federal-aid eligible projects to repay advances to those projects from the revolving funds. Since the passage of the National Highway System Designation Act 1995, eligible states can use up to 10 percent of their federal apportionment as initial capital for a state infrastructure bank, providing that they also endow matching state funds.

Some internal banks lever their initial capital injection, using it as equity and borrowing additional funds from external sources. Only a few of the 32 state departments of transportation that have revolving funds have levered their initial capital with subsequent bond issues: South Carolina is one of them, having issued state revenue bonds to boost its infrastructure bank assets to over $2 billion, so that it can fund large projects with budgets over $100 million.

Direct federal credits (TIFIA)

The *Transportation Infrastructure Finance and Innovation Act* (TIFIA) 1998 allows the FHWA to participate as a creditor in specific and eligible projects up to 33 percent of the project's value. TIFIA credits differ from GARVEEs and SIBs in several ways: TIFIA credits are applied to specific projects on their financial merit, and FHWA participates directly as a financing partner in the project rather than as a source of funds that are administered by states.

The policy objective of TIFIA credits is to boost financial feasibility of surface transportation projects that are on the margin of commercial creditworthiness, such that those projects can attract investment from other sources: without the TIFIA credit, the amounts to be borrowed are too great to be sustained by the revenues that the project is expected to capture. The TIFIA credit reduces the remaining balance to be funded through borrowing such that this remainder can be funded with commercial borrowing against which only the project's revenues are pledged. The clear implication is that only projects that generate revenues are eligible for TIFIA credits. A TIFIA is credit assistance from the USDOT and does not draw from federal funds apportioned to states. One of the largest TIFIA credits to date involves a $2.1 billion highway and transit facility in and around Miami-Dade Airport, with revenues coming from airport lessees, transit users, and rental car surcharges.

The forms of TIFIA credits follow their policy function: they are direct loans, loan guarantees, or lines of credit that take the place of "junior" or subordinated debt on a project, akin to a second mortgage on a home. TIFIA credits must, however, contain a "springing lien" provision: in the event of insolvency, the TIFIA credit rises from its subordinate position to take on rights to revenues that are equal to those held by the senior creditor of the project. There has been much debate about the effects of the "springing lien," an example of which is a $215 million TIFIA credit in the $700 million Cooper River bridge replacement in South Carolina. The project revenue source is a surtax on tourism facilities and, to protect the local municipalities that collect it from the springing lien, South Carolina had to back the TIFIA with state revenues.

Section 129 loans

With the passage of the *Intermodal Surface Transportation Efficiency Act* (ISTEA) 1991, state departments of transportation could loan funds from their regular federal apportionments to federal-aid eligible projects that had sufficient dedicated revenues to repay the loans, then apply the repaid funds on the usual grant basis to another federal-aid-eligible project.

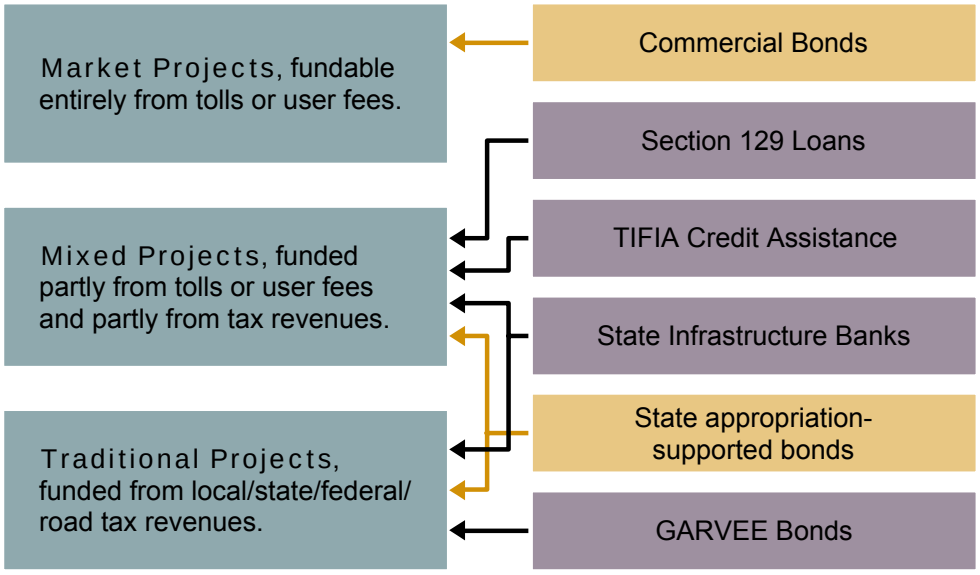
The policy objective of section 129 loans is to encourage more federal-aid eligible projects to be funded from other revenue sources. The dedicated revenue can be a toll or user fee from any state or local source but could not be federal revenue.

