Appendix A: Literature Review

The objective of this appendix is to document the salient findings of the literature review that was conducted by the research team. The appendix provides a brief review of public-private partnerships (PPP) before highlighting the findings of the literature review as it pertains to U.S. and international toll roads, respectively.

Public-Private Partnerships

Public-Private Partnership (PPP) projects can take a number of forms, but typically involve a "long-term contractual relationship between government agencies [and] private sector partners for the provision and operation of an infrastructure asset."[i] The Federal Highway Administration (FHWA)[ii] has listed a number of variations of the Design-Build (DB)[1] contract, such as:

- Build-Operate-Transfer (BOT); Design-Build-Operate-Maintain (DBOM); Design-Construct-Maintain (DCM)—In these DB variations, the public sector finances the project and receives revenues from the private sector. The contractor is not only responsible for the design and construction of the facility but also for its operations and maintenance. This arrangement provides the private sector with more flexibility in the materials chosen and construction methods selected, and thus allows for more innovation.
- Design-Build-Finance-Operate (DBFO)—In this variation, the private sector is responsible for financing the project in addition to designing, building, and operating the project. Fees paid by the users or the public sector in the form of "shadow tolls"[2] or "pass-through" tolls are the major sources of revenue for the private sector. Ownership of the project remains with the public agency and the contractor must return ("handover") the facilities to the public sector at the end of the contract period.
- Build-Own-Operate (BOO)—This variation is less prevalent in transportation projects. In this case, the private sector develops, finances, designs, builds, owns, operates, and maintains the project. The contractor is vulnerable to all the operating revenue risk, but retains all the surplus revenues in perpetuity.
- Performance Specified Maintenance Contracts (PSMC)—This type of contract pertains to the rehabilitation and maintenance of highways for a specified period.
- Concessions[3]—This variation on DB contracts allows the concessionaire to design, build, and operate a project with the right to receive revenues from operations

[1] The Design-Build (DB) contract in its simplest form uses a single contract for two services: design and build. The design-builder (private sector) is responsible for the design work and the construction of the project. Financing, maintenance, and operation are the owner's responsibility (public sector).

[2] Many DBFO projects in the UK are paid for by the government through shadow tolling. In these types of contracts, the government pays the concessionaire or private investor based on the traffic volumes. Shadow toll rates are a function of the vehicle class, the traffic volume range, availability of safety incentives, and lane availability.

[3] The use of concessions is very prevalent in some European countries, such as Portugal and France. In Portugal, 90 percent of the highway network consists of concessions. The concessionaire either levies a toll (paid by the users)

and/or receive payments from the public agency. Thus, if the contractor does not receive adequate revenues from the agency for operations, the concessionaire can charge user fees to cover the costs. Nevertheless, the concessionaire is responsible for all the capital investment. This contract variation has many of the characteristics of the DBOM contracts and typically the average contract period is between 15 and 30 years.

Teigen (2007)[iii] listed the following benefits resulting from PPPs:

- It is a mechanism to provide much-needed infrastructure sooner and allows the public sector to spread the cost of the infrastructure over the life of the asset.
- Most PPP infrastructure projects are completed on-time or earlier because the private sector needs the revenue streams to repay the capital costs or because payments are aligned with project deliverables.
- The maintenance of the infrastructure is usually transferred to the private sector, ensuring that assets are adequately maintained. This also provides an incentive to the private sector to adhere to long term construction quality standards as it will be responsible for operation and maintenance expenses over a long term.
- The private sector is more customer-oriented because they rely on user fees for their revenue streams.
- It frees the public sector to focus on the output instead of inputs.

Although a number of countries have embarked on PPPs to fund infrastructure projects[4], the PPP models adopted vary significantly in their level of maturity. Teigen (2007)[iv] identified three stages in PPP model maturity measured in terms of the sophistication of the model adopted and the level of activity in the country (see Figure A1). Countries in Stage One of PPP model maturity have:

- an established policy and legislative framework for PPPs,
- started to develop a central PPP policy unit to guide the implementation of PPP projects,
- developed deal structures,
- developed a public sector model to compare the PPP model to,
- begun to develop the market for PPP and attract private investors, and
- started to apply early lessons from the transportation sector to other sectors[v].

Countries in Stage Two of PPP model maturity, such as Portugal, New Zealand, Canada, France, and Italy, typically have:

- developed dedicated units in agencies to deal with PPP projects,

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and/or a shadow toll (paid by the government). In the United States, a concession contract was used to design, build, and operate the U.S. Highway 91 Express Lanes in California (SR91).

4 These projects do not only pertain to highway infrastructure projects.

- begun to develop hybrid models[5] for the development of PPPs,
- started to expand the market for PPP projects,
- leveraged new sources of funding from capital markets,
- used PPPs to initiate innovation in service delivery, and
- multiple PPP projects in various sectors of the economy[vi].

Countries in Stage Three of PPP model maturity (e.g., Australia and the UK) have:

- adopted new innovative PPP models,
- applied creative and flexible approaches to the roles of the private and public sector in the delivery of PPP projects,
- adopted more sophisticated risk models,
- emphasized the total lifecycle of a PPP project,
- a sophisticated infrastructure market with access to pension and private equity funds,
- leveraged underutilized assets into financial assets, and
- developed the organizational and skill sets required in government to implement and support a greater role for PPPs [vii].

[5] Examples of hybrid models are alliancing, bundling, competitive partnerships, and incremental partnerships. Under the alliancing model, "*the public and private sectors agree to jointly design, develop, and finance the project. In some cases they also work together to build, maintain, and operate the facility.*" Bundling entails "*contracting with one partner to provide several small-scale PPP projects in order to reduce the length of the procurement process as well as transaction costs.*" Under the competitive partnership model, "*several private partners are selected, in competition with each other, to deliver different aspects of a project.*" In an incremental partnership, "*the public sector contracts with a private partner, in which certain elements of the work can be called off, or stopped, if deemed unproductive. The public sector can commission work incrementally, and it reserves the right to use alternative partners if suitable*" (Teigen, 2007).

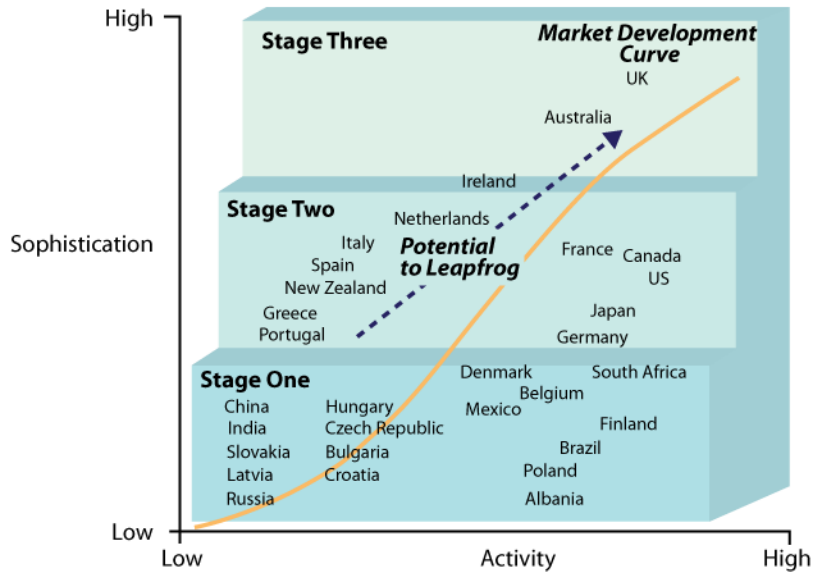

Figure A1: Public Private Partnership Maturity Model[viii]

The U.S. is considered to be in Stage Two of PPP model maturity, mainly because of the level of sophistication of the PPP agreements that are being entered into.

U.S. Toll Roads

In 2005, toll roads accounted for 3 percent or 4,800 miles of the 160,000 miles of U.S highways[ix]. However, the more than 150 toll roads in operation have different characteristics. Differences pertain to the toll pricing system, responsibility for setting the toll rates, the toll collection system [e.g., electronic toll collection (ETC), open road tolling (ORT), etc.], ownership (i.e., public or private), and whether it is part of a system or an individual link, or an urban or inter-city connector. For example, in San Diego, the Interstate 15 Value Pricing Project uses a specific toll pricing scheme—i.e., dynamic real time congestion pricing—to maintain speeds close to the speed limit even in rush hours[x]. Control over the toll rate is often legislated by the Authority managing the road. However, in some instances toll rate increases must also be approved by legislative bodies. Even in the case of private toll roads or a PPP arrangement, the toll rate and/or the number of toll rate increases are often stipulated in the contract. Finally, the majority of U.S. toll roads today offer the option of paying for tolls with an Electronic Tag, while ORT lanes are a more recent phenomenon.

Toll Pricing Systems

Traditionally, toll pricing systems took one of two forms: closed ticket or open road systems. In a closed ticket system, motorists are charged for the actual distance traveled. Motorists are given a ticket upon accessing the toll road and pay for the exact distance traveled when they exit. The Kansas Turnpike system, the New Jersey Turnpike system, and the Pennsylvania Turnpike system use the closed ticket toll road pricing system. In the open road system, motorists pay a toll at plazas, either main lane plazas or entry/exit ramp plazas, or both. The New Hampshire Turnpike, the Dallas Tollway, and the Dulles Toll Road are examples of toll roads that adopted this tolling system.

More recently, with increasing levels of congestion, some major U.S. cities have started to experiment with new toll pricing systems. These systems include different forms of congestion pricing and HOT lanes[xi]. For example, California has implemented a congestion pricing system on all the Transportation Corridor Agencies'[6] (TCAs) toll roads. A peak/off peak, as well as a weekend, pricing system has been implemented on these roads[xii]. Also, a congestion pricing tolling system will be implemented on toll roads in Illinois in 2008.

Some U.S. states have decided to develop High Occupancy Toll (HOT) roads as well as or instead of toll roads. States with HOT projects include California, Colorado, Minnesota, Texas, Utah, Virginia, and Washington[xiii]. Utah's HOT lanes are in Salt Lake City. Originally High Occupancy Vehicle (HOV) lanes, these lanes were converted to HOT lanes to increase capacity on I-15. Solo drivers require a pass to travel on a HOT lane. However, only a certain number of passes were sold. Upon the opening of the HOT lane to solo drivers, it became clear that the Utah Department of Transportation (DOT) underestimated the demand for these passes. The DOT was forced to increase the number of passes to satisfy demand. Also, no toll sensing equipment was purchased so the police are responsible for enforcement[xiv]. Washington State is conducting a pilot HOT project in King County and Pierce County. The SR 167 HOT lane project converted existing HOV lanes into HOT lanes. Funding for this conversion came from the FHWA and gas taxes. A flexible congestion pricing system is being tested. The pilot will last for four years[xv].

Setting the Toll Rate

Most toll operators are responsible for setting the toll rates. However, as mentioned earlier, these toll rates must often be approved by the state legislature or the governor. For example, the Florida legislature must approve all toll rate increases by the Florida Turnpike Enterprise (FTE) according to Chapter 339.2275(3) of the Florida statutes[xvi]. In New Hampshire toll road rates must be approved by the DOT commissioner and the Governor. Pennsylvania has passed a law to prevent excessive toll increases. In Kentucky, the Governor used his authority to remove the tolls from the last two toll roads in the state[xvii].

When the toll road is leased to a private concession firm, there is often a stipulation in the contract that regulates toll rate increases. The Dulles Toll Road contract states a regulated return on equity of 18 percent[xviii]. The Indiana toll road concession contract specifies toll rates for different vehicle classes until 2010, after which toll rates can be increased by the greater of two percent, the increase in inflation as measured by the Consumer Price Index (CPI) or the increase in the nominal Gross Domestic Product (GDP) per capita[xix]. SR 125's concession contract stipulates a maximum 18.5 percent return on the investment. The Chicago Skyway concession contract stipulates a reasonable rate of return to the private consortia. The contract states maximum toll levels until 2017, after which toll rates can be increased by the greater of these three variables: 2 percent, the percentage increase in inflation, or the per capita GDP increase[xx].

ETC and ORT Lanes

Even though ETC was only initiated in the early 1990s, it has quickly become the standard for toll collection. From 2003 to 2005, electronically collected tolls increased from 48 percent to 55 percent of total tolls collected[xxi]. Initially, each toll road or authority had their own ETC pass. Now many states are promoting interoperability among all toll tags. Examples are the four ETC passes used in Florida and the three ETC passes used in Texas[xxii,xxiii]. In the northeastern states, the EZ pass is utilized on most toll roads allowing motorists to use the toll

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[6] The Transportation Corridor Agencies (TCA) consists of the Foothill/Eastern Transportation Corridor Agency and the San Joaquin Hill Transportation Corridor Agency.

roads in other northeastern states[xxiv]. States such as Oklahoma and Kansas have one network of roads so there is only one ETC tag.

Similarly, the use of ORT has increased significantly in recent years. ORT lanes, also called Express Lanes, allow motorists to "pay the toll" when passing under a gantry without having to slow down. Most states are implementing or planning on implementing ETC or ORT toll collection to reduce operational costs and congestion at toll plazas. Some existing toll roads, such as the Dallas Tollway, are planning to transition to ETC-only toll collection to reduce operating costs[xxv]. While some planned toll roads, such as SH121 in Dallas, are considering opening as an ETC-only toll road.

Ownership and the system and link characteristics of U.S. toll roads are subsequently discussed under four headings: turnpike systems, urban toll road systems, individual toll roads, and private toll roads.

Ownership and System Characteristics

Turnpike Systems

Although several U.S. states have initiated toll road projects using private capital, the majority of the older systems are operated by public authorities.

In the 1940s and 1950s—before the Interstate system had been proposed—politicians saw the demand for major transportation routes to serve the state's commercial and recreational needs. The first major toll roads in the U.S. were developed in the 1940s as statewide turnpikes. Many of these first turnpikes were developed in the northeastern states[xxvi], often extending from one state border to another.

The first turnpike authority was formed in 1937 to build, own, and operate Pennsylvania's turnpike system. The original route for the Pennsylvania Turnpike was bought for a rail line, but was subsequently used for the toll road. The road opened in 1940 with the major sections running from the Ohio state line to the New Jersey state line. The total length of the turnpike was 470 miles. The turnpike was funded by the federal government (i.e., New Deal loans) and through revenue bonds[xxvii]. The toll road operates using a ticket system, i.e., a motorist pays a toll based on the distance he/she drives[xxviii]. In the past 5 years state officials have discussed leasing the turnpike. The current 514-mile turnpike is estimated to be worth between $2.5 and $30 billion[xxix].

The success of the Pennsylvania turnpike resulted in other states developing their own turnpike systems. These states and the date of their first turnpike section opening are:

- Maine in 1947,
- New Hampshire in 1950,
- New York in 1950,
- New Jersey in 1951,
- Oklahoma in 1953,
- Ohio in 1954,
- West Virginia in 1954,
- Kansas in 1956,
- Florida in 1957,

- Illinois in 1958,
- Delaware in 1963, and
- Massachusetts in 1964.

Most of these turnpike systems are currently managed by toll way authorities that were specifically designed by the states to prevent political interference with the operations of the turnpikes. For instance, the New York Thruway is operated and owned by the New York State Thruway Authority. This Authority was created by state legislation in 1950[xxx]. The West Virginia Turnpike is operated by the West Virginia Parkways Economic Development and Tourism Authority, which was created in 1989 (after the dissolution of the West Virginia Turnpike Commission). This Authority is unique in that the Authority's responsibilities include not only the management of the turnpike, but also the fostering of *"Economic and Tourism Development opportunities."* On average $3 million is diverted to economic and tourism development each year[xxxi].

The financing of the early toll roads varied greatly depending on the state. Funding sources were often federal loans or grants, revenue bonds, or occasionally gas tax funds. The Maine Turnpike was financed using federal funds. The Maine Turnpike Authority, however, re-paid the federal government to allow tolls to continue to be collected once the debt had been retired[xxxii]. The New Jersey Turnpike was built without any state funds. High toll revenue from the New Jersey toll system allows the New Jersey Turnpike Authority to provide $12 million annually to the state transportation fund[xxxiii]. The Ohio Turnpike was financed using revenue bonds and a small percentage of gas tax funding in the amount of $0.05 per gallon of gasoline purchased at a Turnpike gas station[xxxiv]. The West Virginia Turnpike received federal funding for lane expansion to bring the toll road up to interstate standards, while maintaining the right to charge a toll[xxxv]. The Delaware Turnpike was paid for up front by state funds that were later reimbursed by the federal government. The Kansas Turnpike was funded through the passage of the Federal-Aid Highway Act of 1956[xxxvi]. This roadway was built to connect with the Oklahoma Turnpike.

Senate Bill 225 created the Oklahoma Turnpike Authority (OTA) in 1947. Since then the OTA has owned and operated ten toll roads within Oklahoma. Oklahoma's turnpike system is slightly different from the other turnpike systems. The first toll road—the 86-mile Turner Turnpike—connects Oklahoma City to Tulsa. In 1954, the Oklahoma public voted to deposit all toll revenue into a trust fund—i.e., the Turnpike Trust Fund—from which all Oklahoma's toll roads could be financed. Thus, even when a particular toll road is paid for the tolls remain on the road. The OTA also finances toll roads through the use of revenue bonds[xxxvii]. As approximately 40 percent of the traffic on the OTA toll roads is out-of-state motorists, these bonds are re-paid using out-of-state funds. The OTA receives a percentage of the states motor fuel taxes in accordance with the Authority's Enabling Act, but the Authority has always returned all of this funding to the Oklahoma DOT[xxxviii]. Other states, like Kansas, also return their gas tax funds to the state DOT.

In 1956 Eisenhower's Interstate and Defense Highways Act proposed and funded the Interstate Highway System. This sparked a debate over the inclusion of the existing toll roads into the Interstate Highway System as Congress wished for the system to be free to all travelers. The options included either *"constructing toll-free interstate highways in these corridors"* or *"purchasing the bonds to allow the removal of the tolls."*[xxxix] Both options were deemed too expensive and, therefore, many of the existing state toll roads were integrated into the Interstate Highway System.

Urban Toll Road Systems

After the turnpike boom of the 1940s, 50s, and 60s, states began to focus on developing roads that allow travel within major urban areas. Many states proceeded by developing toll roads as single roads or as a system of toll roads in a city. The urban toll road systems in Florida and Texas are discussed in this below.

Florida

Florida is one of the most heavily tolled states in the country. Major cities with toll road systems in Florida are Orlando, Tampa, and Miami. Orlando is the most heavily tolled city in the U.S and more toll roads are planned for the area. Currently, there are eight toll roads operated by two authorities in the city. Four of these toll roads are operated by the Orlando-Orange County Expressway Authority (OOCEA). The OOCEA was established in 1963 as an independent special district. Even though Orlando is a major tourism city, 93 percent of the motorists who travel on the OOCEA toll roads are from Central Florida[xl]. The busiest and most profitable toll road, accounting for 29 percent of the OOCEA's toll revenue, is the East West Expressway. The other four toll roads are operated by the Florida Turnpike Enterprise (FTE)[xli].

Miami has a system consisting of seven toll roads, including the Florida Turnpike Mainline. Five of these toll roads are operated by the Miami-Dade Expressway Authority (MDX). The MDX was created by the Miami-Dade County Commission in 1997. At that stage, MDX took over the operation of some of the FTE's toll roads[xlii]. Currently, the FTE operates two toll roads in the Miami area[xliii].

Finally, Tampa has a toll road system consisting currently of three toll roads, but many more are being planned. One of the toll roads, the Lee Roy Selmon Crosstown Expressway, is operated by the Tampa-Hillsborough County Expressway Authority. This toll road is a major commuter route to downtown Tampa and is currently being expanded due to severe levels of congestion. The expansion is a three-lane elevated highway in the median of the existing highway. These lanes will be reversible to provide extra lanes for commuters coming into the city in the morning and leaving the city in the evenings. The other two toll roads are the Veteran's Expressway and the Suncoast Parkway[xliv]. Though the Tampa-Hillsborough County Expressway Authority originally designed these toll roads, acquired the rights-of-way, and constructed the roads, the FTE has since taken control and manages these two toll roads[xlv].

Texas

Dallas was the first city in Texas to build a toll road. Three toll roads are currently in operation in the city, but there are multiple toll roads in various planning and construction stages. The main toll authority in the Dallas area is the North Texas Tollway Authority (NTTA). The NTTA was established as a state agency by SB 370 in 1997. The Dallas North Tollway, whose first section opened in 1968, is still being expanded[xlvi]. This road serves mainly commuter traffic with only about 5 percent of the traffic being heavy vehicles. The NTTA also operates the George Bush Turnpike (SH 161) and has recently acquired the rights to build, operate, and toll SH 121[xlvii].

The city of Houston has four toll roads. Three of these toll roads are operated by the Harris County Toll Road Authority (HCTRA). HCTRA was created by Houston-area voters in 1983[xlviii]. Houston also has two roads with HOT lanes. These roads—the Katy Freeway (IS 10) and the Northwest Freeway (US Highway 290)—are operated by the Harris County Metropolitan Transit Authority. These HOT lanes were funded using either Federal Transit Administration (FTA) funds or revenue bonds. Tolls on these lanes are a function of the number of occupants and congestion levels[xlix].

Finally, a system of toll roads is currently being developed in the Austin urban area. The Central Texas Regional Mobility Authority (CTRMA) recently opened the 12-mile toll road 183A[l]. This toll road has seen traffic levels exceeding projected traffic levels since opening. Other toll roads in the urban area are segments one through four of SH 130, Loop 1, and SH 45 SE[li]. These toll roads are operated and owned by the Texas Turnpike Authority. Segments 5 and 6 of SH 130 will be built in the near future by Cintra Zachery[lii].

Individual Toll Roads

Some states have yet to develop toll roads as a part of their transportation system. In Colorado only the E-470 in Denver and its extension, the Northwest Parkway, are tolled. Georgia has only the GA-400 toll road in Atlanta. South Carolina has the Southern Connector in Greenville and the Cross Island Parkway, but the latter is mainly used by tourists to access Hilton Head. Virginia has a total of seven toll roads[liii]. However, these toll roads are spread across the state instead of being concentrated within one city.

Private Toll Roads

Inadequate funding from the traditional fuel tax, together with increased highway demand and maintenance needs—resulting from an aging highway system—have resulted in U.S. state DOTs looking to the private sector to provide much-needed capacity sooner. One alternative is for state DOTs, toll authorities, and other government institutions to lease existing roads to the private sector. Often these types of contracts provide the seller with a *"lump sum of money"* up front. In return, the concessionaire acquires the right to operate and toll the road for a period of time specified in the contract. The leasing of the Chicago Skyway was the first privatization project of this type in the U.S. The private consortia Skyway Concession Company (SCC) signed a 99-year, $1.8 billion contract for the 7.8-mile road. SCC is composed of the Australian company Macquarie and the Spanish company Cintra[liv]. Also, in January 2006, the Governor of Indiana announced that the Cintra-Macquarie offer of $3.85 billion to lease the Indiana Toll Road for a period of 75 years was accepted. The *"lump sum payment"* allowed Indiana to fund their ten-year transportation program and to allocate $150 million to address transportation project needs and backlogs in Indiana's 92 counties[lv]. In addition, there has been discussion about:

- privatizing the Ohio Turnpike in the recent 2006 Governor race[lvi],
- selling the Delaware Turnpike in mid-2000, but this never materialized[lvii], and
- in 2003 Harris County Toll Regional Authority (HCTRA) rejected an offer to sell its Houston toll roads [lviii].

Another alternative is to expand the highway system (i.e., Greenfield projects) by using private capital to finance, design, construct, operate, and maintain the road for a specific period of time. The private company is allowed to collect revenue from the facility to cover expenses and make a profit during the contract period. At the end of the contract period, the facility is transferred back to the public agency at no cost. Texas is actively pursuing the use of private capital to provide needed infrastructure sooner.

International Toll Roads

Toll roads have been well established in many international countries. For example, networks of toll roads reside in Spain, Italy, France, and Norway, while most toll roads in

Australia are in urban areas. Many Latin American countries and South Africa operate intercity toll roads. Many countries also toll beltways or ring roads that bypass urban areas. With many international countries having a long history of tolling, toll roads tend to be privately owned and operated for profit unlike toll roads in the U.S. This section of the appendix details the salient findings of the literature review on international toll roads.

Europe

European countries have seen a resurgence of toll roads since the 1960s. Many countries have turned to the private sector to finance road projects, partly because of the Maastricht Agreement signed in 1992. The Maastricht Agreement—signed by 15 EU members and states—calls for the annual deficit and debt of any country to be below 3 percent and 60 percent of the GDP, respectively[lix]. As a result, governments are constrained from increasing debt to fund major public infrastructure projects. PPPs allow countries to comply with the Maastricht Agreement criteria by allowing projects to be funded without increasing the country's debt. Twenty-one European countries currently have operational toll roads. The toll systems in Spain, Portugal, Italy, Norway, France, the United Kingdom, Germany, and Austria are briefly highlighted.

<u>Spain</u>

Spain has been a leader in the development of toll roads since the 1960s. After World War II Spain experienced an economic crisis that affected the provision of transportation infrastructure. Due to limited funds, the Spanish government allowed private companies[7] to build, operate, and maintain new toll roads. The first PPP toll road awarded in Spain opened in the early 1970s. However, traffic levels were affected by the 1970s oil crisis and the expected traffic was not realized. During this crisis, the government offered to purchase the toll roads from the private investors. However, the private investors were adamant that toll roads were a long-term investment and that profits would be realized in the later years of the contract. This business model proved to be extremely successful. Today, six Spanish toll road concession companies are among the top ten transportation developers in the world. They are:

- Abertis,
- FCC,
- Ferrovial (with subsidiary Cintra),
- ACS/Dragados,
- OHL, and
- Sacyr Vallehermoso[lx].

Abertis operates 68 percent of Spain's toll roads, as well as toll roads in Argentina, Chile, Columbia, France, Italy, Portugal, Puerto Rico, and the United Kingdom[lxi]. Apart from Spain, Ferrovial (Cintra) also has a presence in Australia, Canada, Chile, Ireland, Italy, Portugal, the United Kingdom, and more recently in the U.S.[lxii]. Ferrovial is currently the primary concession firm in North America.

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[7] At the same time, many other European countries were also building toll roads. However, some of these countries, such as France and Italy, chose state-owned companies to operate their toll roads.

Portugal

Portugal's road network consists of two-thirds tolled highways and one-third non-tolled highways. The majority of the non-tolled highways were funded through shadow toll contracts (called SCUTs in Portugal[8]). However, as these shadow toll contracts began to mature, the Portuguese government was faced with increasing budget shortfalls. In 2004, the Finance Minister announced that all shadow toll roads would be converted to tolled highways. Analysts from Standard & Poors, however, noted that traffic levels on some of the shadow toll roads would not generate adequate revenue. In fact, on most of these shadow toll roads the pre-tolling traffic counts indicated inadequate revenue. Because it is expected that the already low pre-tolling traffic levels will decrease further with tolling, this solution might not be as feasible as the Portuguese Finance Minister suggests[lxiii].

Portugal's privately operated toll roads are under the control of a government agency called Estradas de Portugal (EP)—formerly Junta Autonoma de Estradas[lxiv]. Many of the private toll road concession companies that operate in Spain also operate in Portugal. The largest toll operator in Portugal, however, is Brisa. Brisa operates 11 toll roads and is part of multiple SCUTs[lxv]. Almost all Portugal's toll roads are equipped with ETC equipment and all operate under the Via Verde toll collection system.

Italy

Italy was the first country in the world to construct toll roads when it began constructing toll motor highways, or *autostrade*, in 1924[9]. Although these roads did not attain the standards of later express highways, they did provide limited access and eliminated grade crossings. They were constructed and owned by private companies and paid for by tolls and advertising. In 1941, however, construction ceased with the advent of World War II. In 1950, a company called Autostrade Concessioni e Costruzioni S.p.A. was founded. This company played a leading role in the post-war road reconstruction efforts in Italy. For example, in 1956 the first agreement was signed between Autostrade and Azienda Nazionale Autonoma delle Strade Statali (ANAS), to construct and manage the main north–south artery on the Italian peninsula—the so-called Autostrada del Sole (A1 Milan–Naples)—with a total length of over 800 km. Thus, during the 1960s and 1970s most of the Autostrade was rebuilt to the extent that Italy today has the fifth largest motorway network[10] in the world.

In 1999 Autostrade was successfully privatized by the Italian government to create one of the leading European Toll road concession companies. Today, approximately 60 percent of the Autostrade are operated by the "Autostrade per l'Italia"—the operating company for motorway concession and construction and part of the Autostrade S.p.A group. ANAS, Italy's motorway agency and regulator, oversees Autostrade per l'Italia and other toll road concession companies operating in Italy. All toll road concession companies are required to build, operate, and maintain their networks at a cost that covers their expenses from the toll they collect. Therefore, tolls vary and are typically a function of the construction and maintenance costs of the toll road and the type of vehicle. Typically, tolls in Italy are paid at toll booths when the user exits the network. Tolls can be paid in cash, by credit card, by pre-paid card, or by TELEPASS[11]. TELEPASS is an

8 The SCUT-IP5 motorway *"was the largest shadow toll concession in the world,"* valued at $1.5 billion.

9 The "Autostrada dei Laghi" (Lakes' Highway), from Milan to Varese, was the first toll road built in 1924.

10 Most of these autostrade are toll roads.

11 In 1990 Autostrade Concessioni e Costruzioni S.p.A introduced the first dynamic toll payment system, Telepass, in the world. Today it has more than 4 million users which represent approximately 50 percent of the European market.

all-electronic toll collection system used on motorways that are operated by Autostrade per l'Italia, its affiliates, and other legal entities.

Norway

Norway, like Spain, Italy, and France, has an extensive network of toll roads. Although Norway has been building toll roads for over 70 years, the number of toll roads has increased exponentially over the last 30 years. From 1930 to 1980 only 5 percent of the annual road construction budget came from tolls. Since 1980, tolls account for almost 35 percent of the total annual road construction budget[lxvi]. Norway was the second country in the world to toll a ring road around a major city. After the opening of the tolled Bergen ring road in 1986, many of Norway's major cities, including Namos, Oslo, Trondheim, Tonsberg, Stavanger, Listerpakken, and Kristiansand, followed by developing tolled ring roads. On the majority of these ring roads drivers pay a fixed amount regardless of the actual distance traveled. Today, most intercity roads and ring roads are tolled in Norway. However, most Norwegian toll roads only cover the investment cost—not the maintenance and operational expenses. Also, Norwegian toll roads are built and operated by The Norwegian Public Roads Administration. This Administration forms a separate local authority to manage each individual toll road. In the case of many of the toll roads, the tolls will be removed after a 20-year operational period.

Norway's National Transportation Plan 2002-2011 allowed for the building of new roads using PPPs[lxvii]. On June 30, 2007, the first PPP toll road opened in Klett-Bardshaug[lxviii]. This toll road—the E39 Klett-Bardshaug—is owned by the private consortium Orkdalsvegan AS. Norway has been embracing ITS toll equipment. Almost all toll roads have electronic toll collection, thereby allowing the use of the AutoPASS toll tag nationwide. Also, many of the toll roads have started to implement the use of ORT lanes. Norway is currently working towards interoperability among the Scandinavian countries.

France

France's road network is dominated by toll roads. The 1955 Toll Act allowed for the creation of state-owned toll road companies, so initially most of the French toll roads were operated by state-owned companies[lxix]. However, in 2005 the French government sold their shares in these companies to private investors, because the French treasurer anticipated that this sale would provide France with $13.3 billion. Most of the funding was dedicated to general improvements, although a small percentage was used to improve the condition of non-tolled roads[lxx]. Nowadays, most French toll roads are owned by six private concession companies:

- Compagnie Financière et Industrielle des Autoroutes (COFIROUTE),
- Société des Autoroutes du Nord et de l'Est de la France (SANEF),
- Autoroutes du Sud de la France (ASF),
- Société des Autoroutes Paris-Normandie (SAPN),
- Autoroutes Paris-Rhin-Rhône (APRR), and
- Société des Autoroutes Esterel-Côte d'Azur (ESCOTA).

Of these six concession companies, COFIROUTE is the only French concession company that has always been privately operated[lxxi]. SANEF was initially a state-owned company operating toll roads in the north and east of France, but has since been purchased by the largest toll road operator in Spain, Abertis. The setting of toll rates in France is usually stipulated in the concession contract.

United Kingdom

The M6 Tollway in Birmingham is currently the only operational toll road in the United Kingdom. Before this toll road, roads in the United Kingdom have been financed using shadow tolls[lxxii]. The M6 toll road was built to relieve congestion on the free alternative—the M6 motorway. The 47 kilometer M6 Tollway—a privately financed, owned, and operated toll road—opened in 2003[lxxiii]. The private concession company, Midland Expressway Ltd.—part of Macquarie Infrastructure Group—signed a very favorable-to-the-private-sector 53 year, £485 million contract for the M6 Tollway[lxxiv]. In terms of the contract, the private concession company has the sole toll rate setting authority and can withhold traffic count information from the government. The government was unsuccessful in taking the concession company to court. One reason for the favorable private sector contract was that the M6 Tollway was the first PPP road in the UK and as such best practices had not been established. Due to all the contractual disputes, the United Kingdom has not entered into another road concession contract. However, two PPP road projects are being planned: the M4 and the Leeds Inner City Ring Road.

Germany

In preparation for World War II, Germany constructed an expansive highway network. The German government thus did not need to enter into private concession agreements to fund its road network after World War II. However, now over 50 years later, this road network is falling in disrepair. A major reason for this disrepair is the increase in truck traffic, which has *"increased five-fold since 1970."*[lxxv] Given that over 35 percent of this truck traffic is generated in other countries[lxxvi], the German government introduced distance-based truck tolling[12] in January 2005 using Toll Collect[13]. Toll Collect is a GPS system that tracks all truck travel on Germany's 12,000 kilometer highway network[lxxvii]. Trucks are charged once per trip and the toll is based on the total distance the truck traveled on the highway system—similar to the ticket system on U.S. toll roads. When the system was implemented in 2005, the average toll amounted to about 20 U.S. cents per kilometer[lxxviii]. The expected revenue from truck tolls is estimated at $4 billion per year[lxxix]. Some of this money goes to the national Electronic Tax Collection system, which is used to widen congested motorways.

Although the truck tolling system is regarded a success, the revenue generated is not sufficient to solve Germany's infrastructure problems. Germany thus signed the first of four PPP agreements for the building of road infrastructure in May 2007. The first agreement with a+ is for the widening of the A8, which runs from Munich to Augsburg. The $310 million agreement allows a+ to operate the toll road for 30 years. The private concession company, a+, is composed of Dutch BAM PPP, American Flour, French Egis Project, and German Berger Bau[lxxx]. It is foreseen that Germany will enter into more of these PPP-type agreements in the future.

Austria

During the 1970s, six road companies were established in Austria with the responsibility to build a complex 2,000-kilometer tolled motorway system through the Alps. The toll

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12 In addition to Germany, a number of other European countries have implemented truck tolling systems, i.e., Austria, Switzerland, and more recently the Czech Republic. All these countries have implemented ORT systems.

13 Toll Collect is operated by a private consortium consisting of automaker DaimlerChrysler, Deutsche Telekom, and French toll road concessionaire Cofiroute.

motorways were financed from loans and credits, toll revenues, and from government grants (i.e., the Republic of Austria and the Federal States). In 1982 the government created the Autobahnen- und Schnellstraßenfinanzierungs- Aktiengesellschaft (ASFINAG) and in 1997, ASFINAG was given the right to collect tolls and user fees from all users of the federal highways with the signing of the ASFINAG Authorization Act. ASFINAG is a public limited company and therefore all ASFINAG shares are held by the Republic of Austria.

In January 2004, ASFINAG implemented a national toll system that charges all vehicles over 3.5 tons a distance-based toll for use of Austria's 2,000-kilometer highway network. This system requires that vehicles over 3.5 tons install an on-board unit, called a GO-Box, which sends microwave signals that allow for a truck to be scanned and its distanced recorded as it operates on Austria's road network. Users of the GO-Box have the option of paying the toll in advance or after the journey. Vehicles below 3.5 tons (typically passenger vehicles) are required to pay a "flat" fee for the use of Austria's highway network. Users of these vehicles must purchase a toll sticker called a *vignette* that has to be prominently displayed on the inside of the front window. Users have the option of purchasing an annual, two-month, or ten-day vignette costing €72.60, €21.80, and €7.60 respectively. In addition, vehicles under 3.5 tons are charged a separate toll for the use of certain motorway sections that are excluded from the vignette system. These sections total 140 kilometers and required significant investment due to the nature of the alpine terrain. To traverse these sections, users must pay a separate toll at toll collection booths.

North America

Canada

Highway 407 was completed in 1997 and runs east–west north of Toronto in Canada. Originally, funded through a PPP, it was anticipated that the $1.6 billion in bonds sold to fund the construction of the road would have been repaid from user fees, i.e., tolls, over a 35-year period. However, the government leased the highway in 1999—after 18 months of operation—to 407 International Inc, which comprises Cintra Concesiones de Infraestructuras de Transporte, Macquarie Infrastructure Group, and SNC-Lavalin. The contract between the private concessionaire and the Ontario government is for 99 years[lxxxi]. Thus for $3.1 billion, the concession company obtained the right to own, operate, and toll the 108-kilometer road for 99 years.

The toll road agreement has some unique features. For example, the contract stipulated that the private concessionaire has to pay the government a certain fee (as determined by a formula) if congestion reached a certain predetermined level. Also, the toll road was the first in the world to use only ETC to collect tolls. A system of cameras record license plate numbers and drivers are charged subsequently. The tolls are differentiated on a peak/off-peak basis[lxxxii]. A number of lawsuits have been brought forward about the concessionaire's right to set toll rates[lxxxiii] and the government's responsibility to deny the issuing or validation of vehicle permits to frequent toll abusers. Despite the controversy surrounding the sale of Highway 407, at least three more Canadian toll road projects are in the planning phases.

Latin America

The building of toll roads in Latin America has been increasing substantially as countries are expanding and modernizing their road networks. Many Latin American countries are granting concessions to private companies to fund major road infrastructure projects.

Mexico

Toll road PPPs have not always been successful in Latin America, as was the case with Mexico in the early 1990s. The Mexican Government initiated a highway program to expand its road infrastructure by building new roads that were financed by private concessions. However, one of the fatal flaws of this program was the fact that the contract periods were too short. This caused the private companies to increase toll rates. As the toll rates increased, traffic levels fell, and the new toll roads failed. The Mexican government first responded by extending the concession contracts, but eventually most roads were transferred to a newly created federal entity called Fideicomiso de Apoyo al Rescate de Autopistas Concesionadas (FARAC) (Support Trust for Rescue of Commissioned Highways). Today, some of these roads are still operated by CAPUFE (Caminos y Puentes Federales de Ingresos y Servicios Conexos[14]), while others are operated by the private sector or by state governments[lxxxiv]. Recently, the Mexican government had started to lease the operations of some federal toll roads to the private sector. One example of the latter is the $4.1-billion bid by Empresas ICA and Goldman Sachs to build and operate four toll roads in Central Mexico for 30 years[lxxxv].

Chile

In the late 1990s Chile began building a system of urban toll roads in an effort to expand its road infrastructure. The new toll roads have been regarded as very successful, because they decrease congestion, improve travel times, and are considered safer. For example, the four private toll roads around the capital city of Santiago have added much-needed capacity to combat congestion in the city[lxxxvi].

The Autopista Central was the first ORT road in Chile. Initially users could use this toll road for five months without paying a toll. The cost or lost revenue associated with these five non-tolled months amounted to $700 million, but this measure was implemented to encourage usage and address any technical issues. Given the success of the ORT system on the Autopista Central, the same toll collection system was implemented on three other urban toll roads in Santiago, Chile[lxxxvii].

Peru

The first PPP project and only toll road open in Peru is the Amazons Norte Toll Road. This 360-kilometer road runs through northern Peru and is owned and operated by the private consortia, Concessionaria IIRSA Norte S.A[lxxxviii]. This project forms part of the Regional Integration Plan for South America, which is supported by the Inter-American Development Bank (IDB). Although the toll road secured private funding, Fitch Ratings reported that *"upon completion, the road is not expected to generate sufficient revenues to cover its construction costs"*[lxxxix]. This project is, however, supported by the Peruvian government and the international community.

Australia

The first two Australian toll roads—the M4 Western Motorway and the M5—opened in 1992 to traffic. Of the nine operational toll roads in Australia, only these two are owned and operated by the Australian government's Road and Traffic Authority (RTA). The other seven toll roads are operated by private concession companies. The two major concession companies in

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[14] CAPUFE is responsible for the regulation and maintenance of all federal and concession roads in Mexico. FARAC operates under CAPUFE.

Australia are Transurban Group and Macquarie Infrastructure Group (MIG). Transurban has shares in the Melbourne CityLink toll road, the WestLink M7, and the M2. MIG has shares in the Airport Motorway, M4, M5, and WestLink M7[xc].

All Australia's toll roads are located in one of the three major urban centers: Melbourne, Sydney, or Brisbane. Australia's first fully electronic toll road, the Melbourne City Link, opened to traffic in 1999, but tolling only started in 2000. This tolling method proved to be so successful that all toll roads built in Australia since 2000 have been using the ETC and video tolling payment method. The privately owned M2 in northwest Sydney is currently being renovated to allow ORT[xci]. The M2 currently uses toll plazas. It is foreseen that all Australian toll roads will eventually adopt the ORT system. A significant step in this direction is the fact that the Australian ETC tags are interoperable.

The Cross City Tunnel PPP in Sydney deserves special mention. The Tunnel opened in 2006 and immediately experienced inadequate traffic levels. The original traffic and revenue report[15] estimated 90,000 vehicles per day, but the actual vehicles per day were closer to 30,000[xcii]. The private concessionaire, Cross City Motorway Pty (CCM), was thus unable to make interest payments and declared bankruptcy. On June 20, 2007, the Cross City Tunnel was sold to ABN Amro, an investment bank, and Leighton Contractors Pty Ltd. for $700 million[xciii].

Middle East

Israel

Israel's only toll road—Highway 6: the Yitzhak Rabin Highway—was the largest infrastructure project in Israel's history at a construction cost of $1.3 billion. The toll road is operated by the consortia Derech Eretz Group, which consists of CHIC and Construction Limited. The first section of the 86-kilometer road opened in 2004[xciv]. Highway 6 has been converted to ETC and video tolling only. The technology used is similar to the technology of the 407 ETR in Canada. The concession contract stipulates the amount of profit the private company can receive each year. Since traffic has exceeded expectations, the concessionaire has been required to pay a fee to the government. If the traffic had been below projections, the government would have had to pay a subsidy to the concessionaire.

Africa

South Africa

The South African National Roads Agency Limited (SANRAL) manages and maintains the national road network in South Africa on behalf of the Minister of Transport. The South African national road network constitutes:

- 74 percent non-toll roads that are maintained from an allocation from Treasury,
- 8 percent public agency toll roads, and
- 18 percent concession toll roads[xcv].

All concession agreements in South Africa are for a period of 30 years. Concession agreements are regarded an integral component of the South African government's strategy to

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[15] These traffic and revenue forecasts were done by Hyder Consulting.

seek alternative financing sources to taxes for funding South Africa's road network. The three concession toll roads are:

- the *N4 Maputo Development Corridor*, a 504-kilometer corridor that extends from the Gauteng border on the N4 to Maputo in Mozambique. The concessionaire is Trans African Concessions (TRAC) and the total concession was valued at R3.0 billion.
- the *N3 Toll Road*, a 418-kilometer corridor from Cedara in KwaZulu Natal to Heidelberg in Gauteng. The concession was valued at R3.5 billion and the concessionaire is N3 Toll Concession (Pty) Ltd (N3TC).
- the *N4 Platinum Highway*, a 380-kilometer portion of the N1 between the N1/N4 system interchange in Tshwane and the Warmbaths interchange, westwards through Akasia, Brits, Rustenberg, and Zeerust to the Skilpadhek border post with Botswana. The total concession was valued at R3.2 billion and the concessionaire is Bakwena Platinum Concession Consortium (Pty) Ltd (BPCC)[xcvi].

Asia

Indonesia

Indonesia's tolled highway network consists of both private and public toll roads. The public toll roads have been owned and operated by the public authority PT Jasas Marga (JM), since its founding in 1978. JM has been *"the largest toll road operator"* in Indonesia with responsibility to operate 16 toll roads and another 4 *"are run in joint ventures with private groups"*[xcvii]. In March 2007 it was reported that JM is going to concession all 16 toll roads that it currently operates in an effort to raise the necessary capital to fund new highways.

Toll increases are regulated in Indonesia. Government Regulation No. 15 (2005) and Law No. 38 (2004) stipulate that toll rates can be adjusted every 2 years in accordance with the inflation rate. However, these laws have not prevented controversy about toll rate increases.

South Korea

South Korea currently has six operational toll roads and two more are in the construction phase. All six operating toll roads are operated by Macquarie Korea Infrastructure Fund[xcviii]. The length of most of the leases is between 24 and 30 years. The toll collection system on these roads currently includes cash, ETC (i.e., Hi Pass), and cell phones. However, Macquarie recently announced plans to introduce open road tolling lanes in the future.

Thailand

Thailand's toll roads are all located either within Bangkok or originate from Bangkok. Two government agencies—The Expressway and Rapid Transit Authority of Thailand (ETA) and the Department of Highways—own extensive networks of toll roads. Both these agencies also operate toll roads, while some toll roads are managed by private concessionaires, such as the Bangkok Expressway Public Company Limited (BECL)[xcix]. Some toll roads use ETC to collect toll fees, but more passive card-based systems are also widely used.

Malaysia

With almost 20 operational toll roads, Malaysia's extensive toll road network amounts to more than 1,000 kilometers. The first toll road in Malaysia was completed in 1974. As such, Malaysia has a relatively long history of toll roads. All the toll roads are owned by the Malaysia

Highway Authority, but operated by private concession firms. Most of the toll roads in Malaysia allows ETC and cash collection and have implemented an ORT pricing system. One exception is the New Klang Valley Expressway, which adopted a closed toll system[c]. In the latter case, users collect toll tickets when accessing the toll road and pay a toll based on the distance traveled when exiting the toll road.

India

An interesting PPP project in India is the Bangalore Mysore Infrastructure Corridor Project (BMICP) in India. The project includes the construction of a 111-kilometer concrete tolled expressway, connecting Bangalore and Mysore, as well as the development of five townships along the corridor[ci]. The main objective of the project is to alleviate congestion in Bangalore. It is estimated that the road will reduce travel time between Bangalore and Mysore from 4 hours to 90 minutes[cii].

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Appendix B: Orlando's Eastern Beltway

This appendix covers the initial feasibility and history of Orlando's Eastern Beltway, the T&R reports reviewed, and the various bond documents issued for the toll roads comprising the Eastern Beltway.

Initial Feasibility and Historical Perspective[1], [i]

The discussion of a beltway around the City of Orlando dates back to the 1963 official first meeting of the Orlando Orange County Expressway Authority (OOCEA) board. Then, in the early 1970s, the idea for this beltway was reinvigorated by the OOCEA chairman, James Greene. Greene was influential in the major growth and expansion of the OOCEA's system. He served as the chairman from 1971 to 1984 (with only a brief hiatus).

Though the land outside the borders of Orlando was mainly rural in the early 1970s, Greene had the foresight to envision how the city would expand. Building the road early would allow for the land to be acquired more cheaply and easily, as the area was not populated. However, the land use at that time could not support the sale of the bonds to construct the road. According to Greene, *There is no good time to build a toll facility. You're either ahead of time or behind time*.[ii] Despite Greene's support, the road was stalled until growth could support the bonds.

In 1972, the OOCEA began to aggressively study the feasibility of a tolled beltway around Orlando. This study was strengthened when in 1973 Governor Reuben Askew formally requested that the OOCEA act as the Florida Department of Transportation's (FDOT's) agent in the matter of creating a beltway around Orlando. FDOT loaned the OOCEA $150,000 for preliminary financial and engineering studies to achieve this objective. Figure B1 illustrates the early 1976 plan for the Eastern Beltway around Orlando.

[1] Unless otherwise noted, the information and figures in this section of the appendix are from 2007.

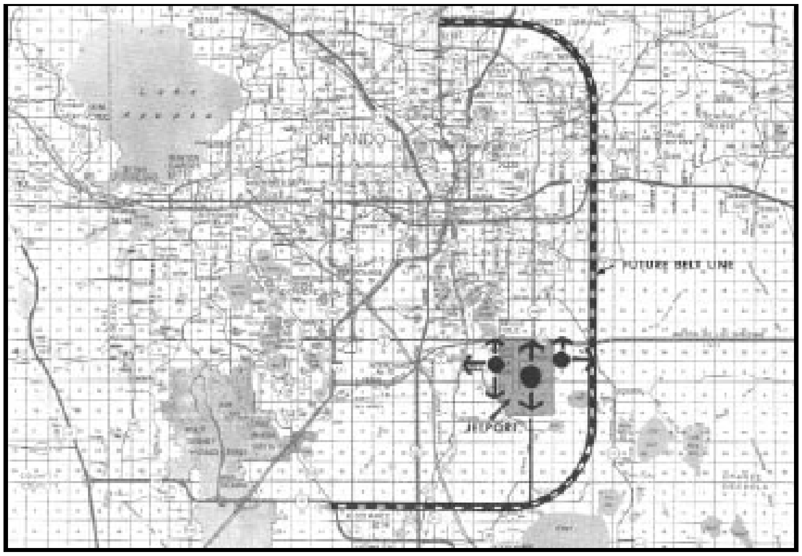


Figure B1: The Eastern Beltway Envisioned in 1976

The initial feasibility study suggested an Eastern Beltway starting at a point north on I-4 in Osceola County, passing through Orange County, and joining the I-4 again in Seminole County—thereby requiring the permission of both Osceola County and Seminole County. The legislation that created the OOCEA in 1963 required that the Authority receive permission from counties before entering their jurisdiction. Both Osceola and Seminole counties had been reluctant to give permission to build within their county lines. This reluctance stemmed mostly from the counties' desire to remain in control and have a voice in the road's development. Seminole County further asserted their control by creating a toll authority for the county. The Seminole County Expressway Authority (SCEA) was created in 1974. The SCEA proceeded to hire an engineering consultant to assess the feasibility of the Seminole section of the Eastern beltway.

With the feasibility study underway, Greene began the difficult process of trying to unite the OOCEA, FDOT, and all the other stakeholders in the road's development. As already mentioned, Seminole County (through the SCEA) had a vested interest in the eastern beltway as did the governments of the other neighboring counties, Orange County and Osceola County. At the time the Orlando, Seminole, Osceola Transportation Authority (OSOTA) was more involved in public transit than roads, but had aspirations to be a stakeholder in the beltway. With revenues from the toll road at stake, everyone had a vested interest.

Greene negotiated an agreement among the stakeholders, but unfortunately due to political issues it fell through at the last moment. Before more could be done to unite the organizations, the first preliminary T&R forecasts were released. WSA predicted that traffic on the eastern beltway would be insufficient to cover the estimated cost of the road. The predicted cost (from $140 to $144 million) for the 35-mile eastern section of the beltway was much higher than the expected revenue that the toll road would generate. This goes back to Greene's quote that there is never a good time to build a toll road. Either a lack of development does not support the bond sales for the road or the existing developments result in high right-of-way costs making the road unfeasible. The movement behind the construction of the road slowed, but was not abandoned.

In 1977, federal law required the Orlando area to create a Metropolitan Planning Organization (MPO), which would later change its name to Metroplan Orlando. One of the first tasks of the non-county affiliated planning agency was to create an area-wide transportation plan. The 1977 transportation plan showed a disparity between available and needed funding. As the only tollway authority in the area with operational roads, the OOCEA was the prime candidate to help address the budget shortfall. The MPO's 1977 plan identified three projects in which the OOCEA could take the lead. The projects, in no particular order, were:

1. a connector toll road between downtown Orlando and the Airport (later named the Central Connector),
2. an extension of the OOCEA's Holland East-West Expressway to connect with a Western Bypass, and
3. an Eastern Bypass with special emphasis on the section from the East-West Expressway to the Bee Line.

The release of this plan resulted in the OOCEA reexamining the feasibility of the eastern beltway. The OOCEA was in a better position to support bonds sales as its other two toll roads showed increasing traffic growth. FDOT loaned the OOCEA $800,000 to conduct the preliminary engineering work for the central section of the Eastern Beltway—i.e., from the Seminole County line to the OOCEA's Bee Line Expressway.

The MPO continued to develop plans for Orlando's transportation system. The 1983 Long Range Expressway Plan identified three additional OOCEA projects. The projects were also ranked for the first time. Figure B2 provides an image of the potential OOCEA projects that were included in the 1983 Long Range Expressway Plan.

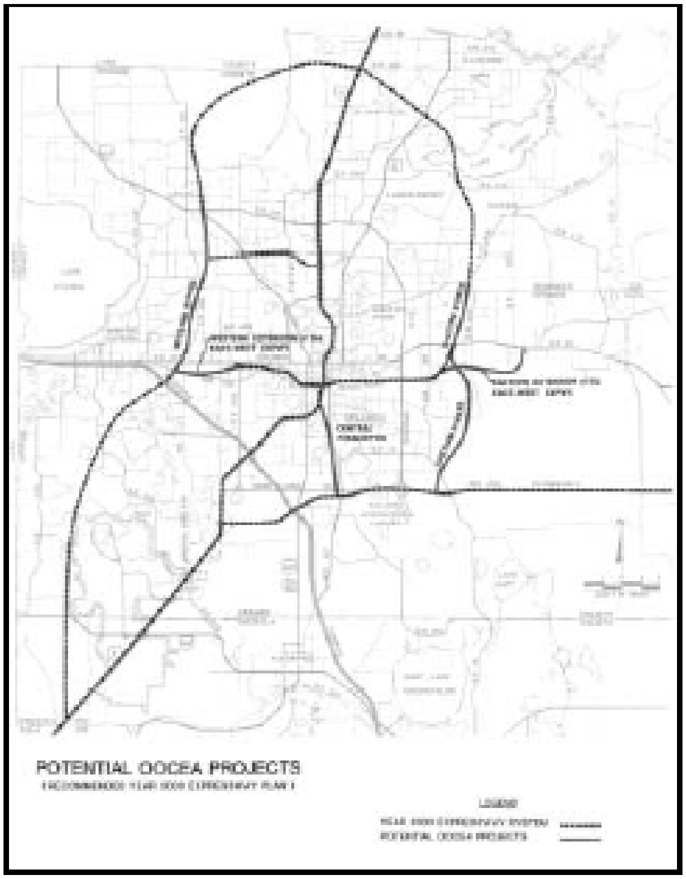


Figure B2: Potential OOCEA Projects in the Long Range Expressway Plan 1983

The priority project was a section of the Eastern Beltway. However, the prioritized section for construction was different from the section recommended in the 1977 plan. The priority section ran from the Seminole-Orange County line to the East-West Expressway. The “1977 section” was still included as a potential project, but was the third priority after the eastern extension of the East-West Expressway. The MPO’s reasoning for this priority reversal was the growing right-of-way costs in the northern section. Also, as the area was experiencing increasing development, the prioritized section was regarded the most financially feasible. The MPO was trying to build the road at the perfect time: before the land was too expensive, yet the development to support the road was starting to occur.

In 1985, the OOCEA began to refinance their debt. Previous bond sold had covenants that required that all tolls be used to pay off existing debt only. The OOCEA’s two operational toll roads, the East-West Expressway and the Bee Line, generated a surplus of revenues over what was required to pay the OOCEA’s debt. The OOCEA then refinanced its debt, allowing the surplus revenues to be used for new projects. Refinancing would eventually save the OOCEA $27 million over the next 25 years. The OOCEA also raised tolls on its existing system to increase the agency’s bonding capacity.

The OOCEA used this new financial bonding capacity to begin the largest building period in its history.

Since creation, the OOCEA had only one full time employee, an office manager. With the expected construction, the OOCEA needed more full time employees. In the next year, an assistant director, a manager of communications, a director of construction, and a director of planning were hired. The new executive director, Bill Gwynn, also assumed more day-to-day duties.

Northeastern Beltway

The priority section of the eastern beltway that Metroplan Orlando had identified in their 1983 Long Range Plan was selected as the first section of the Eastern Beltway to be constructed. This section was named the Northeastern Beltway. A "general alignment" had been identified but the necessary environmental approval was not yet obtained. New environmental laws and procedures had been enacted since the OOCEA had built their previous roads. The OOCEA required approval from the Department of Environmental Regulation (DER). The SCEA was also still actively pursuing their portion of the Eastern beltway, and by 1987 had adopted a final alignment for their 18-mile toll road.

A T&R study was conducted of the entire Eastern Beltway in the early 1970s, but much had changed since then. Much of the area had seen development and economic growth since the first study. The study also needed to be revised for the smaller section. The OOCEA hired Vollmer and Associates as its T&R consultant.

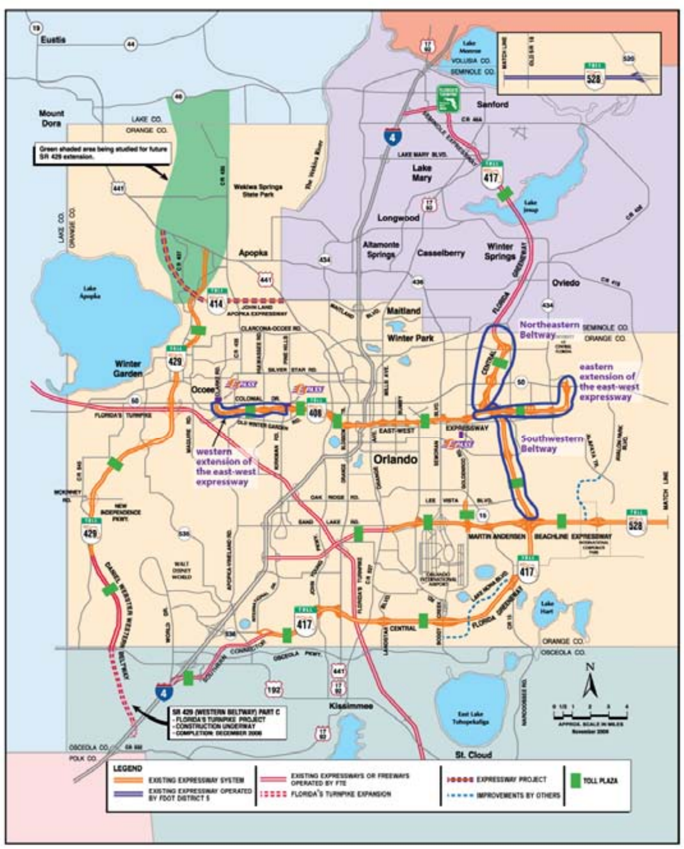
During the feasibility phase of the project, the land around the northern section of this road corridor was increasingly developed. Located in the south section of Seminole County, within the city of Winter Springs, was a large residential development entitled Tusca Willa. This section of the Eastern Beltway was constructed at the same time as the eastern extension of the East-West Expressway. The idea was that residents in the Tusca Willa development would use the northeastern segment of the beltway to reach the East-West Expressway, which would take commuters downtown. Though the entire beltway would form a ring road, this particular section could act as a spoke in conjunction with the East-West Expressway.

The OOCEA began to conduct public hearings. The proposed alignment would result in the relocation of about 60 houses and two businesses. The opposition to the road was lead by The University Boulevard Coalition. The organization initially tried unsuccessfully to solicit political support to stop the road. Next, the organization attempted to persuade the DER to reject the road due to environmental concerns. The DER initially ruled in the Coalition's favor, but reversed their decision when the OOCEA agreed to create new wetlands in place of the ones that would be destroyed by the toll road.

After the environmental concerns had been addressed, the OOCEA moved forward with the acquisition of the needed right-of-way. However, during the course of dealing with the environmental concerns, the number of properties to be acquired had increased to 92 houses and 4 businesses. Most of these properties could be acquired without litigation, but some required court involvement. The total cost of the right-of-way amounted to $35 million.

After almost 35 years of planning, construction of the first segment of Orlando's beltway began July 15, 1987. The construction of the first segment was divided into six separate contracts due to the project's large scale. The section of the road inside Seminole County would lead to much dispute. The SCEA and the OOCEA had agreed in July 1987 that the OOCEA would construct the road as an agent of the SCEA. However, as construction was set to begin, the SCEA requested an amendment to the agreement. The SCEA insisted that the revenue from the segment in Seminole County be deposited in a separate fund to be returned to Seminole County at some point in the future. OOCEA executive director, Gwynn, announced that the SCEA would "handle the project as their own." The SCEA received the news favorably. The SCEA always preferred a bigger role in the beltway and was eager to build the road. The SCEA arranged for a $5 million line of credit and pledged a portion of Seminole County's gas tax revenue. The construction of the SCEA's 2000-ft segment of the road proceeded without issue. It opened in December 1988. The OOCEA segment of the Northeastern Beltway opened two weeks early on December 16, 1988. The final cost of the road amounted to approximately $105 million, of which $35 million was used for right-of-way.

Figure B3 maps the 1986 Bond Document Projects.



EXPRESSWAY SYSTEM

Figure B3: The 1986 Bond Document Projects (including the Northeastern and Southwestern Beltways)[iii]

Vollmer predicted that upon opening traffic volumes on the road would be 12,000 vehicles a day. As a marketing scheme, the toll road was opened for two weeks without tolls. Traffic on the road during this period was about 17,900 vehicles per day. In March 1989, 1,176,176 drivers used the road.

Southwestern Beltway

The third priority project from the 1983 MPO Long Range Expressway Plan was the section of the Eastern Beltway initially identified in their 1977 plan. The section—the Southwestern Beltway—was a 7.6-mile section running from the end of the Northeastern Beltway south to the Bee Line Expressway. This section was funded through the same bond sale as the Northeastern Beltway, although this segment was constructed later. The predicted traffic on this road was 29,000 vehicles per day by year 2000.

The recommended alignment for the Southwestern Beltway was through an undeveloped area. Figure B4 presents an aerial photograph to illustrate this point.

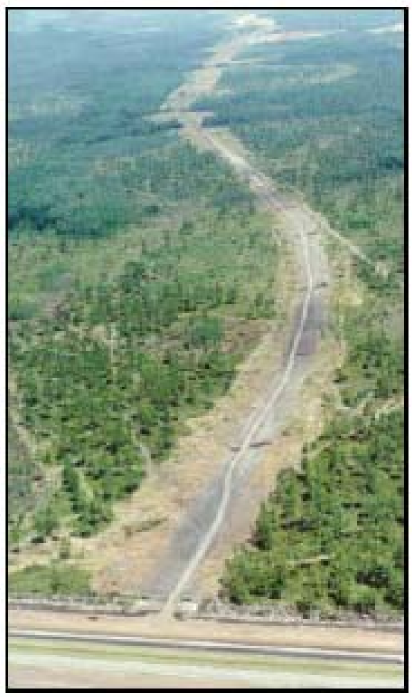


Figure B4: Aerial Photograph of Southwestern Beltway Prior to Construction

The alignment was designated by 1984, but both developers and environmentalists wanted to make adjustments. The developers wanted the road closer to their land, while environmentalists wanted to address their concerns. In the end, the chosen alignment was determined not by developers' interest or by environmental issues, but by cost. The selected alignment would cost about $15 million less than the other proposed routes, yet generated the same level of traffic. Next, the selected alignment underwent an in-depth environmental study. The OOCEA again donated wetlands to mitigate environmental concerns. The right-of-way acquisition began in early 1988. As the area was largely undeveloped, fewer houses and businesses were affected. However, over a fourth of the properties required litigation. The right-of-way cost amounted to $13 million. The first part of the Southwestern Beltway opened on April 14, 1990. An aerial photograph of the final nine-mile road, which cost $72 million (including right-of-way costs), is provided in Figure B5.

Figure B5: Aerial Photograph of Completed Southwestern Beltway

The Northeastern Beltway and the Southwestern Beltway were renamed the Central Florida Greeneway in 1993 in honor of James Greene.

Southern Connector

The next section of the Eastern Beltway, the Southern Connector, ran from the end of the Southwestern Beltway south to S.R. 535/536. The construction of this section was not a high priority for the OOCEA. The Orlando Sentinel reported that the road was *still a long range concept*. One of the reasons was that the road was not a priority in the MPO's 1983 Long Range Expressway Plan. In the mid-1980s, four large local landowners formed a group called the Southern Connector Group to lobby for the construction of the Southern Connector. The group hired a firm to conduct a corridor study at a cost of $250,000. Due to the Southern Connector Group's influence, the MPO added the Southern Connector to their Long Range Expressway Plan.

A preliminary study for the section was subsequently prepared. The Orange County Commission provided $400,000 for this study to be conducted in October 1987. Originally, the section would pass through Osceola County. The Osceola County Commission thus wanted to be involved in the planning process. Their involvement would ultimately lead to a route change for the Southern Connector avoiding Osceola County all together. The proposed alignment is shown in Figure B6.

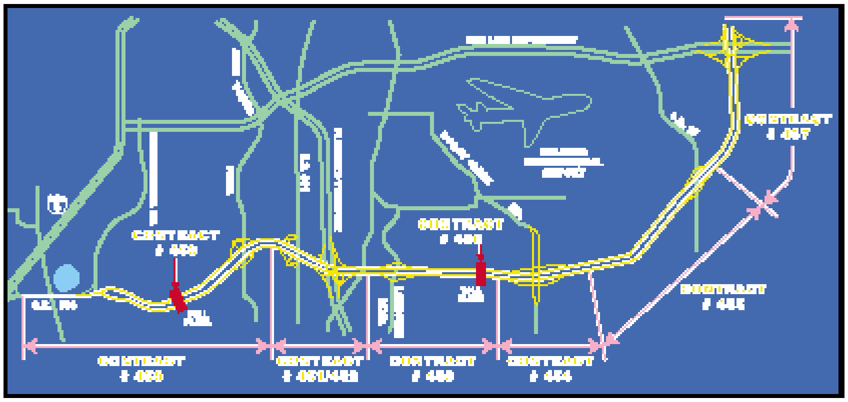


Figure B6: Proposed Southern Connector Alignment

In 1990, the OOCEA secured funding for the project by selling bonds. The bonds were backed by a pledge of Orange County gas tax funds. The bonds were sold by December 1990, and right-of-way acquisition began immediately. The right-of-way cost finally amounted to $65 million. The only major design change was the elimination of the Turnpike Southern Connector interchange. At the time of the bond sale, the interchange's design had not been finalized. FDOT decided that the new toll road would not generate significant traffic and deemed the interchange unnecessary. The Southern Connector opened in May 1993 at a cost of $273 million. Tolling began on July 1. The intersection between the Turnpike and the Southern Connector is shown in Figure B7.

Figure B7: View of Intersection of the Turnpike and the Southern Connector

Since 1988 the OOCEA has opened almost 36 miles of new expressways. Their contribution to the Eastern Beltway ran from the Seminole County line south to S.R.

535/536. Yet the Eastern Beltway was not complete. There were still 12 miles in the north from I-4 to the northeastern section and 6 miles in the south between the Southern Connector and I-4 that needed to be constructed. However, these sections were not in Orange County, and in the past the OOCEA found working in other counties very challenging. These two sections would eventually be constructed by the Office of the Florida Turnpike.

Seminole Expressway, Phase I

Within Seminole County, the SCEA was still planning the Seminole County portion of the Eastern Beltway. However, in the process the structure and legislature of tolling in Florida was changing. The 1988 legislature created the Office of the Florida Turnpike[2] and the 1990 legislature (Senate Bill 1316) gave the Office of the Florida Turnpike the authority to use the Turnpike's revenue to back other toll projects across the state. This increased the Florida Turnpike's bonding capacity to $1.1 billion.[iv]

The Turnpike System embarked on a major expansion period during the early 1990s when the Turnpike Office began to look for projects to start or acquire. The 1990s were conducive to construction as construction costs and interest rates were relatively low. The legislation restricted the type of projects the Turnpike Office could own and operate. The Turnpike Office had to prove that a project could pay off its cost in a set time period. Specifically, a project had to pay half of its cost by year 12 and all of its cost by year 22. Many projects were rejected because they could not meet this stringent requirement.

Projects at various stages of completion were considered as potential Turnpike projects. Some of these projects, such as the Sawgrass Expressway in South Florida, were operational, while others, such as the Seminole Expressway in Orlando, were still in the design phase. The Turnpike sold $220 million in revenue bonds to finance their expansion projects.[v] The Turnpike selected the Sawgrass Expressway as its first expansion project and purchased the toll road in late 1990.[vi]

Just before Senate Bill 1316 was passed, the SCEA was at the point of acquiring the necessary right-of-way for its section of the Eastern Orlando Beltway. The SCEA was eager to build its section and had hired a firm to conduct a T&R study. However, the results of this study were not encouraging. The study found that only the southern portion, the 12-mile section from U.S. 17-92 south to S.R. 426, was a sound investment, and had enough land development to support the cost of the road. The SCEA decided to move forward on this section with the hope that the other section would become financially feasible at a later date.

After the passage of Senate Bill 1316, the SCEA saw the opportunity to use the turnpike system to back its toll road. The SCEA could finish the toll project themselves or appeal to the Florida Turnpike for assistance. However, the SCEA was not sure that the project would be selected by the Florida Turnpike, because of the political climate at

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[2] Since the 1960s, the Turnpike Authority had been trying to expand. The Authority had successfully built and maintained the mainline of the Turnpike, but was legally restricted from starting other projects. The 1968 Constitution eliminated the Turnpike Authority and made the FDOT responsible for the management of the Turnpike System. Years later, in April 2002, legislation would reform the Turnpike system into its own entity, the Florida Turnpike Enterprise (FTE).

the time. The SCEA decided to issue bonds, pledging a portion of Seminole County gasoline tax funds, to fund the 12-mile southern section. However, before the bond issue was sold, the Office of the Florida Turnpike offered to help fund the project. The SCEA was unsure whether they had adequate funds to build the four-lane road they desired to construct themselves. In fact, they planned for some sections of the road to have only two lanes due to insufficient funds. If the Florida Turnpike built the project, there would be sufficient funds to guarantee the construction of the road in a timely manner. In the end, the SCEA took the offer from the Florida Turnpike to construct the project with one request. The SCEA wanted the Turnpike to commit to aggressively pursuing funding for the northern section that was not currently financially feasible. The Turnpike agreed as FDOT also wanted the Eastern Beltway completed. The SCEA finished acquiring the right-of-way and then deeded it over to the Turnpike. Also, the SCEA provided the Turnpike with its final design plans for the road. In turn, the Turnpike sold $337 million in revenue bonds in January 1991 to finance the Seminole Expressway, as well as the right-of-way acquisition for the Northwest Hillsborough Expressway in Tampa.

The Turnpike Office immediately began construction of the road.[3] The construction period was met with little public opposition. The main issue was that the construction of the road took longer than expected. The road opened in sections with the final section opening in May 1994. The completion of this twelve-mile segment left only the segment between I-4 and U.S. 17-92 and a small section in the south[4] to be constructed for the Eastern Beltway to be complete.

Southern Connector Extension

The missing segment in the south between I-4 and the Southern Connector was about seven miles, but the area needed a transportation link to the Disney theme park. Disney acquired land in the area and wanted the government to provide infrastructure to their future facilities. Disney entered into negotiations with both the Office of the Florida Turnpike and Osceola County. Disney eventually contributed funding to the Osceola Parkway in Osceola County, and the Florida Turnpike's Southern Connector Extension.

The Southern Connector Extension's traffic projections involved the private investor and were therefore somewhat unique. Disney had offered additional funding to ensure the toll road would pass the FTE's stringent economic feasibility test. However, Disney hired their own T&R consultant to protect and minimize their investment. For example, the higher the T&R projections, the more debt the road could support and thus

[3] The southern section of the Seminole Expressway was the first new construction project for the FTE since the construction of the original mainline. The T&R process had become more intricate since the FTE's last construction project, leading to major changes in the process. Also, the nature of the expansion projects was very different compared to early turnpike projects. The early turnpike projects were inter-city routes with few competitive alternatives. These inter-city roads also served a latent demand (i.e., when the road opened traffic was there). Finally, the system was composed of long distance routes and thus had relatively lower toll rates. The expansion projects, on the other hand, were almost all in urban areas, where major existing highways could serve as alternatives. Thus, these roads served mostly as congestion relievers. The roads also had higher tolls to pay off their debt. The expansion projects were also different than the mainline projects in that they were more sensitive to economic growth, toll rate, and time of day factors. Assumptions about these factors impacted the reliability of the T&R forecast.

[4] This section was subsequently built by the Florida Turnpike.

the lower the amount Disney would need to contribute to the project. Consequently, the two T&R consultants debated the final projections. URS, the FTE consultant, wanted to be more conservative while the Disney consultant tended to be more optimistic. This resulted in some disputes and perhaps even increased the assessment period of the project. The T&R consultants were aware that a non-tolled parallel road (i.e., International Drive) would be opening in 2001 and had to consider this in their predictions.

At the time, the Southern Connector Extension was the largest PPP in Florida's history. Disney was willing to provide funds to ensure the completion of the southern section of the Eastern Beltway. Disney and three other large landowners contributed funds not only to the Southern Connector Extension, but also funding for improvements[5] to other roads in the area. The total cost of the Southern Connector Extension was $153 million of which the Turnpike paid $79 million. The private contribution to this road thus totaled $74 million (almost half of the total cost). The agreement between Disney and the Turnpike stipulated that although Disney had financially contributed to the project only the Turnpike would have a right to the revenues generated by the road. Ground broke on the project in early 1994 and construction proceeded without any major issues. The 6.4-mile road opened ahead of schedule on June 23, 1996. The road went from SR535 westward to I-4 and finally completed the southern section of the Eastern Beltway (see Figure B8).

[5] One such improvement was the construction of a frontage road along I-4.

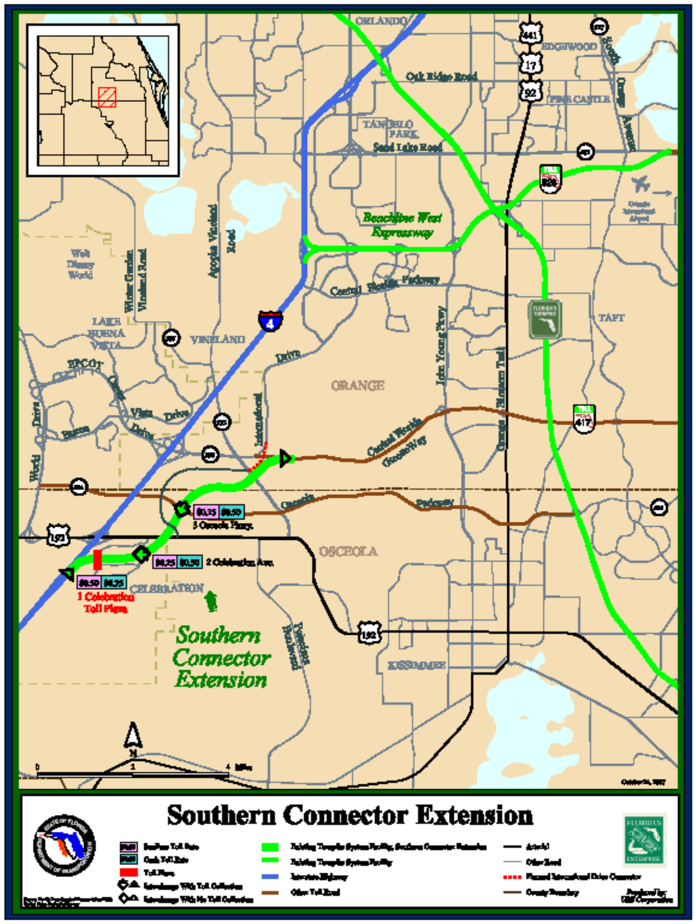

Figure B8: The Southern Connector Extension[vii]

Seminole Expressway, Phase II

With the southern section of the Eastern Beltway completed, the focus shifted to the missing segments in the northern section of the beltway. As mentioned earlier, the Turnpike agreed to construct the road when it became financially feasible. As a standalone project, the road could still not meet the financial feasibility criteria set by the Florida legislature, meaning the road was not going to generate enough T&R to pay off its cost within the required 22 years. Consequently, the Turnpike looked to other sources of funding to offset some of the costs. In the past, the OOCEA had received a loan from FDOT for another project. This loan was set to be paid back in the near future. The OOCEA offered to pay the $30 million back if the state would put it towards the completion of the Eastern Beltway. FDOT also had surplus funding, as the proposed light rail line for which funding had already been allocated was unexpectedly terminated. This $120 million surplus was put forward for the completion of the Seminole Expressway. Finally, the legislation earmarked another $20 million for this project. The Turnpike's approximate final contribution to the road was only $30 million. When this road was being financed, the OOCEA was working on the Northern portion of the Western Beltway. The interchange with I-4 would thus have had to serve the Western and Eastern Beltways. When environmental clearance for that particular section of the Western Beltway proved to be difficult to achieve, the OOCEA terminated their support of the Western Beltway. This meant that the I-4 interchange would only serve the Eastern Beltway, which decreased the project cost by about $13 million. The I-4 interchange was eventually funded by the federal government. All these different funding sources and design changes resulted in the road finally passing the stringent FDOT financial feasibility test. The SCEA provided the final design for the road to the Turnpike. The Central Florida district of FDOT handled the right-of-way acquisition. Given the design and the right-of-way, the Turnpike Office began construction of the last missing segment of the Eastern Beltway.

The northern section of the Seminole Expressway—the six miles from I-4 south to S.R. 417—had a relatively easy construction period and opened to traffic September 2002. Figure B9 illustrates the completed Seminole Expressway.

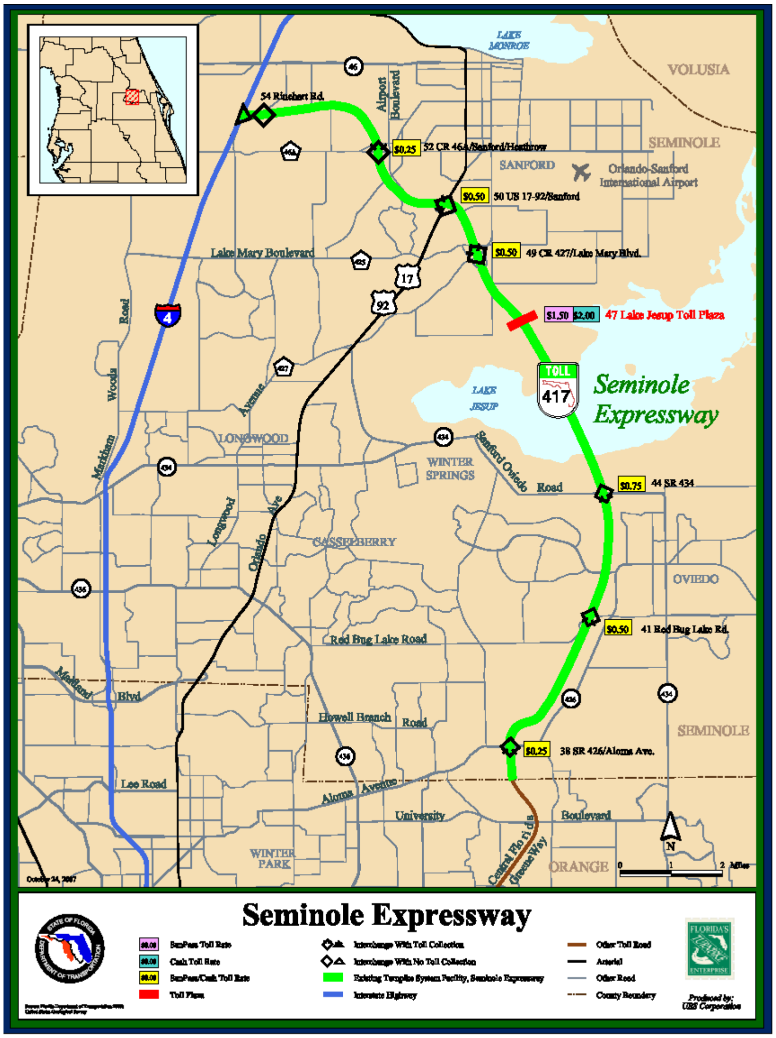

Figure B9: The Completed Seminole Expressway[viii]

With the opening of Phase II of the Seminole Expressway, a full eastern loop was created around Orlando. The eastern beltway around Orlando thus consists of three main roads:

- The 18-mile Seminole Expressway is the most northern section and is owned by the Florida Turnpike Enterprise (FTE).
- The 33.4-mile Greeneway is composed of the Northeastern Beltway, the Southwestern Beltway, and the Southern Connector's central section, and is owned by the OOCEA. This section is named the Central Florida Greeneway after the previous OOCEA chairman Jim Greene.
- The 6.4-mile Southern Connector Extension is the southernmost section and is owned by the FTE.

Figure B10 provides a map of all the toll roads in Orlando—not only the Eastern Beltway—to orient the reader as to the location of the Eastern Beltway.

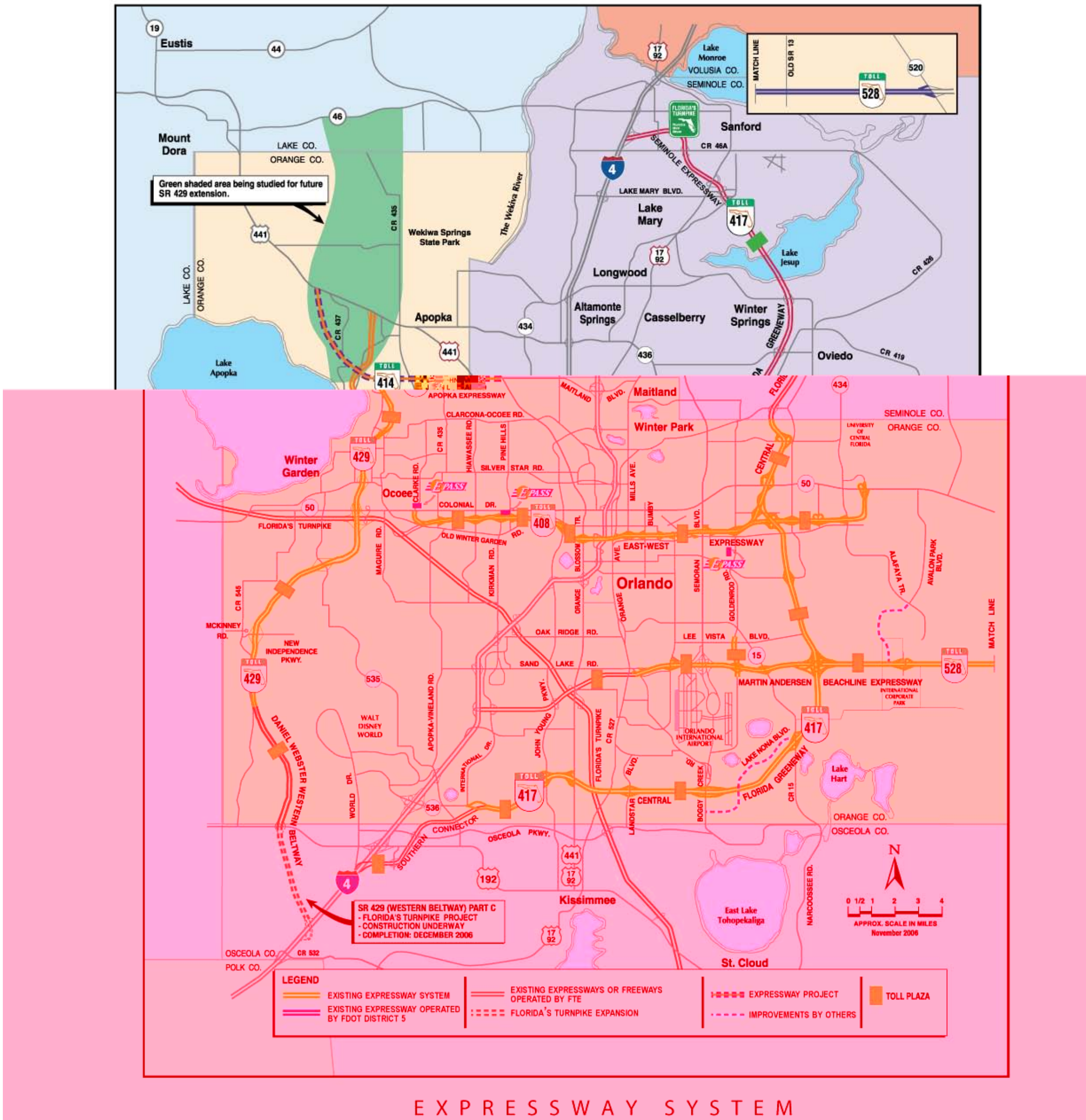

Figure B10: Orlando's Toll Road by Owner[ix]

Traffic and Revenue Reports

As discussed in the previous section, the Eastern Beltway opened in six sections. The characteristics of the sections are summarized in Table B1.

Table B1: Characteristics of the Eastern Beltway Segments[x]

Segment	Date Opened	Length (miles)	Owner	Cost	T&R firm
Northeastern Beltway	Dec-88	6	OOCEA	$105m	Vollmer
Southwestern Beltway	Apr-90	9	OOCEA	$72m	Vollmer
Southern Connector	May-93	22	OOCEA	$273m	Vollmer
Seminole Expressway Phase 1, south	May-94	12	FTE	n/a	URS
Southern Connector Extension	Jun-96	6.4	FTE	$123m	URS
Seminole Expressway Phase 2, north	Sep-02	6	FTE	$265m	URS

As the Eastern Beltway is composed of three different roads that were built in six sections, various T&R reports have been conducted resulting in a separate feasibility study for each section. The OOCEA's T&R consultant was Vollmer. The FTE's T&R consultant is URS. These companies conducted the original T&R reports for the Eastern Beltway. Though the Eastern Beltway was advertised to the public as three distinct roads, this report refers to the segment names for continuity.

The OOCEA sold revenue bonds to finance the construction of their three segments in November 1986 and in December 1990. The first bond issuance in 1986 funded the Northeastern Beltway and the Southwestern Beltway, and the second bond issuance in 1990 funded the Southern Connector.[xi] The FTE sold bonds in the 1991A series to support the construction of Phase 1 of the Seminole Expressway. The FTE did not sell bonds for either Phase 2 of the Seminole Expressway or the Southern Connector Extension. As no bonds were sold for these sections, the original T&R reports could not be obtained[xii].

OOCEA 1986 Bond Document

The OOCEA sold bonds in November 1986 to support the construction of the first sections of the Eastern Beltway[6].

Projects included in the OOCEA 1986 Bond Document[7, xiii]

The bond was to support the following five projects:

1. The north section of the Eastern Beltway—Northeastern Beltway,
2. The eastern extension of the East-West Expressway,
3. The south section of the Eastern Beltway—Southwestern Beltway,
4. The western extension of the East-West Expressway, and
5. General improvements to the East-West Expressway

Only the first and third projects were sections of the Eastern Beltway. Two of the projects, the second and fifth, would have a significant impact on the traffic on the

[6] The bond underwriters were Merrill Lynch, Pierce, Fenner &Smith Incorporated, and PaineWebber Incorporated. The OOCEA received a bond rating of an A from both Standard and Poor's (S&P) and Moody's Investors Service. Because the OOCEA was a public agency, the bonds were tax exempt.

[7] Unless otherwise noted, the information and data in this section are from the 1986 OOCEA Bond Document.

Eastern Beltway, and without the eastern extension of the East-West Expressway, the traffic on the Eastern Beltway would not have been able to connect to the downtown area. Figure B11 illustrates the projects that were funded by the 1986 bond issuance.

EXPRESSWAY SYSTEM

Figure B11: Projects Funded by the 1986 Bond Document[xiv]

The OOCEA initially tried to construct the northeastern and the southwestern sections of the Greeneway simultaneously, but the forecasted traffic could not justify the cost of the segments. The sale of the 1986 bonds funded both roads, but the construction of the southwestern section was delayed by two years until the system's revenue could support its construction. The northeastern segment was selected for early construction, based on demand stemming for the growth in the area between the Seminole County line and the East-West Expressway. Growth in an area can be beneficial and detrimental. Growth holds potential traffic and allows for the sale of large bonds, but growth also leads to an increase in right-of-way costs.

The first project—the north section of the Eastern Beltway also called the Northeastern Beltway—was the 3.5-mile section from the Seminole County line south to the East-West Expressway[8]. The road was conceived as a commuter route providing

[8] Vollmer had initially conducted a T&R study in the early 1970s for the OOCEA section of the Eastern Beltway. This T&R report was for the Northeastern and Southwestern Beltway. However, the SCEA

transportation to major generators, such *as* the University of Central Florida and the Westinghouse Quadrangle.[xv] In particular, the segment was predicted to divert traffic from Dean Road, S.R. 436, and S.R. 551. When the bond document was sold, neither the final design nor the environmental process was completed. Construction was set to begin in July 1987 and last for 18 months. The estimated cost of this project is shown in Table B2.

Table B2: Cost Allocation for 1986 Bond Project 1

Task	Cost
Design	$2.6m
Right-of-Way Acquistion	$26m
Construction	$57m
CEI	$3.5m
Subtotal	$89.1m

Tolls were to be collected at one mainline plaza and ramp plazas. The mainline plaza was located a little south of the interchange at University Boulevard. Tolls were to be collected (from north to south) at the University Boulevard, S.R. 50, and Valencia College Lane ramps.

The third project, the Southwestern Beltway, was the 9-mile section from the East-West Expressway south to the Bee Line Expressway. The project's purpose was to serve traffic from the Orlando International Airport and relieve congestion on the local streets. The project had already received environmental clearance and construction was set to begin in January 1989 after a 2-year design and right-of-way acquisition period. The estimated costs for Project 3 are shown in Table B3.

Table B3: Estimated Costs for 1986 Bond Project 3

Task	Cost
Design	$4.6m
Right-of-Way Acquistion	$22m
Construction	$75m
CEI	$4.5m
Subtotal	$106.1m

Tolls would be collected at one mainline plaza located south of Curry Ford Road. Also, Curry Ford Road would be the only major ramp, and it too will be tolled. At the time of the bond sale, the land between this ramp and the Bee Line Expressway was largely undeveloped. Thus, there were no other major ramps in the original designs. At a later date, another major road, Lee Vista Boulevard, would intersect this road and thus

constructed the most northern section of this road from the Seminole-Orange County line north to S.R. 426. The approximate distance of the SCEA's section was a third of a mile (about 2,000 ft). This section of the road was not included in the OOCEA's cost estimates. Also, the revenue from this segment was not included in Vollmer's T&R projections for the northwestern section of the OOCEA.

another tolled ramp would be added. This ramp was between the mainline plaza and the Bee Line Expressway.

Summary of the Existing Conditions[9, xvi]

This section discusses the Orlando area, local transportation system, and the existing system's T&R levels.

<u>Orlando</u>

Vollmer analyzed the area's growth and employers. This analysis identified a list of the major Orlando employers. The top eight employers are:

1. Walt Disney World Company
2. U.S. Navel Training Center
3. Orange County Public Schools
4. Martin Marietta Orlando Aerospace
5. Seminole County Public Schools
6. Florida Hospital
7. U.S. Postal Service
8. Orange County Government

Given that Walt Disney World Company is the largest employer, the area depends significantly on travel and tourism. Vollmer analyzed the historical tourism trends in Orlando, i.e., the numbers of hotel rooms, the occupancy rate, the number of convention delegates, and the number of tourists between 1970 and 1985. Also, important to their forecast was the historic growth in the area. Important growth rates for the area are shown in Table B4.

Table B4: Historical Growth Rates

	Years	Growth Rate(%)
Avgerage Annual Employment Growth Rate*	1970 to 1985	6.4
Occupancy Rate*	1978 to 1985	79 to 83
Avgerage Annual Population Growth		
Orange County	1975 to 1985	2.8
Entire Region	1975 to 1985	3.6
Average Annual Growth on the Expressway System **	1976 to 1985	8 to10
*Orange, Seminole, and Osceola Counties		

[9] Unless otherwise noted, the information and data in tables and graphs in Section 3.3.2 is from the 1986 OOCEA Bond Document.

Local Transportation System

Vollmer analyzed 24-hour average traffic counts on six non-tolled highway locations for a 10-year period (from 1974 to 1984). Five of the highway locations were on the major north-south corridor, I-4. The values are given in Table B5 and Figure B12 illustrates the traffic count locations.

Table B5: Traffic Count Locations

Counter Number	Counter Location	Average Annual Percent Increase
1	S.R. 436 West of I-4	5.3
2	S.R. 50 West of Mills (17-92)	1.8
3	U.S. 17-92 North of Seminole-Orange County Line	5.9
4	S.R. 535 at Orange-Osceola County Line	18.0
5	U.S. 441 Norht of S.R. 482	4.0
6	S.R. 435 South of Northbound I-4 Exit	12.7

EXPRESSWAY SYSTEM

Figure B12: Location of Traffic Counters[xvii]

The average annual percent increases ranged from 1.8 to 18 percent. The average annual traffic growth rates were higher than the historical area population growth rates (which were 2.8 to 3.6 percent). The lowest percentage, 1.8 percent, was recorded at the counter located downtown. The downtown system was, however, already at capacity, leaving little room for growth.

<u>Toll Transactions on Existing OOCEA System</u>

Toll transactions on the OOCEA's existing system are needed to determine the funding amount the OOCEA can support in bond payments. Vollmer assessed the OOCEA's two existing toll roads: the East-West Expressway and the Bee Line Expressway. This assessment included a brief inventory of the road infrastructure, for example the pavement, interchanges, toll plazas, and bridges. Vollmer also listed the past toll rates and revenues for each road. The toll transaction data for the two roads are shown in Figure B13.

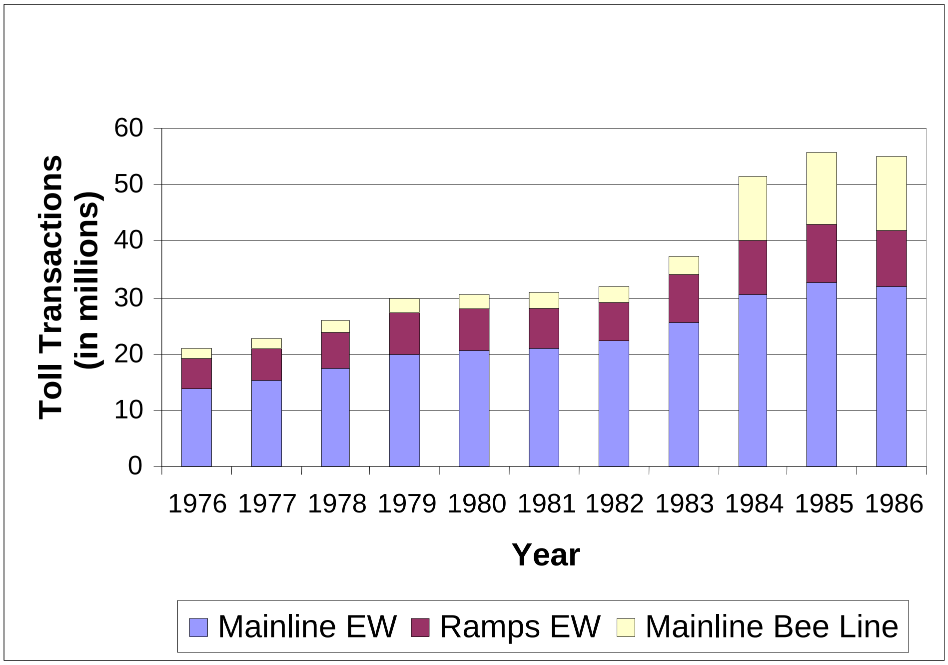

Figure B13: Toll Transactions on Existing System

In 1982, on the East-West Expressway, the mainline plaza accounted for 77 percent of the total transactions and the ramps accounted for the remaining 23 percent[10]. Table B6 provides the percent change in transactions from the previous year for both expressways.

[10] Of the East-West Expressway ramps, the Conway Road ramp accounted for 32.3 percent of the transactions, while the other ramps accounted for 67.7 percent of the ramp transactions in 1982.

Table B6: Annual Transactions Growth Rates for Existing OOCEA System

(FY ended June 30)	Mainline Plaza	Ramps	Mainline Plaza
	(percent(%) change from previous year)		
1976	-	-	-
1977	10.9	8.5	7.1
1978	13.8	15	12.8
1979	14.3	12.9	12.2
1980*	4	1.6	0.7
1981	1.9	-4.5	6
1982	7.3	-6.1	9.8
1983	14	24.6	10.9
1984**	19	14.7	10.4
1985	7.1	7.1	12.3
1976-1985**	10	7.9	3.9

* Tolls increased May 1, 1980
** Airport Plaza opened on Bee Line (growth included in Mainline Plaza values)
*** Average annual percent change

These historical growth rates were later used for predicting future traffic volumes on the existing and new system. Vollmer also analyzed monthly traffic volumes on the existing system to delineate the seasonal variation of the road's traffic. These values are provided in Figure B14.

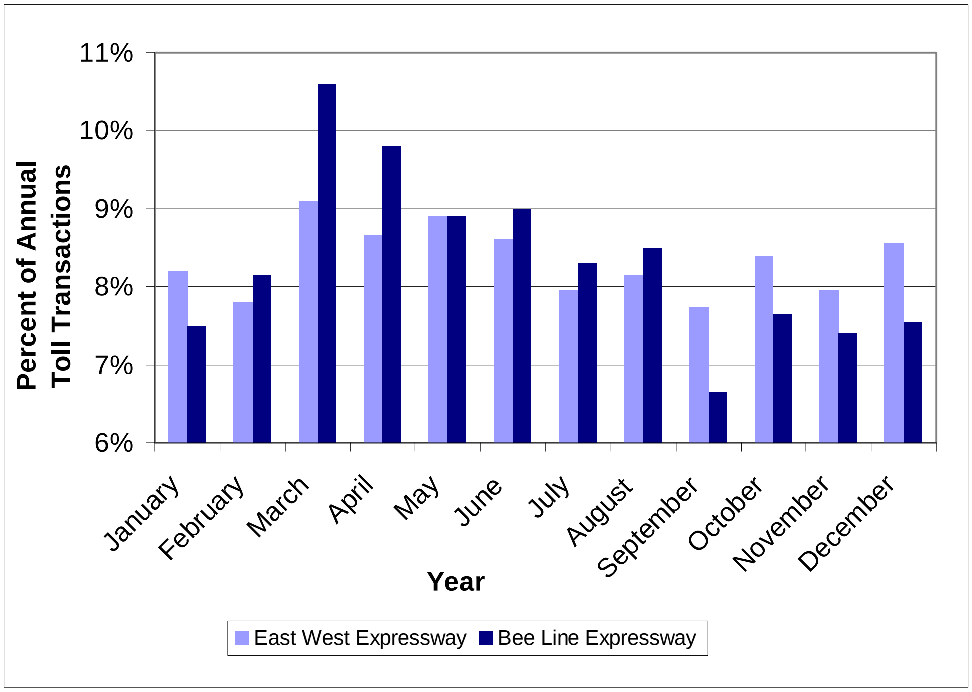

Figure B14: Seasonal Variation on the Existing OOCEA System

Because the roads are located in a tourist city, seasonal variations are expected. For example, higher traffic volumes would be expected during school vacation months. The Bee Line exhibits more seasonal variation. For both roads, March consistently experienced the highest traffic volumes with September the lowest. Also, important to the forecast was the axle count profile of the roads. Table B7 provides the axle count percentage for 1982.