Section 129 loans are best applied to turnpikes and other tolled roads that can fully repay their capital costs from their own revenues. Texas loaned about $135 million of its Surface Transportation Program apportionments to the authority building a new turnpike in the Dallas – Fort Worth area.

General features of innovative financing debt instruments.

The following diagram paraphrases the FHWA representation of how these debt instruments are best applied against projects, differentiated by how much of the revenue required to pay for these projects is paid by users, as opposed to taxpayers.

Exhibit 48: Alignment of Innovative Financing Debt Instruments to Highway Projects[a]



[a]Adapted from Figure 1.1 in the *FHWA Innovative Finance Primer*.

Conventional forms of debt - appropriation supported state bonds and commercial "stand-alone" bonds - are also shown for comparative purposes.

The differentiating features of the different sources of debt suggested by the FHWA are summarized in Exhibit 49.

Exhibit 49: Features of Innovative Finance Debt Instruments

	GARVEE Bond	SIB Loan	TIFIA Loan	S. 129 Loan
Maximum share of financing in a project.	80%	80%	33%	80%
State match required.	20%	20%	No	Loan 100%, then 0%
Additional taxes tolls or fees required?	No	No	Yes	Yes
Local government participation required?	No	No	Sometimes	Usually
Private sector partner required to be present in project?	No	No	Usually	No
Interest rate higher, the same or lower than state bonds?	Same	Same	Higher	Same
Administering agency for credit and payments.	State	State	FHWA	State

All of these funding sources require additional legislative authority to borrow the necessary funds. Usually the debt would be included as state debt in the state's credit rating. All of these funding sources involve a significant increase in the overall cost of the project due to interest, issuing costs, and administrative costs.

There are other financing opportunities in which federal funding can play a part, such as private-public partnerships and government toll authorities that are eligible for IRS 63-20 loans.[76]

FHWA innovative financing and state-match programming

There are many restrictions and conditions on federal highway funding that create challenges for states as they program their transportation improvement plans. Federal highway funds:

- Are *program-specific*, in that federal funds are divided among many different programs which permit only specific types of projects, contain deductions and "earmarked" funds for specified planning activities, must be distributed throughout the regions of each of the states, and the projects themselves must be approved by the FHWA.

- Require *cost-sharing,* in that, most commonly, 80 percent of the expenditures on federal aid-eligible projects can be funded from federal aid, requiring a contribution of state funds to "match," or complete the balance of 20 percent.

[76] A 1963 Internal Revenue Service ruling that allowed certain government-owned, non-profit corporations the same exemption of investors' interest payments from federal income tax as is allowed on municipal bonds.

- Are *reimbursements,* in that, to receive federal funds for a federal-aid eligible project that has been approved by the FHWA and upon which work has commenced, the state must first pay the construction contractor 100 percent of what is owed entirely with state funds then bill the FHWA for reimbursement of the federal share – usually 80 percent.

These and other restrictions create significant challenges for the state officials who are responsible for highway programming as they struggle to ensure that all the federal funds to which a state is entitled are used ("Never send a dollar back to Washington" is the catch-phrase of highway programmers) and to fund the "state match" for federal aid-eligible projects.

The FHWA recognizes the difficulties caused by these restrictions on programming federal funds and matching state funds to federal-aid projects. Under the banner of "innovative financing," the FHWA has offered some variations and exceptions to them, briefly summarized here:

- **Advance construction**, a cash flow management tool in which the state uses its own funds to fully fund and proceed with a federal-aid eligible project that will only be eligible for its apportionment of federal-aid funds in some future year, when the state funds so used can be converted to federal funds.

- **Partial conversion of advance construction**, in which only some of the state funds used in the advance construction of a federal-aid eligible project are converted to federal funds in a given year.

- **Tapered match**, in which the requirement for the state to match federal funds is applied to the project as a whole, rather than on every individual payment of federal funds, allowing states to "back-end load" the payment of the required state-match funds into the payments that occur towards the end of construction.

- **Flexible match**, in which specified non-cash contributions from the state, from local government, or from private sector partners are allowed as contributions towards the match requirements of a federal-aid eligible project.

- **Toll credits**, in which those states that, in past years, used toll revenues to fund state highways that were used to the benefit of interstate commerce are granted credits equal to a portion of their continuing state expenditures on those highways, and permitted to apply these credits in lieu of cash to meet the state matching requirement on other, federal-aid eligible projects.