Table B7: Vehicle Profile of Existing OOCEA System

	East-West Expressway Mainline Plaza, Year 1982		Bee Line Expressway Mainline Plaza, Year 1982	
Axle count	Traffic	Percent	Traffic	Percent
2	21,847	97.1	2,693	95.4
3	209	0.9	37	1.4
4	203	0.9	42	1.5
5	139	0.6	50	1.7
Prepaid	118	0.5	4	0.1
Total	22,516	100.0	2,876	100.0

Table B7 shows that the majority of the traffic on both roads is 2-axle vehicles. The Bee Line has a slightly higher percent of 3+ axle vehicles than the East-West

Expressway. This can be potentially attributed to the fact that the Bee Line serves the airport while the East-West Expressway is mainly a commuter road.

Toll Revenue of Existing OOCEA System

Vollmer also reviewed the revenue collected on the existing system and by year. In fiscal year 1985, the East-West Expressway generated 70 percent of the OOCEA's revenue. Also, the toll revenue from the OOCEA system has been increasing each year. The average increase in revenue (over ten years) was 11.6 percent for the East-West mainline plaza and 12.1 percent for the Bee Line Expressway mainline plaza. Revenue from the East-West Expressway ramps increased at 7.7 percent.

Summary of the Projected Traffic and Revenue[11, xviii]

Vollmer's projections were based on historical trends in the Orlando area and the existing system conditions. The T&R report states:

> *"It was considered prudent to make reasonably certain that these estimates would be attainable. If past growth trends continue, these estimates will be exceeded."*

The growth rates in the Orlando area, the existing system's traffic, and the newer segment revenues were projected.

Orlando

Vollmer predicted the growth of the Orlando area based on historical trends. The predicted growth rates for years 1985 to 1995 are in Table B8. The report noted that historically the traffic on the OOCEA system *grew annually about three times as fast as the area population.*[xix] Vollmer applied a reduction factor to this difference, and stated that "*this reduction factor results from conservative estimates of traffic growth to reflect possible deceleration in the rate of growth of other activities such as business development and tourism.*" The report further noted that there were no signs of a slow down so their forecasts were more likely to be under than over.

Table B8: Forecasted Average Annual Population Growth Rate

	Years	Rate(%)
Orange County	1985 to 1990	1.8
	1990 to 1995	1.7
Entire Region (4 counties)	1985 to 1990	2.6
	1990 to 1995	2.4

[11] Unless otherwise noted, the information and data in this section are from the 1986 OOCEA Bond Document.

Projections for Existing System

Vollmer predicted the traffic on the existing system prior to the opening of the new segments for the last month of 1986 and 1987. Vollmer's 1987 projections conservatively predicted only a 5 percent increase over 1986 revenues. Previous increases had been double digits. Vollmer also made predictions for the existing system after the new segments opened. Initially, the predicted revenue from the existing system was insufficient to cover the bonds for the newer segments. Thus, the OOCEA planned to raise toll rates to increase the revenue intake and therefore bonding capacity of the authority. The tolls were set to increase January 1987 and again in July 1990. The new toll rates were used in the final revenue projections for the existing system and the new segments.

Vollmer anticipated that the toll increases would result in some traffic loss. Vollmer examined the effect of a previous 1980 toll rate increase on the OOCEA's traffic. The report noted that at that time the United States was in an economic recession. However, even during an economic recession the toll rate increase had little impact on traffic volumes. Vollmer also examined the impacts of toll rate increases on other roads to evaluate the general effect of a rate increase on toll road usage. The report then estimated the expected traffic loss on the existing system based on (a) the average effect of toll rate increases, (b) the expected conditions on the competing non-toll routes, and (c) the amount of toll rate increase. For the Northeastern Beltway, Vollmer predicted a traffic loss of between 10 percent and 20 percent after the 1990 toll rate increase. The Southwestern Beltway was scheduled to open in 1990 at the higher toll rate and thus no effect was expected.

Traffic and Revenue Predictions for the Northeastern and Southwestern Segments

Vollmer predicted diversion rates from the non-tolled alternatives on opening day on the northeastern and southwestern segments (Table B9).

Table B9: Forecasted Diversion Rates for Northeastern and Southwestern Segments

	Corridor Volume (per day)	Diversion Volume (per day)	Diversion Rate (%)
Northeastern	93,000	11,000	11.8
Southwestern	80,000	11,000	13.8

The forecasted revenues for the next six years are shown in Table B10.

Table B10: Forecasted Revenue for Northeastern and Southwestern Segments

	Northeastern*	Southwestern**	Total (gross toll)
	(millions of dollars)		
1989	1.4	-	1.4
1990	3.1	-	3.1
1991	4.2	4.1	8.3
1992	4.3	4.7	9.0
1993	4.6	5.0	9.6
1994	4.8	5.2	10.0

* Assume opening December 1988

** Assume opening July 1990

Vollmer predicted that the construction of the segments will induce trips that would not have been taken otherwise. Accordingly, Vollmer increased revenue predictions by 20 percent to account for these induced trips. Also, Vollmer predicted a 6 percent average annual revenue growth rate. Vollmer noted that this is slightly higher than the rate used for the existing system because they felt that traffic growth on new roads is higher in the initial operating period than in later years when the road reaches capacity.

Differences in Historical Trends and Actual Trends

Vollmer considered existing demographic, economic, and transportation trends in the area. They assumed that the historical trends will continue in the future. Therefore, historical trend were compared with the actual trends since the road opened.

Demographic Trends

The T&R report lists the average annual employment growth rate for a three-county region—Orange, Seminole, and Osceola Counties—during 1970 to 1985. The more recent employment growth rates are graphed in Figure B15.

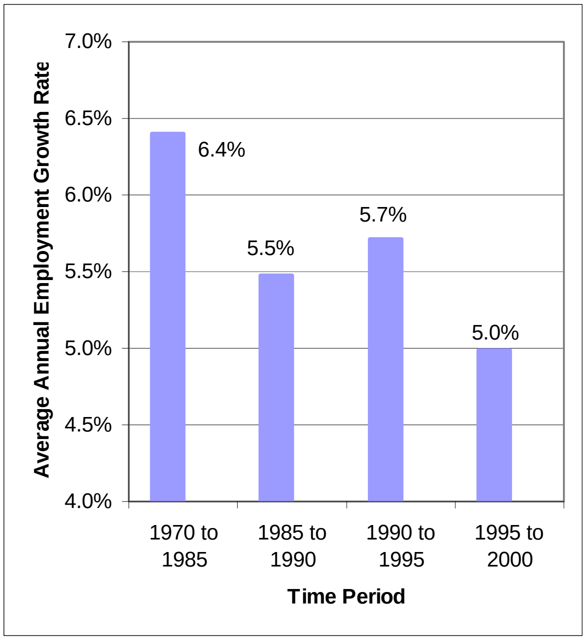

Figure B15: Historical Average Annual Employment Growth Rates[xx]

As the Figure demonstrates, average annual employment growth fluctuated in any five-year period.

Vollmer also listed the historical occupancy rates for the same three-county region from 1978 to 1985 at 79 to 83 percent. However, the bond document did not source this information, and therefore these rates could not be compared to other more recent rates.

The historical transaction growth rate was listed for the existing Expressway System, consisting of the East-West Expressway and the Bee Line Expressway. The average annual growth rates are provided in Figure B16.

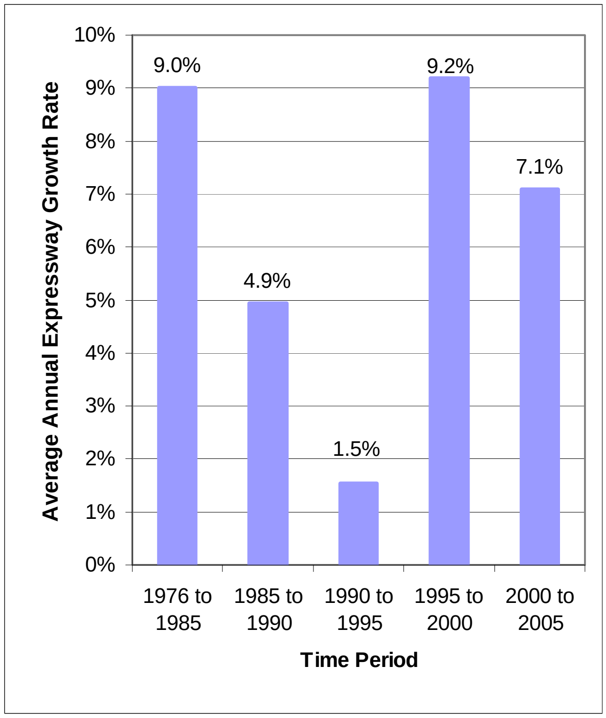

Figure B16: Historical Average Annual Expressway System Growth Rates[xxi]

Figure B16 demonstrates the fluctuation in average annual growth rates in different time periods between 1976 and 2005.

Expressway Traffic Volume Trends

Figure B17 shows the annual expressway growth rates. The decreased growth in 1990 is due to a system-wide toll rate increase.

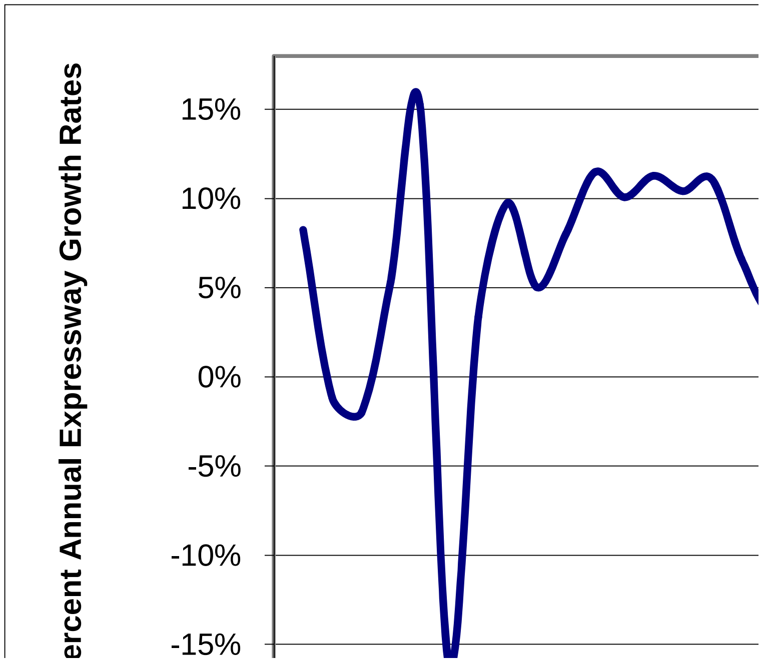

Figure B17: Historical Annual Expressway System Growth Rates[xxii]

Figure B17 confirms that growth fluctuates from year to year.

Differences in Actual and Forecasted Traffic

This comparison consists of two parts:

- An analysis of the differences in actual and forecasted traffic based on an assessment of Vollmer's assumptions, and
- A qualitative assessment of the impact of certain factors on traffic volume.

<u>Orlando Area Assumption Comparison</u>

The only quantitative assumption that was forecasted was the average annual population growth rates in the Orlando area. The forecasted and actual rates are listed in Table B11.

Table B11: Actual and Forecasted Average Annual Population Growth Rates[xxiii]

Area	Years	Forecasted Rate (%)	Actual Rate (%)
Orange County	1985 to 1990	1.8	4.1
	1990 to 1995	1.7	2.6
Entire Region*	1985 to 1990	2.6	4.3
	1990 to 1995	2.4	2.7
*Orange, Brevard, Osceola, and Seminole Counties			

The Table shows the discrepancy between forecasted and actual population growth rates, especially for the 1985 to 1990 time period. The forecasts for time periods in the distant future are more uncertain than for the near term. In actuality, Vollmer's predictions for the later period—1990 to 1995—were closer to the actual rates. Population estimate could impact traffic volumes, i.e., an increase in population could translate into higher traffic volumes.

Projections for Existing System

Vollmer predicted a 5 percent increase in revenues from 1986 to 1987. However, the actual revenues increased by 43.7 percent on the system. Also, the 1990 scheduled toll rate increases was predicted to result in a traffic loss of between 10 to 20 percent. However, the traffic volumes decreased 16.2 percent between 1990 and 1991, and because of the toll rate increase revenues in that same year increased by 29.6 percent.

Traffic and Revenue Predictions for the Northeastern and Southwestern Segment

The diversion rate was predicted for both segments. The diversion volume is the expected number of toll road users on opening day. The OOCEA does not publish daily volumes so a comparison between the forecasted and actual values was not possible. However, the OOCEA history book provides the non-toll opening day volume, which allows the non-toll diversion rate to be calculated. Also, the OOCEA history book provides the average users per day in March 1989 (three months after opening). The values are compared to the forecasted diversion rate in Table B12.

Table B12: Actual and Forecasted Diversion Rates[xxiv]

	Forecasted Diversion Rate (%)	Actual Diversion Rate (non-toll) (%)	Actual "Diversion" Rate (toll) (%)
	January 1989	**December 1988**	**March 1989**
Northeastern	11.8	19.2	40.8

As expected the non-toll diversion rate was higher than the forecasted tolled diversion rate. However, the "diversion" rate with tolls in March 1989 is much higher than the forecasted diversion rate (for January 1989). Some of these trips could have been induced trips, i.e., trips that would not have existed without the existence of the road, although it is arguable that more trips could have been diverted to the toll road the longer the road was operational. Because Vollmer did not predict a diversion rate for March 1989, it can only be noted that the 30 percent difference between the two rates is significant.

Figure B18 provides the actual and forecasted revenues for the Northeastern Segment. Because the T&R did not state whether the revenues were predicted in nominal or real dollars, it was assumed that the values were in real/constant dollars. An inflation rate was applied to the forecasted values to convert the values into nominal or current year dollars. The base year was considered the same as the bond document year, i.e., 1986. These values are provided in Figure B18.

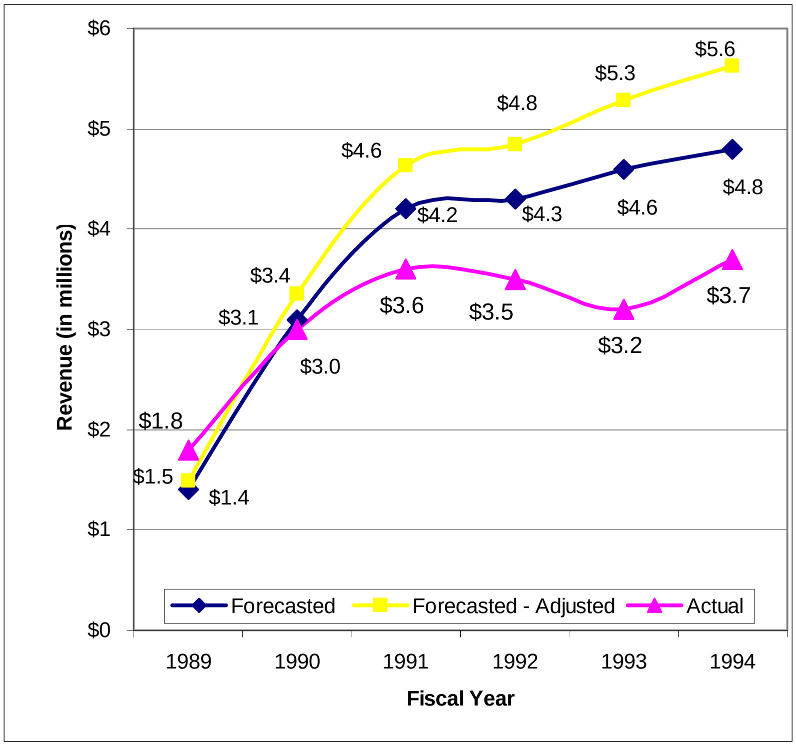

Figure B18: Actual and Forecasted Revenue for the Northeastern Segment[xxv]

Typically, a toll road usage and revenue during ramp-up is very uncertain resulting in actual volumes and revenues not meeting projections. However, the opposite seems to have occurred in the case of this segment. Actual revenues initially met (or exceeded) projections but then subsequently were significantly lower than what was predicted. Also, the second segment of the Beltway, the Southwestern Beltway, opened in April 1990, which explains the increase in expected traffic for that year. Vollmer most likely assumed, as would seem logical, that as more segments were completed more traffic would be experienced on all the segments. Unfortunately, the Southwestern

Beltway generated less traffic than projected, resulting not only in its traffic being over estimated, but also the overestimation of traffic on the connecting Northeastern Beltway. The forecasted and actual revenues for the Southwestern segment are graphed in Figure B19. Again, the forecasted values were also adjusted to current year dollars based on a 2 percent inflation rate.

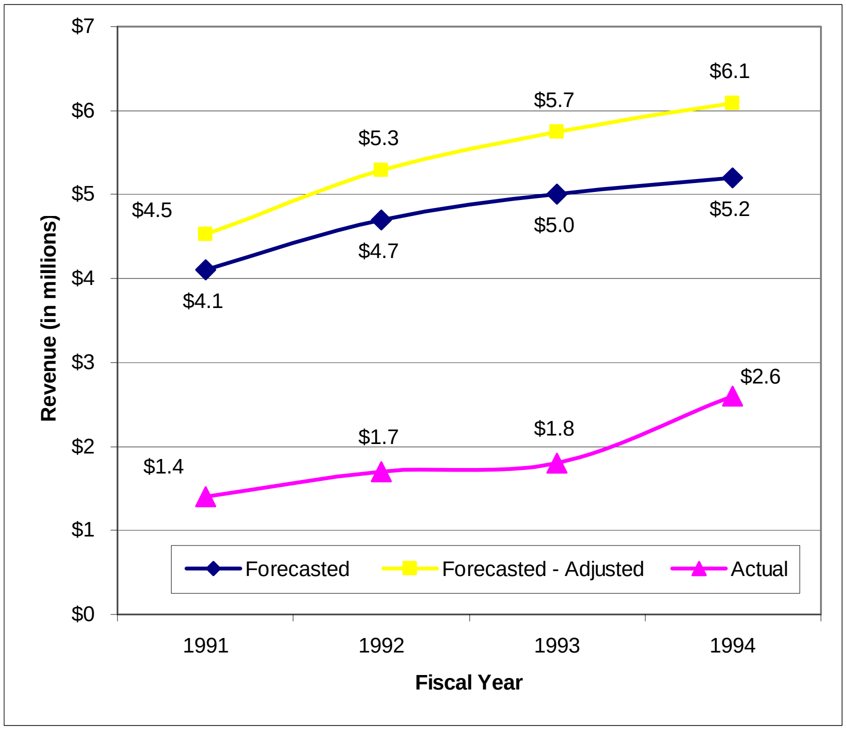

Figure B19: Forecasted and Actual Revenue for the Southwestern Segment[xxvi]

One reason given for actual revenues not meeting Vollmer's projections was that an airport access road did not open on schedule. This access road was supposed to generate 25 percent of the road's traffic. Even so, the difference between the actual and forecasted revenues exceeds 25 percent.

Qualitative Factor: Ramp-up Period

The ramp-up period for the Northeastern segment does not seem to have been particularly lengthy or severe. In the bond document, there is no discussion about the effect of ramp-up on the traffic levels; most likely because the document is older. Though ramp-up does not seem to have influenced forecasts for the northeastern segment, it does seem to have impacted the southwestern segment's forecasts. This is evident from the difference in forecasted and actual revenues for this segment.

General Observations and Conclusions

The T&R report provided few model input assumptions used for their forecasts. Interestingly, it is arguable that the higher actual population growth rates than forecasted would have had a positive affect, leading to an underestimation of traffic and revenue forecasts. Thus, the only factor that Vollmer provided was underestimated yet revenues were severely overestimated. Other model input assumptions not listed and are probably the model structure also thus affected the revenue and traffic levels.

Also, only a six-year (four for the Southwestern Segment) revenue forecast—i.e., not traffic—was provided. This might have been standard at that time. However, given that the bond period was definitely longer than six years, the question is how the rating agencies and financial markets were able to make a sound judgment about the project's feasibility. Figure B20 illustrates the forecasted and actual revenue.

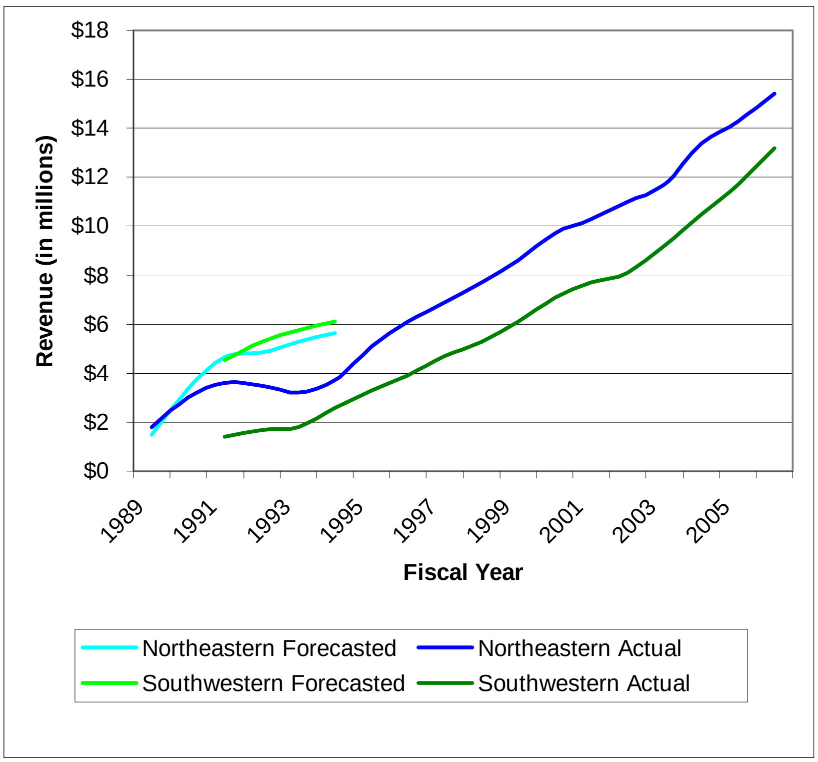

Figure B20: Forecasted and Actual Revenue for the Northeastern and Southwestern Segments[xxvii]

Figure B21 illustrates that actual revenues on the Southwestern Segment did not reach the 1994 revenue projection until four years later in 1998. Bain's research could not be replicated in this case, because Vollmer did not forecast toll traffic volumes. Instead, the actual to forecasted revenue ratio has been calculated (see Table B13 and Figure B21). The nominal revenue values were used for this analysis. A ratio value less than one signifies that actual revenue was less than forecasted revenue.

Table B13: Ratio of Actual and Forecasted Revenue[xxviii]

Fiscal Year	Revenue Ratio	
	Northeastern	Southwestern
1989	1.21	
1990	0.89	
1991	0.78	0.31
1992	0.72	0.32
1993	0.61	0.31
1994	0.66	0.43

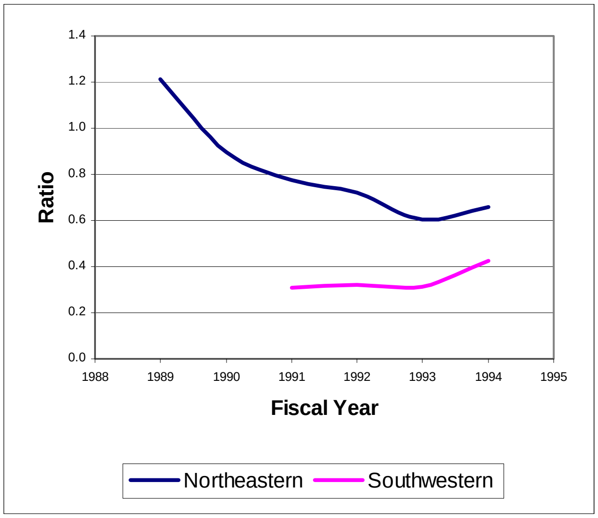

Figure B21: Ratio of Actual and Forecasted Revenue[xxix]

OOCEA 1990 Bond Document

The OOCEA sold bonds in December 1990 to support the construction of only one project: the Southern Connector[12].

Summary of the Projects included in the OOCEA 1990 Bond Document [13, xxx]

The Southern Connector is the southern extension of the Southwestern Beltway which opened in mid 1990. The 22-mile road was to be constructed as a four-lane highway with extra right-of-way provided for eventual expansion to a six-lane highway.

[12] The bond underwriters were Merrill Lynch, Lazard Freres & Co., Smith Barney, Harris Upham & Co. Incorporated, and PaineWebber Incorporated. Bond ratings of an AAA were received from Standard and Poor's (S&P) and Aaa from Moody's Investors Service. Because the OOCEA was a public agency, the bonds were tax exempt.

[13] Unless otherwise noted, the information and data presented in this section are from the 1990 OOCEA Bond Document.

The purpose of this road was to provide a more direct route from the Eastern Beltway to the south end of I-4. The design of the Southern Connector planned for a conversion of S.R. 536 from four lanes to six lanes for two miles. The actual toll road would then start about 1,700 feet east of the intersection of S.R. 536 and International Drive. The bond amount included funding for the expansion of S.R. 536. Next, the toll road would cross over the Turnpike mainline. At the time of the bond sale, an interchange between the Turnpike mainline and the Southern Connector was to be funded by FDOT in fiscal year 1994. As mentioned in the historical background section, this interchange was never built. The location of the Southern Connector is shown in Figure B22.

Figure B22: Projects Funded by the 1990 Bond Documents[xxxi]

Traffic generators for the segment were Walt Disney World and the Orlando International Airport, as well as the growing neighborhoods of south Orange County and north Osceola County. Right-of-way acquisition was set to begin December 1990 with construction scheduled from October 1991 to July 1993. The estimated costs are listed in Table B14.

Table B14: Estimated Costs for 1990 Bond Southern Connector Project

Task	Cost
Engineering, Admin, Legal	$34.3m
Right of Way Acquistion	$82.7m
Construction	$156m
Subtotal	$273m

Mainline plazas were located *between International Drive and John Young Parkway and between Landstar Boulevard and Boggy Creek Road*.[xxxii] Ramp tolls were to be collected at the John Young Parkway, Orange Blossom Trail, Boggy Creek Road, Country Road 15, and Landstar Boulevard ramps. Also, the bond document noted that future interchanges might be added at the following locations:

1. "Southern Connector/Orange Avenue—Local interchange east of Florida's Turnpike,
2. Southern Connector/OIA (the airport)—Systems interchange (expansion of the Boggy Creek Road interchange),
3. Southern Connector/ Lake Nona Boulevard—Local interchange between Boggy Creek Road and C.R. 15, and
4. Southern Connector/Alafaya Trail Extension—Local interchange located between C.R. 15 and the Bee Line Expressway" [xxxiii]

The report noted two other potential roads under consideration that would connect to the Southern Connector and serve as traffic generators for the road. The first was the planned FDOT extension of the Southern Connector west to I-4. This road would replace S.R. 536, which would then act as a frontage road for the new toll road extension. The second road was a two-lane road connecting the southern end of the airport to the Southern Connector. The Greater Orlando Aviation Authority (GOAA) was working to find funding for this road.

Environmental issues were only briefly mentioned in the report when discussing the OOCEA's wetland mitigation. A more detailed account of the road's environmental concerns was listed in the historical section.

Summary of the Existing Conditions[14, xxxiv]

Vollmer did an extensive analysis of the existing OOCEA system for the 1986 Bond Document. Vollmer also published a T&R report for the 1988 Bond Document[15]. The following summary of the existing conditions of the OOCEA system thus notes only the differences between the 1986 and the 1990 bond documents.

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[14] Unless otherwise noted, the information and data in this section are from the 1990 OOCEA Bond Document.

[15] The 1988 bond document was not discussed in this Appendix, because it funded the Central Connector which was not part of the Eastern Beltway.

Orlando

Vollmer noted that the area's growth rate equaled or exceeded the 1986 projections. In particular, the area around the OOCEA toll corridors has seen increasing development. The report listed the area's major employers, which were with a few exceptions consistent with the previous 1986 list. In the following road corridor section, detail about the major employers within the Southern Connector corridor are provided. Vollmer listed the historical growth rates for the Orlando area, provided in Table B15.

Table B15: Historical Growth Rates

	Years	Rate (%)
Average Annual Employment Growth Rate*	1989 to 1990	6.2
Average Annual Pop. Growth Rate		
Orange County	1975 to 1990	3.2
Entire Region	1975 to 1990	3.8
Average Annual Growth on the Expressway System**	1976 to 1990	8.5
* Orange, Seminole, and Osceola Counties		
** East West Expressway and Bee Line Expressway		

Vollmer did not provide occupancy rates as they did for the 1986 bond document, but did discuss office space growth in the past few years. From 1983 to 1987, office space in the area doubled. For this document, Vollmer again reviewed the impacts of tourism on the Orlando area. The rate at which tourism has increased since the 1986 bond document has been higher than the historical rate. This is particularly important because Walt Disney World is located on the West side of I-4 at the S.R. 536 and S.R. 535 interchanges. The Southern Connector provides a connection between this tourist center and the airport.

Road Corridor

For this T&R report, Vollmer conducted a more detailed review of employers and developments within the actual potential toll road corridor. The major employers in the road's area were:

- *Walt Disney World,*
- *Sea World,*
- *Orlando International Airport,*
- *Tupperware Conventions Center,*
- *The Airport Industrial Park of Orlando (AIPO), and*
- *Numerous local retail establishments, businesses, and hotels.* [xxxv]

Vollmer also listed some of the residential developments the road would serve (Figure B23). The developments were:

- *The Parkway,*
- *Osceola Trace,*
- *Hunter's Creek,*
- *Southchase,*
- *Meadow Woods,*
- *Buenaventura Lakes, and*
- *Lake Nona.*[xxxvi]

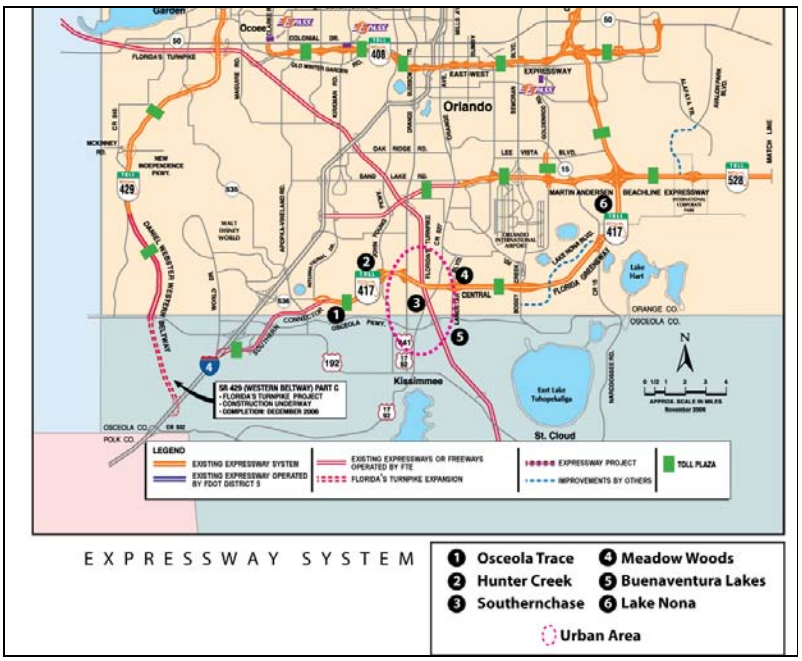

Figure B23: Location of New Residential Developments[xxxvii]

The section of the toll road between the Bee Line Expressway and Boggy Creek Road was primarily through undeveloped area. Boggy Creek Road was a major southern route to the Orlando International Airport. The Lake Nona residential development was planned for the area east of the Airport and west of the Southern Connector. The development would include the Lake Nona Golf and County Club. This development would be in the undeveloped area

At the time of the report, Vollmer noted that the area around U.S. 441 was the most urbanized in the corridor. Also, Vollmer noted the trend in residential developments to the west of U.S. 441 and non-residential developments to the east. The exception on the east side at the time of the report was the Meadow Woods and Buenaventura Lakes residential developments. The Meadow Woods development had about 2,200 residential units and the Buenaventura Lakes development had about 5,900 units at the time of the report. The residential developments of Hunter Creek and Southchase were located near the intersection of U.S. 441 and the Southern Connector.

Local Transportation System

As with the 1986 report, Vollmer analyzed 24-hour average traffic counts at five non-tolled highway locations. The counts were analyzed over a ten-year period (i.e., 1978 to 1988). The average annual percent increase in traffic at each of the locations over 10 years is listed in Table B16.

Table B16: Traffic Counter Information for 1990 Bond Document

Counter Location	Average Annual Percent Increase(%)
Semoran Boulevard	6.8
Orange Blossom Trail U.S. 17-92	3.4
Orange Avenue S.R. 527	5.3
Golden Road S.R. 551	9.4
Conway Road S.R. 12	4.2

The location of these traffic counters could not be mapped, because Vollmer did not provide the cross streets.

At the time of the bond document, other transportation projects were in various stages of planning, including:

- a high speed rail project between Orlando and Miami/Tampa,
- a high speed magnetic levitation train (MAG-LEV) was proposed to run from the airport to the International Drive area, and
- a new toll road from Orlando east towards the coast.

Most of these projects were in the planning phase. Vollmer concluded that if these facilities eventually reached the final design stage, none would greatly impact the OOCEA toll road's traffic levels.

Toll Transactions on Existing OOCEA System

This section discusses any major changes in the assumptions that were included in the 1986 Bond document about the existing OOCEA system. Table B17 shows the average annual growth rate on the pre-1986 OOCEA system (i.e., the East-West Expressway and the Bee Line) since the 1986 Bond Document.

Table B17: Historical Average Annual Growth Rates on the Existing Expressway System

	Years	Rate (%)
East-West Expressway		
Mainline Plazas	1980 to 1990	5.2
Ramps	1980 to 1990	4.1
Bee Line Expressway	1980 to 1990	10.0

Vollmer also considered the average annual growth rates for the last two operational years. The rates are in Table B18.

Table B18: Recent Average Annual Growth Rates on the Existing Expressway System

	1988 to 1989	1989 to 1990
	(%)	
East-West Expressway	9	3
Bee Line Expressway	1	15

Vollmer made traffic projections based on these rates, but as the above Table shows the trends were very different in each year.

Again seasonal impacts were considered and the same trends were observed: March had the highest traffic volumes on the OOCEA system. The axle trends were also reconsidered. The trends were the same as in the 1986 bond document: 97 percent of the East-West Expressway transactions and 93 percent of the Bee Line Expressway transactions were 2-axle vehicles

Toll Revenue on Existing OOCEA System

Vollmer updated their 1986 bond document's assessment of the toll revenue of the existing OOCEA system. For 1990, 64 percent of the OOCEA's revenue is from the East-West Expressway with 90 percent of that being collected at the mainline plazas.

Summary of the Projected Traffic and Revenue

Vollmer's indicated that their T&R projections for the Southern Connector were conservative.

Orlando

Vollmer predicted the growth of the Orlando area. Table B19 lists the predicted average annual population growth rates for the period 1990 to 1995 and 1995 to 2000. Again, the report noted that historically the traffic on the OOCEA system grew faster than the population.

Table B19: Forecasted Average Annual Population Growth Rates

	Years	Rate (%)
Orange County	1990 to 1995	2.6
	1995 to 2000	1.9
Entire Region*	1990 to 1995	2.9
	1995 to 2000	2.2
*Orange, Brevard, Osceola, and Seminole Counties		

<u>Projections for Existing System</u>

The 1986 bond document discussed the impacts of the 1987 and 1990 toll rate increases. An analysis of the 1987 toll rate increase showed that *for the total system, actual traffic loss was less than projected and revenue was greater*. The effects of the 1990 increase were considered still too new to be analyzed. Vollmer predicted a 4 percent increase in traffic on the existing facilities after the effective of the toll rate increase balanced out.

<u>Traffic and Revenue Predictions for Southern Corridor</u>

Vollmer made their predictions consisted of three components: (a) existing traffic, (b) traffic from the airport expansion, and (c) traffic from new developments in the area. First, Vollmer considered the area's existing traffic. Vollmer used a traffic survey conducted for the 1988 Bond Document to determine the potential usage of the road. Time and distance adjustments were made to the survey information, which then allowed Vollmer to calculate the potential time savings from using the road. The potential distance and time savings are listed in Table B20.

Table B20: Potential Southern Connector Savings

Trip Between	Existing Road	Difference via Sotuhern Connector	
		Distance (mi)	Time (min)
Disney World/Epcot Center and Orlando International Airport	Bee Line Expressway	1.6	2.0
Orange Blossom Trail at U.S. 192 and Orlando International Airport	Bee Line Expressway and Orange Blossom Trail	3.8	7.2
East-West Expressway at Colonial Drive and Orange Blossom Trail at U.S. 192	East-West Expressway and Orange Blossom Trail	(-4.3)	8.4

Vollmer predicted diversion rates from non-toll alternatives based on the above assumptions, but the assumptions are not explicitly stated in the bond document.

Next, Vollmer analyzed the effects of the airport's expansion on potential toll road usages. Vollmer assumed different behavior for airport related trips and non-airport related trips. Thus, different growth rates were applied for the two trip purposes, and the trips were considered separately. The growth rates for the two trip purposes are in Table B21.

Table B21: Forecasted Annual Growth Rates by Trip Purpose

Trip Purpose	Growth Rate (%)
Airport Trips	6
Non-Airport Trips	3

Local planners were predicting that the airport would see an average annual growth rate of 10 percent, which is why airport-related trips are at a higher percentage. The report also noted that they predicted tourists will use the road more than Orlando residents. This prediction is based on the idea that tourists will need to use the road only a few times and consequently be more willing to pay the tolls. However, Vollmer predicted Orlando residents will know other routes, and thus be less likely to use the road everyday.

Finally, the effect of new developments in the area was considered. For this analysis, Vollmer considered all developments that had been approved and were in various stages of completion as traffic generators for the Southern Connector. Retail developments were thought to generate the least amount of traffic as nearby residents would make those trips. Vollmer considered the 21 residential developments approved at the time of the bond document. Vollmer did state how many more developments were planned but as they had not yet received permits of approval their affects were ignored.

Twelve of the 21 developments were under construction at the time of Vollmer's report. Concerning the timeline of the projects, Vollmer added additional time onto the construction phase of most developments in an effort to be conservative. For example, Vollmer then estimated that 50 percent of the projects would be constructed by the Southern Connector's opening date. Next, Vollmer predicted that 30 percent of the projects would open by 2000 and 20 percent would never be constructed. For the other nine developments, in the T&R report Vollmer assumed that:

> *"only 80 percent of the first phase of each development would be completed as scheduled with the remaining 20 percent completed with the second phase…The developments used for vehicle trip generation were reduced in size to reflect 80 percent of the development scheduled for completion after 1995, 70 percent after 2000, and 60 percent after 2005."*.

These predictions were input into the Institute of Transportation Engineer's Trip Generation Manual to generate approximate trips for each development. The percent of total generated trips by the developments predicted to use the Southern Connector ranged from 5 to 20 percent. No development was predicted to contribute more than 18 percent of the Southern Connector's first 5 years of revenue. The location of the developments helped to determine the predicted trip length and thus toll revenue.

Predictions for the Southern Connector's first year, fiscal year 1994, were 17.5 million transactions and $25.1 million in gross toll revenue. Vollmer's revenue predictions for the next 17 years are listed in Table B22.

Table B22: Forecasted Transactions (Traffic) and Revenue for the Southern Connector

Fiscal Year	Transactions	Gross Toll Revenue ($)
	(millions)	
1994*	17.5	25.1
1995	20.3	28.4
1996	22.0	31.0
1997	23.3	32.9
1998	25.5	35.9
1999	28.7	40.4
2000	30.3	42.5
2001	30.8	43.3
2002	31.4	44.2
2003	32.4	45.7
2004	33.9	48.0
2005	34.3	48.6
2006	34.7	49.2
2007	35.1	49.9
2008	35.7	50.8
2009	36.7	52.4
2010	36.9	52.8

*Assume opening July 1, 1993

Differences in Historical Trends and Actual Trends

Historical trends were used as the basis for forecasting future trends. The 1990 bond document used average annual employment growth rates and average annual expressway growth in their forecasts. A detailed comparison between the historical trends and the actual trends was provided in the discussion of the 1986 bond document.

Differences in Actual and Forecasted Traffic

This section compares Vollmer's assumptions and the actual rates in forecasting toll usage, and reviews some of the qualitative impacts on the road's traffic volumes.

Orlando Area Assumption Comparison

In the bond document, the only demographic factor forecasted was average annual population growth rates. Even though some of the time periods are the same, the forecasts listed below are not the same as the 1986 Bond Document. The forecasted rates for 1990 to 1995 were higher than the values forecasted in the 1986 Bond Document. For the same time periods, Vollmer predicted growth rates of 1.8 and 2.6 percent for Orange County and the entire region, respectively. Vollmer adjusted their earlier growth rates prior to their 1990 forecast. The forecasted and actual values are listed in Table B23.

Table B23: Forecasted and Actual Average Annual Population Growth Rates[xxxviii]

	Years	Forecast Rate (%)	Actual Rate (%)
Orange County	1990 to 1995	2.6	2.6
	1995 to 2000	1.9	3.0
Entire Region* (4 counties)	1990 to 1995	2.9	4.3
	1995 to 2000	2.2	2.5
* Orange, Brevard, Osceola, and Seminole Counties			

The population growth rates were again different from what was forecasted. All the actual rates are equal to or larger than the forecasted rates. Again, the underestimation of population growth rates could arguable cause an underestimation of traffic and revenue levels.

Traffic and Revenue Projections for Existing System

Vollmer predicted a 4 percent increase in traffic on the existing facilities after the effect of the toll rate increase has balanced out. After implementation of the toll rate increase in 1990, the traffic volumes did see a sudden drop, i.e., 16.2 percent from 1990 to 1991. However, since then the average growth rate for the 1991 to 1995 time period remained constant at about 6.5 percent.

Traffic and Revenue Predictions for the Southern Corridor

Vollmer predicted the distance and time savings for travelers using the toll road, but not the actual time saved. Vollmer also did not provide a time-of-day for their values, and hence their values could not be verified.

Vollmer also predicted different growth rates for airport and non-airport trips (6 and 3 percent respectively). It is impossible, however, to determine origin destination information from the OOCEA transaction data. Thus, the trip purpose cannot be determined, and these growth rates cannot be confirmed. Vollmer predicted an average annual growth rate of 10 percent for the airport. In general, a number of interviews revealed that this airport growth did not materialize.

Vollmer also made projections regarding the timeline of developments. Again, there is no way to confirm their predictions. The percentage of trips generated from all the developments were to range from 5 to 20 percent of the total Southern Connector trips. However, again without origin destination information about the trips there is no way to verify these predictions. The actual traffic and revenue for the Southern Connector is listed in the Table B24 and Figure B24.

Table B24: Comparison between Forecasted and Actual Transactions (Traffic) and Revenue for the Southern Connector [xxxix]

Fiscal Year	Transactions		Revenue ($)	
	Forecasted	Actual	Forecasted	Actual
	(millions)			
1994*	17.5	7.8	25.1	6.9
1995	20.3	11.8	28.4	10.4
1996	22.0	13.0	31.0	11.8
1997	23.3	16.1	32.9	14.8
1998	25.5	18.4	35.9	17.0
1999	28.7	20.5	40.4	18.7
2000	30.3	23.5	42.5	21.5
2001	30.8	25.3	43.3	23.3
2002	31.4	25.5	44.2	23.5
2003	32.4	28.0	45.7	25.6
2004	33.9	30.6	48.0	27.7
2005	34.3	34.1	48.6	30.7
2006	34.7	38.1	49.2	34.0
2007	35.1		49.9	
2008	35.7		50.8	
2009	36.7		52.4	
2010	36.9		52.8	
*Assume opening July 1, 1993				

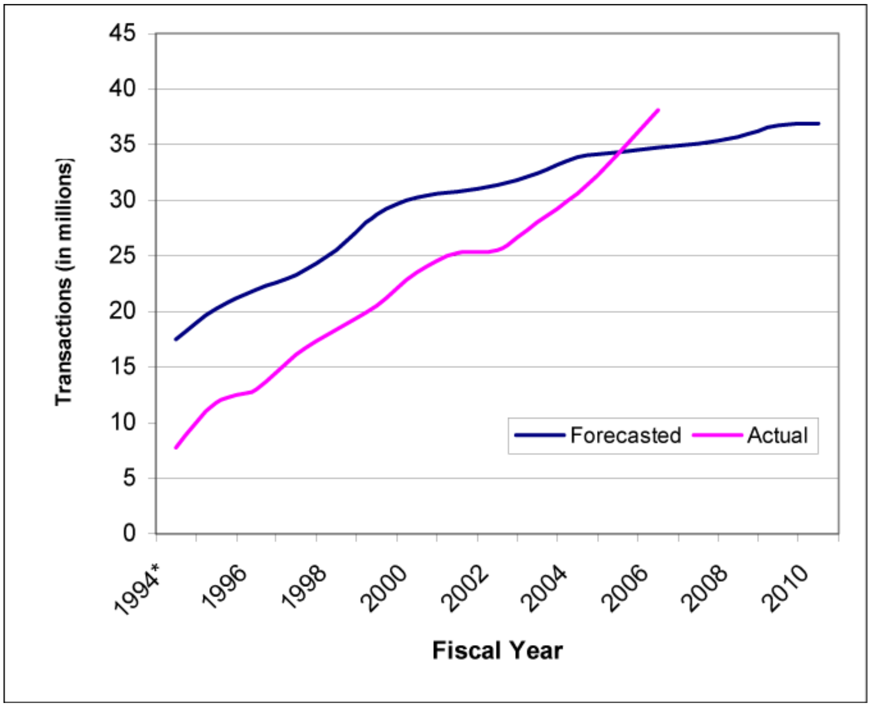

Figure B24: Forecasted and Actual Transactions on the Southern Connector [xl]

Figure B24 shows traffic levels did not meet projections until year 2005. The actual traffic growth rates seem to match the forecasted growth rates for the first 7 years—1994 to 2001—as the slopes of the two lines are similar. The difference seems to come in the initial traffic volumes projected by Vollmer. The difference in first year actual and forecasted transactions was 9.7 million. Transactions were not even half of projections during the first year. Because the traffic forecasts were overestimated, it could be assumed that revenue forecasts would be overestimated. The bond document, however, did not provide annual revenue forecasts. It was assumed that the values were forecasted in real 1990 dollars. An average annual inflation rate of 2 percent was assumed to convert forecasted revenue into nominal dollars. Figure B25 provides the forecasted and actual revenue for the Southern Connector.

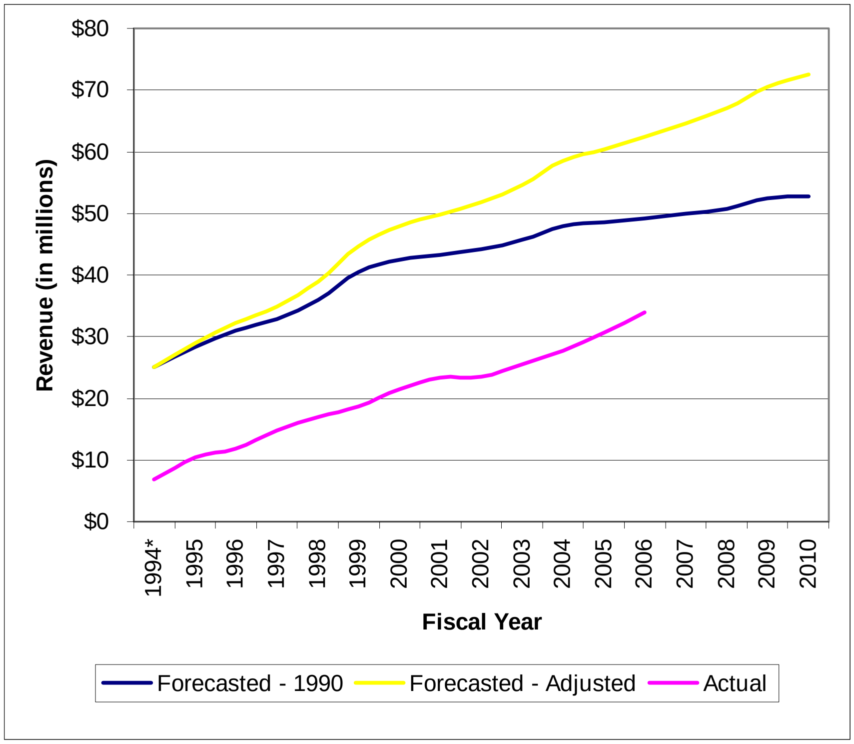

Figure B25: Forecasted and Actual Revenue for the Southern Connector [xli]

Again, the revenue growth rates are similar for the forecasted and actual revenues but the initial starting points differ by $18.2 million. Actual revenue levels have not reached the forecasted levels yet.

Qualitative Factors: Land Use Effect

Land use development can significantly impact toll road usage. A major commercial development, ICP, was planned near the intersection of the Southern Connector and the Bee Line. ICP was predicted to divert traffic from I-4 to the Southern Connector. However, ICP was not constructed and thus those expected trips did not materialize.

The light rail train, which was supposed to run along I-4 to connect the suburbs to the central city, never occurred. The goal of the transit line was to link three major destinations to the suburbs: the Disney theme park, the CBD, and the airport. Originally, there was an additional proposal to build a light rail center near the Southern Connector Extension with a spoke to the airport. The project had been planned and funded at the time of the T&R projections and was therefore considered. However, mainly due to political reasons, the transit line was never constructed and the predicted trips did not occur[xlii].

General Observations and Conclusion

This T&R report was conducted four years after the previous T&R report. Only considering the number of listed assumptions, it is clear that the new report is more detailed than the previous report. The only demographic forecast included was for the annual average population growth rates, which were underestimated. The assumptions specific to the traffic estimates were based on various traffic generators, such as the airport, but the level of detail included in the document prevented the verification of these assumptions. The actual to forecasted traffic ratios are provided in Table B25 and Figure B26.

Table B25: Ratio of Actual to Forecasted Transactions [xliii]

Fiscal Year	Transaction Ratio
1994	0.45
1995	0.58
1996	0.59
1997	0.69
1998	0.72
1999	0.71
2000	0.78
2001	0.82
2002	0.81
2003	0.86
2004	0.90
2005	0.99
2006	1.10

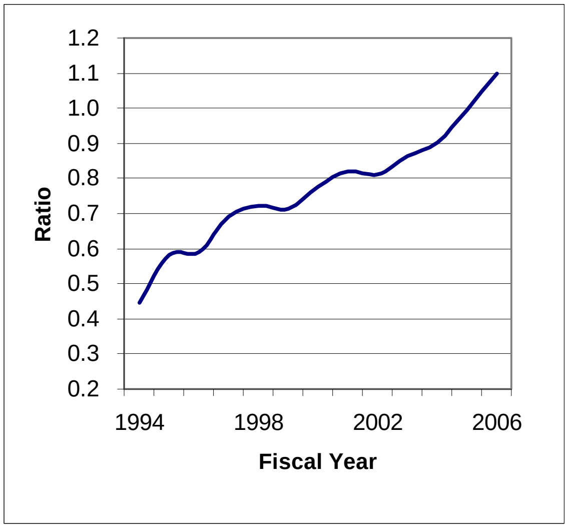

Figure B26: Ratio of Actual to Forecasted Transactions [xliv]

The actual to forecasted nominal revenue ratios are provided in Table B26 and Figure B27.

Table B26: Ratio of Actual to Forecasted Revenue [xlv]

Fiscal Year	Revenue Ratio
1994	0.27
1995	0.36
1996	0.37
1997	0.42
1998	0.44
1999	0.42
2000	0.45
2001	0.47
2002	0.45
2003	0.47
2004	0.47
2005	0.51
2006	0.54

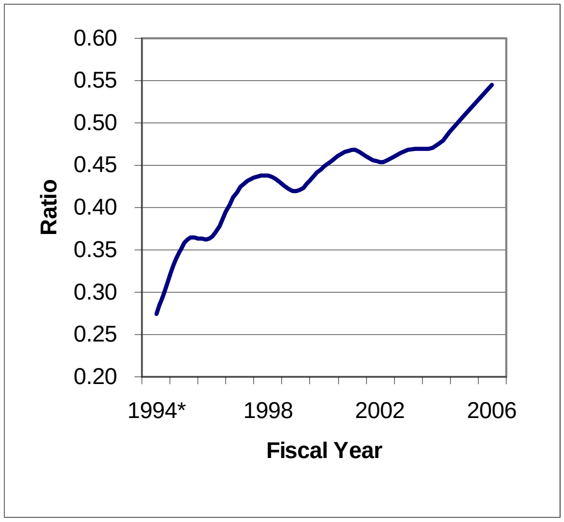

Figure B27: Ratio of Actual to Forecasted Revenue [xlvi]

FTE 1991 Bond Document

Summary of the Projects Included in the FTE 1991A Bond Document[16, xlvii]

The Florida Turnpike sold bonds in 1991 (the 1991A series) to fund Phase 1 of the Seminole Expressway and the preliminary engineering and right-of-way acquisition for the Northwest Hillsborough Expressway. Because the Northwest Hillsborough Expressway is located in Tampa and unrelated to the Eastern Orlando Beltway, this project is not discussed. The location of the Seminole Expressway Phase 1 is highlighted in Figure B28.

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[16] Unless otherwise noted, the information and data in this section are from the 1991a FTE Bond Document.

Figure B28: Seminole Expressway Project Funded by 1991A Bond Document[xlviii]

The Seminole Expressway Phase 1 was designed as a four-lane, twelve-mile limited access highway. The Expressway was to start at U.S. 17-92 in the north and run south connecting with the Eastern Beltway at S.R. 426. The SCEA's 2,000-ft toll road would connect the new Seminole Expressway Phase 1 to the existing OOCEA's Northeastern Beltway.

After the construction of the Seminole Expressway Phase 1, the Florida Turnpike would also take ownership of the SCEA's 2,000-ft section. The missing northern section, from I-4 to U.S. 17-92, was referenced in the document, but URS noted that this section was not funded by this bond series. URS, however, briefly discussed aspects of the 5-mile Northern Phase 2 of the Seminole Expressway. Phase 1 of the Seminole Expressway was scheduled to be completed in February 1994.

The Seminole Expressway Phase 1 segment was to have interchanges at Red Bug Lake Road, S.R. 434, and C.R. 427/Sanford Avenue/Lake Mary Boulevard north of Lake Jessup. This toll segment connects the northern Seminole developments to downtown Orlando and the Orlando International Airport. The route relieves congestion on I-4, U.S. 17-92, and S.R. 436.

The toll collection system was the same system used on the OOCEA's Eastern Beltway. Thus, tolls would be collected at one mainline plaza, located near the Lake

Jessup Bridge, and ramp plazas, including *"southerly ramps at Red Bug Lake Road and S.R. 434 south of the lake."* Also, the S.R. 426/Aloma ramps towards the north end of the existing Eastern Beltway would have continued to be tolled to and from the south. Table B27 lists the proposed tolls for passenger cars at these interchanges. URS suggested the Florida Turnpike office double the tolls by 2009. The average toll rate upon opening would have been 12.5 cents/mile, which was consistent with the OOCEA's Eastern Beltway rates.

Table B27: Opening Toll Rates for Seminole Expressway, Phase 1

Location	Toll ($)
Lake Jessup Mainline Plaza	1.50
Red Bug Lake	0.50
S.R. 434	0.75
S.R. 426/Aloma	0.25

Summary of the Existing Conditions[17, xlix]

The existing conditions included trends in the Orlando area, the local transportation system, and the existing FTE system.

<u>Orlando</u>

URS included in their T&R report historical growth trends for Florida, the Orlando area, and in particular, Seminole County. The historic growth rates for the state of Florida are shown in Table B28.

Table B28: Statewide Historical Growth Rates

	Years	Rate (%)
Average Annual State Employment Growth	1980 to 1990	2.8
Average Annual State Population Growth	1980 to 1990	2.7
Average Annual Growth on the Turnpike System	1980 to 1990	8.1
Motor Vehicle Registration	1980 to 1990	3.5
Growth in Number of Tourists	1980 to 1990	6.2

At the time of this document, a number of residential and non-residential developments were occurring in the Seminole area. Table B29 lists the number and value of planned and under construction projects prepared by the East Central Florida Regional Planning Council (ECFRPC) from 1987 to 1991 in Seminole County and the Orlando area.

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[17] Unless otherwise noted, the information and data in this section are from the 1991a FTE Bond Document.

Table B29: Projects Planned for the Orlando Area from 1987 to 1991

	Non-Residential		Residential	
County	# of Projects	Value ($ mil)	# of Projects	Value ($ mil)
Seminole	16	485	27,100	1,222
Orange	60	6,109	44,000	1,983
Osceola	6	251	10,300	464
Total	82	6,845	81,400	3,669

The majority of the projects in Seminole County are located in the I-4 corridor and in *"the proposed alignment of the Seminole County Expressway."* Also, URS noted the number of non-construction jobs created in the area for the same time period (Table B30).

Table B30: New Non-Construction Jobs from 1987 to 1991

	Non-Construction New Jobs	
County	Projects	New Jobs
Seminole	21	17,729
Orange	85	122,280
Osceola	15	7,701
Total	121	147,710

<u>Local Transportation System</u>

At the time of the bond document, many of Orlando's major roads were operating at capacity. Traffic in Seminole County had been growing *"annually in the range of 3 to 14 percent since 1980."* In preparation for the Seminole Expressway, local roads nearby, including Lake Mary Boulevard, S.R. 434, and Red Bug Lake were being expanded. URS also received the AADT counts from the OOCEA and the County Traffic Engineering Office for areas near the proposed alignment. Figure B29 provides is a map with the traffic count locations. Table B31 lists the average annual traffic growth at these locations from 1980 to 1990.

Figure B29: Traffic Count Locations

Table B31: Average Annual Traffic Growth at Counter Locations

Counter Number	Location	Average Annual Growth from 1980 to 1990 (%)
1	I-4 near S.R. 434 - Lake Mary Blvd.	11.4
2	U.S. 17-92 near S.R. 434 - S.R. 419	3.9
3	S.R. 436 near U.S. 17-92 - C.R. 427	2.8
4	S.R. 434 near Tuscawilla - U.S. 17-92	9.0
5	S.R. 426 near Red Bug - Tuscawilla	13.6
6	S.R. 46 near I-4 - C. R. 15	7.1
	Total	7.4

The high percentages recorded at counters four and five can be partially attributed to the population growth in the Tuscawilla area. The extensive growth in this area has increased traffic on routes to and from the area. This area was considered a major traffic generator for the new Seminole Expressway.

URS also examined toll data from the OOCEA, roadside surveys, and travel time comparisons. The OOCEA provided data for the last north ramp—i.e., the S.R. 426/Aloma ramp—on the existing Eastern Beltway. The traffic counts for this ramp are graphed in Figure B30 and were perhaps the biggest indicator of potential traffic on the Seminole Expressway.

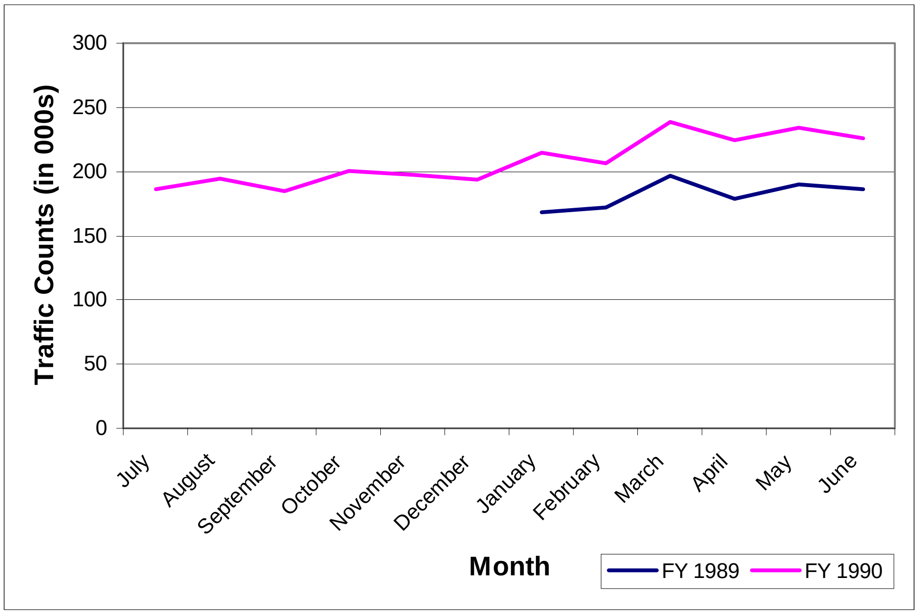

Figure B30: Growth Rates on S.R. 426/Aloma Ramp on Northeastern Beltway

The only year of complete historical traffic transactions was fiscal year 1990. This year had an AADT volume of 6,855, resulting in an average growth of 23 percent in the second half of fiscal year 1990. As Figure B30 shows, the road's traffic did exhibit seasonal variation. The highest traffic volumes were recorded in March, which is consistent with the trends on the OOCEA system.

<u>Toll Transactions on Existing FTE System</u>

URS examined the existing Florida Turnpike system to assess the bonding capacity the system could support. This included a review of historical traffic growth, current traffic, toll rates, and scheduled toll rate increases. At the time of this bond document, the system comprised of:

- the 266-mile Turnpike main line (Miami to Wildwood),
- the 47-mile Homestead Extension (HEFT) in Dade County, and
- the 8-mile western extension of the Orlando Bee Line Expressway.

Also, the Turnpike office was in the process of acquiring the Sawgrass Expressway.

In the early 1960s when the Turnpike main line first opened, the road served the demand for high speed travel between cities. The country was developing its statewide highway system, and the turnpike served as the link between major cities in Florida. The mainline was extended with the opening of the HEFT in 1973/74. The Bee Line was a very different type of facility. The western extension of the Bee Line extended the OOCEA's toll road to provide a connection between I-4, Walt Disney World, and the airport. Table B32 provides the traffic and annual percent increase on the Turnpike's facilities at the time of the bond document.

Table B32: Traffic Transactions on the Existing FTE System

Year	Main Line	HEFT	Bee Line West
	(in millions)		
1978	30.7	17.3	3.6
1979	31.4	17.5	3.8
1980	33	18.4	4
1981	36.2	20.8	4.6
1982	38.1	24.3	4.4
1983	42	28.3	5.7
1984	46.7	33.1	6.9
1985	51.6	37.6	8.1
1986	55.8	45.5	9.2
1987	58.2	50.9	10.6
1988	58.8	53.6	12.2

When comparing transactions on the different toll roads, it has to be kept in mind that these toll roads use different toll collection systems. The Main Line operates on a closed ticket system, which means that each car is only counted once. The HEFT tolls at mainline plazas and ramps, which means each car could be counted various times. The Bee Line West only has one plaza, and thus each car is only counted once. The toll collection system is discussed in more detail in a later section. Figure B31 provides the total FTE system's historical transactions.

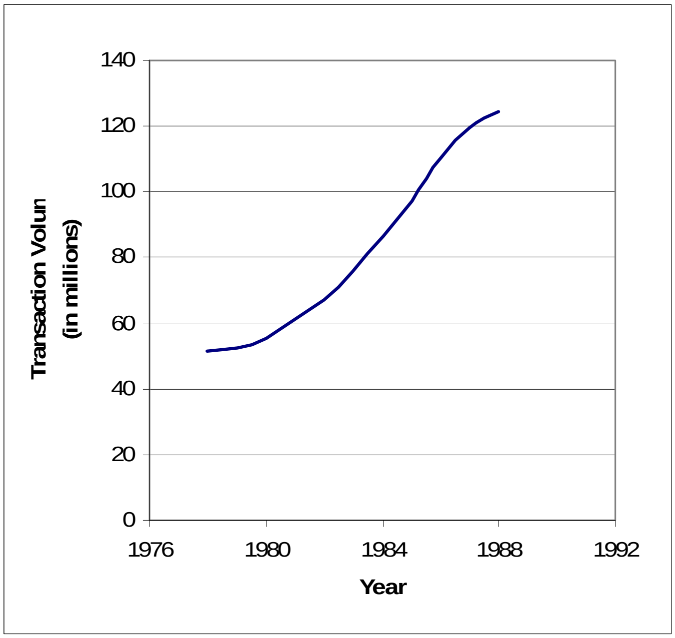

Figure B31: Historical FTE System Transactions

The annual percent increase in transactions between 1977 and 1988 is illustrated in Figure B32.

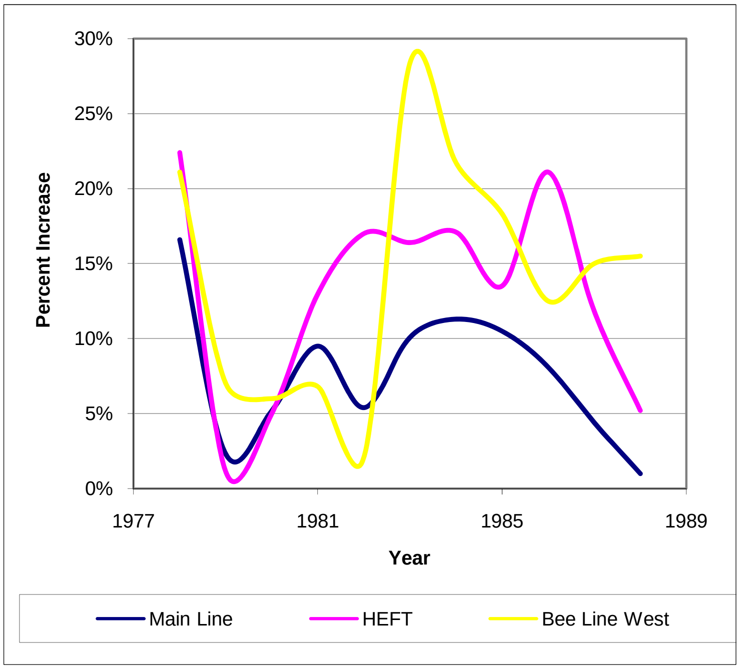

Figure B32: Historical Annual Transaction Percent Increases

All three roads have historically experienced fluctuations in their annual transaction volumes. The percentage increase in transactions has thus ranged from 1.1 to 28.4 percent. T&R consultants normally project an average annual growth rate for the system over a specified time period. To the extent that these average rates, as well as other factors, predict transactions, this variability will complicate a comparison in any given year between forecasted and actual transactions.

The monthly transaction data was also examined for each toll road and is illustrated in Figure B33.

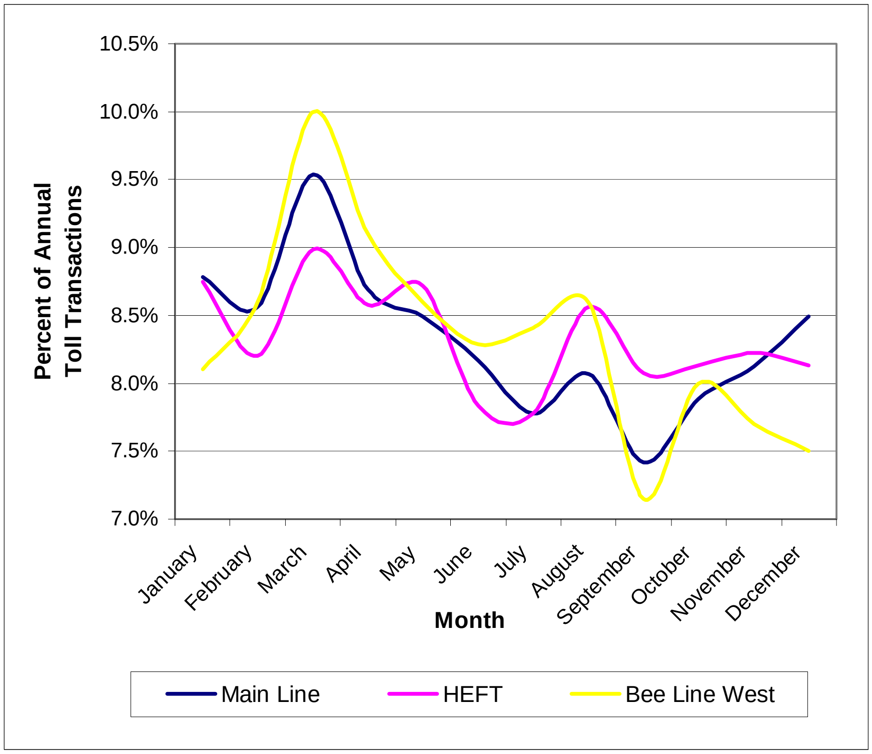

Figure B33: Monthly Transactions on the Existing FTE System

March recorded the highest number of transactions for all roads. URS noted that traffic on the Bee Line exhibited more seasonal variation due to Orlando's dependence on the tourist industry, and the Bee Line providing a connection between the Airport and Disney World. Table B33 shows the axle count profile of the different toll facilities.

Table B33: Vehicle Axle Profile on Existing FTE System

	Main Line		HEFT		Bee Line West	
Axle Count	Transactions (mil)	Percent	Transactions (mil)	Percent	Transactions (mil)	Percent
2 axle	56.50	93.9	47.58	97.2	11.92	97.1
3 axle	0.96	1.6	0.55	1.1	0.14	1.1
4 axle	0.84	1.4	0.32	0.7	0.11	0.9
5 + axle	1.87	3.1	0.47	1.0	0.11	0.9

From the above profiles, it is clear that 2-axle vehicles are overwhelming the majority vehicle type on the Turnpike's facilities. However, more 5+ axle vehicles traverse on the Main Line, because it is an intercity route.

URS conducted a traffic survey of 55,000 individuals in 1988. This survey represented 32 percent of Florida Turnpike's toll-paying traffic. It concluded that trip frequency on the northern section of the Turnpike Main Line (in Orlando) was usually three or less times per week. The exception to this was short distance trips *"between interchanges 244, 254, 259, and 267 where approximately 60 percent of the users traveled four or more days per week."* It also concluded that on the Bee Line West, over half of the trips were made by people who traveled on the road three or less times per week. URS thus concluded that the Bee Line West was more dependent on tourist-oriented trips.

The future toll rate increase schedule and its effect on toll transactions and revenue was examined by URS. At the time of the bond documents, the existing system operated using two different toll collection systems: a closed (ticket) system and an open system. The facilities with their average toll rates and toll collection type are listed in Table B34.

Table B34: Current Toll Rates on the Existing FTE System

System Type		Average Toll Rate (1989)
Closed Ticket System		
	Main Line between Lantana and Wildwood	4 cents/mile
Open System		
	Main Line between Miami and Lantana	unknown

<u>Toll Revenue on Existing FTE System</u>

URS conducted a review of the revenue collected. This is particularly important because the roads operated on different toll collection systems and the number of transactions can thus be misleading. Again, the analysis was done by road, year, and average toll paid by the customer. In 1988, the Main Line generated 81.5 percent of the total system revenue, while HEFT and the Bee Line West generated 15.3 and 3.2 percent, respectively. Also, the Florida Turnpike office receives funds from its various concessions. In the report, these concessions were categorized and analyzed in more detail.

Summary of the Projected Traffic and Revenue[18, l]

URS forecasted T&R on the existing expressway system and the new Seminole Expressway based on the above assessment of the Orlando area, the local transportation system, the existing system, and the project description.

[18] Unless otherwise noted, the information and data in this section are from the 1991A FTE Bond Document.

Orlando

URS predicted that the Orlando area will continue to see growth in the next few decades as listed in Table B35.

Table B35: Forecasted Average Annual Population Growth Rates[li]

	Years	Average Annual Population Growth Rate (%)
Orange, Seminole, and Osceola County	1990 to 1995	2.5
	1995 to 2000	2.1
	2000 to 2005	1.6
	2005 to 2010	1.3

In particular, URS predicted a higher growth rate for the 1990 to 2000 period than for the 2000 to 2010 period.

Projections for the Existing FTE System

T&R on the existing system was projected for the next 10 years (i.e., 1991 to 2000) on a yearly basis. URS considered the factors discussed in the previous Orlando section and other factors that could affect traffic volumes negatively or positively. The other factors and their predicted affect are provided in Table B36.

Table B36: Factors Affecting Traffic Levels on the Existing FTE System

Factor	Affect on Traffic
Intercity Travel Time Comparisons	Increase
Impact of I-95 Completion	Decrease
Turnpike Improvements	Increase
High Speed Rail	Little impact
Air Travel Competition	Little impact
Planned Toll Increase	Decrease
Fuel Availability & Pricing	Little impact

Although the planned toll increase will decrease traffic, overall it was argued that revenue would increase. Also, fuel availability and pricing was considered because of the effects of the Kuwait War. The diversion rates resulting from these factors for each facility were individually considered.

Traffic Projections for the Seminole Expressway, Phase 1

The roadside surveys conducted in 1989 during the months of January and February were one of the main sources for predicting future traffic on the road. The 12-point survey resulted in 15,000 interviews with "*data on vehicle classification, origin-destination, trip frequency, trip purpose, and vehicle occupancy.*" The traffic survey locations were at historical traffic count locations. Thus, URS had historical AADT counts and survey information for these locations (Table B37).

Table B37: Location of Historical AADT Data

I-4 ramps (north) at S.R. 434	U.S. 17-92 at Lake Jessup
I-4 ramps (south) at S.R. 434	U.S. 17-92 at Seminole-Orange line
I-4 ramps (norht) at S.R. 436	S.R. 434 at Dalton
I-4 ramps (south) at S.R. 436	S.R. 46 at I-4
Lake Mary Boulevard at I-4	Dean Road
Seminole Expressway at S.R. 426	

This survey sampled 16 percent of the actual traffic in the area. From this survey, URS noted that 94 percent of the trips were made by passenger cars. Of the passenger car trips, 47 percent were made five or more times a week and 70 percent had a work-related purpose. Thus, at the time of the bond document, the area had a large amount of commuter traffic. It was anticipated that some of this traffic would divert to the Seminole Expressway upon the road's opening.

From the historical AADT counts, URS estimated the 1990 AADT volume using a 7.4 percent average annual growth rate. The 7.4 percent rate is the historical average growth rate from URS's earlier analysis of the historical Seminole County AADT growth rates (discussed in the Summary of the Existing Conditions: Local Transportation System section). Next, URS used the survey data to predict a diversion rate for the Seminole Expressway. The diversion rate was then applied to actual 1989 traffic volumes. Thus, URS predicted the traffic volume that the Seminole Expressway would have generated if it had been open in 1989 (Table B38).

Table B38: Diversion Rates for Seminole Expressway, Phase 1

	1989 AADT	% of Total	% of Potential
Total Survey Traffic	236,700	100.0	
Potential Traffic	65,100	27.5	100.0
Diverted Traffic	20,269	8.6	31.1

URS predicted that of the potential trips, 31.1 percent would use the Seminole Expressway. URS noted that based on their experience, most facilities generated trips just by existing. The amount of these trips can vary from 1 to 100 percent of the diverted trips (here 20,269 trips). URS used Lake Jessup as the dividing point and calculated two trip generation factors. For trips south of Lake Jessup (both origin and destination), a 10 percent trip generation factor was applied. For trips north of Lake Jessup (again both origin and destination), a 20 percent factor was applied. After applying the two factors that were based on the survey, URS added 7,609 induced trips. The total traffic thus amounted to 27,878 trips of which 20,269 were diverted trips.

Next, the predicted 27,878 trips for 1989 were split by ramp based on the origin destination survey information. This information was the starting point for URS's traffic forecast. URS predicted the traffic for the Seminole Expressway toll collection locations for 1995 and 2000. These predictions are provided in Table B39.

Table B39: Forecasted Traffic for the Seminole Expressway, Phase 1

	AADT		
	1989*	1995	2000
S.R. 426/Aloma Ramps	4,651	7,783	8,828
Red Bug Lake Road Ramps	8,515	18,793	21,977
S.R. 434 Ramps	3,545	4,994	5,595
Lake Jessup Barrier	11,167	14,952	17,354
Total	27,878	46,522	53,754
* If road had opened in 1989			

From these traffic projections, revenue projections were also generated in 5-year increments. Truck factors were applied to each ramp. These factors are different for each ramp, but the document provides little insight into how the truck factors were developed. The truck factors and projected revenues are provided in Table B40.

Table B40: Initial Projected Revenue for the Seminole Expressway Phase 1

	Truck Factor	Projected Toll Revenue ($ mil)*	
		1995	2000
S.R. 426/Aloma Ramps	1.12	0.79	0.90
Red Bug Lake Road Ramps	1.05	3.59	4.20
S.R. 434 Ramps	1.02	1.39	1.56
Lake Jessup Barrier	1.04	8.49	9.85
Total		14.26	16.51
* AADT * 365 * passenger car toll * truck factor			

URS used these predictions and interpolation to predict the toll revenue for the first 7 years of operation, assuming that the tolls remained constant. URS also considered the effect of a planned toll increase in 1999. The main plaza passenger car toll would increase from $1.50 to $2.00, while ramp tolls would also increase. This increase would double the tolls for passenger cars, as well as proportionally increase truck toll rates on the facility. The toll rate increase was predicted to decrease traffic by 5 to 15 percent but increase revenues from 27 to 70 percent in that year. The predicted toll revenue resulting from the toll rate increase is provided in Table B41.

Table B41: Final Revenue Forecast for Seminole Expressway Phase 1 with Toll Increases

Fiscal Year	Constant Tolls	Scheduled Increases
1994*	$5.97	$5.97
1995	$14.27	$14.27
1996	$14.72	$14.72
1997	$15.17	$15.17
1998	$15.62	$15.62
1999	$16.07	$20.35
2000	$16.52	$20.92
* from February to June		

Differences in Historical Trends and Actual Trends

URS stated that one of their assumptions is that historical demographic and transportation trends will continue into the future. The following section compares the historical trend of these factors at the time of the bond documents with the trends that materialized since then.

<u>Demographic Trends</u>

The report first reviewed statewide trends. These trends were for:

- average annual employment growth,
- average annual motor vehicle registration growth, and
- average annual growth in the number of tourists.

Figure B34 shows the value for the time period 1980 to 1990 that was provided in the bond document.

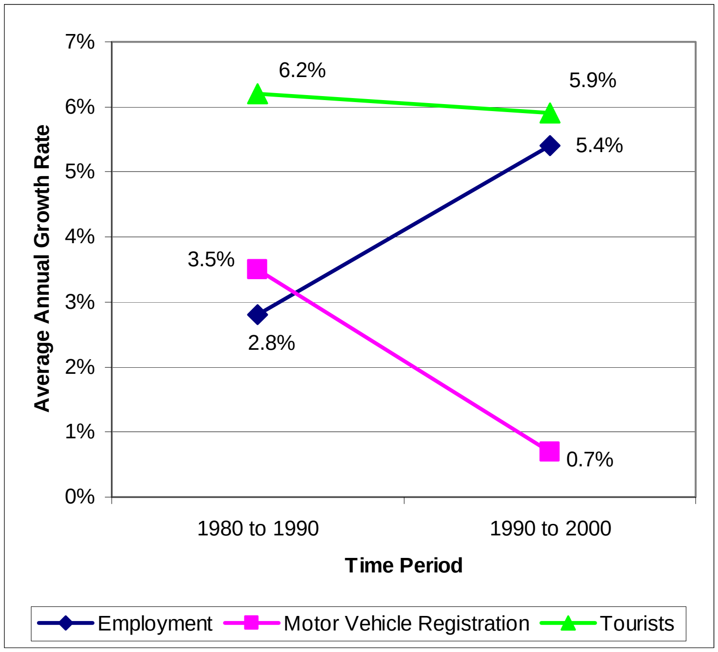

Figure B34: Historical Average Annual Growth Rates[lii], [liii], [liv]

As the Figure illustrates, employment has been growing at a higher rate than projected. The motor vehicle registration growth rates have been decreasing significantly and the average annual growth rate for tourists have remained more-or-less constant.

<u>Existing System Growth Trends</u>

The historical growth rate for the FTE Expressway System—composed of the Mainline, HEFT, and Bee Line West Expressways—was discussed in the Existing Conditions of the Expressway System section. Figure B35 illustrates the annual percent increases in the transactions on the existing system.

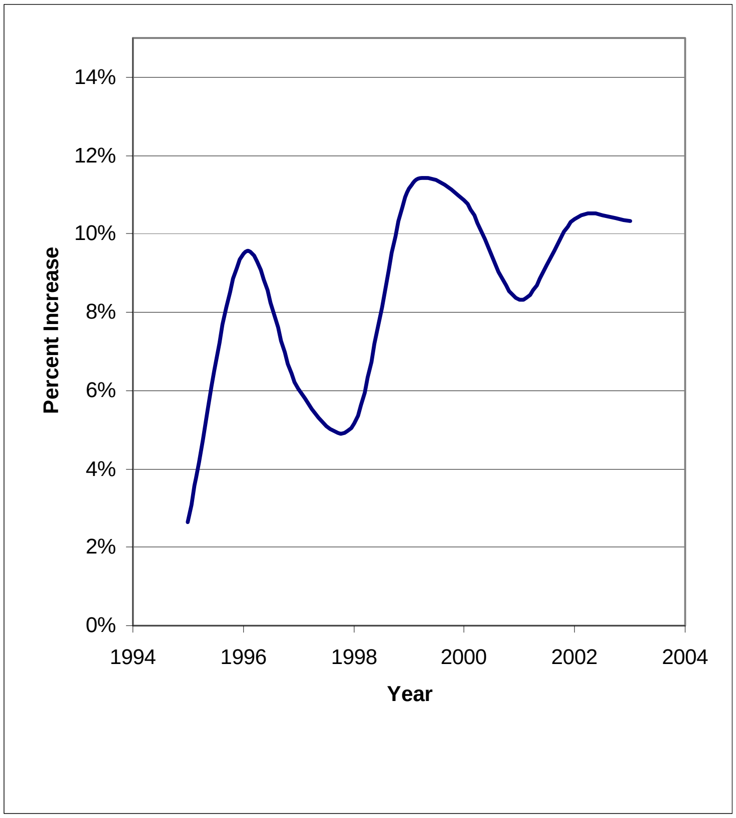

Figure B35: Annual Percent Transaction Increases on Expressway System[lv]

Two years of low percent transaction increases can be seen, but the reasons for these are not clear.

Differences in Actual and Forecasted Traffic

Vollmer's assumptions in forecasting toll road usage compared with the actual rates and the qualitative factors that impacted the road's traffic volumes are highlighted in this section.

<u>Orlando Area Assumption Comparison</u>

Again, the only demographic forecast was the population growth estimates. The forecasted and actual average annual growth rates are provided in Table B42.

Table B42: Forecasted and Actual Average Annual Population Growth Rates[lvi]

Years	Forecast Rate* (%)	Actual Rate (%)
1990 to 1995	2.5	2.8
1995 to 2000	2.1	2.9
2000 to 2005	1.6	2.9
2005 to 2010	1.3	-
*Orange, Seminole, and Osceola Counties		

The rates for the first two five-year periods were similar to the actual growth rates, although slightly lower. The 2000 to 2005 forecasted rate was much lower than the actual growth rate. The underestimation of population growth rates could arguable lower the forecasted traffic levels.

Projections for Existing System

URS forecasted the impact of various factors on traffic on the existing system. These impacts—positive or negative—could only be analyzed qualitatively. Unfortunately, there is no way to verify these assumptions.

Traffic and Revenue Predictions for the Seminole Expressway, Phase 1

URS started their projections using predictions for the road had it been open in 1989. These values cannot be verified. Thus, the diverted traffic can also not be confirmed. Also, URS applied trip generation factors (for south of Lake Jessup and north of Lake Jessup). These factors cannot be verified as it is impossible to determine which trips were simply generated by the road and which existed before.

AADT was predicted and converted to ramp and plaza counts. In this analysis, these counts have been totaled and multiplied by 365 to get annual volumes. This seems appropriate because URS noted that revenue was calculated by multiplying the AADT by 365 and then by the passenger toll rate and the truck factor. This suggests that annual volumes are simply AADT multiplied by 365. Also, it was assumed that because the road has one mainline plaza, each car counts as one transaction. This is consistent with the OOCEA's system (which the Seminole Expressway replicated). The forecasted and actual annual transactions are in Table B43.

Table B43: Forecasted and Actual Traffic on Seminole Expressway, Phase 1[lvii]

	Transactions	
Year	Forecasted	Actual
	(in millions)	
1995	17.0	9.6
2000	19.6	17.4

URS provided forecasts for only two years. The 1995 forecast is very low, but the 2000 forecast is closer to actual traffic. The revenue forecast was for a longer time period, which allowed for more detailed analysis. The forecasted and actual revenue values are listed in Table B44 and Figure B36. Again, the revenue was assumed to be forecasted in real or constant 1991 dollars. Hence, an inflation rate of 2 percent was assumed to convert the values in nominal or actual year dollars.

Table B44: Actual and Forecasted Revenue for the Seminole Expressway: Phase 1[lviii]

Fiscal Year	Revenue		
	Forecasted	Forecasted (adjusted to nominal year values)	Actual
	($ millions)		
1995	14.3	15.4	6.5
1996	14.7	16.2	8.5
1997	15.2	17.1	10.7
1998	15.6	17.9	12.2
1999	20.4	23.8	14.3
2000	20.9	25.0	16.0

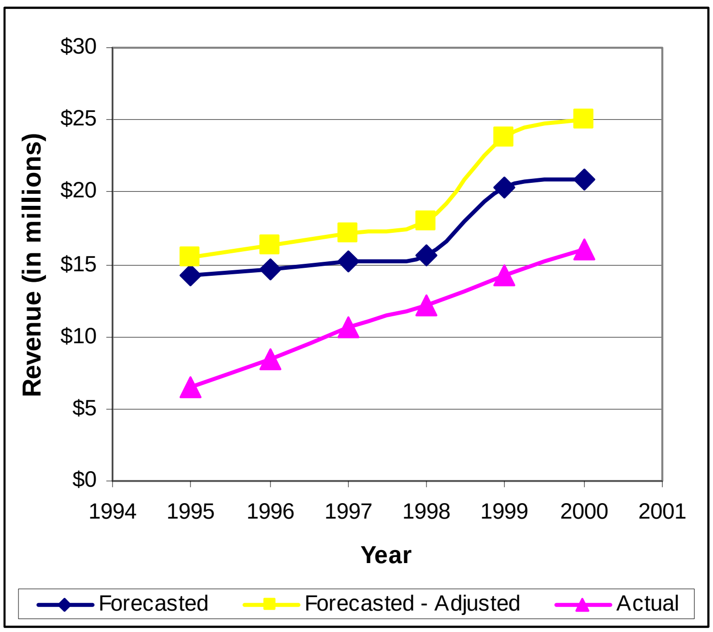

Figure B36: Actual and Forecasted Revenue for the Seminole Expressway: Phase 1[lix]

Qualitative Factors: Land Use Effect and Peaking Characteristics

In a meeting with the URS consultant for the FTE, the possible reasons as to why forecasts were higher than actual values were discussed. The URS consultants identified two key inputs: land use lag and peaking characteristics of the road. The predicted land use did not occur as planned, and the land use that did occur was often later than originally expected. Some developers will wait until the road was open, and then build their projects. This is called a “land use lag” in the T&R industry.

Also, the peaking characteristics of the road were not considered. The peaking characteristic is the difference in the traffic patterns between a weekday versus a weekend. There are usually fewer passenger cars on the weekend and diversion rates tend to be different during the different time periods. If a reasonable alternative is offered, a person might choose to use this option during less congested time periods, such as the off peak, night, and weekend times[lx]. The trucking sector also has different travel patterns compared to passenger cars that were not considered adequately.

General Observations and Conclusion

The level of T&R complexity has changed dramatically since this T&R document was produced so that few conclusions should be drawn from these results.

The ratio of actual to forecasted revenue is provided in Table B45 and Figure B37. The forecasted revenue reflects nominal or actual year dollars.

Table B45: Ratio of Actual to Forecasted Revenue[lxi]

Fiscal Year	Ratio
1995	0.42
1996	0.52
1997	0.63
1998	0.68
1999	0.60
2000	0.64

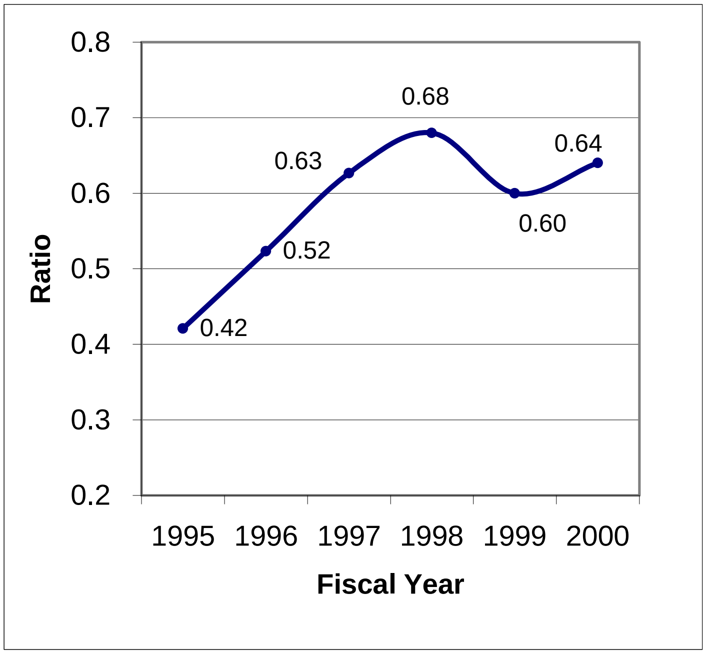

Figure B37: Ratio of Actual to Forecasted Revenue[lxii]

The Figure shows that the revenues for the third segment of the Eastern Beltway also did not meet projections.

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[xlii] Interview with previous Orlando Orange County Expressway Authority individuals. January 2007.
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Appendix C: Toronto's Toll Road

This appendix summarizes the initial feasibility and history of Toronto's toll road, the T&R report reviewed, and the bond document issued for the Highway 407 toll road.

Initial Feasibility and Historical Perspective[1, i]

During the 1950s, Highway 401 opened in Toronto. The highway was conceived as an outer bypass around—and almost as a border for—the city of Toronto. However, the road spurred such growth and instead Highway 401 became an inner congested beltway. Planning began for a new outer beltway that would eventually result in the construction of Highway 407 (see Figure C1).

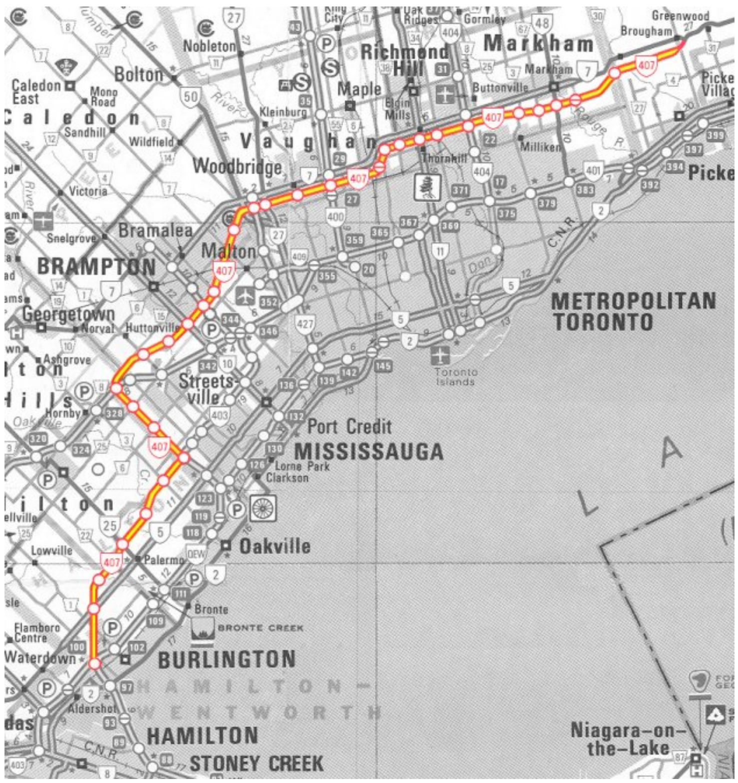


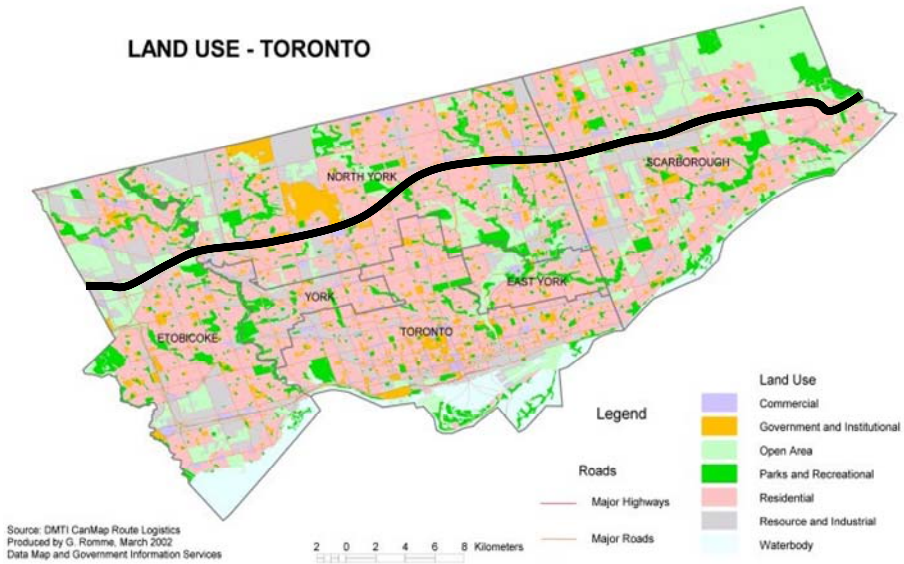
Figure C1: Current Toronto Transportation Network[ii]

In 1967, Toronto officials reserved a corridor of land for infrastructure, such as highways and transit lines, utility lines, and parks in an effort to avoid future escalations in right-of-way costs. These officials also obtained environmental clearance for future infrastructure projects in the corridor from the Environmental Assessment Act. The corridor or greenbelt was called the Parkway Belt West. With planning for an alternative outer beltway thus begun, the only logical location for the highway was the reserved Parkway Belt West.

The actual design of Highway 407 was initiated in the 1970s and early 1980s. Given the tremendous growth around the Highway 401 corridor—with rural lands changing to suburbia

1 Unless otherwise noted, the information and figures in this section are from Mylvaganam and Borins (2004).

almost overnight—the design of Highway 407 was undertaken as the congestion on Highway 401 worsened. Figures C2 and C3 illustrate the land use in the Highway 401 corridor in 2002.



Note: Highway 401 in black

Figure C2: 2002 Land Use in Toronto[iii]

Note: Highway 407 in blue; Highway 401 in black

Figure C3: 2002 Land Use in the GTA[iv]

The Figures illustrate the residential developments north of the corridor. Commercial users[2] on Highway 401, who anticipated using the road for just-in-time deliveries, had to share this new "bypass" with daily commuters. In 1980 a Ministry of Transportation Ontario (MTO) study calculated the cost of congestion to the commercial sector in Toronto at $2 billion a year. Congestion relief was needed on Highway 401, but there was no funding for Highway 407. A temporary solution was the addition of three lanes in both directions to Highway 401 in 1980s.

Political parties in Ontario, lobbied by commercial interests to address congestion levels, realized the potential of elevating congestion relief as a key campaign issue. In 1987, the then current government struck ground on the first part of Highway 407—conveniently, right before the provincial election—in an effort to prove that actions were more meaningful than campaign promises. The incumbent Liberal party won the election, partly because of this issue. However, after the pressure from the election was relieved, construction on Highway 407 was again deferred because of a lack of funding. The only structure completed was the interchange between Highways 407 and 400 at a cost of approximately $50 million.

In the 1980s, government project funding was allocated on an annual basis, which meant that projects might have received funding for one year but there was no guarantee that funding would be available the following year. This resulted in most projects being small in scope. Each year, multiple small-scope projects went up for bid. The bidding process was based solely on

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2 The automotive sector used Highway 401 to reach other automotive plants in Oshawa to the east and Windsor and Detroit to the west. Approximately 25 percent of the U.S.-sold motor vehicles are assembled in Ontario.

price, which meant the lowest bidder got the project. Given this funding and bidding method, it was anticipated that Highway 407 would not be fully constructed until 2020. Funding allocations and the bidding process remained unchanged until 1990 when the New Democrats Party (NDP) took office and began reforms.

Party leader Bob Rae and the NDP felt that government was inefficient and that transportation funding allocation proved a key example of that inefficiency. The Rae government began to issue larger projects and allowed the private sector to have a more active role, for example by allocating design build contracts. The Rae government also wanted to provide Ontario's larger transportation firms with the opportunity to work on larger scale projects. A recession in the early 1990s resulted in large government-funded infrastructure projects that the Rae government felt would boost Toronto's economy and promote the experience of transportation firms.

The MTO discussed tolling briefly, but the staff felt that tolls were unlikely to receive the political support needed for implementation. The Rae government insisted that MTO conduct a survey to determine the area's receptiveness to tolling, as tolls had not existed in Ontario since the 1920s. Surprisingly, the public had an overwhelmingly positive response to tolling provided that the facility could be built faster and that the collected tolls would support only that project. The MTO officials remained concerned about the ability of tolls to cover the cost of the entire new highway, but the Rae government wanted to move forward.[3] Highway 407 was selected as the first tolled project in Toronto.