- **Off-system bridge credits**, in which state funds spent on certain off-system bridge projects can generate credits, similar to toll credits, that can be applied in lieu of state or local cash contributions to federal-aid eligible bridge projects.

It is important to remember that toll credits are not cash. While substituting toll credits for state revenues in state match contributions will free up state revenues for projects that are not eligible for federal aid, they will not increase the amount of cash available for all projects. The inability of toll credits to increase cash availability of the number of projects funds is illustrated in the following example of how $100 million in state revenues and $100 million in federal revenues can be applied, with and without toll credits, across federal-aid and state projects.

Exhibit 50: An Example of the Use of Toll Credits in Highway Program Funding

$ Millions	State Match from State Revenues	State Match from Toll Credits
Federal-Aid Projects		
Federal Revenues (cash)	100	100
State Revenues (cash)	25	0
Toll Credits (non-cash)	0	25
Total Federal-Aid Projects	**125**	**100**
State Projects		
State Revenues	75	100
All Projects (cash)	**200**	**200**

The net effect of toll credits is to reduce the funding of the federal-aid projects, increase the funding of state projects, and leave the total spent on all projects unchanged. In this example, the toll credits allow $100 million of federal-aid projects to proceed with a $25 million cash state match. However, the total amount spent on federal-aid projects must be reduced by $25 million, as state cash is no longer committed to those projects. An additional $25 million is made available for state projects. Because toll credits bring no cash, the total funds available for all projects in the highway program are not increased above $200 million of cash that is available from state and federal revenues.

3. Appendix: Glossary

These terms are used in different ways by state departments of transportation. The definitions given here flow from the management of federal-aid highway funds.

Advance construction	The funding of a federal aid-eligible project over multiple years, such that a state expends state funds on the project in a year or years prior to the year in which that state and FHWA agree that the federal-aid *apportionment* to that project will be *authorized* (i.e. authorized in the general sense) by the US government and available for payment to the State. Same as *conversion*.
Allocation	A distribution of federal funds to programs that do not receive an *apportionment* through a distribution formula set in the *authorizing legislation*. Allocations are made at the discretion of the US Secretary of Transportation and may be made at any time during the fiscal year.

Allotment	The state budget approvals for spending at the program level administered by the state's executive budget authority. Funds must be first be *appropriated* by the legislative branch of government before they can be *allotted* by the executive branch of government.
Apportionment	Funds that are available to the each state from the US government under the US *Federal-Aid Highway Act*. Apportionments are distributions by formula of future federal funding commitments. Apportionments control how much Federal-Aid Montana receives and in which program categories, such as Interstate Maintenance, National Highways, and the Surface Transportation Program. Except for congressionally earmarked projects during the appropriations process, it controls how much obligation authority the state receives (see below for more information on obligation authority). Apportionments are available for the fiscal year plus three of the following years.
Authorization or Authorizing legislation	Basic substantive legislation that establishes or continues Federal programs or agencies and establishes an upper limit on the amount of funds for the program(s). The current authorization act for surface transportation programs is the *Safe, Accountable, Flexible, Efficient Transportation Equity Act - Legacy for Users* (SAFETEA-LU) which was passed by Congress on July 29, 2005.
Contract authority	Some programs within the Federal-Aid highway program are excused from the dual legislative requirements of authorization and appropriations. These programs are deemed to have contract authority under which the government can obligate authorized funds without an appropriations bill or any other further congressional action. These include high-priority projects to which Congress distributes specific amounts of money in authorizing legislation.
Conversion	Same as *advance construction*.
Obligation	A legally binding promise to pay, made under statute or the law of contract. In the federal context an obligation is a federal *commitment* to pay a state the federal share of a project's eligible costs.
Obligation authority	Obligation or budget authority is made available through annual appropriations acts. It is the commitment by the Federal government to pay out money. Obligation authority is not tied to any apportioned program category, but it is used to commit federal apportionments that are program-specific. Obligation authority is generally available only for the fiscal year in which it is received. While there are exceptions to this single-year availability of obligation authority, MDT manages the program to fully utilize all obligation authority the year it is first available. Obligation authority is the controlling element regarding the size of the state's highway construction program. If it is not carefully managed, contracting opportunities will be lost or fiscal crises may arise if the state's commitments exceed available Federal-Aid.
Obligation Limitation	A restriction on the amount of Federal funds that may be *obligated* during a specified time period. This statutory budget control does not affect the apportionment or allocation of funds; rather, it controls the rate at which these funds may be used.
Partial conversion	A particular type of *advance construction*, used in large multiple year projects, in which only some of State's expenditures on a project are funded through *advance construction*.