Highway 407 supported many aspects of the Rae government's ideology: a larger project scope, non-traditional funding (i.e., private funds, tolls), and a fast construction schedule. The Rae government also sought to separate politicians from the private bidding process. Thus, when the Rae government announced its intent to involve the private sector in the construction and possible financing of Highway 407, a non-politician—i.e., George Davies—was appointed to handle the bidding process. As a newly appointed Deputy Minister, George Davies assembled an inter-ministerial committee to guide the project. Besides the MTO, the committee consisted of the Deputy Minister of Finance, Consumer Affairs, and the Ministry of Economic Development and Trade (MEDT). The committee hired Wilbur Smith and Associates (WSA), IBI Consultants, Goldman Sachs, CIBC Wood Gundy, and Price Waterhouse as consultants. The committee also reached out to key stakeholders in the area, such as the Ontario Trucking Sector, the Canadian Automobile Association, the Chamber of Commerce, local elected officials, and environmental groups. Although the road had environmental clearance, the committee was concerned that environmental activists could dissuade the private sector from participating. This fear was unfounded as the environmentalists felt that congestion on Highway 401 was environmentally more degrading than the impacts caused by the construction of a new highway.

WSA was contracted by the government to conduct a T&R report that was used in the bidding process. A key input into their T&R process was the Transportation Tomorrow Survey, which is conducted every five years to gather information on origin-destination, demographic, and trip purpose in the greater Toronto area. WSA and IBI Consultants also conducted interactive surveys at office buildings and shopping centers in the corridor to gather additional information on various trip and behavioral responses, such as:

- current route to work,
- use of Highway 407 given approximate time savings,
- willingness-to-pay, and

[3] Some MTO staff predicted that tolls on Highway 407 would only cover 30 percent of the total cost.

- use of an ETC tag? [v]

WSA also approached the stakeholder group previously contracted by the MTO to determine willingness-to-pay tolls by different sectors. WSA then used the MTO forecasting model to generate an approximate estimate for usage of the central 40 kilometer (km) section of Highway 407.[vi]

A major challenge was devising an electronic toll collection (ETC) system that could accommodate infrequent users of the toll highway. The government felt strongly that the road would not be successful unless cash pay and toll plazas were eliminated, thus allowing free-flow speeds on the entire highway. This type of toll collection (i.e., ETC only) had never been used before, introducing a high degree of uncertainty about the actual collection of these electronic toll payments.[vii] However, a forecast was finalized and provided to all potential bidders. The government was confident about the projections of WSA.

Legislation was passed that stated that the tolls must be removed from any road after the road's debt was paid and that only roads with a viable free alternative could be tolled. Two private groups qualified and participated in the bidding process: the Ontario Road Development Corporation (ORDC) and the Canadian Highways International Corporation (CHIC). ORDC was considered the frontrunner by many, including themselves. Bids were due by December 13, 1993. The bidders submitted their bids in which they addressed the construction of the road, the electronic tolling system, and the funding of the road. The government reserved the right to select the most appealing components of each bid. The available information concerning the two bids is summarized in Table C1.

Table C1: 1993 Bidding Process[viii]

ORDC	CHIC
Asphalt Roadway 4 Lanes ETC and LPR Govern. Debt Assuance (unspecified amount)	Concrete Roadway 6 Lanes ETC and Cash Govern. Debt Assuance (unspecified amount)

As can be seen from Table C1, the two bids were fairly different. The bids reflected the groups' ties to the asphalt industry and concrete industry, respectively. Also, CHIC felt that the WSA forecast was conservative and proposed to build a six-lane road. ORDC was more risk averse and proposed to build only four lanes initially with the option to expand to six lanes at a later date.

The government was particularly disappointed in the financial aspects of the two bids. Both bidders wanted the government to guarantee the debt—i.e., take on the risk—but not share in the revenue. However, the government's borrowing rate was much lower than the private sectors', leading to the decision that the government would finance the road. The government selected the CHIC consortium's road design and the tolling system from the ORDC consortium. The ORDC's tolling system firms were Bell Canada/Bell Sygma/Hughes. The toll system firms entered into a separate agreement with the government to provide the ETC system. Upon announcing CHIC as the preferred bidder, ORDC was shocked that although they were the first private bidder to express interest—and even wanted to circumvent the bidding process—they were not awarded the contract.

The central 43-mile (69-km) section of the road was constructed over the next three and a half years. The road's operations were overseen by the Crown Corporation: Ontario Transportation Capital Corporation (OTCC) and delivered by CHIC. In addition, the approximately 40-person OTCC oversaw the design and construction process (handled by CHIC) and reported to the Transportation Minister through an independent Board of Directors. A major issue was whether OTCC should issue its own debt. The Ministry of Finance felt strongly that allowing OTCC to issue its own debt was a threat to the Ministry's power. However, ultimately it was decided that the OTCC has the right to issue its own debt. This allowed the OTCC to function without political interference—exactly how the Rae government wanted. The road was constructed at a cost of $929.6 million and the toll collection system cost $80 million. Though most of the right-of-way had been reserved previously, an additional $30 million was spent on right-of-way acquisition.

The road's opening was, however, delayed. One reason was that the local police had raised some concerns about the safety of this privately designed road. The design met code, but historically the MTO had over-designed roads so the police felt that the safety measures on this road were inadequate. Adjustments were made to address these concerns, including surrounding the median light poles with crash barriers and installing rumble strips. However, the main reason the opening of the road was delayed was because of concerns about the ETC system. The intention was to use video imaging of license plates to charge non-transponder users and there was some issues concerning matching license plates to an entry and exit point. The central 37km section ultimately opened in June 1997 as a non-tolled road. The road operated toll free until October 1997. These four non-tolled months ultimately served as an unplanned marketing promotion for the road. Traffic reached over 300,000 vehicles/day. These volumes were so high that the government and the toll collection manufacturer were concerned that the computers would overload, losing all the video images. Finally, after adding computer memory, the toll collection system was implemented. The first weeks of tolling saw traffic volumes of 100,000 vehicles/day and a 50 percent transponder penetration rate. Figure C4 illustrates the opening dates of the various segments of Highway 407. Only segments one to four, comprising the central section, were opened by the OTCC. The extensions—i.e., segments 5 and 6—were constructed and opened by a private "owner" at a later date.

Figure C4: Road Section Opening Dates

The 43-mile (69-km) central section cost $1 billion to build and by February 1999 handled over 200,000 vehicles/day..

The Rae government's decision to fund Highway 407 through a Crown corporation, instead of the private sector, resulted in controversy between the government and the opposition political parties along with the rejected bidder, ORDC. ORDC claimed that lobbying resulted in the selection of CHIC. ORDC claimed that because CHIC had signed a labor contract with construction unions (that also contributed to the NDP), the NDP chose CHIC. The Conservatives and Liberals thus accused the NDP government of favoritism. They demanded that all the bidding documents be publicized. The Rae government, however, had been exceptionally careful to avoid the tainting of the bidding process with politics and scandal. The bid decision was made by the board mentioned earlier. In fact, the Minister of Transport had no knowledge of the details of the two bids. This controversy became a significant issue in the next election.

In March 1995, bids for the extension of Highway 407 to the east and west were sought. Only four months later, the governing political party changed, and with that the plans for the Highway 407 extensions changed.

The election of June 1995 resulted in the Conservatives led by Mike Harris coming into power. The Harris government suspended the bidding for the two extensions, and construction was stalled until late 1996. During their campaign, the Conservatives mentioned that corrupt methods were used in the 1994 bidding process, but upon examining the documents after their victory they determined that the Rae government acted ethically. The Rae government was initially elected on the ideology of reducing government costs through improved efficiency. The Harris government won on a similar platform, announcing plans to privatize large inefficient government bureaucracies.

By 1998, little progress was made in terms of privatizing the Highway 407 extensions, or any other government bureaucracies for that matter. A few assets had been sold but by no means to the extent that the campaign had promised. In addition, there was a large deficit. Not until February 1998—16 months before the next election—was the idea of selling the OTCC and the right to build the extensions an option. Notably, when the idea was first suggested some politicians expressed concern that tolls would rise. The Minister for Privatization and the Minister of Transportation both stated that tolls would decrease if the road was privatized, because the new owner would want to encourage usage. The government subsequently introduced and passed legislation to allow the sale of the Crown Corporation: OTCC.

WSA, Price Waterhouse's successor PricewaterhouseCoopers, Parsons Brinkerhoff, Dillon Consulting, and KPMG were hired as the government's advisors. Leaders in the Harris government were active in the bidding process as opposed to the Rae government who insulated themselves from the bidding process. Qualifying bids were due by late November 1998.

WSA updated their 1996 T&R report for the 1998 private bidding process. Their update was provided to all the bidders and allowed the government to have a benchmark of what the potential value of their asset was. Most of the bidding firms hired their own T&R consultants to do a peer review of the WSA report. Thus, most bidders had at least two T&R estimates in preparing their bids: the WSA forecast and their own T&R consultant's forecast. Four bidders participated in the process. The members of the different consortiums and their financial backers are listed in Table C2.

Table C2: 1998 Bidding Consortiums

	ORDC	CHIC	407 International Corporation	Woodbridge Company
Team Members	Grupo Dragados	Canadian Highways Management Corporation (CHMC) (a subsidy of CHIC)	Cintra (subsidy of Ferrovial) SNC-Lavalin	Peter Kiewit Sons Warran Paving
Financial Partners	Infrastructure Trust of Australia (predecessor of Macquaire Infrastructure Group Borealis Infrastructure Management	Newcourt Credit CIBC	Capital D'Amerique CDPQ	Goldman Sachs TD Bank

The four bidders had to provide indicative bids in the first part of the bidding process. The bids were due in early February, and listed the price the consortium was willing to pay for a 50-, 99-, and 199-year lease, respectively. These bids were nonbinding and only served a political purpose. In accordance with the ideology of the Harris government, the Minister of Privatization felt that the private sector could operate the toll road more efficiently than the public sector, even if the public sector is a Crown Corporation. The Minister of Privatization supported a long lease, but other members of the deciding committee desired a 35-year period. The actual lease length was decided by the indicative bids. The bidders provided higher values the longer the lease in their indicative bids, knowing very well that their actual bids might value the longer leases at lower values than the indicative bids. The length of the lease was decided at 99 years.

The final bids were due March 28. This was an extremely short schedule. The bidders had to present four bids. All the bids included the Western Extension, but the length of the

Eastern Extension varied in the four bids. Since most Eastern sections had not received environmental clearance, the government predicted that the inclusion of these sections would reduce the total price. Near the end of the process, CHIC's financial backers, which included CIBC, Newcourt, Cheung Kong, and others, were unable to assemble sufficient equity for a credible bid. The builder of the Central section and apparent frontrunner was thus out of the running. Table C3 provides bid data for Options 1 and 4.

Table C3: Consortiums Bids for Options 1 and 4

	Ministry of Finance Predictions	ORDC	407 International Corp.	Woodbridge Company
	(in billions of Canadian dollars)			
Option 1	$2.50	$2.40	$2.80	$2.805
Option 4	$1.00	around $1.4	unknown	$2.830

The highest bid was received from Woodbridge Company for Option 4. This bid would have completed the entire 407 in the fastest possible time. The other alternative was to select Option 1 and have the two highest bidders re-bid that option. As mentioned earlier, the government was facing a large debt and an election was approaching. The government was thus interested in the highest bid and the completion of the full beltway did not seem to be a priority. The two bidders—407 International Corp. and Woodbridge Company—presented their second bids 6 days later on April 12, 1999. 407 International's bid of $3.107 billion was the highest. The contract was signed on May 5, 1999, just one month before the elections.[ix] Given a balanced budget, the incumbent was reelected.

407 International acquired all the shares in the OTCC and the turnover of the road occurred without any incident. 407 International purchased a 99-year lease for the Central 69km section and the two yet to be constructed extensions: the 15km Eastern section and the 24km Western section. The road with the completed extension and current lane widths are illustrated in Figure C5.

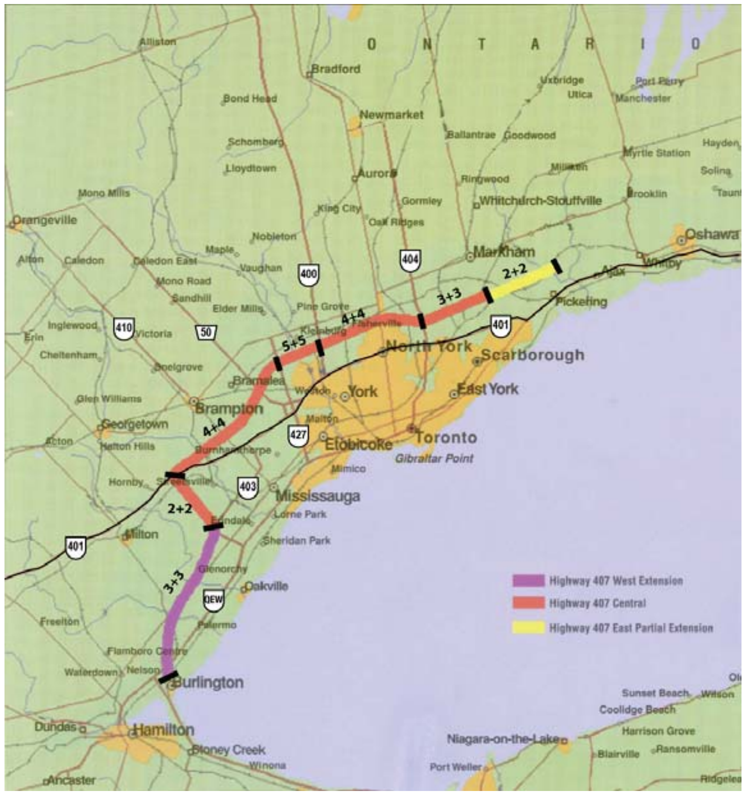

Figure C5: Current Lane Widths on 407 International's Highway 407[x]

407 ETR 1999 Bond Document

In July 1999, the 407 International Inc. sold bonds to lease the 407 ETR from the Province of Ontario. The company acquired the 99-year lease for a purchase price of $3.107 billion. The total cost, including acquisition cost, construction and toll equipment, and other, for the 407 ETR amounted to $3.192 billion. The breakdown of the various costs is illustrated in Figure C6.

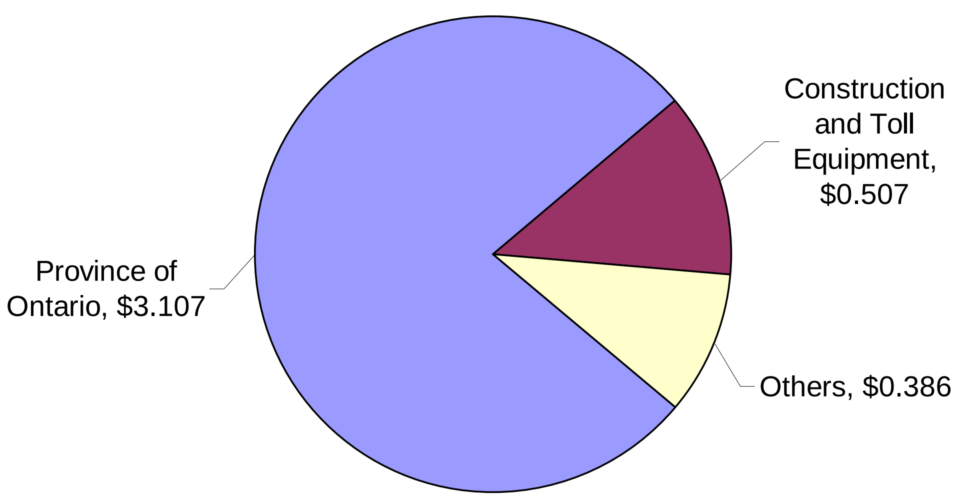

Figure C6: Distribution of Funds (billions of Canadian dollars)[xi]

The bonds were assessed and received the following ratings (Table C4).

Table C4: Bond Ratings[xii]

Agency	Rating
Standard & Poor's Rating Service	A
Canadian Bond Rating Service Inc.	A
Dominion Bond Rating Service Limited	A

The T&R report prepared by WSA—that was mentioned in the earlier historical and feasibility section of the appendix—was not certified to be presented to the bond market. Halcrow Fox[4], a well-known international transportation planning consultant, was initially hired by the banks and then by the private concessionaire after being awarded the concession contract. Halcrow reviewed the WSA's T&R report used in the bidding process. Halcrow's revised T&R report is included in the Official Bond Document. The following assumptions and analysis are of the T&R report that was included in the official Bond Document. Their analysis of WSA's previous report, assumptions, and T&R forecasts are discussed here.

Concession Agreement [5, xiii]

The concession agreement was lengthy and detailed the specific rights of the parties to the agreement.

The Terms of the Concession Agreement[6]

The concession agreement between the Province[7] and the Concessionaire[8] leases the 407 ETR to the Concessionaire for 99 years beginning April 6, 1999. The *Concession Agreement*, the *407 Act*, and the *Tolling, Congestion Relief and Expansion Agreement* (the Tolling Agreement) are the key documents in this agreement. The Concessionaire's rights are:

- to *"develop, design, and build the Highway 407 Central Deferred Interchanges, 407 West Extension and 407 East Partial Extension."* The extensions had to be completed by a date specified in the Concession Agreement for the Concessionaire to avoid paying a set penalty plus a fee for each additional day behind schedule.

The Concessionaire is also obligated to:

- "finance, operate, manage, maintain, rehabilitate and toll the Project,"
- meet safety standards set by the Province on the 407 ETR,
- expand the road if certain levels of traffic congestion as specified in the Tolling agreement are met, and

[4] Referred to as Halcrow from here on forward.
[5] Unless otherwise noted, the information and data in this section are from the 407 ETR 1999 Bond Document.
[6] The entire Concession and Ground Lease Agreement is publicly available and can be downloaded from the 407 ETR website at http://www.407etr.com/About/sale_agreement.htm
[7] Government of the Province of Ontario
[8] Originally, the 407 International Inc comprised Cintra Concesiones de Infraestructuras de Transporte and SNC-Lavalin. Since then Macquarie had purchased shares in the concession. The current consortium comprises SNC Lavalin (17 percent), Cintra (53 percent), and Macquarie Infrastructure Group (30 percent).

- allow free access to official vehicles, for example police cars.

The Province has the right to:

- build "transit ways (for public or private mass transit) on corridor lands,"
- build "inspection stations on corridor lands," and
- install various utilities in the 407 corridor.

The Province is also tasked with:

- providing the Concessionaire with access to their vehicle registration information, and
- denying Ontario license plate renewals to individuals with outstanding toll payments[9].

The concession agreement also lists the conditions under which the lease may be terminated by either party.

<u>The Terms of the Tolling Agreement</u>

The *Tolling Agreement* is briefly summarized in the Official Bond Document. The objective of this agreement was to ensure that the 407 ETR will serve as a congestion relief route and to prevent the Concessionaire from raising toll rates to the point where traffic would be diverted away from the 407 ETR onto local roads. However, the Concessionaire has the right to raise tolls to a level they desire if certain predetermined traffic volumes are met. The traffic volume thresholds were based on peak period traffic volumes the first year that the entire road was open to traffic. Subsequently, the traffic volume threshold increase at a rate that varies from 1 to 3 percent per year depending on the particular segment.

The *Tolling Agreement* also prohibits the Concessionaire from charging more than $3 per trip for video tolling (in 1999 dollars) and limits the difference between light and heavy vehicle toll rates. Also, the Agreement limits the total monthly transponder fee a customer can be charged in one year to $60 (in 1999 dollars).

<u>Private Concessionaire's Statements about the Project</u>

At the time of the lease with the Province, only the central 69-km section was in operation (Figure C7 maps the existing central section). The two extensions—24 km to the west and 15 km to the east—were scheduled to be opened on July 31, 2001, and December 21, 2001, respectively. Instead, the east section opened four months ahead of schedule on August 30, 2001.

[9] After a 90-day grace period after notice of non-payment by the Concessionaire.

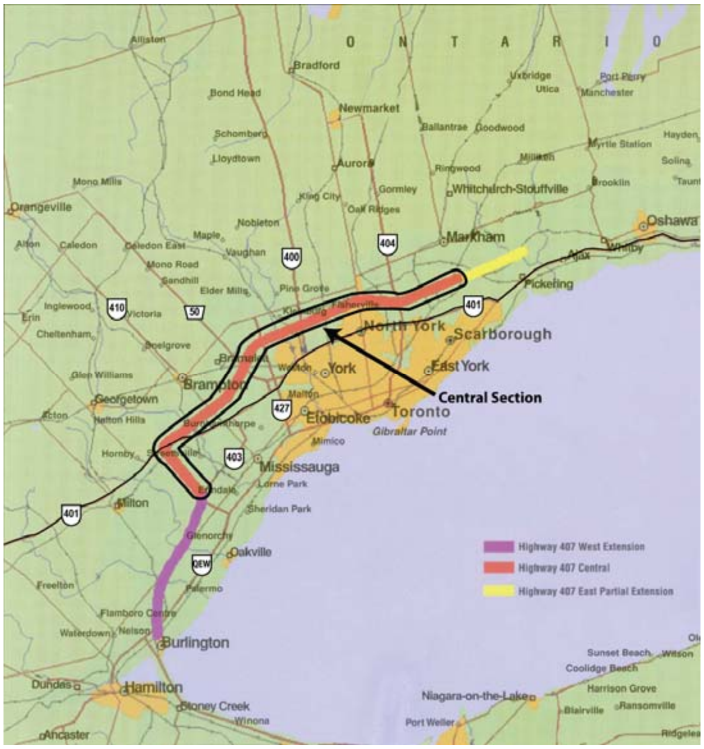

Figure C7: Map of Existing Central Section

The private concessionaire considered expected revenue and expenses in its analysis of the road. Revenue was expected from tolls collected, video tolling fees, and transponder surcharges. The tolls are distance-based and vary depending on the day of the week (i.e., weekday versus weekend) and time-of-day. Expenses included the tolling system cost, highway maintenance, depreciation, interest, and administrative costs. Another issue considered in the analysis was the potential impact of the Year 2000 (Y2K) issue.

The Concessionaire identified a number of risk factors, including:

- traffic volumes and toll revenues,
- possible transportation improvements (to other non-toll roads in the area),
- construction risks,
- operating and maintenance expenses,
- adequate insurance/risk management,
- ownership of intellectual property,
- Y2K issue,
- default under the Concession Agreement,
- regulatory approvals,
- changes in Tax Laws, and
- market for securities.

Some of these factors are discussed later in this appendix.

Summary of the Projects[10, xiv]

The money collected from the bonds issued was not to fund the construction of a new road but to purchase an operational road, construct a number of interchanges, and to build two extensions. The agreement stipulated that the Concessionaire complete five partial interchanges on the Central Section at Britannia Road, Mavis Road, Woodbine Avenue, Kennedy Road, and McCowan Road.[xv] The Concessionaire also had to build two new interchanges at Centre Street and Kipling Avenue. The lease agreement also required that the Concessionaire construct the two extensions to the existing Central section (see Figure C8 for a map indicating the two extensions).

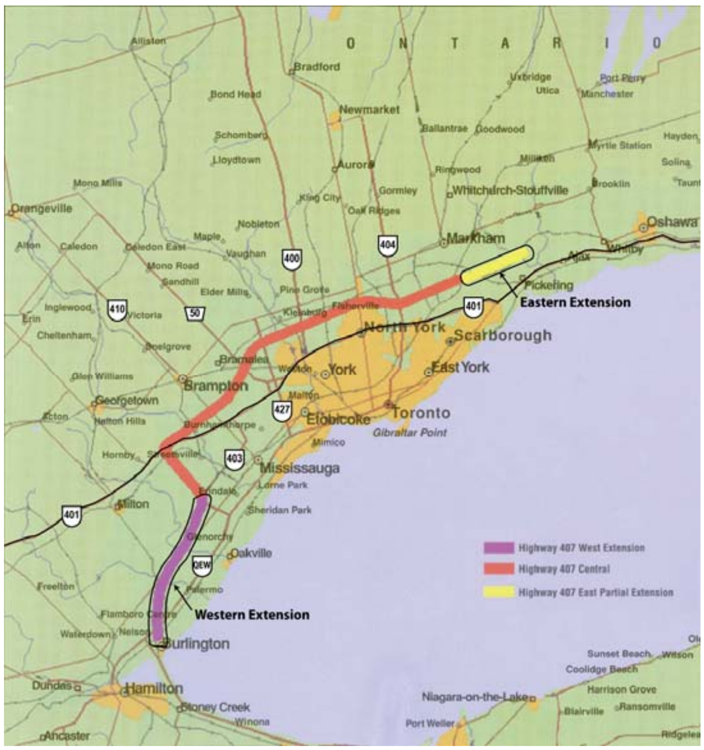

Figure C8: Location of the Two Extensions

The extension to the west was from the end of the west side of the 407 ETR southward to the intersection with Queen Elizabeth Way (QEW) and Highway 403. The road was to be six lanes initially, but enough right-of-way was reserved for eight lanes. Construction of the 15-mile (24-km) west extension began in August 1999. Though the road extension intersects with the QEW at certain points, the 407 ETR also runs parallel to it. Thus, the extension is an alternative to the congested QEW. The QEW is an important highway[11] connecting the GTA with the northern U.S. Seven interchanges were planned for this extension.

The 9-mile (15-km) eastern extension was to be built with only four lanes, but enough right-or-way was reserved for ten lanes. The extension starts at the east end of the 407 ETR

[10] Unless otherwise noted, the information and data in this section are from the 407 ETR 1999 Bond Document.

[11] In the late 1990s, the QEW often had traffic volumes greater than 150,000 vehicles/day.

running east to Highway 7 just east of Brock Road. Construction of this segment began in August 1999. This extension parallels the existing, severely congested, non-toll Highway 401. Only three interchanges were planned for this extension.

It is important to note is that the completed 407 ETR would not have formed a bypass around the city, because the eastern section did not connect to Highway 115/35 at Clarington. This section was not selected for privatization at the time of the bond document. This section is called the East Completion Section.

A detailed cost breakdown for the East Extension and the West Extension was not provided in the bond document. However, the right-of-way was acquired by the Province and was thus included in the leasing cost. An estimate of $507 million for general construction and toll equipment was provided by the private Concessionaire during an interview.[xvi] The extensions were to continue using the same toll collection system.

Summary of the Existing Conditions [12, xvii]

This section covers demographics, the economy of Canada, the household travel surveys conducted, and value-of-time surveys.

Toronto

The historical demographic trends cited in the Bond Document were first presented in the WSA T&R reports. The main source of historical and projected population and employment values was the 1993 Hemson and Coopers Lybrand report. This report looked at the cities comprising the Greater Toronto Area (GTA) and projected two scenarios for future growth in the GTA. The main difference between the two scenarios was the distribution of the population and employment growth within the GTA. The MTO and WSA used the first scenario in their projections, because this scenario was more conservative in the 407 ETR corridor.

When WSA updated their 1996 report for the 1998 bidding process, they re-evaluated the 1996 Hemson forecast by comparing it with the recently released 1996 Census values. WSA's updated forecast included population values for the city of Hamilton-W and the wider GTA area. The Office for the Greater Toronto Area (OGTA) also pointed to discrepancies between the census results and the Hemson report. It was felt that the Hemson report's predictions were too conservative (i.e., low). Consequently, the OGTA hired a firm to review the Hemson report's forecasts. This report, by Greg Lampert, concluded that the Hemson report *"under-estimated the figures for the City and over-estimated them for the Region."* Lampert's conclusion led the OGTA to commission a new demographic forecast from another consultant, but this study was not completed in time to be used by Halcrow.

Halcrow's report does not list the historical values used in the WSA's report. The only historical population numbers in the bond document are for 1996 (see Table C5).

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[12] Unless otherwise noted, the information and data in this section are from the 407 ETR 1999 Bond Document.

Table C5: 1996 Population Values

City/Area	Hemson	WSA- adjusted
Toronto	2.368	2.385
Peel	0.869	0.854
York	0.644	0.592
Durham	0.504	0.459
Halton	0.365	0.340
GTA	4.750	4.629
Hamilton -W		0.468
Wider GTA		5.097

Halcrow adjusted the Hemson report values based on discussions with local municipalities and the real estate sector. Also, Halcrow noted that *"population growth in the [407] corridor has been less than for Greater Toronto but was still around 17 percent over the decade starting in 1986."* In addition, immigration has significantly increased the population of Canada and the GTA in particular. Statistics Canada estimated that immigration has added approximately 67,000 individuals per year to the GTA in the previous 3 years.

Other factors examined included housing starts, commercial floor space, and land values as a proxy for historical land use. Halcrow provided overall housing start trends for the GTA. Housing starts increased substantially from the early 1990s to the late 1990s. Land values for the GTA were also increasing between 1997 and 1999. In Housing starts had thus grown, the vacancy rate was at approximately 5 percent, and the property values had been increasing. In particular, the cities of Peel and York were expected to see increased land use development and values after both extensions of the 407 ETR opened.

Halcrow also reviewed historical Gross Domestic Product (GDP) growth rates for all of Canada. Halcrow felt that *"Ontario, and specifically the GTA, has closely followed the GDP growth of Canada*." The 1960s and 1970s saw a high rate of growth, which slowed down in the 1980s to an average of 3 percent per annum. After a recession in the early 1990s, GDP growth rebound to the values of the 1980s. The historical GDP growth rates for Canada included in the bond document are presented in Table C6.

Table C6: GDP Growth rates for Canada

	1990-1996	1997	1998	1999-2003
	(%)			
Growth Rates	1.3*	3.7	2.9	2.5*

* per year

Specific industries located within the GTA that were experiencing high growth rates included the manufacturing, motor, and high technology industries.

An extensive travel survey called the Transportation Tomorrow Survey has been conducted every five years since 1986 in the GTA. The 1986, 1991, and 1996 surveys were used by WSA in their analysis. Information on household location, size, type, and car ownership is gathered, as well as information about individuals within the households including their age, sex, employment status, and number of driving licenses. More importantly, the survey records important trip details, such as origin, destination, trip purpose, trip time, and trip mode. The 1986 survey was a sample of 4.2 percent of the households in the GTA. The 1991 survey was an update of the 1986 survey and focused only on the areas that had experienced significant growth in the last five years. The 1996 survey included areas outside the GTA. The 1996 was a full survey—i.e., not an update—and included 115,000 interviews, representing a 5 percent sample of the households in the survey area.[xviii]

The Transportation Tomorrow Survey is used by the MTO to *"update previous trip tables for the GTA transportation model"* and evaluate *"peak and inter-peak periods."* The MTO model is developed for the AM peak, PM peak, and Inter-Peak periods. WSA adapted the MTO trip tables for their 1998 report. Halcrow also reviewed this information in their analysis.

For the WSA 1993 T&R report, they conducted a Stated Preference Survey to determine area resident's receptiveness to tolls. Because this was the first toll road in the area, assessment of value of time was less established and thus more uncertain. The Stated Preference survey resulted in 1,657 passenger car responses and 92 commercial responses. Though the number of commercial users surveyed was very low, WSA calculated a value of time (in 1993 dollars) for each user class.

After the 407 had been operational, WSA adjusted their value of time predictions. Their updated values were included in their 1998 report. Transportation Association of Canada (TAC) also predicted value of time (in 1993 dollars). Table C7 presents the value of time predictions by WSA and TAC.

Table C7: Value of Time

	Value of Time		
User Class	WSA 1993 in 1993 dollars	WSA 1998 in 1998 dollars	TAC in 1993 dollars
Passenger Car	AM peak: $0.17/minute	AM peak: $0.27/minute	Work Time: $0.27/minute
	PM peak: $0.19/minute	PM peak: $0.29/minute	Non-work Time: $0.13/minute
	Off-peak: $0.15/minute	Off-peak: $0.23/minute	-
Commercial User	$0.33/minute	no update	$0.40/minute

WSA increased their value of time estimates substantially between 1993 and 1998. This increase is partially attributable to inflation, but also to a better understanding of the Toronto area's receptiveness to tolling.

In addition to the values in Table C7, Transport Canada also assessed a value of time based solely on trip purpose. Business trips were valued at $0.40/minute and non-business trips at $0.12/minute (in 1993 dollars). These values, along with the TAC values, are for all of Canada—not just the Toronto area. Halcrow noted that the 407 ETR traverses higher income areas and be used mainly as a commuter route. Halcrow thus predicted that the users of the 407 ETR will have a higher value of time than the Canadian average. Halcrow subsequently used WSA's 1998 value of time estimates as they are based on surveys in the GTA area and actual traffic volumes on the 407 ETR.

Local Transportation System

Halcrow predicted that even if economic growth slows and the country experiences a recession, traffic levels in the area will most likely remain constant due to a lack of alternative transportation routes. Table C8 lists the historic traffic volumes for Highway 401—the parallel facility to 407 ETR. Highway 401 is severely congested and had been expanded various times.

In general, Table C8 shows that when the economy is growing, traffic often grows at a faster rate. During an economic downturn, such as the recession experienced in the early 1990s, traffic volumes basically remain constant instead of actually decreasing. Based on the historic traffic growth and economic rates, Halcrow suggested an average traffic growth rate of around 3 to 4 percent per year in the 407 corridor.

Table C8: Comparison between Economic and Highway 401 Growth Rates

		1986-1989	1989-1992	1992-1995
Economic Growth (%)		13.5	-3.8	9.2
Traffic Growth (%) on Hwy 401	Neilson - Hwy 48	17.5	4.4	1.6
	Hwy 400 - Weston	17.5	0.0	14.2
	Dixie - Hwy 403	21.5	5.8	14.1

Conditions on the 407 ETR (pre-lease)

At the time of the Halcrow T&R, only the central section of the 407 ETR was open to traffic. This section was 69-km long and ran from Highway 403 in Oakville to Highway 48 in Markham. The opening schedule of the central section is provided in Table C9 and Figure C9.

Table C9: Central Section Opening Details

Number	Section	Date Opened	Length (estimate)
1	Highway 410 to 404	Jun-97	37 km
2	Highway 410 to Highway 401	Dec-97	12.5 km
3	Highway 404 to McCowan Road	Feb-98	7 km
4	Highway 401 to Highway 403	Sep-98	9 km

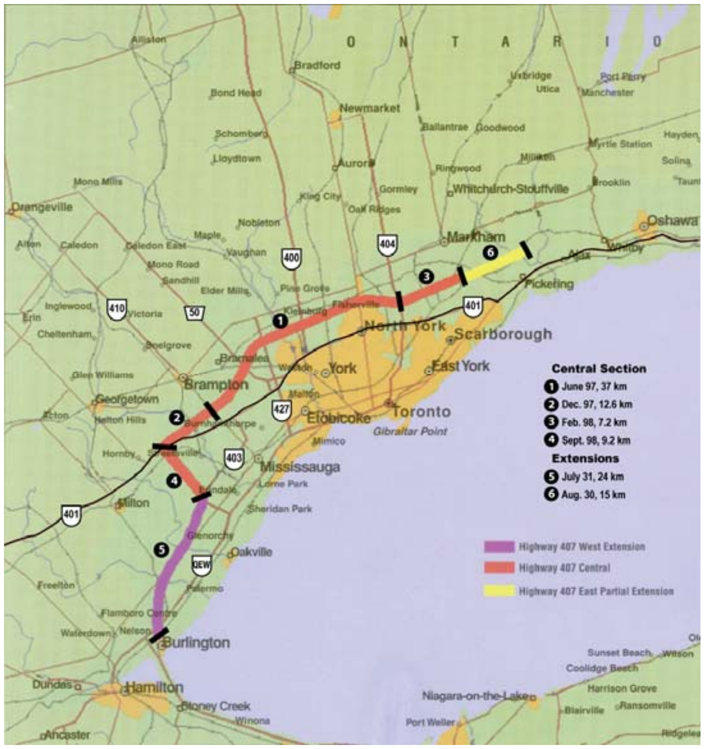

Figure C9: 407 ETR Sections and their Opening Date

The central section of the 407 ETR had four and six lane sections that, if the traffic volumes demanded, could be expanded to eight or ten lanes. Originally, the Province planned more interchanges but chose to defer the construction of some interchanges to a later date. Consequently, the private concessionaire was required to build seven of these interchanges by December 31, 2001 in terms of the lease agreement.

<u>Tolling on the 407 ETR (pre-lease)</u>

Tolls on the 407 ETR are collected by electronic tolling or by video tolling. The 407 ETR is the first toll road in the world to rely solely on ETC to collect tolls. Tolls are collected through electronic transponders that are distributed to anyone with a toll account. These transponders identify each vehicle at the beginning and end of their 407 ETR trip. The distance traveled is calculated and the appropriate toll is charged to the customer's account. Each account holder is also charged a monthly transponder account fee. For motorists without a transponder account, an image of their license plate is taken at the beginning and end of their trip. Again, the distance traveled is calculated but instead of automatically charging an account, the motorist receives a bill in the mail for the toll and an additional video tolling fee. These bills are sent on a monthly basis to the address registered to the license plate. The address is obtained from the Ontario Ministry of Transportation. As of June 1999, there were 302,000 transponder accounts. When the road opened, ETC by means of transponders was approximately 50 percent. At the time of the handover to the private concessionaire, transponder usage had increased to account for approximately 60 percent of total transactions.

Prior to the lease, the toll road had a dynamic pricing schedule[13] with lower tolls during the non-peak day time period, nights, weekends, and holidays. At the time of the Bond Document, peak periods were from 5:30 to 9:30 a.m. and 4:00 to 7:00 p.m. (resulting in a total of seven peak period hours). Tolls were also differentiated by vehicle type with heavy duty vehicles further categorized into single units and multi units. The vehicle class and toll rates at the time of handover are listed in the Tables C10 and C11.

Table C10: Vehicle Class Definitions

Vehicle Class	Included Vehicles
Light Vehicle (under 5,000 kg)	Passenger cars, vans, limousines, station wagons, pickup trucks, sport utility vehicles, light duty trucks
Heavy - Single Unit (over 5,000 kg)	Single unit trucks, tractors, school buses, transit buses, inter-city buses
Heavy - Multi Unit (over 5,000 kg)	Trucks and tractors with 1 or 2 trailers

Table C11: Toll Rate Schedule at Time of Turnover

Vehicle Class	Day Time Peak Weekdays: 5:30 to 9:30 AM 4:00 to 7:00 PM	Day Time Off-Peak Weekdays: 9:30 AM - 4:00 PM 7:00 PM to 11:00 PM Weekend & Holiday: 5:30 AM to 11:00 PM	Night Time Weekdays: 11:00 PM to 5:30 AM Weekend & Holiday: 11:00 PM to 5:30 AM
Light Vehicle*	$0.10 / km	$0.07 / km	$ 0.04 / km
Heavy - Single Unit	$0.20 / km	$ 0.14 / km	$ 0.08/km
Heavy - Multi Unit	$0.30 / km	$0.21 / km	$0.12 / km
* $1.00 extra per trip for video billing			

Prior to the lease, account holders were charged a $2.00 monthly transponder fee. Heavy duty vehicles were required by law to have a transponder and could be fined $25 if they used the road without one. Toll payments could be made by pre-payment, direct debits to credit cards, and monthly invoices.

13 The *Concession Agreement* allows the Concessionaire to toll various sections of the road at different rates, but this option was not used pre-lease.

Toll Transactions on the 407 ETR (pre-lease)

The historic traffic volumes listed in Table C12 were provided to the consultants in the bidding process.

Table C12: Historical 407 ETR Traffic Data

Month	Year	Actual Weekday Users	Seasonally Adjusted Weekday Users
September	1998	209,300	203,200
October	1998	216,500	215,000
November	1998	211,500	218,500
December	1998	198,300	214,700
January	1999	197,700	215,300
February	1999	204,800	215,900
March	1999	207,400	216,400
April	1999	222,000	219,700
May*	1999	228,400	221,600
* Volumes up to the 25th			

The toll road's traffic volumes experienced seasonal fluctuations. Toronto's harsh winters affect winter traffic levels, particularly in January. However, there was a general increase in traffic volumes the longer the road was opened if the winter impacts were accounted for. This suggested that the road was still experiencing a ramp-up effect. Also, as mentioned earlier, the 407 ETR exhibits a strong peak-based daily traffic volume because it is mostly a commuter road.

The original 1998 WSA report provided the traffic volumes by time period, section, and direction. This information was not available in the Bond Document. However, the following general traffic trends were noted:

- Based on all-day traffic flow volumes, the busiest sections were between Highway 410 and Highway 404 with two-way all-day traffic flows between 58,000 and 96,000 vehicles/day.
- Based on peak period traffic flow volumes, the busiest sections were between Highway 27 and Highway 400 with traffic volumes between 90,000 and 96,000 vehicles/day.
- Traffic during the non-peak daytime hours is *"just under half the maximum peak rates."*
- Traffic during the early morning hours between 1:00 and 4:00 a.m. is non-existent.

Toll Revenue of the 407 ETR (pre-lease)

The only historical toll revenue information available to the prospective bidders was for five months in 1999 (see Figure C10).

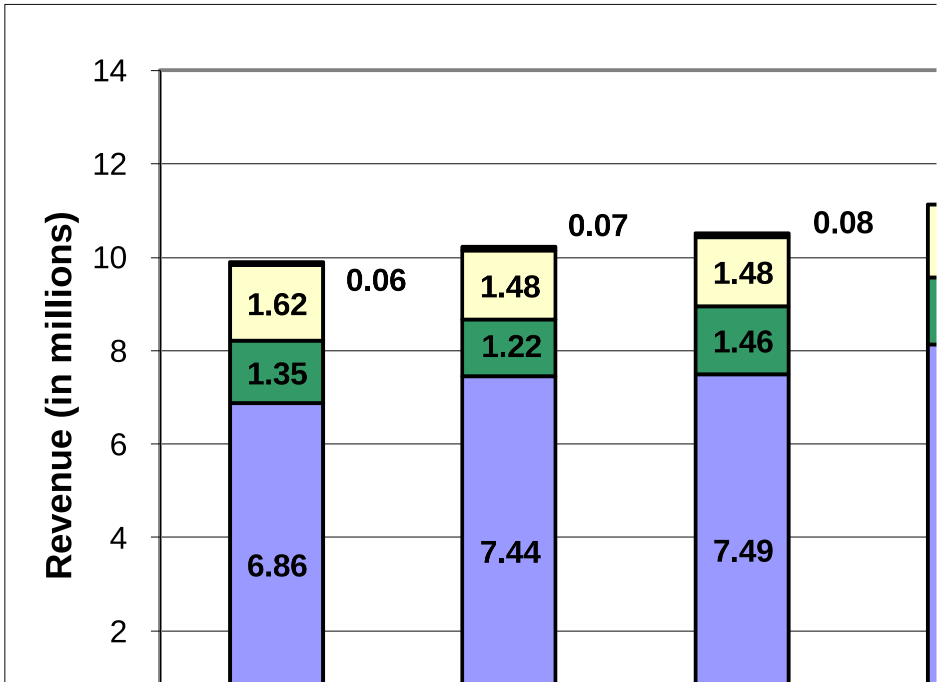

Figure C10: Historical Highway 407 Revenue Data (1999)

The May values were adjusted to reflect monthly volumes. Also, the transponder activation fees are included in the Figure, but due to their relatively low values (about $0.05 million), their contribution to the total revenue is hard to see.

Based on the trends, *"total annual revenue(s) of over $140 million look[ed] achievable for 1999."* High revenues from the transponder activation fee in April 1999 may have resulted from a MTO marketing effort of the toll road that ended March 31, 1999. The effort included the distribution of electronic toll collectors at mall kiosks and sporting events. Also, in the early years, the government was still determining the actual cost of video billing a customer.[xix]

An important component of the revenue is the impact of unbillable transactions. There are four types of transactions that are unbillable:

1. Trips identified at both entry and exit, but the license plate is registered in a jurisdiction with which the current road operator does not have an information exchange policy.
2. Trips identified at both entry and exit but the address registered with the government is not current.
3. Trips identified at the entry but not the exit or vice versa (called half trips).
4. Unreadable trips. This refers to video-based transactions where the image of the license plate is not readable.

Half trips were not billed pre-lease. However, the bond document noted that the Concessionaire would in the future bill the half trips by *"a deemed minimum distance traveled."* Also, prior to the lease the government had information sharing agreements to share address details of vehicle registrants with *"all Canadian jurisdictions other than Manitoba and the Northwest Territories, and with the states of Ohio, New York, Pennsylvania, and Michigan."*

However, it would be the Concessionaire's responsibility to renegotiate these agreements if they wish to continue to have access to the license plate registration databases of these jurisdictions.

Unbillable transactions were approximately 6 percent of the total trips prior to the lease. The bond document points out that this is not only lost revenue, but that additional operating expenses are incurred to pursue these more difficult transactions. The Concessionaire was hoping to decrease the percentage of unbillable transactions *"through technology improvements, more reliable transponder transactions, and increased enforcement efforts."*

Previous Traffic and Revenue Reports for the 407 ETR (pre-lease)

Pre-lease WSA conducted three T&R reports:

- a preliminary 1993 assessment,
- an official 1996 report, and
- a 1998 report that was an updated version of the 1996 report.

A preliminary assessment of the road was conducted in 1993 by WSA. As mentioned earlier, this report considered different toll collection systems, examined the area's traffic model, and considered the area's sensitivity to tolls. An important component of this report was the traffic information that was collected for the area, including the stated preference surveys, the corridor origin-destination surveys, traffic counts, and the journey time surveys.

The 1996 WSA report provided actual T&R forecasts. However, little is known about this 1996 report except through Halcrow's evaluation of the 1998 report that is an update of the 1996 report. Both the 1996 and the updated 1998 reports are not publicly available.

Summary of the Projected Traffic and Revenue [14, xx]

Halcrow considered WSA's assumptions and forecasts. This included examining economic growth factors, land use changes, trip tables, value of time assumptions, and many other factors. Many of these factors are correlated, for example if the economy grows so will employment in the area. The forecasts for the Toronto area, local transportation system, and finally for the 407 ETR are discussed in detail in the following section.

Toronto

The main source of population forecasts were the Hemson report mentioned earlier. Given the discrepancy between the Hemson report and the Census values (mentioned earlier), the Regional Municipalities were asked to revise the forecasts (as shown in Table C13).

14 Unless otherwise noted, the information and data in this section are from the 407 ETR 1999 Bond Document.

Table C13: Forecasted Population Values for Toronto Area

	2001		2011		2021	
City/Area	Hemson	Region	Hemson	Region	Hemson	Region
Toronto	2.42		2.54	>2.50*	2.70	
Peel	0.99	1.04	1.15	1.21	1.26	1.33
York	0.74	0.74	0.93	0.94	1.11	1.11
Durham	0.61	0.56	0.80	0.76	0.95	0.97
Halton	0.42	0.38	0.53	0.49	0.65	
GTA	5.18		5.95	>5.90	6.78	

*this is the minimum expected value

Halcrow indicated that the WSA-adjusted Hemson forecasts were optimistic, but could be reached if the economy continued to prosper. Halcrow considered both the regional forecast and the individual city forecasts. The cities of Peel and York predicted higher population forecasts, partly because of the expected development that the 407 ETR would induce. Also, discussions with the real estate sector suggested that these two cities were *"the favored areas for industrial/commercial floor-space and housing starts."* After these areas, the next premium land space will be the surrounding areas of the Western Extension and the East Partial Extension. The cities of Durham and Halton have thus issued a substantial number of construction permits for the 407 extension corridors.

The historical GDP growth in the GTA was provided earlier. The only forecasted economic values were for the years 1999 to 2003, predicting a GDP annual growth rate of 2.5 percent in the GTA.

<u>Projections for the Local Transportation Systems</u>

There is little discussion of the local transportation's future status. The Concession Agreement does not prevent the local government from making improvements to parallel non-toll routes. However, Halcrow predicted that even non-toll road improvements will not significantly affect 407 ETR's traffic volumes.

<u>Traffic Projections for the 407 ETR—WSA and Halcrow's Initial Base Case</u>

WSA started with the existing MTO traffic model and their 1996, 2001, 2011, and 2021 trip tables for the AM, PM, and Off Peak periods. For the 1998 WSA T&R report, WSA began with the MTO's 1996 trip tables and their own traffic model, TRANPLAN. This model was an adaptation of the MTO's model. WSA calibrated its TRANPLAN model by comparing their 1998 traffic forecasts with actual 1998 traffic volumes on the 407 ETR. Instead of using the 2001 MTO trip table, WSA used their calibrated model to generate a more realistic 2001 trip table. Future year trip tables—i.e., 2011 and 2021—were so far in the future that WSA chose to use the MTO trip tables for these years. The WSA 1998 report was made available to the private bidders, but WSA did not provide their estimated 1998 and 2001 trip tables to the private bidders. Halcrow therefore did not have access to these trip tables.

The WSA 1998 and 2001 trip tables divided the potential trips into ETC trips and video billing trips. There was no differentiation for freight trips. WSA noted that

> *"freight traffic is not explicitly modeled as a separate class (it forms 7 percent of current [407 ETR] trips) but the extra revenue generated by these vehicles*

is taken into account in the revenue estimates (through increases to assumed toll rates in the revenue calculations)."

When the government released the 1998 WSA report to the potential bidders they were also interested in the bidders constructing the two extensions. The traffic volumes for these extensions were thus also predicted by WSA. WSA adjusted their model results (forecasts) for the extensions based on their professional judgment (Table C14). WSA felt that the model had overestimated off-peak period traffic for the Western extension and for all periods for the Eastern extension.

Table C14: WSA Volume Adjustments to Extension Traffic

Roadway Segment	Traffic Reduction			
	2001		2011	
	Peak Periods	Off Peak Periods	Peak Periods	Off Peak Periods
Western Extension	-	40%	-	10%
Eastern Extension	10%	10%	-	-

Halcrow noted that the adjustments to the Western Extension seem a little over-conservative as that particular corridor is quite congested. Also, though Halcrow does not comment on this, the Western Extension traverses a particularly wealthy area. Thus, people's value of time should be higher in the off peak period as well, especially given that the corridor was already congested.

When Halcrow performed their T&R forecasts, they too started with the MTO's traffic model. They also modified it to replicate the actual traffic volumes on the 407 ETR. The model runs considered the toll rate schedule on the highway pre-lease. Halcrow evaluated the accuracy of their model on a link basis. The Halcrow model predicted a value of 375,000 total vehicle kilometers and the actual volume was 379,200 vehicle kilometers, which is a difference of less than 2 percent. Thus, their model sufficiently replicated current traffic conditions. Halcrow stated though that their model is reliable when projecting traffic on the whole road, but not on individual section of the road.

An important input into Halcrow's trip generation model is value of time. As mentioned earlier, Halcrow agreed with the 1996 WSA value of time assessment. The value of time for the AM peak, PM peak, and off peak were respectively $0.27, $0.29, and $0.23 per minute. The pre-lease toll rate schedule required the average speed on the 407 ETR to be double the speed on Highway 401 during peak periods to justify the use of the road (based on these values of time).

The demographic and socio-economic factors discussed earlier were also important inputs into Halcrow's trip generation model. Other factors that Halcrow considered were the length of the ramp-up period, the trips the road itself would generate (induced trips), and special events that could cause spikes in traffic volumes.

WSA and the government considered the ramp-up period to be over by September 1998. However, the historical traffic volume information listed in the bond document (for September 1998 to May 1998) seems to suggest that traffic volumes were still increasing after accounting for the seasonal effect. Also, the WSA report forecasted that ramp-up for the two extensions will last from July 1, 2001 to Dec 31, 2001. The latter implied that both extensions will open well before their scheduled opening dates and that the ramp-up period will be very short. WSA's 2002 traffic volume forecasts thus did not include any ramp-up effects. Halcrow assumed that the central section would still experience some ramp-ups effects and the extensions would experience a ramp-up period of approximately six months. Halcrow also assumed that the extensions would open by July 1, 2001.

Often the mere existence of a road induces residents to take trips that would not have otherwise been taken. These trips can be difficult to quantify. WSA did not consider the additional trips the road itself would generate in their forecasts. However, during the peak periods the road will offer substantial time savings over the non-tolled alternatives. Halcrow hypothesized that the road would generate induced trips during the peak periods and considered these trips in the risk analysis.

The following key assumptions were included in the 1998 WSA forecasts and also in Halcrow's initial base case forecasts in an effort to verify the reliability of Halcrow's model:

- *"Current toll rates on the Highway 407 are increased by 10 percent in real terms by 2001, by a further 27 percent by 2011, and by a further 21 percent by 2021 in the peak periods but only 7 percent at other times*
- *The video surcharge remains at $1*
- *The proportion of transponder users will gradually increase over time (and that of video users decrease)*
- *Both the West Extension and the East Partial Extension are open to traffic by July 1st, 2001*
- *The carriageways on Highway 407 will be widened as necessary to maintain adequate service levels to meet the increasing traffic demands*
- *No new interchanges will be added to Highway 407 although existing partial interchanges will be converted to full interchanges by 2001."*

ETC usage was assumed to increase at higher rates during the road's early years and thus reach WSA's proposed penetration level (22 percent) in a later year. The forecasts for the years between the modeled years (i.e., 1998, 2001, 2011, and 2021) were determined through interpolation, as shown in Table C15 and Figure C11.

Table C15: WSA and Halcrow Initial Base Case Forecast

Year	ETC users/day	Video users/day	Total users/day	Annual Toll Revenue* (in millions)
1998	89,400	54,000	143,300	$91.5
2001	165,900	74,100	240,000	$179.3
2011	349,500	103,800	453,300	$387.9
2021	466,400	133,000	599,400	$551.4
* in 1998 dollars and includes only toll revenue				

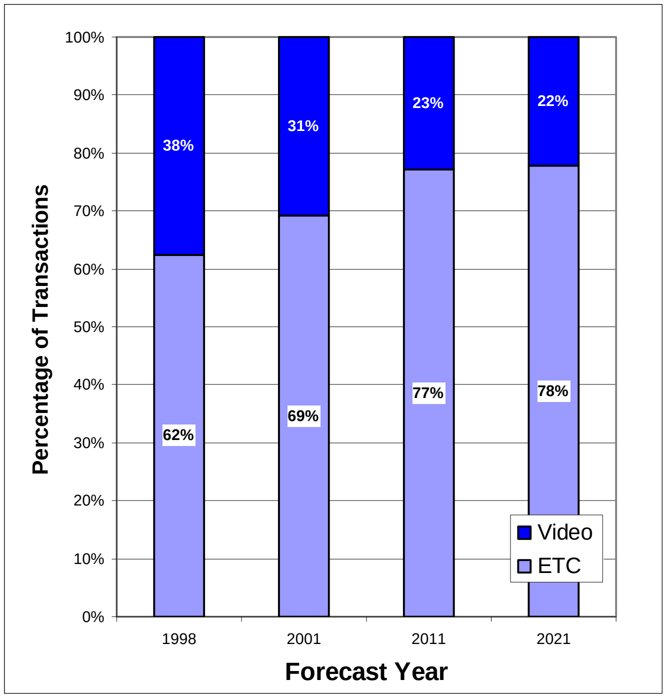

Figure C11: WSA and Halcrow Initial Percentage ETC and Video Users/Day

<u>Traffic Projections for the 407 ETR—Halcrow's Sensitivity Analysis</u>

Halcrow subsequently took WSA's base case forecast and performed a sensitivity analysis based on their observations and expertise. They tested various factors and predicted their impact on the initial base case traffic volumes and revenue values. It should be noted that Halcrow only changed the factors they explicitly state to have changed in their final base case model (see next section). However, this analysis revealed the sensitivity of the overall traffic or revenue levels to changes in each of these factors (considered in isolation). In general, these impacts should also be applicable to the final base case forecasts. The various factors and Halcrow's analysis are discussed in detail:

- Halcrow compared the <u>forecasted traffic volumes</u> from the WSA and Halcrow models for the AM peak period (see Table C16). The comparison showed that the models predicted very similar traffic volumes for the base case assumptions. One difference between the two models is the rate at which the road will be expanded. The WSA model assumed that only the segments that experience congestion will be expanded. The Halcrow model assumed that the entire road will be expanded each time any segment experience a certain level of congestion. Table C16 shows that the Halcrow model forecasted slightly higher traffic volumes than the WSA model for 2001 and 2021. In general though, the two models (given the same assumptions) forecast similar traffic volumes, indicating a respectable replication of WSA's adjustments to the MTO model.

Table C16: Differences between WSA and Halcrow Models

	Year			
	1998	2001	2011	2021
Halcrow model volumes/ WSA model volumes	-1.1%	1.5%	-3.0%	4.2%

- The toll rate has a direct effect on traffic volumes. Halcrow listed their revenue maximizing toll rates for each forecasted year as well as the values used by WSA. Halcrow indicated that a reduction in tolls during the off-peak periods will maximize toll revenue (see Table C17 and Figure C12 for values used). However, Halcrow does not mention whether these toll rates were discussed with the private concessionaire.

Table C17: Revenue Maximizing Toll Rates

Year	AM Peak		Inter-Peak	
	Halcrow	WSA	Halcrow	WSA
	(toll in $/km)			
2001	0.125	0.11	0.07	0.077
2011	0.175	0.14	0.07	0.098
2021	0.2	0.17	0.0875	0.105

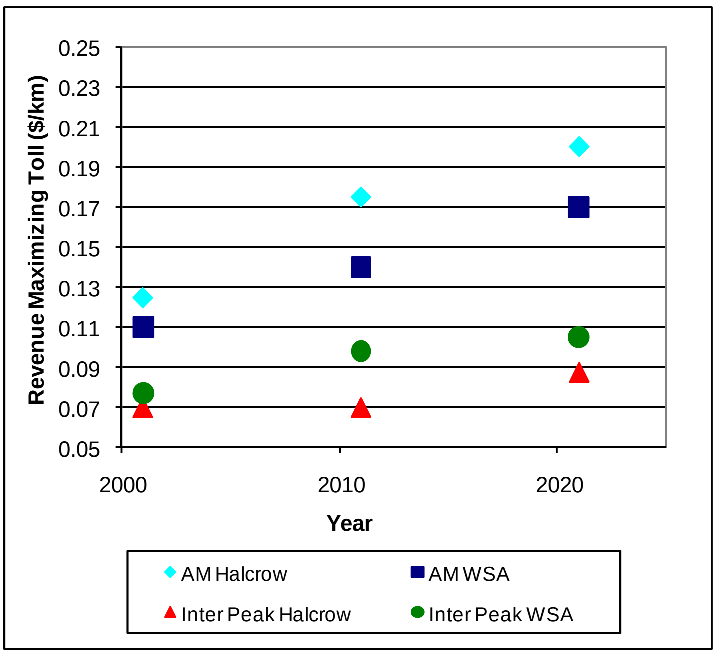

Figure C12: Revenue Maximizing Toll Rates

- As mentioned earlier, the private concessionaire has the right to adjust the toll rates by road segment. Halcrow suggested that an additional supplementary toll be charged for use of the Western Extension. Halcrow speculated that where the 407 ETR will parallel the congested QEW, users will be less sensitive to toll rates as there are fewer options. Also, the Western Extension traverses a wealthy area in the GTA. Suggested supplementary tolls were an additional 2.5 cents/km and 1.75 cents/km during the peak and off-peak, respectively. The additional revenue from these supplementary tolls was estimated at 1 percent for the peak periods and 8 percent for the off-peak periods. This was the only toll rate schedule and strategy that was explicitly explained, but the bond document noted that other strategies could also be profitable and should be explored.

- Halcrow examined the effects on traffic volumes if the land use did not change as expected—for example, if the land use did not disperse as Hemson forecasted, but instead densified in the existing locations. Halcrow did this forecast using the 1996 trip distributions and the total trip volumes from the 2001, 2011, and 2021 MTO trip tables. This analysis suggested traffic during all time periods would decrease if the area does not experience some amount of sprawl. This seems logical because the road will be over 100km long and will serve a large area of land. If land use densifies only in the current locations, there will be less demand in the outer edges of the road.

- Halcrow reviewed the impact of reduced growth in the area. In this test, Halcrow halved the model inputs for economic growth in each time period. Not surprising, the lower economic growth assumptions reduced the traffic volumes on the 407 ETR.

- The completion of the Western Extension and East Partial Extension was found to have a positive impact on traffic on the overall road as drivers using the extensions will also use at least part of the existing central section. Although the 39km extensions will represent only 36 percent of the total road length, Halcrow suggested that they will generate proportionally more traffic on the central section than a 36 percent increase in length.

- Halcrow tested the impact of a 25 percent higher and 25 percent lower value of time on the forecasted traffic volumes for years 2001 and 2011. The results in Table C18 show that value of time is an important factor in determining toll road usage and that uncertain value of time assumptions can lead to large differences in forecasted traffic volumes (especially if value of time was overestimated).

Table C18: Change in Value of Time

		AM Peak		Inter-Peak	
		. + 25%	-25%	. + 25%	-25%
Change in Revenue	2001	10.30%	-17.50%	5.40%	-27.50%
	2011	4.10%	-12.80%	2.10%	-28.40%

- Halcrow conducted a sensitivity analysis to determine the traffic volumes if a certain number of lanes are open for the whole road in years 1998, 2001, 2011, and 2021. In general, traffic volumes in any given year increases if the road capacity increases. Halcrow concluded from this sensitivity analysis that the most congested segments of the road will need three, four, and five lanes in years 2001, 2011, and 2021 respectively.

The forecasted effects on traffic volumes and revenue levels given Halcrow's sensitivity analysis are summarized in Table C19.

Table C19: Summary of Halcrow's Sensitivity Analysis

Factor	Affect on Traffic	Affect on Revenue
Model Comparison	Little impact	-
Change Peak to Off Peak Toll Rate Ratio	-	Increase
Charge Different Toll Rates by Segment	-	Increase
Lower Land Use Expansion	Decrease	-
Reduced Economic Growth in the Area	Decrease	-
Impact of Opening Extensions on Entire Road's Traffic	Increase	-
Higher than Estimated Value of Time	Increase	-
Lower than Estimated Value of Time	Decrease	-
Impact of Widening the 407	Increase	-

Traffic Projections for the 407 ETR—Halcrow's Final Base Case

Based on their expertise, research, sensitivity analysis, and assumed discussions with the private bidder, Halcrow made the following adjustments to their initial base case forecasts:

- Included the revenue from video billing, transponder account fees, and transponder activation fees at the current rates. The revenue from these sources was approximately $20 million per year. Halcrow assumed "*these revenues will increase in proportion with the number of users, and that the fees will be escalated in real terms at a similar rate as the tolls.*"
- Increased the collection rate for the current unbillable trips (i.e., decrease the percentage of unbillable trips) based on the private bidders more aggressive collection policy. Halcrow estimated that total revenue will increase by one percent due to this more aggressive policy.
- The construction of three more central section interchanges required by the Concession Agreement. WSA estimated that these interchanges will increase traffic by 2.6, 2.0, and 1.9 percent in years 2001, 2011, and 2021, respectively. This will result in revenue increasing by 1.3, 1.5, and 1.7 percent, respectively in the corresponding years.

- WSA in a February 1999 letter to Merrill Lynch adjusted the yearly adjustment factor (i.e., the annualisation factor) for calculating revenue. In the bond document, Halcrow noted that *"there are fewer trucks at weekends, toll rates are lower than during the rest of the week, and there are a different proportion of transponder and video users at weekends."* WSA's revised annualisation factors are listed in Table C20. WSA's revised annualisation factors decrease revenue by around 4 percent in each of the forecasted years.

Table C20: WSA Revised Annualisation Factor

	For Traffic	For Revenues
Transponder Trips	308.2	298.9
Video Trips	335.8	319.5

- The ramp-up period for the central section was extended beyond the WSA September 1998 end date. Halcrow assumed that *"half of the 17 percent [traffic volume weekday] increase is background traffic"* but that the other half *"is due to continuing ramp-up."* This factors into the predicted growth in future years.
- Halcrow shifted the peak and non-peak time periods from the existing time periods in an effort to maximize revenues. The previous and recommended time periods are shown in Table C21. This adjustment to the peak time period was estimated to increase annual revenue by two percent.

Table C21: Peak Period Adjustments

	Previous Time Period*	Halcrow Recommended Time Period
AM Peak	5:30 to 9:30	6:30 to 9:30
PM Peak	4:00 to 7:00	3:00 to 7:00
Total Peak Hours	7 hours	7 hours

* Used in WSA forecasts

Halcrow's adjustments to their initial base case to derive their final base case are shown in Table C22 for year 2001.

Table C22: Adjustments to Halcrow's Initial Base Case to Derive Final Base Case (2001)

Source	Adjustment	Total Users per Weekday	Revenues (in millions)
Initial Base Forecast		240,000	179.3
Other Revenues	+ 20 *1.1 (price escalation) *1.2 (increase in users)	-	205.7
3 new Interchanges	+ 2.6% in traffic + 1.3% in revenues	246,200	208.4
Annualisation Factor	No change to traffic - 4.2% in revenues	-	199.6
Continuing Ramp-up	+ 8.5%	267,200	216.6
Unbillables	+ 1% in revenues	-	218.8
Peak Period Shifting	+ 2% in revenues	-	223.1
Final Users & Revenue		267,200	223.1

Halcrow did a similar forecast for years 2011 and 2021. Halcrow noted that traffic volumes and revenue for each year not explicitly modeled can be determined through simple interpolation. The forecasts are provided in Table C23 and Figure C13.

Table C23: Halcrow's Final Base Case Forecast

	Halcrow Final Base Case	
Year	Users/day	Revenue (in millions)
2001	267,200	223.1
2002	318,400	280.4
2003	337,300	299.8
2004	357,600	319.9
2005	377,400	340.4
2006	397,000	361.3
2007	416,500	383.8
2008	437,100	407.9
2009	458,800	433.3
2010	480,000	460.6
2011	501,700	490.6
2012	520,000	512.7
2013	537,000	533.9
2014	554,500	554.9
2015	571,100	575.5
2016	588,200	596.8
2017	605,200	618.5
2018	620,200	639.3
2019	635,600	660.2
2020	648,300	681.5
2021	662,700	696.8

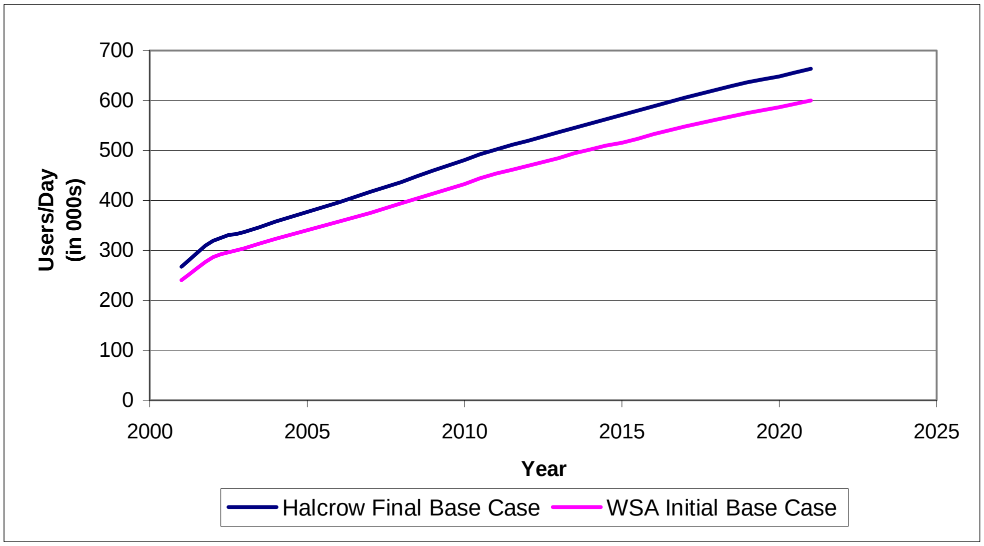

Figure C13: Forecasted Users/Day

Figure C13 shows that Halcrow forecasted higher traffic volumes than WSA's original forecast. Also, Figure C14 shows that Halcrow's revenue forecasts were higher than WSA's revenue forecasts.

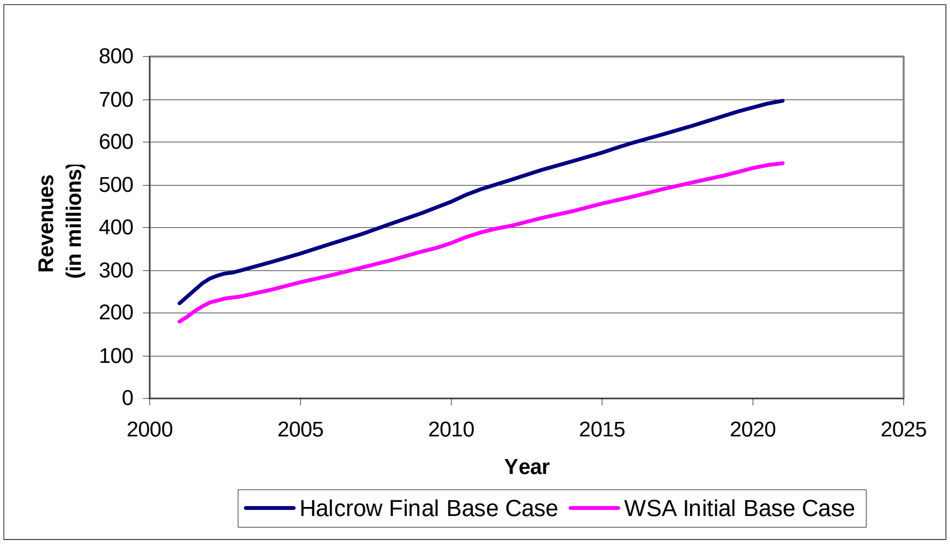

Figure C14: Forecasted Revenue

Summary of Halcrow's Risk Analysis[15, xxi]

Halcrow also conducted a sensitivity analysis (called a Risk Analysis) of their forecasts. The objective of the analysis was to quantify the level of uncertainty associated with specific variables within a reasonable range of values: *"The overall objective is thus to identify ranges of revenue levels, with confidence limits, taking account of variation in key socio-economic, land use development, and other variables."* Halcrow's four-step risk analysis as provided in the bond document is summarized here:

- identify the key input variables that affect the Final Base Forecasts,
- define the probability distributions for each key variable,
- define the sensitivity functions for each variable, and
- run the Halcrow Fox's RISK model.

However, Halcrow's analysis seems mainly founded in their professional judgment, not necessarily on statistical evidence. The key factors identified were:

- GDP growth rates,
- socio-economic growth rates,
- values of time,
- tolls charged,

15 Unless otherwise noted, the information and data in this section are from the 407 ETR 1999 Bond Document.

- the differences between the WSA and Halcrow models,
- traffic generation,
- unbillables, and
- model errors.

For the Risk Analysis, the analysts had to identify the lowest and highest possible value for each key variable. An illustrative example is the unbillables variable. Originally, Halcrow assumed that by decreasing unbillables total revenue would increase by 1 percent. The lowest value resulted from the assumption that unbillables will not change and thus there will be no increase in revenue. The highest value assumes that the private company will aggressively decrease the amount of unbillables resulting in a total revenue increase of 3 percent. The probability range for each key input variable is listed in Table C24.

Table C24: Halcrow's Risk Analysis

Key Variables	Overall Effects	Probability Distribution
GDP Growth	Upside & downside but mainly downside	-3% to +2% in 2001 -6% to +2% in other years
Land Use Assumptions	All downside	-5% to 0% range in 2001 -19% to 0% range in 2011 -29% to 0% range in 2021 (weighted around 0% impact)
Toll Rate Optimisation	All upside	0% to +16% in 2001 0% to +20% in 2011 0% to +20% in 2021 (weighted towards 0% impact)
Real Increases in Value of Time	All upside	Not included in 2001 0% to 3% in other years (weighted towards 0% impact)
Differences between Halcrow/MTO & WSA models	Either upside or downside	0% to +2% in 2001 -3% to 0% in 2011 0% to 4% in 2021
Trip Generation	All upside	0% to 3% in other years (weighted towards 0% impact)
Unbillables	Mainly upside	-1% to 2% in other years
Model Error	Upside & downside	-10% to +10% in 2001 -15% to +15% in 2011 -20% to +20% in 2021

The wider ranges apply to the land use assumptions, toll rate optimization, and model error. The land use assumption's low case is the WSA's low growth scenario and the high case is the Halcrow final base case scenario. Thus, the range that Halcrow tested is limited to what might happen if land use does not reach their projections. The possibility that land use could exceed their expectations was not considered in this particular risk analysis. Halcrow mentioned that *"any up-side resulting from faster than expected development is included in the trip generation effect."* The toll rate optimization analysis looked at possible toll rate strategies and their impact on generated revenue. These strategies included:

- increasing peak toll and reducing off-peak tolls (as Halcrow suggested in their final base case),
- adding a supplemental or premium toll on the Central section,
- implementing directional tolling,
- increasing video billing rates, and
- using discounts to increase marginal use.

The low value of the toll rate optimization range was based on Halcrow's Base Case forecasts (and tolling strategies). The final factor with a wide range was the impact of model errors. The extent of the model error is largely unknown in the industry. Halcrow assumes the model introduces some errors, but is not sure about what they are or the impact that they have.

The final steps of the risk analysis involve selecting various values for each variable within their possible ranges and thus simulating various scenarios that could possibly occur. The scenarios are selected using the Monte Carlo method. Halcrow generated revenue levels for 10,000 possible scenarios. Halcrow did this for the three model years, i.e., 2001, 2011, and 2021. The resulting distributions for these scenarios are listed in Table C25. The distributions are *"effectively display[ed] as a normally distributed profile"* with the *"mean and median for each distribution are very similar in each case."* The Final Base Case revenues were set at 100 for each model year.

Table C26 shows that the revenue ranges are widest for the year 2021 as information for this year is obviously more uncertain. These ranges are also illustrated for the model years in Figure C15. The darkened point is the actual Halcrow forecast.

Table C25: Halcrow's Risk Analysis Revenue Distributions

	2001	2011	2021
	100 = Final Base Case Revenues		
Mean/Median	105.7/105.5	99.9/99.4	98.7/97.9
80% confidence	98.9	90.1	85.7
20% confidence	112.4	109.6	111.5

Table C26: Halcrow's Risk Analysis Revenue Ranges

	2001	2011	2021
	(in million per year)		
Final Base Case Forecast Revenues	223.1	490.6	698.8
Probable Range of Revenues	220.6 to 250.8	442.0 to 537.7	597.2 to 776.9

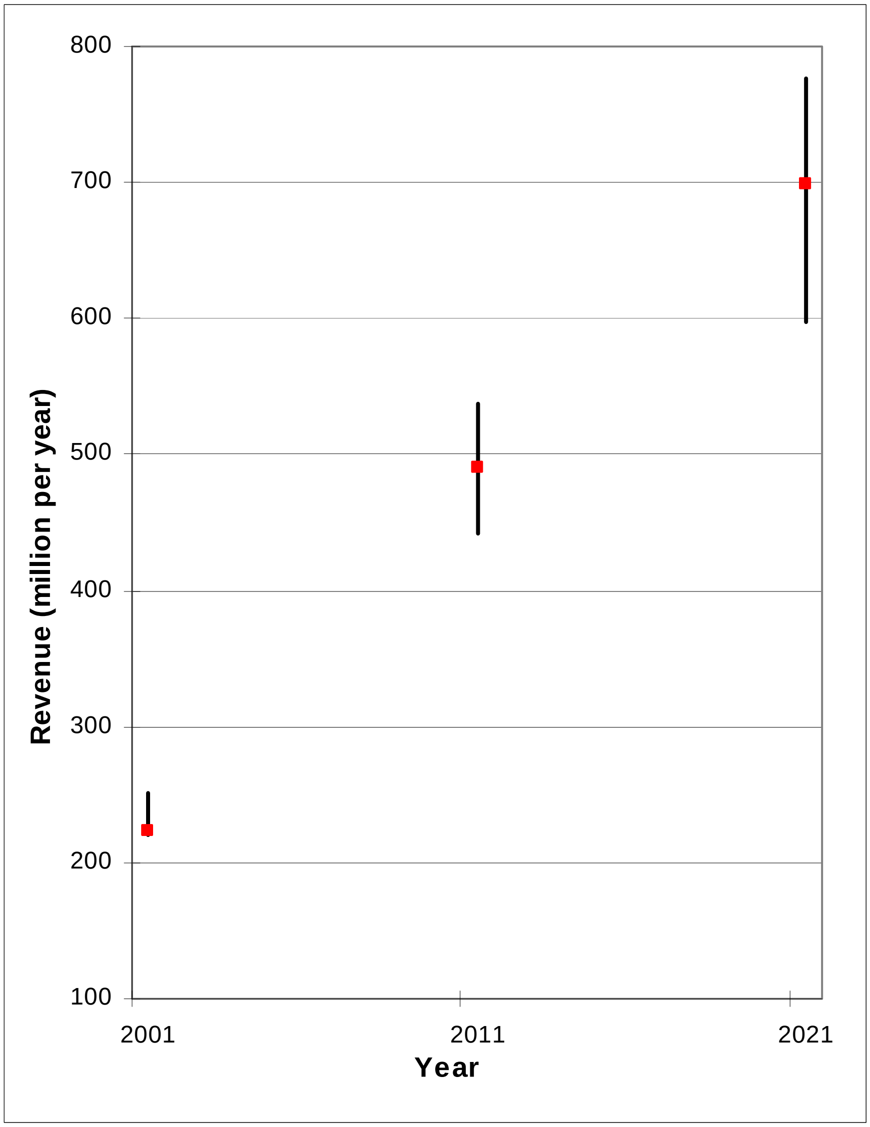

Figure C15: Halcrow's Risk Analysis Range

The Figure shows that Halcrow's Final Base Case Revenue Forecast for year 2001 is close to the lower end of the range. Halcrow interpolated revenue ranges for each year (from 1998 to 2021), but did not include this information in the T&R document.

Differences in Historical Trends and Actual Trends

In their forecast, Halcrow assumed that existing socio-economic, and transportation trends in the area would continue in the future. Therefore, a comparison between the historical trends and the actual factor trends since the road opened is worthwhile.

<u>Socio-Economic Factors</u>

Halcrow noted that at the time of the bond document the vacancy rate in Toronto had been at 5 percent for the last few years. A comparison of more recent vacancy rates with the historical values revealed that the vacancy rates for Toronto for the years 1999 to 2003 ranged from about 0.75 to 4 percent. During this time period, vacancy rates have been increasing steadily—i.e. the 4 percent was for the year 2003.[xxii]

Land use was considered in terms of housing starts, building permits, and land values. Halcrow noted that the number of housing starts is an indicator of the state of the economy. However, the housing starts Halcrow included in the T&R report were simply general trends for the GTA that was obtained from the Canadian Mortgage and Housing Corporation (CMHC). Halcrow noted that housing starts were in the range of 20,000 per year during the early to mid 1990s, and provided the actual starts for 1997 and 1998 (i.e., 28,848 and 28,683). The CHMC provides the housing starts for the metropolitan area of Toronto (see Figure C16).[xxiii] It is, however, unclear whether the area specified is the GTA or simply the city of Toronto. It was assumed that the values are for the GTA, because they were similar to Halcrow's numbers.

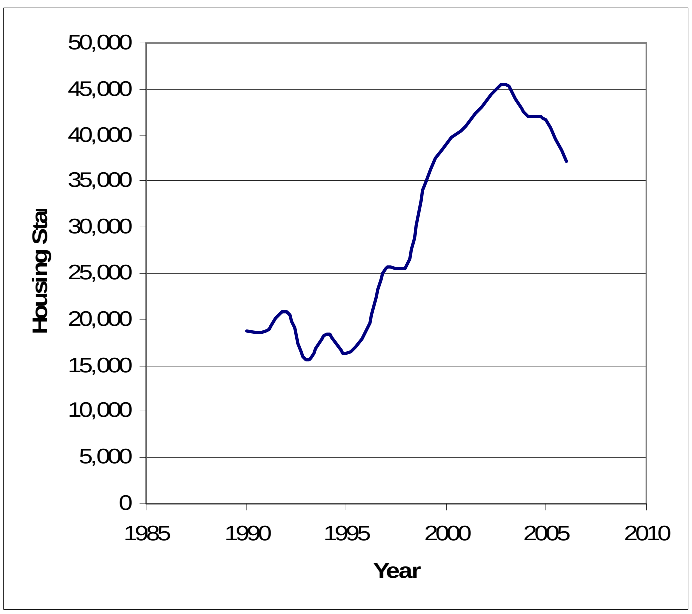

Figure C16: Housing Starts for the Toronto Area [xxiv]

Not much can be deduced from the historical housing starts. The number of housing starts increased from 1995 to 2003, but has since been decreasing. Halcrow also does not expand upon how housing starts were factored into their forecasts. However, it should be noted that the trend towards increasing housing starts has changed since 2003.

Local Transportation System

A section of 407 ETR parallels the most congested road in Toronto, Highway 401. Capacity had been added to Highway 401 multiple times, even reaching 16 lanes in certain highly congested areas. Halcrow thus assumed that traffic will divert from this congested option to the new, less congested toll alternative. Halcrow emphasized that even during economic downturns traffic in the area remained constant although it may not have grown. Halcrow did not reference their information, but it was assumed that the MTO provided the traffic numbers for Highway 401. Updated Highway 401 AADT figures were obtained from the MTO and an attempt was made to replicate Halcrow's calculations. The results proved to be quite different from the growth rates included by Halcrow in their T&R report. The AADT numbers provided by the MTO and the calculated growth rates are listed in Table C27.

Table C27: Historical Highway 401 AADT[xxv]

	Historical AADT					
	Neilson Road to Hwy 48		Hwy 400 to Weston Rd.		Dixie Rd to Hwy 403	
Year	Historical AADT	% Change from Previous Year	Historical AADT	% Change from Previous Year	Historical AADT	% Change from Previous Year
1986	159,300	-	288,300	-	173,700	-
1987	n/a	-	n/a	-	n/a	-
1988	176,100	-	319,600	-	201,000	-
1989	186,850	6.1%	338,150	5.8%	209,000	4.0%
1990	196,200	5.0%	351,700	4.0%	221,550	6.0%
1991	186,400	-5.0%	349,950	-0.5%	220,450	-0.5%
1992	188,100	0.9%	351,200	0.4%	221,000	0.2%
1993	197,400	4.9%	357,500	1.8%	228,700	3.5%
1994	206,700	4.7%	363,700	1.7%	236,500	3.4%
1995	213,100	3.1%	370,000	1.7%	244,200	3.3%
1996	219,400	3.0%	376,200	1.7%	252,000	3.2%
1997	225,700	2.9%	382,500	1.7%	259,700	3.1%
1998	232,100	2.8%	388,700	1.6%	267,500	3.0%
1999	235,000	1.2%	395,000	1.6%	275,200	2.9%
2000	244,800	4.2%	401,700	1.7%	283,000	2.8%
2001	249,700	2.0%	407,800	1.5%	290,700	2.7%
2002	255,800	2.4%	409,000	0.3%	298,500	2.7%
2003	261,900	2.4%	410,000	0.2%	306,200	2.6%
2004	268,000	2.3%	420,800	2.6%	314,000	2.5%
2005	274,100	2.3%	426,400	1.3%	321,700	2.5%

Listed in Table C28 are the traffic growth rates referenced by Halcrow and the growth rates calculated based on the AADT numbers obtained from the MTO. The Table also provides more recent traffic growth rates based on the information obtained from the MTO.

Table C28: Highway 401 Growth Rates[xxvi]

	1986 - 89		1989 - 92		1992 - 95		1995 - 98	1998 - 2001	2001 - 05
	Halcrow	MTO	Halcrow	MTO	Halcrow	MTO	MTO	MTO	MTO
Neilson Road to Hwy 48	17.5%	17.3%	4.4%	0.0%	1.6%	13.3%	8.9%	7.6%	9.8%
Hwy 400 to Weston Rd.	17.5%	17.3%	0.0%	3.9%	14.2%	5.4%	5.1%	4.9%	4.6%
Dixie Rd to Hwy 403	21.5%	20.3%	5.8%	5.7%	14.1%	10.5%	9.5%	8.7%	10.7%

The traffic growth rates for 1986 to 1989 are similar. However, for the 1989 to 1992 period, it seems that the growth rates have been switched for the Neilson Road to Highway 48 and Highway 400 to Weston Road sections. For the 1992 to 1995 period, the traffic growth rates are very different. At the time of the T&R report, this was the most recent time period for which information was available.

Halcrow used the Highway 401 traffic growth rates, historic economic growth rates, and a future 2.5 percent annual economic growth rate for Ontario to forecast average traffic growth on the 407 ETR. This resulted in a forecasted 3 to 4 percent per year corridor traffic growth rate.

Differences in Actual and Forecasted Traffic

Halcrow documented the historical trends for many variables, but also forecasted certain economic and demographic factors. These forecasts were input into their model and used for generating the final T&R numbers. The previous section compared historical trends to current data available for key variables. In this section, the forecasted economic and demographic values are compared to the actual values. Also, forecasted traffic and revenue is compared with actual traffic and revenue and the differences are discussed in great detail. An attempt is made to highlight the impact of estimates for, for example, ramp-up and trip generation on the road's actual traffic volumes and revenue.

Toronto Area Assumption Comparison

This section reviews the economic growth, population growth, and value of time assumptions used for the Toronto area. Halcrow examined the annual GDP growth in Canada for the following time periods: 1990 to 1996, 1997, and 1998. Halcrow also predicted the annual growth for the 1999 to 2003 time period. Actual annual growth rates obtained from Statistics Canada and some of Halcrow's numbers are provided in Table C29.

Table C29: Annual GDP Growth for Canada

	Halcrow		Statistics Canada	
	1990-1996	1999-2003	1999-2003	2003-2006
	Historical	Forecasted	Actual	Actual
Annual GDP Growth (%)	1.3	2.5	3.1	3.0

Canada experienced a higher annual GDP growth rate during the late 1990s when compared to the early 1990s. From Table C29, it is evident that the actual GDP growth (from Statistics Canada) was higher than the forecast used by Halcrow for the 1999 to 2003 time period.

For the Ontario/Toronto area specifically, Halcrow compared traffic growth on Highway 401 with the economic growth in the area. Economic growth values for Ontario were obtained from Statistics Canada. Table C30 provides the change in GDP in the respective time periods (as opposed to the annual GDP growth shown in Table C29).

Table C30: Economic Growth in Ontario [xxvii]

	1986-1989	1989-1992	1992-1995	1997-2000	2000-2003	2003-2006
Provided by	Halcrow (included in bond) (%)			Statistics Canada (%)		
Economic Growth in Ontario (%)	13.5	-3.8	9.2	19.7	5.7	8.1

Halcrow used the historical economic growth information to forecast future growth in the Ontario area. Table C30 shows that the economy experienced very different growth rates in the different time periods, ranging from -3.8 to 19.7 percent. However, the bond document does not provide the actual model inputs that Halcrow used for future economic growth rates, so no quantitative comparison could be conducted. The values in Table C30, however, illustrate the uncertainty associated with using historical economic growth values to predict future economic growth.

In Table C31, the forecasted population estimates were compared with the actual population numbers for the year 2001.[xxviii] For Toronto, Peel, and York, the actual population values were very similar to the Hemson forecast. For Durham and Halton, the regional forecasts were closer to the actual population values than the Hemson forecasts.

Table C31: Forecasted and Actual 2001 Population Values [xxix]

City/Area	2001		
	Actual*	Forecasted	
		Hemson	Region
	(in millions)		
Toronto	2.49	2.42	-
Peel	0.99	0.99	1.04
York	0.73	0.74	0.74
Durham	0.51	0.61	0.56
Halton	0.38	0.42	0.38
GTA	-	5.18	-
* from Statistics Canada			

Population was also forecasted for 2011. Actual population values for 2006 were obtained and compared with the forecasted 2011 population values (see Table C32). As is evident from Table C32, the City of Toronto has almost reached the predicted 2011 population in 2006. The City of Peel's population has already surpassed the Hemson 2011 forecast. Only Durham seems to be lagging behind and it is uncertain whether the population in this city will reach the forecasted values.

Table C32: Forecasted 2011 and Actual 2006 Population Values [xxx]

	2006	2011	
City/Area	Actual*	Forecasted	
		Hemson	Region
	(in millions)		
Toronto	2.50	2.54	>2.50*
Peel	1.16	1.15	1.21
York	0.89	0.93	0.94
Durham	0.56	0.80	0.76
Halton	0.44	0.53	0.49
GTA	-	5.95	>5.90
* from Statistics Canada			

Figure C17 illustrates the percentage change in Toronto's population between 1996 and 2001. Note that the darker the census tract, the higher the population growth in that tract.

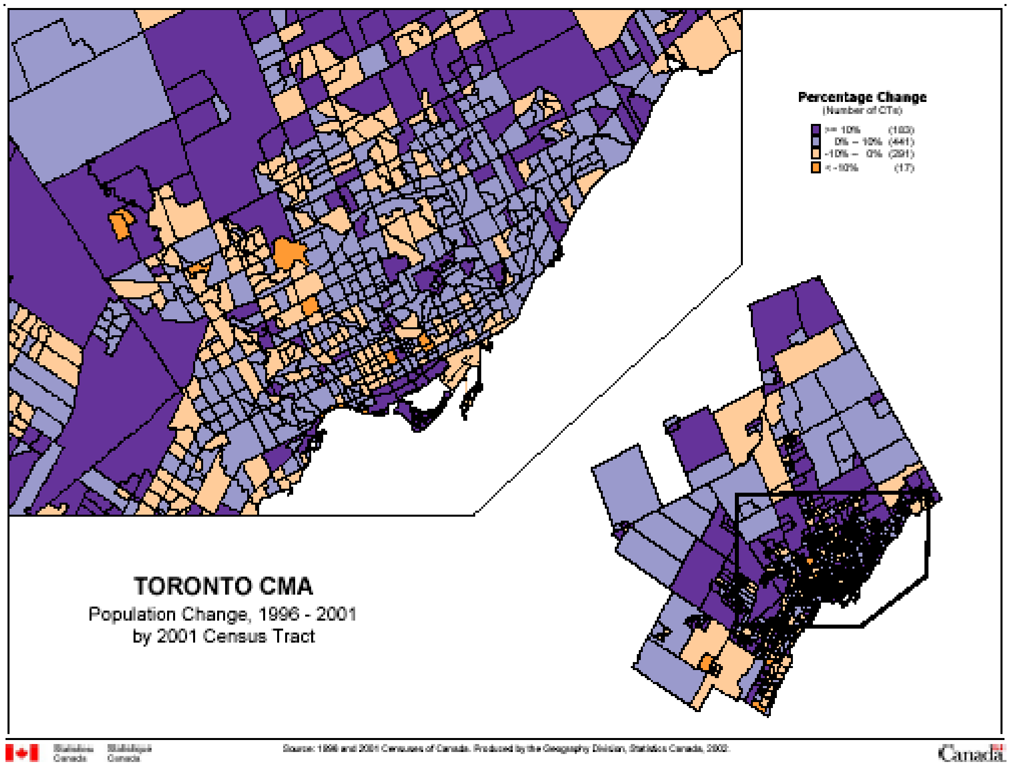

Figure C17: Population Growth in Toronto from 1996 to 2001[xxxi]

Halcrow used WSA's 1998 value of time in their forecasts. The WSA 1998 value of time was based on a 1993 Stated Preference Survey and calibrated given traffic levels on the 407 ETR. Halcrow reviewed a number of studies by the Transportation Association of Canada (TAC) and Transport Canada (TC) that estimated value of time for Canada. TC updated their value of time estimates in 2000 for the Toronto area. The values were provided in 2002 dollars, because that is the year the report was published and all numbers were converted to the publication year. The different value of time estimates by WSA, TAC, and TC are provided in Table C33. An inflation rate of 2 percent per year was used to adjust all the values to 2002 dollars.

Table C33: Value of Time Estimates[xxxii]

	WSA 1993	WSA 1998	TAC	TC Canada, 1993	TC* Toronto area, 2000
User Class	in 2002 year values				
Passenger Car	AM peak: $0.21/min	AM peak: $0.30/min	Work Time: $0.33/min	Work Purpose: $0.48/min	Work Purpose: $0.51/min
	PM peak: $0.23/min	PM peak: $0.32/min	Nonwork Time: $0.16/min	Nonwork Purpose: $0.14/min	Nonwork Purpose: $0.16/min
	Offpeak: $0.18/min	Offpeak: $0.25/min	-	-	-
Commercial Users	$0.40/min	$0.40/min	$0.49/min	-	-

Halcrow did not use TC's values as they pertained to Canada. In TC's 2000 update they calculated value of time for all the major Canadian metropolitan areas. The Toronto area was reported to have the second highest value of time, yet the value of time calculated by TC for Canada in 1993 is very similar to the value of time calculated for the Toronto area in 2000. This seems suspect.

Halcrow's risk analysis discusses the *"effect of increasing driver's VOT as a function of income; in reality, there is an upscale within this assumption that has not been explicitly taken into effect."* If value of time is calculated as a function of real income, then value of time will increase as real income increases. In other words, income can increase at a higher rate than inflation, resulting in a real increase in the value of time. However, Halcrow did not include the effect of increasing value of time on revenue forecasts.

Traffic and Revenue Forecasts for the 407 ETR (post-lease)

The users per day forecasted by Halcrow and WSA compared with the actual users per day are provided in Table C34 and Figure C18.

Table C34: Forecasted and Actual Users/day [xxxiii]

	Users/day		
Year	WSA Forecast	Halcrow Final Forecast	Actual Values
	in (000)		
1999	-	-	237.2
2000	-	-	263.8
2001	240.0	267.2	285.1
2002	286.6	318.4	308.9
2003	303.8	337.3	313.8
2004	322.2	357.6	329.5
2005	340.2	377.4	346.1
2006	358.1	397.0	357.4
2007	375.8	416.5	374.3
2008	394.5	437.1	
2009	414.3	458.8	
2010	433.6	480.0	
2011	453.3	501.7	
2012	469.9	520.0	
2013	485.3	537.0	
2014	501.2	554.5	
2015	516.3	571.1	
2016	531.8	588.2	
2017	547.2	605.2	
2018	560.8	620.2	
2019	574.8	635.6	
2020	586.3	648.3	
2021	599.4	662.7	

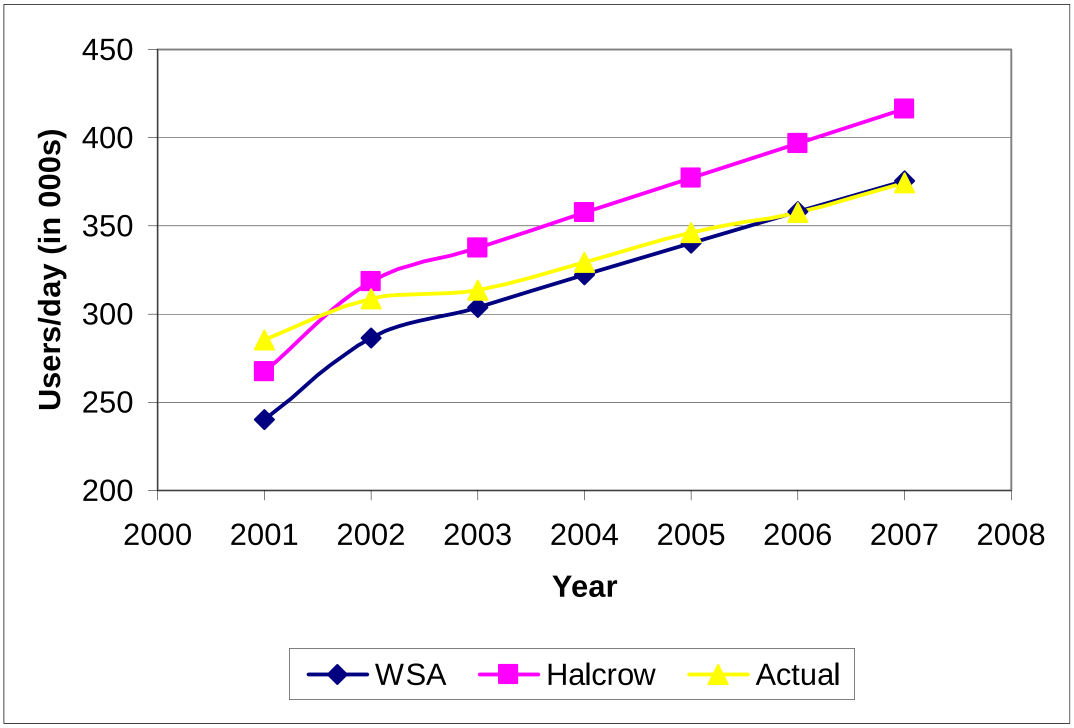

Figure C18: Forecasted and Actual Users/day [xxxiv]

From Figure C18, it is evident that Halcrow's 2001 and 2002 forecasts are very similar to the actual traffic volumes—more so than in the case of WSA. WSA's toll road usage forecasts for 2001 and 2002 were substantially lower than the actual usage. However, after 2002 actual traffic volumes were much closer to WSA's projections, while it seems that Halcrow overestimate toll road usage from 2003 onwards. However, the information in Figure C18 has to be interpreted against the large toll rate increase that occurred in 2002 and subsequently in each year since then, i.e., 2003, 2004, 2005, 2006, and 2007. These toll rate increases were much higher than the inputs used by Halcrow in their forecasts. Table C35 and Figure C19 thus illustrate the forecasted revenue by WSA and Halcrow compared to actual revenues.

Table C35: Forecasted and Actual Revenue [xxxv]

	WSA Forecast*	Halcrow Final Forecast*	Actual Values
Year	(in millions)		
2000	-	170.1	189.5
2001	186.5	232.1	244.1
2002	237.7	297.6	311
2003	258.8	324.5	349.5
2004	281.3	353.2	380.2
2005	305.0	383.3	420.3
2006	329.8	415.0	455.7
2007	356.9	449.7	518.9
*In current year dollars assuming a 2% inflation rate			

Figure C19: Forecasted and Actual Revenue [xxxvi]

As with the forecasts of toll road usage, Halcrow's revenue estimates for 2000, 2001, and 2002 are very similar to actual revenues collected. On the other hand, WSA's forecast for 2001 and 2002 are much lower than the actual revenues collected. As mentioned earlier, higher toll rates were implemented in 2002—and every year subsequently—than what Halcrow or WSA used as model inputs. Table C36 illustrates the difference between the forecasted and the actual revenue for the period from 2001 to 2007.

Table C36: Differences in Forecasted and Actual Revenue [xxxvii]

	Total Revenue	Difference
Actual	$2,679.7 m	
WSA Forecasted	$1,956.0 m	$723.7 m
Halcrow Forecasted	$2,455.4 m	$224.3 m

A more in-depth analysis of the factors that could have contributed to the difference between actual and forecasted toll road usage and revenue, besides the higher toll rates, are provided here.

Opening Dates

Both the WSA and the Halcrow T&R forecasts assumed that the new extensions would be open by July 1, 2001 after a construction period of 26 months. The actual opening dates of the extensions were one month later (on July 31, 2001) for the West extension and two months later (on August 30, 2001) for the East extension. The T&R reports therefore include an additional three months of toll road usage on the two extensions in their 2001 forecasts. Despite the additional traffic and revenue resulting from the extensions opening later than assumed by the T&R firms, both 2001 revenue and traffic forecasts were lower than actual values. The 2001 forecasted and actual traffic and revenue are provided in Table C37.

Table C37: 2001 Forecasts and Actual Values [xxxviii]

2001	Users/day	Revenue (in millions)*
WSA Forecast	240,000	186.5
Halcrow Final Forecast	267,200	232.1
Actual Values	285,100	244.1

Construction of Additional Interchanges on Central Section

In terms of the concession agreement, the private concessionaire agreed to complete several interchanges and construct two new interchanges on the existing Central section. The partial interchanges to be completed were Britannia Road, Mavis Road, Woodbine Avenue, Kennedy Road, and McCowan Road.[xxxix] The two new interchanges were at Centre Street and Kipling Avenue. WSA's initial forecasts included only four of these interchanges, so they later revised their forecasts in a letter to Merrill Lynch in February 1999. The letter stated that the three additional interchanges[16] would generate 1.3, 1.5, and 1.7 percent additional revenue in years 2001, 2011, and 2021 respectively.[xl] These interchanges were, however, very close and this prompted the concessionaire to negotiate the number of interchanges they were required to build. In the end the following interchanges were completed: Britannia Road, Mavis Road, Woodbine

[16] It does not stipulate which interchanges.

Road[17], Kennedy Road, and McCowan Road. The two new interchanges at Centre Street and Kipling Avenue were never constructed.[xli] Given that WSA predicted that three interchanges would increase revenues by the amounts listed, it can be argued that the traffic and revenue would decrease by a similar amount given that two full interchanges were never constructed.

Electronic Tag Usage and Market Penetration

The 407 ETR had a 50 percent ETC usage during the first year of operation. In 1999, ETC usage reached 67 percent. Furthermore, the number of ETC transactions has increased from 300,000 in 1999 to 857,000 in 2007. Table C38 lists the number of transponder accounts and the current percentage of trips billed to transponder accounts.

Table C38: ETC Penetration [xlii]

	Transponder Accounts	ETC Usage (%)
1999	346,371	67
2000	419,743	69
2001	489,326	71
2002	535,323	74
2003	588,005	75
2004	640,969	77
2005	709,376	78

Figure C20 shows the growth in ETC usage as a percentage of users/day and the associated decrease in video users over time. It also illustrates WSA's initial ETC and video usage percentages, as well as the interpolated percentages for the non-modeled years. Halcrow did not document a change in the ETC usage levels used by WSA, so it was assumed that Halcrow used the WSA estimates in their final base case.

[17] The Woodbine Interchange was possibly completed at a later date.

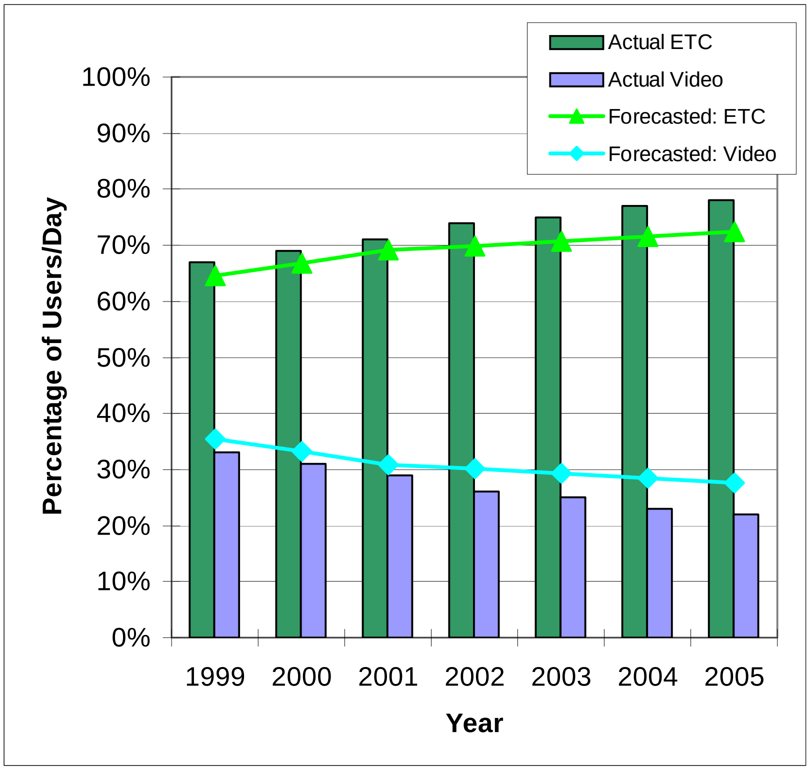

Figure C20: Forecasted and Actual ETC and Video Usage [xliii]

For 2011, WSA predicted that 77.1 percent of the daily users would use a transponder, but as Figure C20 and Table C38 show, ETC usage already reached 78 percent of daily users by 2005. The private concessionaire reported an 82 to 83 percent ETC daily usage during the winter months and a 76 to 77 percent ETC daily usage during the summer months in recent years. The lower ETC usage in the summer months can be attributed to occasional users visiting the Toronto area. [xliv] WSA's prediction of ETC usage is thus lower than the actual values.

The level of ETC penetration is important as it impacts revenue levels and to some degree usage[18], but it is impossible to determine the extent of the impacts. Trips that are billed through video imaging incur a fee per trip to offset the higher costs associated with video billing. For example, video billing requires additional resources to identify, process, and bill the user. Conversely, each transponder account holder pays a one-time activation fee and a monthly account fee. Thus, both payment types—video and transponder—have associated fees that have changed over time. Given that it is not known how ETC penetration is considered in the estimation of toll road usage and revenue levels, it is impossible to determine the impact of the higher than expected ETC penetration level on toll road usage and revenue levels.

In Halcrow's review of WSA's initial base case forecast, and consequently their own analysis, there is very little discussion of transponder penetration levels and how that might affect traffic or revenue levels. For example, Halcrow does not discuss how many of their predicted trips will be ETC or video imaging.

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18 It is often argued that an electronic tag makes the user less sensitive to the toll rate charged. Users are billed monthly, with the result that users only become aware of the charges a full month later. On the other hand, an occasional user—who does not have a transponder account—might choose not to use the road because of a lack of information about the total costs that will be incurred.

Unbillables and Uncollected Revenue[19]

At the time of handover, unbillable trips were approximately 6 percent of total trips. Note that this percentage is for March 1999, but that January 1999 and December 1998 had 11.9 and 7.0 percent unbillable trips, respectively.[xlv] Also note that this is not the percentage of outstanding bills.

Upon taking possession of the 407 ETR in May 1999, the concessionaire began pursuing unpaid bills aggressively[20]. The government had been less aggressive in pursuing unpaid bills, and unfortunately this initiated some tension between the concessionaire and the government. The government stated that the concessionaire's customer service center was inadequate and that users did not have a reasonable opportunity to reach an individual to discuss their bill. The concessionaire, however, took over the customer service center from the government. Some citizens with outstanding tolls claimed to never have driven on the road. Other citizens with tolls due from many months prior thought they would never need to pay the tolls, because so much time had passed. The concessionaire suspended the collection process (not the outstanding bills) for a period of time while they improved their customer service[21].[xlvi] A comparison between the customer service center at handover and in 2007 is provided in Table C39.

Table C39: Customer Service Characteristics [xlvii]

	1999	2007
Work Stations	21	174
Telephone Lines	21	640
Wait Time	long	less than 30 sec.
Size of Center	1,400 sq. ft	13,800 sq. ft.
Transponder Accounts	300,000	857,000
Average Workday Trips	237,000	400,000

After the concessionaire addressed the customer service concerns, they turned their efforts to pursuing each and every transaction, specifically trips for which there was a clear amount of tolls due that had simply not been paid. The government, however, objected when the concessionaire began pursuing overdue bills again. Lawsuits were filed between the concessionaire and the government. These lawsuits resulted in lengthy litigation and much ill will. In terms of the concession agreement, the government had to deny vehicle license and registrations to Ontario citizens with outstanding tolls due, i.e., users who had already received a bill. The legal system sided with the concessionaire and the government was required to deny license plate renewals to anyone with outstanding toll debt. The concessionaire has increased collections of overdue payments substantially.

19 There seems to be some sensitivity surrounding unbillables or "free trips," because most of the toll agencies interviewed were not forthcoming in providing the percentage of trips or transactions that were unbillable, i.e., for which they did not collect a toll payment. One reason given was that a "free trip" has not been defined in the industry. For example, is it a trip in which the user does not pay the full toll or is it only those trips which the agency has unsuccessfully pursued the overdue tolls from users? In the case of the 407ETR, the concessionaire aggressively pursues all tolls due no matter the amount. However, there seems to be two types of "free trips": those trips were the customer refuses to pay the toll and those trips that for lack of information cannot be collected.

20 This pertained to users that did not pay overdue tolls.

21 They invested over $27 million.

A little-mentioned fact is that during the time period that the customer service center was revamped and during the litigation period the concessionaire charged interest on the overdue payments. The highest interest rate allowed by the Canadian government is 26 percent per year. Unpaid bills were thus accruing interest at 26 percent per year during the time when the concessionaire stopped to actively pursue unpaid bills.[xlviii] Thus, a $1 bill will increase to $1.26 by the next year.

The concessionaire has decrease the number of unbillable trips substantially. In an interview with the concessionaire, it was suggested that five initiatives[22] have decreased the unbillables:

1. an increase in transponder and thus ETC usage,
2. upgrade to OCR (toll collection system),
3. replacing certain cameras (toll collection system),
4. improved and increased toll enforcement by police, and
5. upgrade to VDAC (toll collection system).

Three of the initiatives relate to technology advancements, one involves higher ETC usage, and one involves higher enforcement. Figure C21 illustrates the decrease in unbillable transactions since handover.

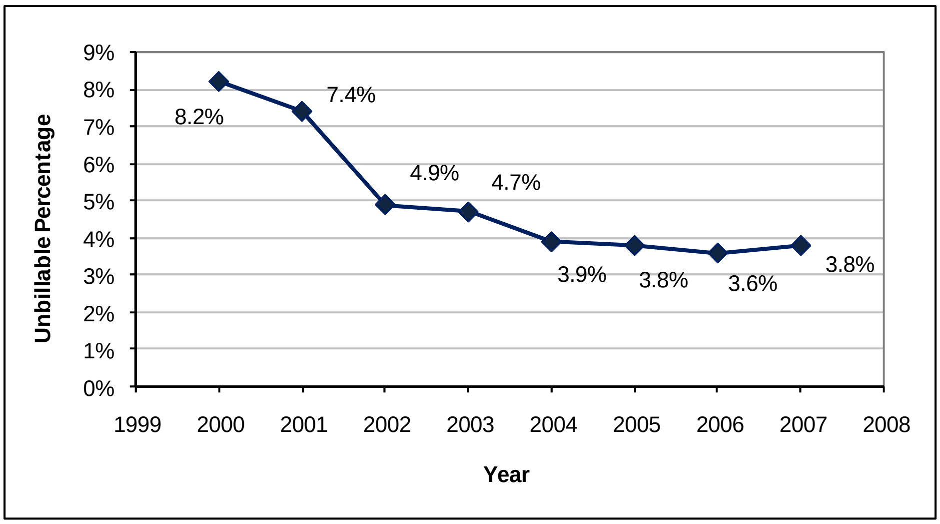

Figure C21: Percentage of Unbillable Transactions [xlix]

In 2000 and 2001, the toll collection system was improved, which seems to have been effective in decreasing the percentage of unbillable transactions. Halcrow argued that decreased unbillables could increase total revenue by one percent. In Halcrow's 2001 revenue calculations decreased unbillables would result in a $2 million increase in forecasted revenue. As it is unclear what the assumed percentage reduction in unbillables was that resulted in the one percent increase in revenue, the calculations could not be replicated for future years.

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22 The bond documented suggested that *"technology improvement, more reliable transponder transactions, and increase enforcement efforts"* would decrease the number of unbillable trips and increase revenue by 1 percent.

Toll Rates

The right of the concessionaire to increase toll rates has been another contentious issue between the concessionaire and the Liberal McGuinty government. The concession agreement defines the following terms:

- *"Base Year: The year in which the previous calendar year had more than 4 months of operation of both extensions.*
- *Traffic Threshold: This is 95 percent of the average segment of traffic flow during the peak period for the highest peak traffic levels during 60 percent of the business days of the base year. Additionally, the traffic threshold value grows by 1-3 percent per lane after the base year, up to a maximum of 1,500 vehicles per hour per lane.* [l]
- *Toll Threshold: The initial toll threshold in year 1999 was $0.11/km for light vehicles, x2 for heavy single unit, and x3 for heavy multi-unit. This increased by 1.5 percent in 2000 and 2 percent every year after that. The toll threshold is capped at 'a total increase (before inflation) of not more than 30 percent'."* [li]

The concessionaire can thus raise tolls to the toll threshold in the base year. Then, as long as traffic volumes were higher than the traffic threshold, the concessionaire could raise tolls to their desired rates. If the traffic volumes are below the traffic threshold and the toll rates above the toll threshold, the concessionaire has to pay the province a steep penalty.

The T&R report stipulated the assumed toll rate increase schedule. WSA and Halcrow assumed that tolls would increase by 10 percent in real or constant terms from 1999 to 2001, another 27 percent from 2001 to 2011, and from 2011 to 2021 another 21 percent for peak periods and 7 percent for off-peak periods. The tolls implemented by the concessionaire differed greatly from this schedule. Table C40 lists the actual tolls charged.

Table C40: Actual Passenger Car Toll Rates for Each Year [lii]

	Peak	Off Peak	Night
1998	0.100	0.070	0.040
1999	0.100	0.080	0.040
2000	0.105	0.105	0.050
2001	0.110	0.110	0.060
2002	0.115	0.115	0.115
2003	0.130	0.121	0.121
2004	0.140	0.131	0.131
2005	0.149	0.141	0.141
2006	0.163	0.155	0.155
2007	0.190	0.180	0.180

The peak and off-peak toll rates for passenger cars were the same in 2000, 2001, and 2002 (see Table C40). During these years, the highest toll rate the concessionaire could charge was the peak period toll rate. The concession agreement with the Province did not define the peak hour periods. The concessionaire interpreted this to mean the peak period for toll rate purposes—not actual traffic volumes—could be all day. This all day peak period resulted in slightly lower traffic volumes, but higher revenue levels than if peak toll rates were charged for 7 hours a day (as the OTCC had done previously).

This toll rate strategy suppressed the traffic during the base year. Because all future traffic thresholds would be determined considering the base year volume, the lower the base value the lower the traffic needed to reach the following year's traffic threshold. In other words, the lower the traffic threshold, the higher the chance for the threshold to be met, and the higher the chance for the concessionaire to charge the toll rate they chose. The all-day peak period angered the government and litigation resulted that challenged the use of 2002 as the base year. However, the courts sided with the concessionaire. Legally, the concessionaire has the right to charge any toll rates as long as traffic volumes are above the traffic threshold.

A comparison between the tolls charged by the concessionaire and the tolls that were used to forecast the traffic and revenue are provided in Figure C22.

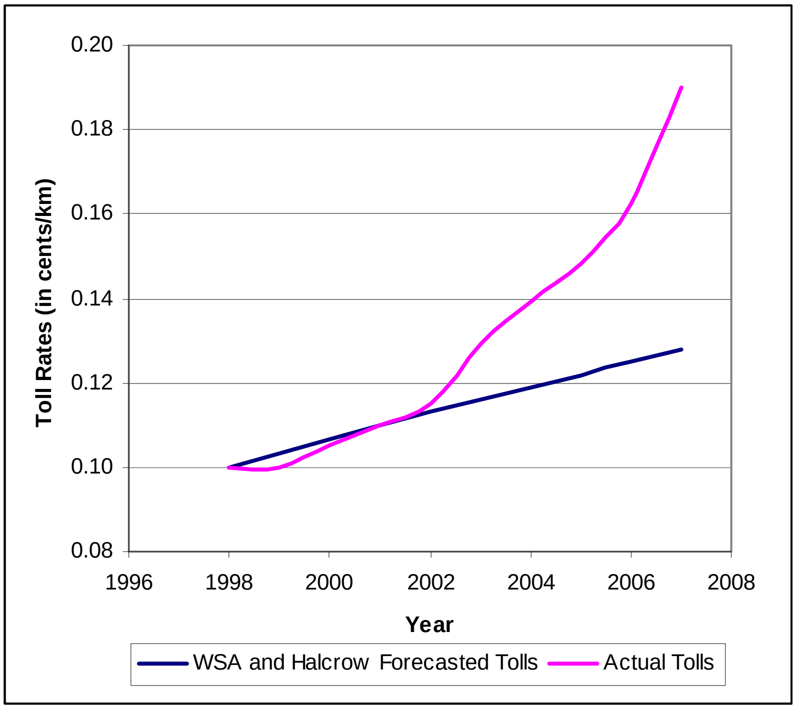

Figure C22: Forecasted and Actual Toll Rates Charged for Passenger Cars during the Peak Period [liii]

The Figure clearly illustrates the large difference in the toll rates used in the forecast and that were implemented given the 2002 base year. The use of a lower toll rate[23] potentially impacted both the traffic and revenue levels. Higher toll rates should decrease traffic volumes, hence leading to the overestimation of traffic volumes. Also, higher tolls increase the revenue to a point, potentially leading to the underestimation of revenue levels.

[23] This was no fault of WSA or Halcrow as this is the schedule the Province and the concessionaire provided to them, respectively.

Revenues from Other Sources

Halcrow's assumed revenue from other sources was based on past amounts collected from the monthly account fees, video billing fees, and new account fees. Halcrow assumed that the then $20 million from other sources would increase each year at a similar rate as the assumed toll rate schedule. As the previous section showed, the planned toll rate schedule used by Halcrow did not materialize. However, it is not quite clear how the higher toll rates impacted the estimated revenues from other sources, given higher ETC usage, lower video billing, and a more than doubling of the number of transponder accounts. Ultimately, the actual revenue from these sources is not public information and thus this assumption could not be verified.

Truck Percentages

Because trucks pay two or three times higher tolls than passenger vehicles, depending on the size of the truck, the revenue generated by trucks could be substantial in terms of total revenue. The bond document stated that trucks accounted for approximately 7 percent of the Highway 407 transactions and thus it was assumed that the same truck percentage would remain in the future. Truck percentages on the Highway 401 non-toll alternative, where it parallels 407 ETR, are approximately 12 to 13 percent. On the western section of Highway 401 the percentage reaches 15 to 20 percent. The concessionaire indicated that Highway 401 attracts a number of trucks because many truck destinations (i.e., industrial areas) are around the road. Many trucks also use Highway 401 to get to Toronto, not through Toronto.[liv] Unfortunately, the concessionaire does not release information about the current 407 ETR vehicle profile, so it was not possible to verify this assumption.

Annualisation Factor

An annualisation factor is a value that is used to convert daily traffic volumes and revenues to annual values. The reason for an annualisation factor is because conversion from daily to annual traffic volumes is more complicated than simply multiplying by 365, especially when conducting revenue forecasts. The bond document states that *"there are fewer trucks at weekends, toll rates are lower than during the rest of the week, and there is a different proportion of transponder and video users at weekends."* An annualisation factor attempts to balance these differences out and thus allow daily volumes to be converted to annual volumes. Ultimately revenue is estimated on an annual, not daily, basis.

WSA indicated the need to adjust their annualisation factors in 1998 as follows:

- For Traffic: 308.2 for ETC trips, 335.8 for Video trips
- For Revenue: 289.9 for ETC trips, 319.5 for Video trips

Halcrow also used these factors in their calculations.[lv] However, it was not possible to multiply the average users/day Halcrow predicted with the annualisation factors to obtain total annual users, because Halcrow did not provide separate estimates for ETC usage and video trips in each year. WSA provided ETC usage percentages for 2001, 2011, and 2021. However, ETC usage was predicted to increase as time passed, but it was not stated whether this increase was linear or not. Thus, to interpolate in-between year values without this information could discredit any conclusions.

However, by using available information—such as actual average users/day, actual ETC percent usage, and actual video percent usage—and the assumed annualisation factors, the number of annual trips the annualisation factors would have generated can be calculated and compared with the actual annual trips[24]. The results of this calculation, i.e., annual trips calculated based on actual users/day and the annualisation factors, are summarized in Table C41.

Table C41: Annual Trips Calculated Using the Annualisation

Year	Actual Users/Day	Average Actual ETC usage	Average Actual Video usage	Actual ETC trips	Actual Video trips	Total Trips *
	Provided	Provided	Provided	Actual users/day * ETC usage	Actual users/day * Video usage	ETC trips*308.2 + Video trips*335.8
2000	263800	69%	31%	182022	81778	83,560,233
2001	285100	71%	29%	202421	82679	90,149,760
2002	308900	74%	26%	228586	80314	97,419,646
2003	313800	75%	25%	235350	78450	98,878,380
2004	329500	77%	23%	253715	75785	103,643,566
2005	346100	78%	22%	269958	76142	108,769,539
* Annualisation Factors: ETC trip: 308.2, Video trip: 335.8						

Table C42 and Figure C23 illustrate the difference between the estimated annual trips (using the annualisation factors) and the actual annual trips as obtained from the concessionaire.

Table C42: Comparison between Annualisation Factor Annual Trips and Actual Annual Trips [lvi]

	Total Yearly Trips		
Year	Actual	Annualisation Factor	% Difference
	(in millions)		
2000	79.4	83.6	5.2
2001	86.1	90.1	4.7
2002	93.2	97.4	4.6
2003	94.5	98.9	4.7
2004	99.5	103.6	4.2
2005	103.6	108.8	5.0

[24] The concessionaire provided actual annual trip information for 2000 to 2005.

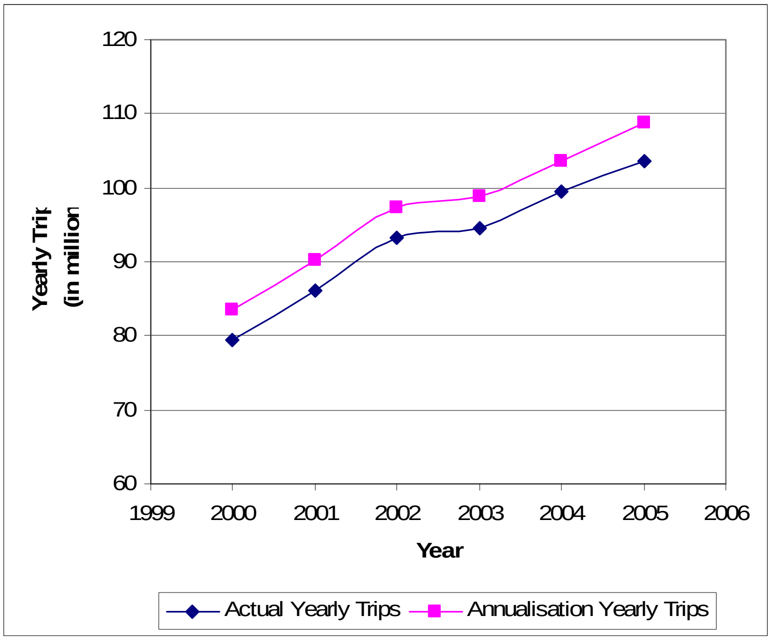

Figure C23: Comparison between Annualisation Factor and Actual Annual Trips [lvii]

Figure C23 shows that the annualisation factor resulted in an overestimation of the annual trips in each year between 2000 and 2005. This would also result in an overestimation of the revenue. WSA mentioned that when they changed their annualisation factors in 1998 it reduced revenue by about 4 percent in 2001, 2011, and 2021. However, there is little discussion about these factors, how they are determined, or the rational for adjusting these factors.

Ramp-up Period

WSA assumed that the ramp-up period for the central section was finished, while Halcrow assumed it was still ongoing. Halcrow noted a traffic growth of 17 percent more users/day from September 1998 to May 1999—the time of handover. Halcrow assumed half of the 17 percent is normal traffic growth and the other half is trips diverted from other routes. Accordingly, in their final base case adjustments they added an additional 8.5 percent total users/week. This resulted in an additional 21,000 users/day and $17 million in additional revenue for the 2001 forecast. It seems unclear as to why the consultant added these users to the 2001 forecast. By that time, the central section would have been open for three years, which is much longer than the predicted ramp-up period by both Halcrow and WSA.

One rationale for adding these users might be to account for the extensions' ramp-up period. However, both Halcrow and WSA predicted the two extensions would be open by July 1, 2001, and have a ramp-up period of only six months, thus ending in December 2001. WSA included the effect of the extension's ramp-up in their forecast, which was the starting point for the Halcrow forecast. In addition, Halcrow noted in their trip generation section that the opening of the extensions might spur additional trips on the central section but decided not to include these trips in the final base case forecast.

Land Use Effect

Land use assumptions that do not materialize can introduce substantial uncertainty into the T&R forecasts. Halcrow did not clearly specify their land use assumptions so this section addresses general land use growth in the Toronto area. General land use questions were asked during interviews with the MTO and the 407 ETR concessionaire. A general map of the Toronto area is provided in Figure C24.

Figure C24: Map of Toronto Area [lviii]

The MTO mentioned both residential and commercial land use in the 407 ETR corridor when the central section was built. The concessionaire indicated that most of the area around the extensions was rural prior to their construction. The MTO indicated that more development and denser land use around the 407 ETR have occurred, but that it has been limited by local municipality zoning. Also, the MTO noted a few multi-family units (i.e., apartments) have been developed in the 407 ETR corridor and that development in Burlington has began adjacent to the highway. Also, in Oakville commercial developments have occurred near the highway.[lix] The concessionaire indicated growth on the north side of the 407 ETR, but felt that land development has been slow in the area around the East extension.

Most stakeholders interviewed emphasized that the areas around the 407 corridor (particularly the Western extension) are very affluent. For example, Oakville has the highest salary/capita in the region. Other wealthy neighborhoods are Markham, Richmond Hill, Mississauga, and Brampton.

The concessionaire mentioned that employment is currently moving from the downtown area to the suburbs.[lx] The 407 ETR is a major commuter route but it is not apparent how employment relocation might affect toll road usage. Presumably, faster-than-predicted land development would have a positive impact on toll road usage and slower development would have a negative impact on toll road usage. However, in the 407 ETR corridor, some areas have seen substantial growth while other areas, such as the east, have seen slower growth. The impact of these land use developments on the traffic and revenue forecasts could not be determined because Halcrow did not clearly specify their land use assumptions.

General Observations and Conclusions

There is a clear difference in the level of detail and number of assumptions included in this T&R report compared to Orlando, Dallas, and Houston. In addition, this document includes a sensitivity analysis and a risk analysis, unlike all the other T&R documents.

The most notable observation is that a private concessionaire's innovation and operational strategies can result in a large discrepancy between actual traffic and revenue and forecasted traffic and revenue. For example, the 407 ETR concessionaire increased toll rates at substantially higher rates than assumed by WSA or Halcrow in their forecasts. This suppressed traffic levels—i.e., traffic demand for the road is higher than the actual usage of the road due to the high toll rates—and resulted in higher than forecasted revenues. The private concessionaire has this authority in terms of the leasing agreement and since the concessionaire is not beholden to a board or the public (as a public toll agency would be) it could implement these higher toll rates. Given the continued growth[25] in the use of the toll road and high congestion levels on the parallel alternatives, it is also probable that Toronto motorists are not as sensitive to toll rates as WSA and Halcrow predicted through their value of time estimates. It is thus arguable that the toll road users have a higher than predicted value of time. Until conditions change (such as value of time, congestion, etc.) the concessionaire will be able to raise toll rates unilaterally, aggravating the difference between forecasted and actual traffic and revenue levels.

[25] Traffic growth has not been as high as predicted, but overall toll road usage continues to increase.

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Appendix D: Harris County's Toll Road Authority

This appendix covers the history of Harris County's Toll Road Authority (HCTRA) and the development of its toll road network. It covers historical plans for Houston and Harris County's highway and arterial network, feasibility studies, traffic and revenue (T&R) studies, and various bond documents issued by HCTRA for the toll roads that comprise HCTRA's system.

Figure D1 shows the HCTRA system as it exists today. It is composed of the Hardy Toll Road, the Sam Houston Tollway (West, South, and East sections), the Houston Ship Channel Bridge, the Airport Connector, the US90A spur, and the Westpark Tollway. The system connects with a smaller system run by the Fort Bend Toll Road Authority along the Westpark Tollway to the west and the US90A spur to the south. Construction is underway to extend the Hardy Toll Road from IH610 into downtown and to finish the northeast corner of the Sam Houston Tollway.

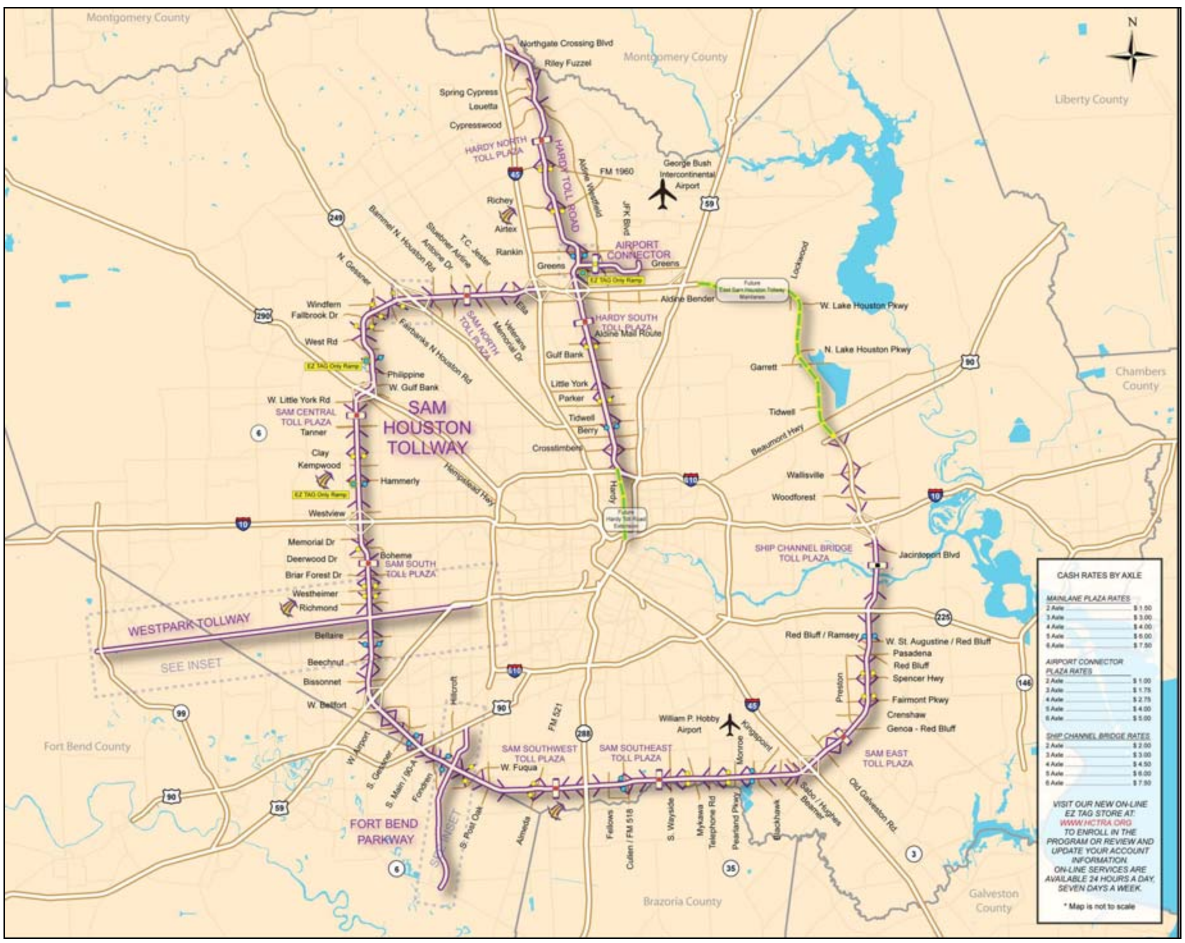
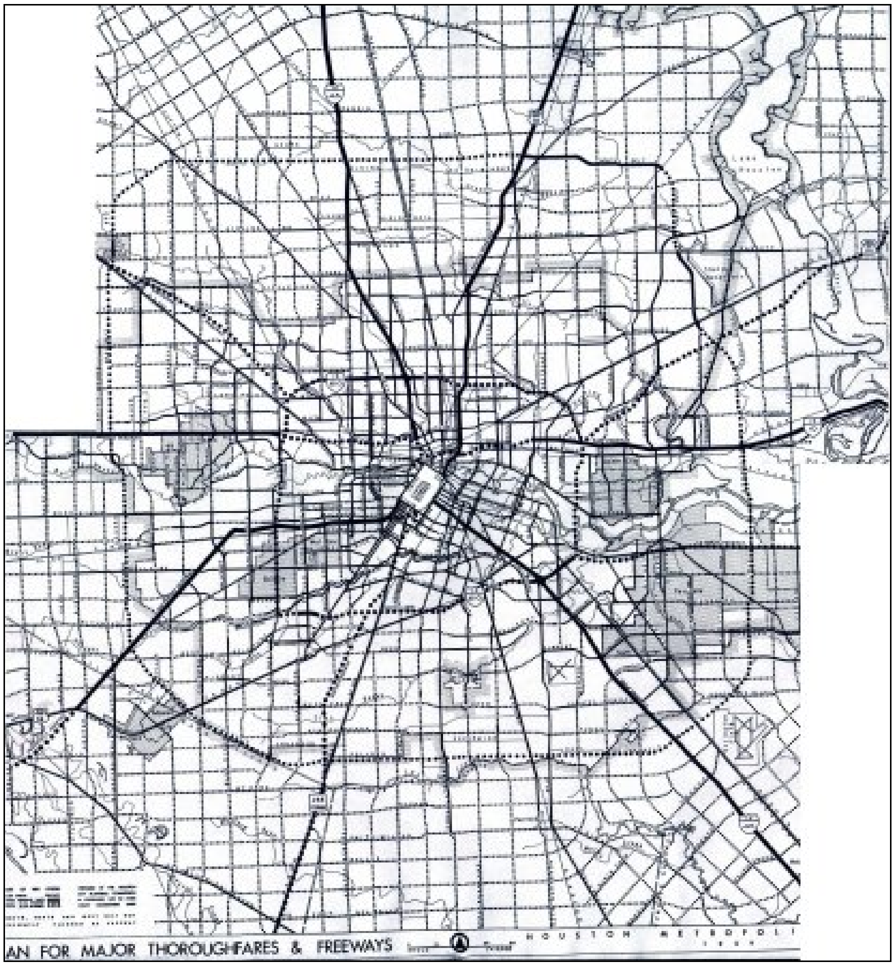


Figure D1: HCTRA System Map

Initial Feasibility and Historical Perspective

The first public designation of an outer loop around the City of Houston within Harris County was in the 1952 city plan. This plan provided a brief description and rationale for its need, location, and the means of development (Slotboom 2003). In the 1959 Major Thoroughfare and Freeways Map, the route was specifically outlined. Figure D2 shows the proposed route, which—aside from the segment though Jersey Village—is the basic route that the Sam Houston Tollway follows today.



Source: Slotboom, 2003

Figure D2: 1952 City of Houston Plan for Major Thoroughfares

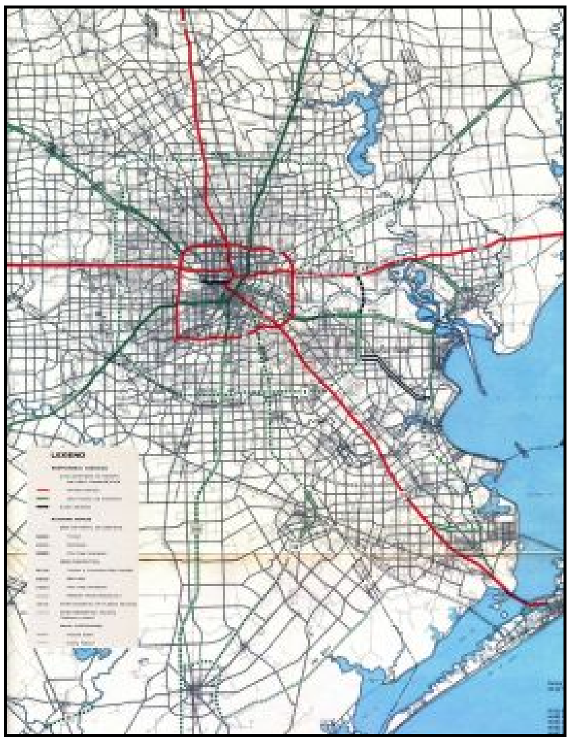
This loop was subsequently promoted by various agencies, including the Houston Chamber of Commerce[1] (Chamber), the Texas Turnpike Authority (TTA), the City of Houston, and the Texas Department of Transportation (TxDOT), formerly Texas Department of Highways (DOH).

Houston's highways benefited from strong business support throughout the 1960s, 1970s, and 1980s. The Chamber, along with business and industry leaders, provided constant support for highway development. For example, the Chamber, actively helped to facilitate the production of transportation plans through its Highway Committee, as well as the development and implementation of freeways (Slotboom, 2003). According to Slotboom (2003), the Chamber's

1 The Houston Chamber of Commerce merged with the Houston World Trade Association and the Houston Economic Development Council in 1989 and formed the Greater Houston Partnership

efforts were *"crucial in the formulation of the original freeway plan in the early 1950s and in the formulation of the Regional Mobility Plan in 1982."* During this period the Chamber was also extremely active in securing voter approval for highway bond issuances and was involved in legislative efforts regarding state and federal highway funding. However, it was not until influential County Judge John Lindsay was elected in 1974 that this beltway route—along with the Hardy Toll Road—moved beyond concept to implementation.

The concept for the Hardy Toll Road was first publicly enunciated by the TTA in 1979. The TTA commissioned a feasibility study in October 1979 that was performed by Wilbur Smith and Associates (WSA). As can be seen on the 1982 proposed thoroughfares map issued by the Houston Galveston Area Council (H-GAC), the Hardy Toll road had yet to appear as a formal part of the planned network (Figure D3).



Source: Slotboom, 2003

Figure D3: 1982 Map of Proposed Thoroughfares—Houston Galveston 1982 Study

When the outer loop was first proposed in the 1950s, Harris County and the City of Houston had experienced a period of rapid population and business growth[2]. Between 1940 and 1958, 80 square miles of land were subdivided in and around the city of Houston.

Houston's growth was driven by its emergence as a petroleum economy following the discovery of oil at Spindeltop in 1901. In its official history, the City of Houston states that this discovery *"marked the beginning of Houston's transformation from an exporter of agriculture and lumber products to a national petroleum center"* (City of Houston, 2000). Houston was also often immune to the economic downtowns that affected the rest of the U.S. For example, during the Great Depression Houston experienced no major bank failures and building permits actually

[2] Houston's population and business growth rates were among the highest the U.S. during the twentieth century.

increased during this time. During the Second World War, Houston's economy benefited from the federal government's program to develop a synthetic rubber industry in Houston because of the city's access to petroleum feed stocks and good port facilities. After the oil embargo in 1973 Houston saw a fourfold increase in the price of oil and this led to a 9.5 percent increase in local employment when the nation saw a 1.5 percent decline (City of Houston, 2000).

Harris County and Houston have undoubtedly benefited from the energy industry, which in 1982 accounted for 84.3 percent of Houston's economic base. This has declined over time to 61 percent in 1989 and 48 percent in 2002. Harris County also experienced significant population growth because of the petroleum industry. Table D1 illustrates Houston and Harris County's population growth from 1900 to 1980.

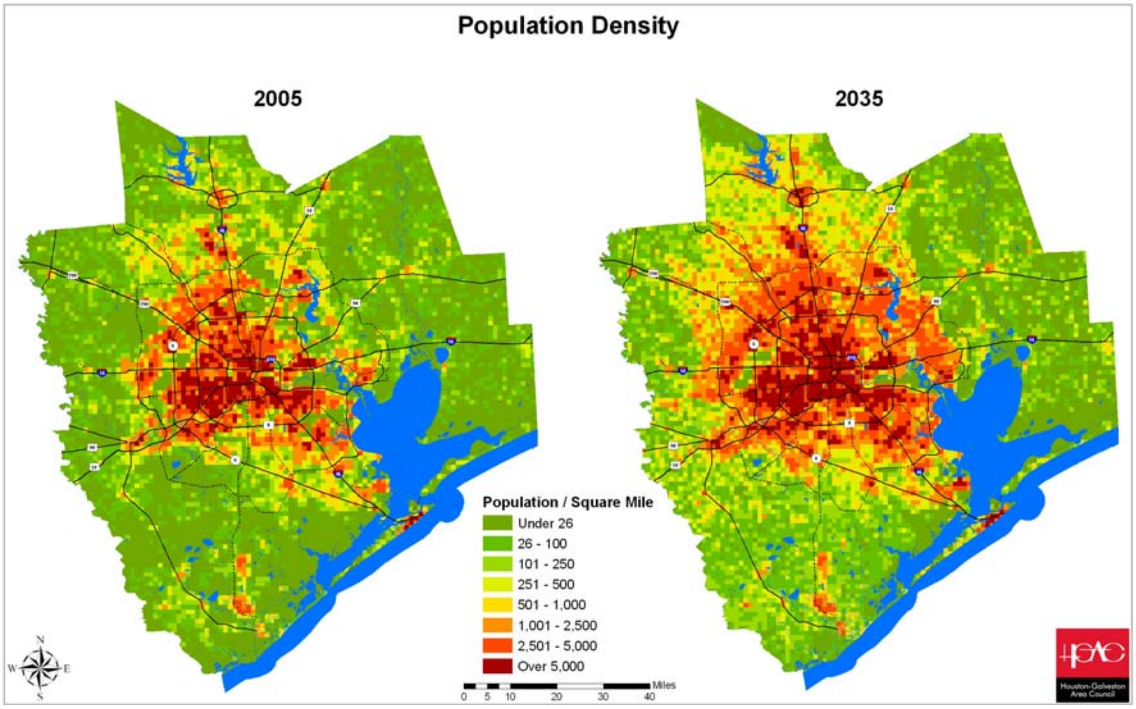
Table D1: Historical Population of City of Houston and Harris County (1900-1980)

Year	City of Houston	Harris County
1900	44,633	63,768
1920	138,276	186,667
1930	292,352	528,961
1950	596,163	806,701
1970	1,233,505	1,741,912
1980	1,595,138	2,409,547

Source: City of Houston, Land Use and Demographic Profile 2000

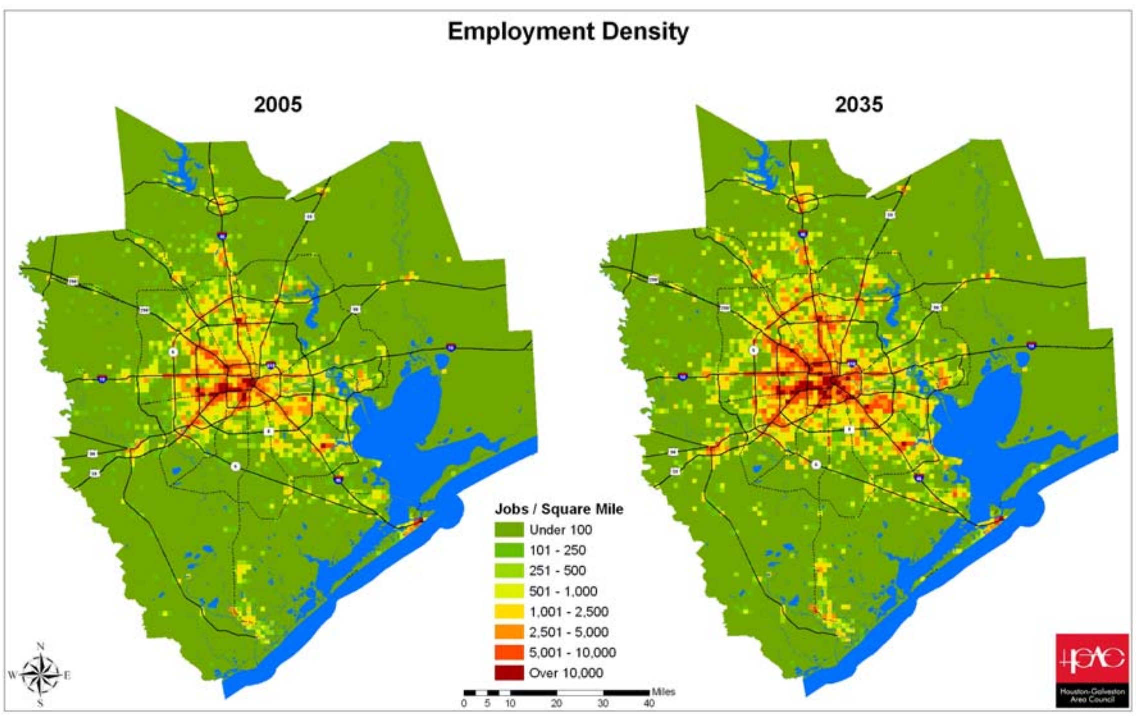
This growth in population occurred notwithstanding the energy crisis of the early 1980s that saw oil price speculation, leading to an "overheated economy" in Houston. According to the Energy Information Administration (1998), oil prices were at very high levels from 1973 to the mid-1980s, partly because of a second oil shock in 1979-80 after the Iranian Revolution. This led to increased American oil production and an enhanced energy services sector (EIA, 1998). However, in the mid 1980s the price of oil collapsed, and according to the Federal Reserve Bank of Dallas (1999) Houston lost 220,000 jobs (or roughly one-eighth of total employment).

By 2000 Harris County and the Houston Metro Area's population was a little over 3.4 and 4.4 million, respectively. Today, Harris County is the nation's third most populous county, ranking behind Los Angeles County, California and Cook County, Illinois (HCTRA, 2007). Figure D4 shows the 2005 and 2035 projected population density for the eight-county H-GAC area.



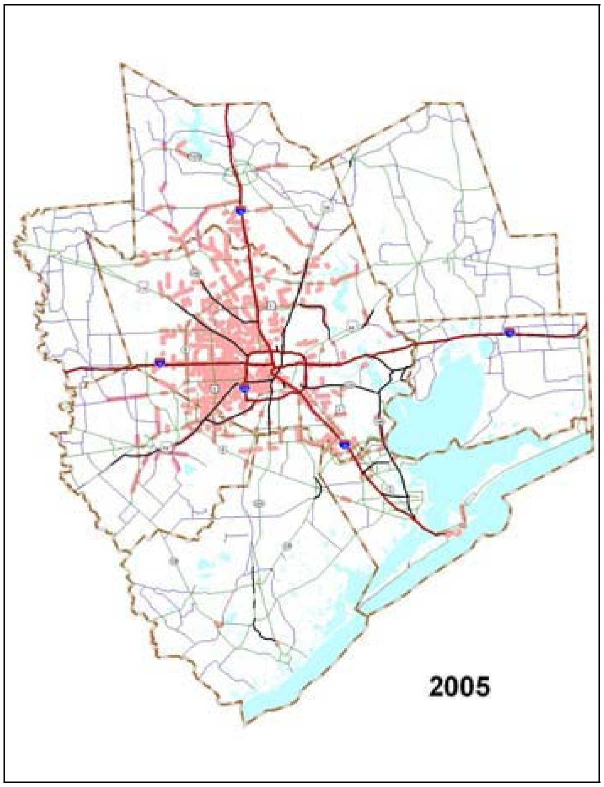
Source: HGAC
Figure D4: Population Density Map 2005-2035

Figure D5 shows 2005 and 2035 projected employment density in the eight-county H-GAC region.



Source: HGAC
Figure D5: Employment Density Map 2005-2035

All this growth, however, has resulted in intractable and severe congestion in Houston and the surrounding counties since the early 1970s. Figure D6 illustrates areas of severe congestion (i.e., red road links) in Houston in 2005.



Source: HGAC 2035 Plan

Figure D6: 2005 Areas of Severe Congestion in Houston during PM peak periods.

Beltway 8

Initial Feasibility

While Houston's electorate had been very supportive of the freeway during the 1950s, it took multiple attempts to garner the requisite votes in bond elections before construction of Beltway 8 could begin. Prior to 1970, the Texas State Constitution required a two-thirds majority vote for county bond issues that support roads to pass. While the Chamber provided needed campaign support, bond issues by Harris County failed in 1956 and 1963. It was not until 1966 that the electorate authorized funds for the first major work on Beltway 8. However, the climate in support of freeway development was to be short lived. During the 1970s, the DOH experienced a funding crisis, because of inadequate gasoline tax revenues and a rapid increase in construction and right-of-way costs. On the west side of Harris County, the alignment of Beltway 8 passed through areas that were rapidly growing and DOH had to incur considerable expenditures to purchase and preserve this critical right-of-way. These high right-of-way expenditures then precluded the quick construction of the road.

A group of land owners in the vicinity of the right-of-way formed the Beltway 8 Group and structured a deal with the DOH to lock their property values at existing appraisals amounts in an effort to encourage the DOH to construct frontage roads as soon as all the land could be acquired (Slotboom, 2003). Twenty-three parcels of property in a five-mile segment of the Beltway 8 with a selling price of $36.8 million were included in this deal. According to Slotboom (2003), this concession saved the DOH approximately $17 million. The DOH thus re-negotiated the land acquisition process with Harris County. At the time Harris County was responsible for the actual land purchase and it did not have funds to do so. The DOH agreed with Harris County that the county would pay a 10 percent share of the ROW cost, if the department acquired the ROW.

In 1974 County Judge John Lindsay won election. Lindsay foresaw the need for new transportation infrastructure in Harris County, given the tremendous growth that both Harris County and surrounding counties were experiencing. According to Art Storey, the Executive Director of Harris County's Public Infrastructure Department, Lindsay wanted to accelerate the construction of TxDOT's Beltway as a way to *"solve, ease and create need all in one fell swoop"* (Storey, 2008). According to Robert Collie (2008), Judge Lindsay's rationale was to *sustainably* prepare the county for the future. Judge Lindsay acknowledged that congestion was in essence resulting in a moratorium on growth (i.e., keeping tax levels flat) and that there was a need for new highways to grow the county and create a strong economic base for the future.

However, at the time the project was being advanced, the United States was on the *"lip of a recession"* (Collie, 2008). Houston was facing the beginnings of what would be the early 1980s oil crisis—which severely impacted Houston's economy—and was about to face the Savings and Loan Bank crisis. Judge Lindsey, however, wanted to move forward, so that the County could take advantage of lower construction costs during an economic downturn and be ready when the economy started to grow again. Lindsay spearheaded the campaign for the promotion and development of Beltway 8—which had not had any detailed tolling feasibility studies undertaken (Rich, 1983)—and the Hardy Toll Road (Storey, 2008).

Early Opposition against the Beltway

The Beltway did encounter some early opposition. In 1973 Jersey Village opposed the planned alignment of Beltway 8 through its downtown. This feud continued throughout the 1970s and the residents were ultimately successful in rerouting the Beltway around the Jersey Village. Residents of Memorial also opposed the proposed Beltway alignment, but they were unsuccessful in rerouting the beltway. Instead accommodations were made to keep this alignment as narrow as possible. As a result, this is one portion of the Beltway 8 that does not have frontage roads.

In 1997, the Texas Attorney General stated that the bond issuances of 1965 could not be used to build a toll facility. The reason offered was that the Commissioners Court did not indicate that they contemplated the outer belt would be a toll facility in the minute order authorizing the bond placement before voters (Attorney General Opinion H-969).

Despite the events depicted, support for the development of the Beltway continued to grow as Harris County was growing.

Hardy Toll Road

<u>Initial Feasibility</u>

In 1979 TTA commissioned a feasibility assessment for three Houston Tollways, including the Hardy Toll Road and Westpark Toll Road. According to the feasibility study undertaken by WSA:

> *"The Hardy Road Corridor would connect on the south with the Elysian Street Viaduct providing direct access to the CBD. It would extend northward, paralleling Hardy Street/Hardy Road and the Missouri Pacific Railroad line for most of its length. The 28.6 mile route would terminate at the connection with I-45 in the community of Shenandoah in Montgomery County. The Hardy Road Corridor lies between I-45 and the Eastex Freeway, (U.S. Route 59) and would also provide service to Houston Intercontinental Airport via a proposed 3.2 mile connector to the west side of the Airport."*

The study showed annual trends in area traffic growth from 1967 to 1977 (see Table D2).

Table D2: Annual Trends in Area Traffic Growth 1967-1977

Location	1967	Average Annual Percent Change (%)	1972	Average Annual Percent Change (%)	1977
US 59					
North of I-610	38,840	10.8	65,110	4.6	81,810
South of Aldine Bender Road	24,460	10.9	41,010	9.3	63,960
North of North Belt Road	18,020	13.8	34,490	8.3	51,400
North of Harris Couty Line	13,750	9.7	21,870	8.7	33,350
I-45					
North of I-610	51,930	13.8	99,370	7.9	145,320
South of S.R. 261	40,790	15.1	86,500	6.4	118,130
South of S.R. 149	44,630	15.3	90,990	8.7	138,640
North of N. Belt Road	23,250	16.7	50,670	8.3	75,420
North of S.R. 1960	19150	16.1	40,430	9.5	63,670
South of Harris-Montgomery County Line	17,510	13.5	32,990	6.8	45,950

Source: TTA 1979 Feasibility Assessment

The feasibility study also reviewed population projections and expected land use within the corridor up to 1990. The population was forecast to increase from 161,376 to 292,991 between 1970 and 1990. Total units developed were expected to increase on average 3% annually. Land development was projected to increase from 22,797 to 35,218 acres. Table D3 shows the population and land use projections for the Hardy Road corridor that was included in the feasibility study.

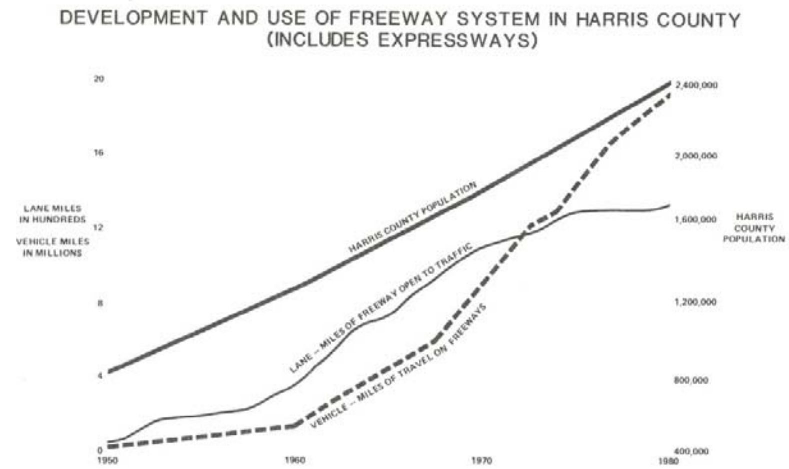
Table D3: Population and Land Use Projections (Hardy Road Corridor)

Item		1970	1990	Average Annual Percent Change (%)
Population		161,376.0	292,991.0	3.0
Total Units (acres)	**Residential**	13,875.5	20,298.5	1.9
	Commercial	2,008.2	4,290.4	3.9
	Industrial	3,854.7	6,428.9	2.6
	Educational	638.9	1,110.9	2.8
	Open Space	960.4	1,726.5	3.0
	Resource Production	41.2	41.2	
	Highway Right-of-Way	1,322.2	1,322.4	
Total Developed Area (acres)		**22,797.1**	**35,218.8**	**2.2**
Total Undeveloped Area (acre)		**73,195.8**	**60,833.1**	**-0.9**
Water		**655.9**	**655.9**	
Total Area (acres)		**96,666.8**	**96,666.8**	

Source: TTA 1979 Feasibility Assessment

The feasibility study noted a relatively small proportion of trips on the proposed facility that are discretionary travel. The study also noted that despite energy supply and cost constraints it was *doubtful* that major shifts would affect usage of the facility. If anything, energy constraints were anticipated to induce higher commuter use as motorists endeavored to minimize their total trip costs and take advantage of the point-to-point service that the toll road would offer. However, this was predicated on basic assumptions, one of which was that no directly competing facility or other expressway-type facility would be constructed.

In 1982 the Houston Regional Mobility Authority produced its mobility plan. It noted that the development of freeways in Harris County was not keeping up with population growth. As can be seen in Figure D7, freeway demand had greatly exceeded freeway supply since the 1970s.



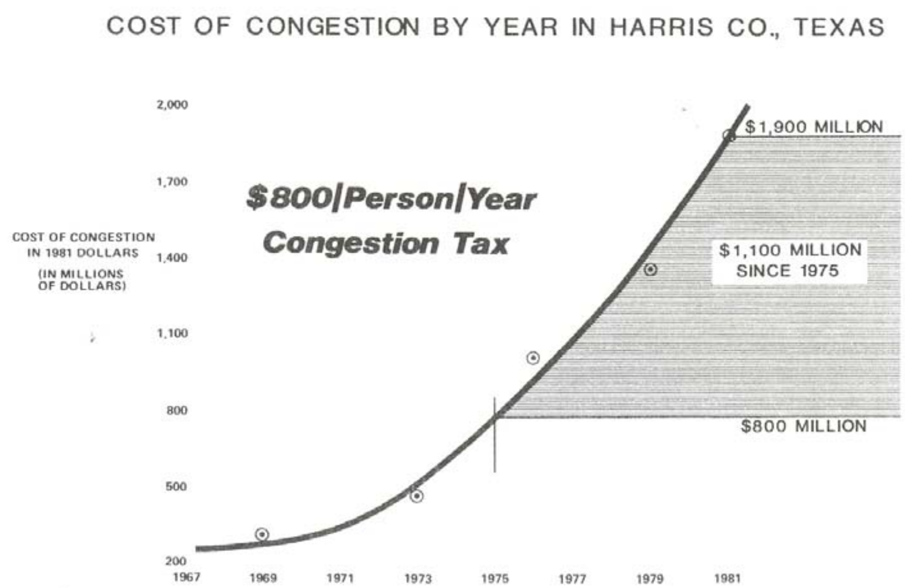
In Houston, Freeway demand has exceeded supply since the early 1970's.

Source: Data compiled by Houston-Galveston Regaional Transportation Study Office and U.S. Census

Source: Houston Regional Mobility Plan July 1982

Figure D7: Freeway Demand in Houston

The Mobility Plan also calculated the cost of congestion in Harris County at $800 per person per year, when the value of time, fuel, and insurance is accounted for. This translated into a total congestion cost of approximately $1.9 billion in 1981 (see Figure D8).



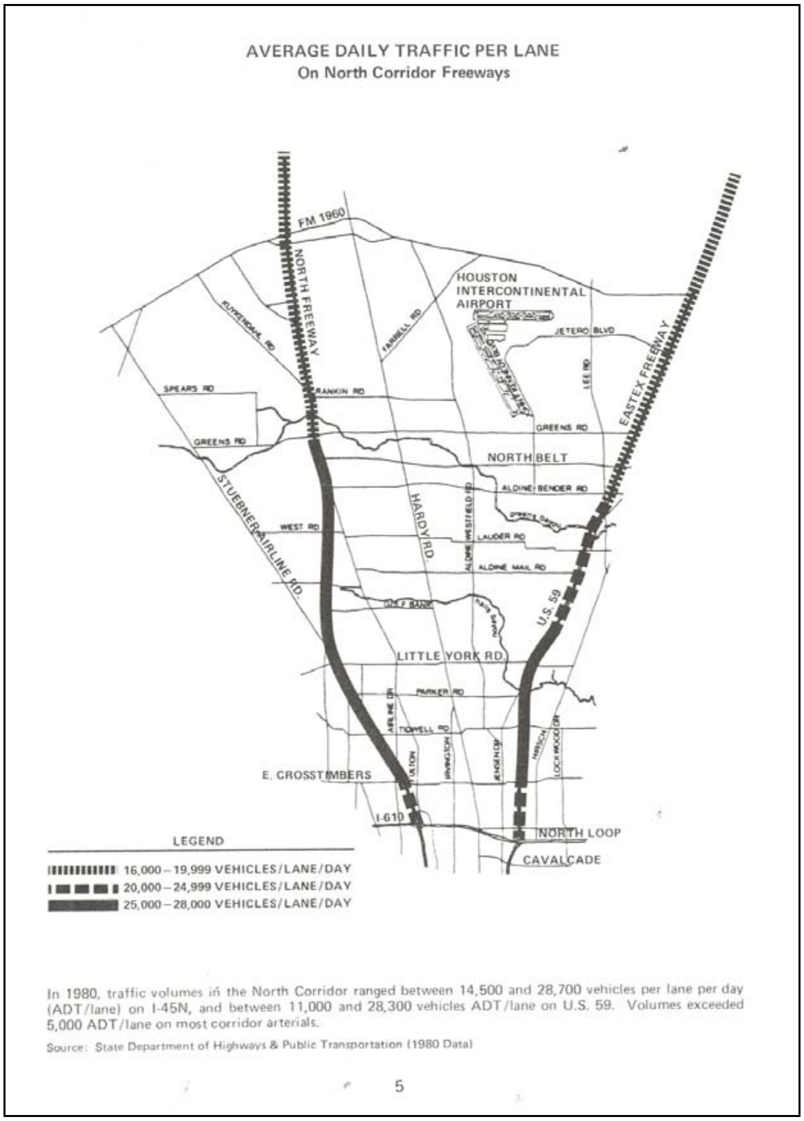
Taking into account the value of time, gasoline, and insurance, it is estimated that Houstonians pay a "congestion tax" of almost $800/person/year, or about $1.9 billion/year total.

Source: Regional Mobility Plan for the Houston Area

Source: Houston Regional Mobility Plan July 1982

Figure D8: Cost of Congestion in Harris County

Figure D9 shows the traffic volumes on US59 and IH45 that were included in the Houston Regional Mobility Plan. The current and projected volumes indicated that congestion would worsen on IH45 and US59, as well as arterial streets in the corridor. According to the Regional Mobility Plan, traffic volume had increased at an average annual rate of 10 percent per year during the previous 15 years. The Regional Mobility Plan also noted that more than 45,000 vehicles moved in and out of Intercontinental Airport each day in 1980. The latter was expected to exceed 80,000 vehicles by 1990 (Regional Mobility Plan, 1983).



Source: Houston Regional Mobility Plan July 1982

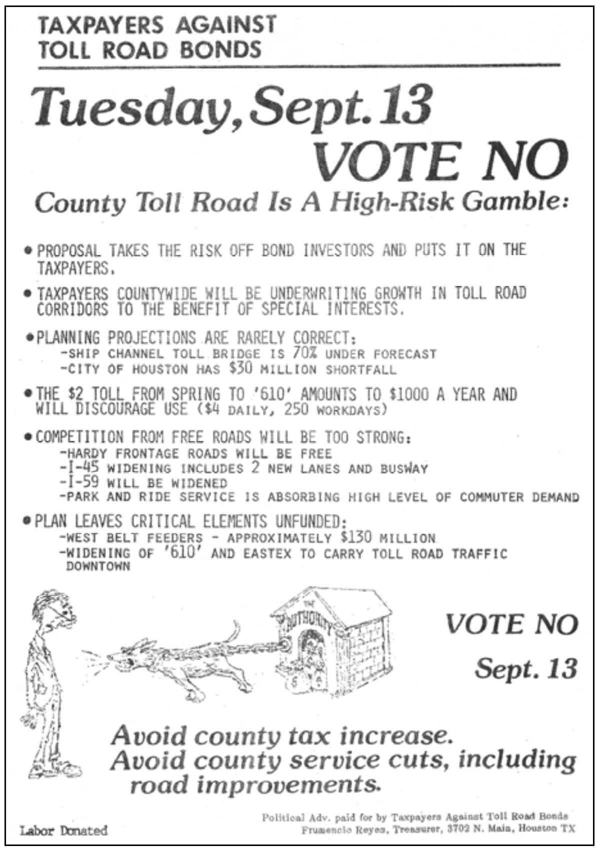
Figure D9: Average Daily Traffic on North Corridor Freeways

The promotion of the Hardy Toll Road by Judge Lindsay and Harris County was supported by the findings of the WSA's feasibility study and the 1982 Houston Regional Mobility Plan.

Opposition against the Hardy Toll Road

In 1980 a group came together to oppose the proposed Hardy Toll Road. Created out of the Houston Interfaith Sponsoring Committee, The Metropolitan Organization (TMO) became a strong opponent garnering political support[3] from multiple stakeholders of the toll road. TMO argued that the toll road was not financially viable and that a transit option—i.e., rail—should be considered for this corridor.

There were also other groups who opposed the toll road bond for the Hardy Toll Road Project (see Figure D10). *"Taxpayers Against Toll Road"* produced a position paper in which they argued that Harris County's growth pattern had been traditionally decentralized, with only 14 percent of county wide employment being downtown. This, they argued, had led to over 17 major centers offering employment/commercial activities outside of the downtown business district (Taxpayers Against Toll Road Critique, 1983) that would impact the project's feasibility.



Source: Hardy Toll Road Controversy Files

Figure D10: Taxpayers against Toll Road Bonds Flyer

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3 The group was supported by U.S. Congressman Mickey Leland (Texas 18th District), Senator John Whitmore (Senate District 15), Congressman Roman Martinez (District 148 Harris County), Congressman Gene Green (29th District), and County Commissioner El Franco Lee. Texas Congressman Gene Green went as far as to say in a letter to the TTA that *"the toll road on Hardy is misplaced, misapplied and a waste of an opportunity to serve North Harris County with real mass transit—rail"* (Green, 1983).

Proponents for the Completion of Beltway 8 and Hardy Toll Road

As mentioned earlier, TTA and TxDOT did not have the required funding for the completion of Beltway 8. Judge Lindsay by this time had come to the conclusion that it was up to the County to develop this route. Lindsay proposed that the County create its own Toll Road Authority, which would bond and develop the toll road system. This required some major legislative changes, including authority for the county to issue bonds for toll projects and changes to how right-of-way acquired from any source could be used for toll projects procured by the county. Senate Bill 970, which passed in the 68th legislative session in 1983 (Texas Legislative Council, 1983), allowed for the financing, construction, and operation of toll transportation facilities in counties with populations of more than 50,000 bordering the Gulf of Mexico. The Act provided that revenue bonds may be issued by the County's Commissioners Court without voter approval and authorized the use of ad valorem taxes, among other funds, to pay for the operation and maintenance of these projects. The Bill also authorized the counties to use any land or right-of-way acquired from any source for the development of toll projects. This was codified in Texas Transportation Code Chapter 284.

Next the Commissioner's Court had to create the new toll authority. At Commissioners Court in May 1983 (when County Judge Lindsay was absent), the Commissioners voted against establishing the authority and issuing $50 million in toll road bonds. The Court was led by County Commissioner Eugene A. "Squatty" Lyons, Jr. County Commissioner Lyons was opposed to the Hardy Toll Road, which ran through his district and which had been the subject of a three-year battle involving local residents and the TMO. Local residents and the MTO were against this route and wanted a rail system to be placed in the right-of-way. However, Judge Lindsay was not deterred. At the next Commissioner's Court on June 23, 1983, the Court voted 4-1[4] to put forward a September referendum asking voters to approve county issuance of $900 million in general obligation bonds to build three toll roads (Minute Order, 1983a). If the voters approved this referendum, the County could then create its own turnpike authority.

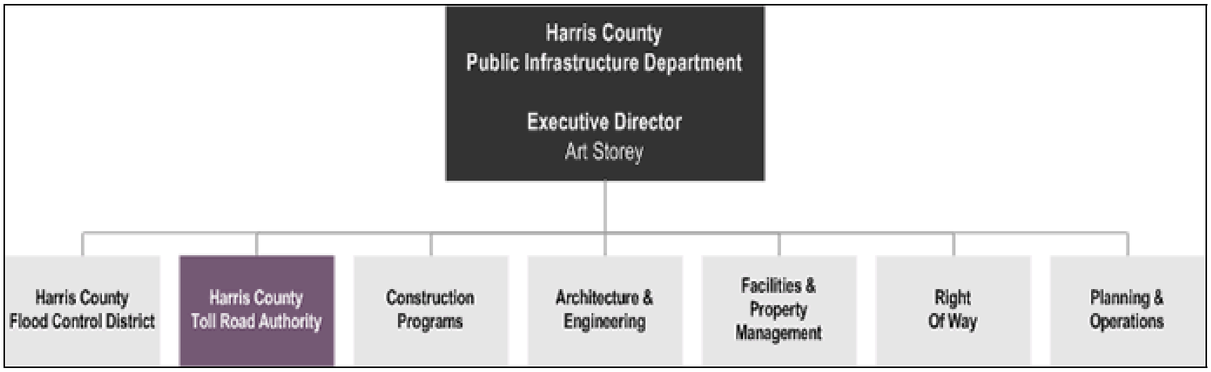
At the same time as the County was advocating for the development of the Hardy Toll Road and Beltway 8, Houston METRO and the Mayor of Houston (i.e., Kathy Whitmire) were putting forward a ballot to implement stage one of a regional rail system in Houston. The rail system was to operate on the north side of Houston for 18.5 miles—with 17 stations—running from Crosstimbers through the CBD and out to the West Belt. The stage one rail line was proposed to use the old Missouri Pacific rail line that paralleled Hardy Road from just outside the IH610 Loop. METRO's 1983-1990 Plan for financing the Regional Transit Capital Improvement Program also proposed extending the commuter rail line along the entire Hardy Toll Road Corridor and out to the intercontinental airport. Essentially, the rail would use the right-of-way that was proposed for the Hardy Toll Road.

On June 11, 1983, the City of Houston placed a bond referendum before the voters for the rail system. The bond was to issue $2.35 billion in revenue bonds to finance a heavy rail system and expand the current bus system (Rich, 1983). This referendum was defeated by an almost 2:1 margin. Immediately following this juncture, the TMO and County Judge Lindsay began to have discussions on the possibility of reaching a compromise on the Hardy Street toll road plan (Boyer 1983). This included a scaled down version of the toll road, as well as stopping it at the North Belt so it would interline with a rail station instead of continuing on to IH610.

4 County Commissioner Lyons voted against the referendum.

On September 13, 1983, Harris County placed a bond issuance for $900 million in General Obligation Bonds (GO) before the voters. The referendum was passed with 95,524 votes for and 40,055 votes against in a 12.67 percent turnout[5] (Houston Post, September 14, 1983).

On September 22, 1983, the Commissioners Court voted to create the toll road authority, which would become responsible for the development of the Beltway and the Hardy Toll Road (Minute Order, 1983b). Figure D11 illustrates how HCTRA fits into the organization of Harris County's Public Infrastructure Department as at June 2008.



Source: Harris County

Figure D11: Harris County's Public Infrastructure Department

Interestingly, the bond issuance[6] was for general obligation (GO) bonds and not revenue bonds. According to Collie (2008), Harris County was one of the first counties in the U.S. to use general obligation bonds for a highway facility, pledging the full faith and credit of the county for this debt. The opposition groups argued that the use of general obligation bonds would burden the tax payers of Harris County, because they believed both the Hardy Toll Road and the Beltway would not be financially viable. However, the Tax Research Association of Houston and Harris County noted that a marginal project, such as Beltway 8, might not otherwise be built and that it was better to obtain a tax subsidy than not build at all. They estimated that the issuance of the $900 million in GO debt would increase the County's per capita tax burden by 23 percent. Judge Lindsay argued that the chances of one of the projects requiring a tax increase was slim, because the County could pool revenues from all the projects. Judge Lindsay also argued that by utilizing GO bonds the County could save between $200 to $400 million dollars in interest costs depending on the debt retirement schedule (The Houston Post, 1983).

Construction Schedule

The first sections were constructed very quickly with a new section opening every year, beginning the year after the bonds were approved by voters. The County was fortunate in that

5 This was double the turnout at the previous bond election held in February 1982 (Houston Post, September 14, 1983) and almost the mirror image of the results for the rail bond proposed in May.

6 The Financial Advisors to the County were First Southwest Company and Underwood, Neuhaus & Co. Vinson & Elkins were the bond counsel for the County. Deloitte Haskins & Sells were the County's then independent accountants (Bond Instrument, 1983). The bond underwriters were Underwood, Neuhaus & Co Incorporated and Bankers Trust Company. HCTRA received a bond rating of an AAA/NR and Aaa from Standard and Poor's (S&P) and Moody's Investors Service, respectively. Since HCTRA was a public agency, the bonds were tax exempt.

much of the ROW had already been purchased. There were also few eminent domain takings still to be undertaken for this project that also assisted in the fast construction of sections. Also, because most of the right-of-way was purchased without federal funds, no environmental review under the National Environmental Policy Act 1970 (NEPA) had to be undertaken (Storey, 2008). This shortened the construction lead time. Collie (2008) noted that at this time the state did not have any environmental laws similar to NEPA, so no state environmental review was conducted either. Judge Lindsay advocated a quick construction schedule, because he recognized that congestion mitigation relief was paramount for the county.

According to Art Storey (2008), Judge Lindsay and HCTRA did not advertise or attempt to educate the public about the time savings benefits of the toll road. However, by the time the routes were to be constructed, most were in developed areas of Houston. For example, the Hardy Toll Road ran between an existing rail line, industrial area, and two other major freeways. The routes thus provided congestion mitigation from the outset and did not require as much advertisement as other toll routes—e.g., greenfield projects—may need.

According to Art Storey (2008), the project was a schedule driven project, with one segment opening each year, and each segment being constructed by different groups. HCTRA used more than 60 engineering and contractor groups to build this facility. The project was *"on time and on budget"* (Storey, 2008).

Westpark Tollway

The Westpark Tollway was included in the major transportation plans for Houston and Harris County for many years. The freeway master plan that was developed in 1953 showed a freeway along this corridor following the old San Antonio and Aransas Pass Railroad right-of-way. As the plans evolved over the years, US59 took a more southerly route down to Sharpstown and on to Fort Bend County, leaving the west side of Houston without a freeway (Slotboom, 2003).

Westpark was also reviewed in the 1979 TTA feasibility study. Westpark was conceived as a six-lane toll road on 100 feet of right-of-way, extending for 15.5 miles from US 59's downtown split to SH6. The feasibility study concluded that the estimated revenues for Westpark were below the levels generally considered adequate for successful financing and therefore was not feasible. This was partly because conservative growth forecasts were used for the Westpark Corridor. Population was forecasted to increase by an average of 2.3 percent annually. The average annual growth in units developed was estimated at 2.2 percent and the increase in developed land at 1.7 percent (see Table D4). However, the study noted that the project could meet its financial obligations *over its lifetime* and costs could be substantially reduced if the route used the existing railroad right-of-way.

Table D4: Population and Land Use Projections (Westpark Corridor)

Item		1970	1990	Average Annual Percent Change (%)
Population		415,677.0	661,210.0	2.3
Total Units (acres)		166,055.0	256,620.0	2.2
	Residential	27,559.4	38,367.3	1.7
	Commercial	7,448.4	10,748.5	1.9
	Industrial	2,185.4	3,140.8	1.8
	Educational	1,545.8	1,710.1	0.5
	Open Space	2,436.6	3,529.6	1.9
	Resource Production	302.0	302.0	
	Highway Right-of-Way	1,554.0	2,223.0	1.8
Total Developed Area (acres)		**43,031.6**	**60,021.3**	**1.7**
Total Undeveloped Area (acres)		**43,026.0**	**26,436.3**	**-2.5**
Water		**1.205.7**	**1,205.7**	
Total Area (acres)		**87,663.3**	**87,663.3**	

Source: TTA 1979 Feasibility Assessment

The feasibility study also reviewed annual trends in area traffic growth (see Table D5).

Table D5: Annual Trends in Area Traffic Growth 1967-1977

Location	1967	Average Annual Percent Change (%)	1972	Average Annual Percent Change (%)	1977
US Route 59					
West of Smith and Louisiana St Connector	85,710	0.2	86,000	12.5	154,680
West of I-610	71,080	12.4	127,590	7.4	182,820
State Route 1093					
East of I-610	16,490	20.7	42,280	2.7	48,510
East of F.M. 1960	2,230	56.9	21,180	10.3	34,550

Source: TTA 1979 Feasibility Assessment

After the 1979 feasibility study, attention was diverted away from the Westpark Tollway during most of the 1980s. The project was briefly resurrected in 1983 when METRO proposed the heavy commuter rail line and June bond issuance. After the rail defeat plans for using this corridor were dormant until 1991. In 1991, METRO's proposal for monorail resulted in controversy and became a major platform in the 1991 mayoral election. When Bob Lanier, a previous Chair of the Texas Transportation Commission, was elected as mayor, he promptly changed the makeup of the METRO board after taking office in 1992. Lanier replaced three of the five City of Houston representatives on METRO's board of directors. This changed the dynamic of the board and broke what was seen as the *"rail-majority"* (Slotboom, 2003). Lanier also decided to use METRO's reserve fund, which contained $650 million that had been earmarked for the $1.2 billion monorail proposal, for projects that he felt were of greater benefit to Houston, such as policing and improved highways.

In 1993, west Houston business interests proposed a transit-friendly toll route in an attempt to persuade METRO to donate land for toll road use. At this juncture, County Judge John Lindsay proposed that HCTRA should be the lead agency for this route. However, HCTRA was still in its infancy and was focused on purchasing the Jesse Jones Memorial Bridge over the Ship Channel, as well as completing the southern sections of the Beltway. METRO meanwhile began to develop plans for creating a one-lane reversible transit way for buses and HOVs. In 1996, it authorized an $800,000 detailed toll road feasibility study (Feldstein, 1996). This study, according to Slotboom (2003), concluded that revenue from the transit-tolled hybrid would not be sufficient to make the project feasible. The project was also further complicated by the required funding agreements necessary to gain Federal Transit Administration grants for the dedicated bus way. The feasibility study recommended converting the route to a traditional toll road. METRO, however, moved ahead and issued bids for the reversible transit way in 1997 and was set to award contracts in early 1998 (Slotboom, 2003).

Lanier left office at the end of 1997 when his term ended. His successor, Lee Brown, was *pro rail* according to Slotboom (2003). Mayor Brown changed the composition of the METRO board once again to make it more rail oriented. This reduced the likelihood of METRO donating land for the Tollway. However, business stakeholders obtained an injunction to stop the transit way construction in early 1998 (Houston Chronicle, 1998).

Meanwhile, Harris County Judge[7] Robert Eckels took up where Judge Lindsay left off in supporting the Tollway's development through HCTRA. Despite the modest projections for the Tollway, Judge Eckels felt that the Tollway would not impose any greater cost to METRO, but would provide numerous benefits for the West Houston and the metro area. Negotiations began between HCTRA and METRO in 1999 for METRO to sell HCTRA a 50-foot strip of Westpark. HCTRA Executive Director, Wesley Friese, led the negotiations. HCTRA paid $14.3 million for a 50-foot 13-mile strip of right-of-way. METRO retained 50 feet for future transit use. This was approved November 18, 1999.

On May 1, 2004 the Westpark Tollway opened to traffic. It was the nation's first ETC-only toll road. Westpark was estimated to have cost $260 million. Table D6 shows the opening dates of the two Westpark Tollway sections.

Table D6: Westpark Tollway

Section	Opening Date	Lane Miles (approx)	Actual Miles
IH610 to SH6	May 1, 2004	44	11
SH6 to SH1464	June 8, 2005	12	3
Total		**36**	**14**

7 Judge Eckels also headed the area's Regional Transportation Council.

Review of Selling or Leasing HCTRA's System (2006)

In 2006, HCTRA was approached by a group inquiring whether the county would consider selling or leasing[8] its system to a private entity—similar to the Chicago Skyway and Indiana Toll Road leases seen in 2005. The Commissioner's Court voted on June 20, 2006 unanimously to continue operating the system. County Judge Robert Eckels did commission a study to review the implications of selling or leasing the system, as well as revenues that could be raised. At the urging of other commissioners and staff, the county also commissioned three further studies to review leasing options, sale options, and retaining the system in-house (Storey, 2008). Goldman Sachs and Loop Capital reviewed the leasing options and estimated the county could have received $7.5 to $10 billion for a 50 year lease, and $10 to $13 billion for a 99-year lease (Murphy, 2006[a]). JP Morgan and Popular Securities reviewed the sale options and concluded that the county could receive as much as $20 billion if it sold the system and ceded all or nearly all control over tolls. Citigroup-Siebert Brandford Shank & Co. studied retaining the system as a county-operated system and concluded that it would continue to be profitable, especially if the county leveraged its steady revenue streams for expansion. First Southwest advised the county that it could increase profits by imitating private sector practices. According to Art Storey (2008), the county is using the "equity" in its system to leverage another $600 million in GO bond offerings to repair the rest of the county's infrastructure.

Other Issues

Since the opening of the toll roads there has been some litigation, according to HCTRA officials, mostly surrounding flooding issues. According to HCTRA officials, they also had minor complaints regarding noise.

Rate Setting, Bonds and Electronic Tolling

According to Storey (2008), toll rates were set by the Commissioner's Court in the past. These were not set per mile, but in increments of $0.25 for cash users and $0.05 for EZ tag users. In the summer of 2007, the Commissioners Court authorized HCTRA to set rates. The formula for setting toll rates is designed to pay bond service and coverage, and ensure safety. There have been 32 bond issuances since inception in 1983. Overall HCTRA has issued approximately $2.4 billion in bonds to date.

In 1992 electronic tolling was implemented using the EZ Tag. This provides users a discount and dedicated lanes through the mainline toll booth gantries where customers do not have to stop.

Traffic and Revenue Reports

As mentioned earlier, the HCTRA system opened in sections. Table D7 shows each section with its opening date, length, how it was funded, and when it first appeared in a T&R study. For T&R studies, HCTRA has used WSA exclusively.

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[8] This was not the first time that the county had considered selling the tollways. In 1999, Lehman Brothers offered the county $2.1 billion for selling its 84 miles of tollways to a nonprofit corporation—created specifically to operate the toll roads—who would be allowed to collect and keep the tolls (Feldstein, 1999). This county rejected this offer.

Table D7: Houston Toll Road System[1]

Road	Section	Opening Date	Funding	First T&R Study	Lane Miles (approx)	Actual Miles
Hardy	North	Sept. 20, 1987	1983 Bond	T&R 1984	73	14
	South	June 28, 1988	1983 Bond	T&R 1984	46	8
	Airport Connector	Jan. 28, 2000	Other[2]	N/A	12	3
Sam Houston	West/South	June 29, 1988	1983 Bond	T&R 1984	66	8
	West/Central	June 24, 1989	1983 Bond	T&R 1984	50	6
	West/North	July 8, 1990	1983 Bond	T&R 1984	90	11
	Ship Channel Bridge	May 6, 1994 (May 6, 1982)[3]	April 1994 Bond	T&R 1994	17	4
	East	July 1, 1996	April 1994 Bond	T&R 1994	36	9
	South/East	March 1, 1997	Oct 94 Bond	T&R 1994	44	11
	South/West	May 3, 1997	Oct 94 Bond	T&R 1994	48	12
Westpark	IH610 to SH6	May 1, 2004	Pooled Debt[4]	Westpark 2002	44	11
	SH6 to SH1464	June 8, 2005	Pooled Debt[4]	Westpark 2002	12	3
Spur 90A		March 15, 2005	Toll Revenue[5]	April 2002	12	3
				Total	**550**	**103**

1 Information provided by HCTRA
2 Provided equipment and operate it. Construction was financed with outside funds.
3 When built by TTA
4 After 1994, all HCTRA debt was pooled. There is no specific bond document for each new project.
4 Paid for using available toll road revenue
5 Responsibility of Fort Bend Toll Road Authority

WSA conducted a series of comprehensive studies for HCTRA in 1984, 1989, 1994, and June 2006. In between those comprehensive studies, updates to the T&R studies were done, as well as a T&R study of the Westpark Corridor in 2002.

HCTRA had permission from the voters to sell GO bonds to finance the construction of the toll roads. As a result the bond documents do not contain individual T&R studies. Furthermore, after 1994 and the acquisition of the Ship Chanel Bridge from TTA, all debt was pooled and as a result there are no specific bond issuances for each new toll road segment or section. The projects were originally funded with Revenue and Commercial paper, which means that each bond funded specific project(s).

1983 Bond Document[9]/ 1984 Traffic & Revenue Study

HCTRA sold $50 million of GO bonds in November 1983 to support the construction of the Hardy Toll Road and the western section of the Sam Houston Toll Road or Western Belt[10]. This bond was to support the construction of the Hardy Toll Road from the southern end at IH610 just east of Hardy Street and north along Hardy Street to IH45 just south of the Harris-Montgomery County line—a distance of 21.7 miles. The bond also supported the construction of the West Belt Toll Road from the Southwest Freeway (US59) near Roark Road northward to almost 3 miles north of Hempstead Road (US290), where it would turn and continue easterly to a terminus with I45 near Greenspoint Shopping Center—a distance of 36.1 miles. Figure D12 shows the original projects that were funded by the 1983 bond issuance.

As mentioned before, HCTRA constructed the toll projects using many different engineering companies in an attempt to expedite construction and to be under budget. The Hardy Toll Road construction began first, because it was believed it would generate more traffic than the Western Belt. The first section opened in 1987, with additional sections opening approximately every year thereafter until 1990 when both the Hardy Toll Road and the West Belt were complete.

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9 Unless otherwise noted, the information and data in this section are from the 1983 Bond Document.

10 The bond underwriters were Underwood, Neuhaus & Co. Incorporated and Bankers Trust Company. HCTRA received a bond rating of an AAA/NR and Aaa from Standard and Poor's (S&P) and Moody's Investors Service, respectively. Because HCTRA was a public agency, the bonds were tax exempt.

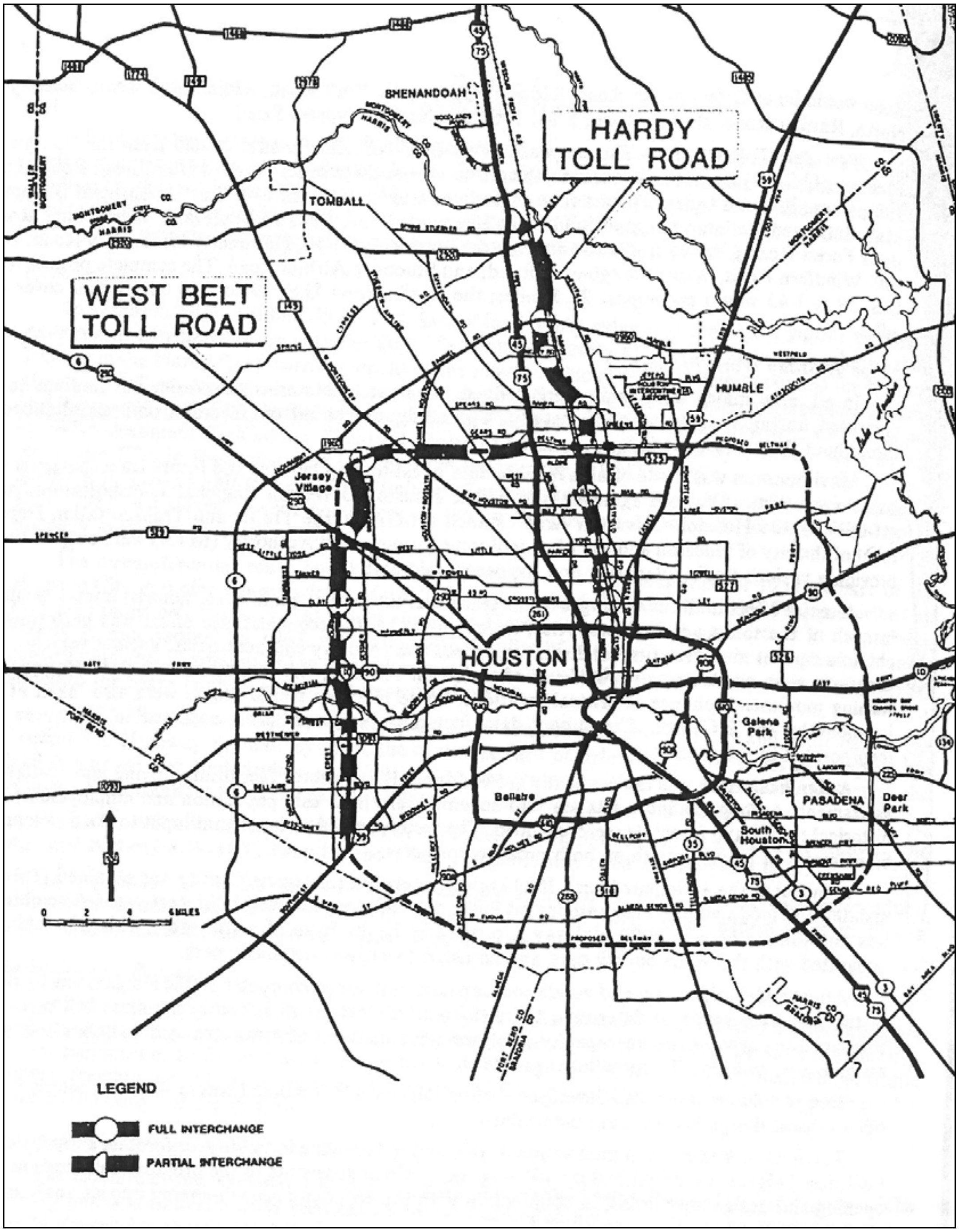

Figure D12: Projects Included in the 1983 Bond Issuance

Summary of the Existing Conditions[11]

This section presents the background information that WSA used in their 1984 T&R study.

[11] Unless otherwise noted, the information and data in this section are from the 1984 Traffic and Revenue Study.

Travel Pattern and Traffic Inventory

To obtain a clearer picture of the potential traffic on the proposed toll roads, WSA conducted motorist interview surveys and traffic counts in 1981 and 1984 in the Hardy Corridor and in West Houston. The survey results for the two years were combined and used to determine travel patterns and trip characteristics for the corridors. WSA looked at vehicle profiles in terms of the number of axles, trip purpose distribution by trip frequency, and vehicle occupancy.

WSA also performed a traffic inventory in the area. This included obtaining annual traffic trends along existing freeways in the corridor and calculating travel times between common destinations. Table D8 shows the annual traffic trends at selected traffic recorder stations between 1977 and 1983. A general increase in traffic can be seen, with the Hardy corridor seemingly growing faster than the West Belt corridor.

Table D8: Annual Traffic Trends at Selected Automatic Traffic Recorder Stations

Location	1997	% Change	1978	% Change	1979	% Change	1980	% Change	1981	% Change	1982	% Change	1983
I-45, N of FM 1960	57,400	11.3	63,900	(0.3)	63,700	1.6	64,700	8.5	70,200	5.8	74,300	3.2	76,00
US59, S of FM 1314	33,300	16.5	38,800	4.6	40,600	3.4	42,000	13.8	47,800	14.0	54,500	5.9	57,000
I-10 W of I-610	137,500	2.2	140,500	(1.6)	138,300	1.8	140,800	6.5	150,00	2.9	154,300	1.3	156,300
US59, W of I-610	182,800	5.9	193,600	0.6	194,700	1.4	197,500	1.7	200,800	1.5	203,800	1.6	207,000

Note: The brackets represent negative values.

To estimate the percentage of people that would use the new toll road, WSA had to calculate the benefit of using the toll road. This was accomplished by calculating the average time savings compared to various non-toll routes for common origins and destinations. For example, to travel between Glenshire and Jersey Village using US59, the IH610 West Loop, and US290 would take 30.1 minutes. In contrast, using US59 and the Proposed West Belt Toll Road would only take 18.6 minutes—a total saving of 11.5 minutes. This data combined with people's value of time and the proposed toll rate schedules allowed WSA to estimate the diversion rate to the toll road from the other freeways in the corridors.

Area Growth

The economic and demographic characteristics of a region are indicative of likely transportation demand. WSA reviewed the economic forecasts for the eight-county region comprising H-GAC for 1980, 1990, and 2000. This included trends and projections of population, office employment, industrial employment, retail employment, single and multi-family households, retail sales activity, and average disposable household income. The projections were converted into typical trip generation levels for each of the categories and traffic in the corridors was grown accordingly.

Traffic Modeling and Analysis Methodology

The economic and demographic trends and projections were combined with the trip level data from the 1981 and 1984 motorist interview surveys and a detailed traffic model was developed for the study area. Figure D13 shows how the zonal growth factors are integrated into the development of the trip table. Then using the previously calculated trip diversion rates, the trip assignment was undertaken.

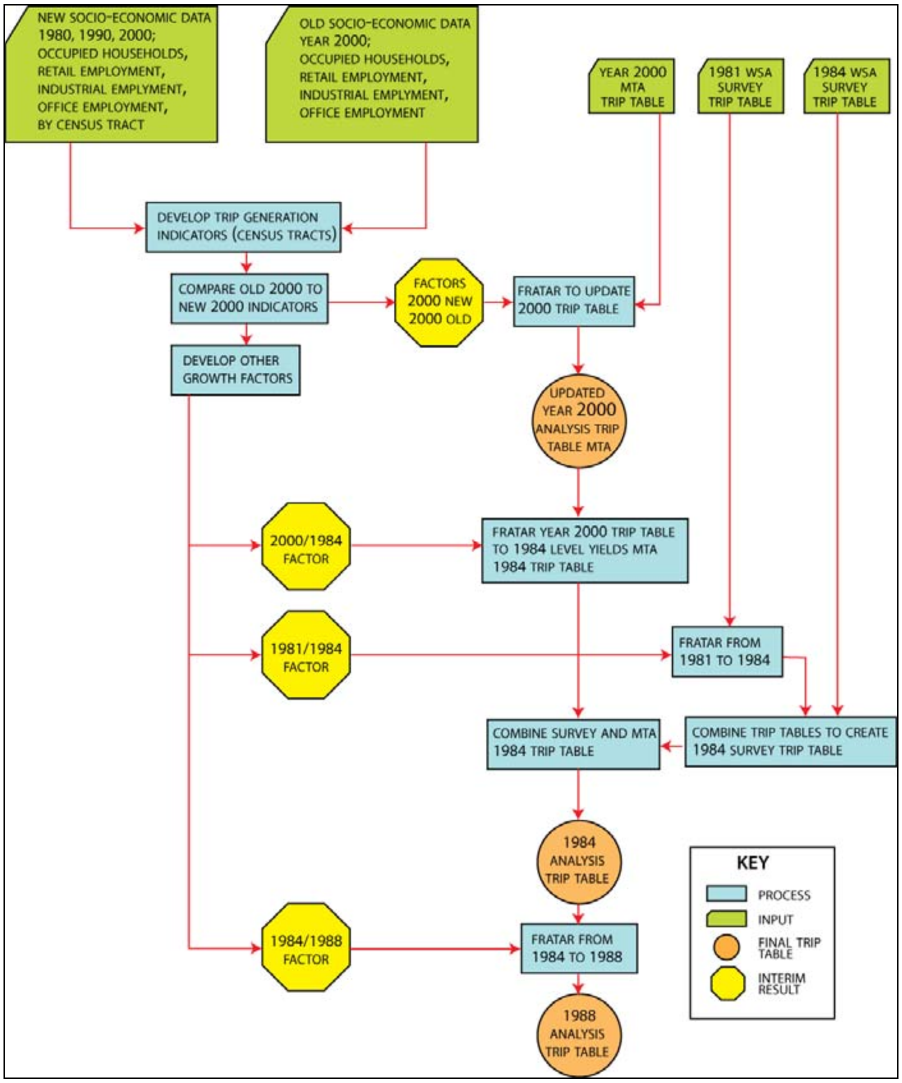

Figure D13: Use of Zonal Growth Factors in Trip Table Development

Summary of the Projected Traffic and Revenue[12]

Economic and Demographic Characteristics

The second part of WSA's analysis of the toll roads' traffic potential reviewed the area growth and energy situation in Houston. WSA completed a comprehensive economic growth analysis of the entire eight-county H-GAC region, but paid particular attention to Harris and Montgomery counties. More specifically, WSA focused on the two study areas of the West Belt Toll Road Corridor and the Hardy Toll Road Corridor, which included areas that had a direct influence on the toll roads. They also looked at broader county level data when appropriate. The selected indicators to forecast traffic growth were:

- population,
- office employment,
- industrial employment,
- retail employment,
- retail sales activity,
- single and multi-family households, and
- average household disposable income.

WSA evaluated the Effective Buying Income (EBI) and retail sales in an effort to estimate the region's purchasing power and economic health. EBI was calculated to have been growing a rate of about 10 percent per year. However, when inflation was taken into account, those numbers were closer to 2 percent. Retail sales figures revealed a booming retail industry in the 1970s when retail sales grew at a rate in excess of 20 percent per year—more than doubling during the decade. And although rates had slowed, it was concluded that retail sales would continue to grow at a rate of 15 percent per year. This was predicated on a successful recovery of the downtown area, stabilized oil and gas prices, and a shift to a more diversified technology and service oriented economy.

Population was also regarded an important factor generating travel demand within the corridors. As shown in Table D9, population in both corridors was projected to grow at slower rates in the future. However, population growth in the two corridors was still predicted to outpace the total overall population growth in Harris County. Much of the population growth in the Hardy corridor was predicted to come from southern Montgomery County, whose population was expected to more than double by the year 2000. The population growth within the West Belt corridor was driven by suburban growth that was prevalent in the years preceding the study.

[12] Unless otherwise noted, the information and data in this section are from the 1984 Traffic and Revenue Study.

Table D9: Corridor Population Trends and Projections

Study Areas	1970	Average Annual Percent Change (%)	1980	Average Annual Percent Change (%)	1990	Average Annual Percent Change (%)	2000
Hardy Corridor	291,807	5.2	482,706	3.6	687,699	2.9	910,561
% of Study Area	13.4		15.1		16.9		18.2
West Belt Corridor	399,379	6.1	721,610	4.1	1,081,802	2.5	1,385,465
% of Study Area	18.3		23.1		26.2		27.7
Harris County	1,741,912	3.3	2,409,544	2.4	3,061,617	2.0	3,713,432
% of Study Area	79.9		77.2		75.3		74.1
Montgomery County	49,580	10.0	128,487	5.4	217,121	3.4	303,670
% of Study Area	2.3		4.1		5.3		6.1

Another significant input into the trip generation calculations by WSA was a set of employment statistics for retail, industrial, and office employment in the area. This was an important factor because travel to work is one of the largest trip generators in travel demand modeling. Also, retail employment was seen as particularly important, because although it may not be the largest economic sector in terms of total employment, daily trips associated with retail are generally three to four times higher than for other types of employment, such as industrial or office. Table D10 shows the trends and projections that WSA used for determining the retail employment in the corridors. WSA chose fairly conservative growth rates for the two corridors given previous growth trends.

Table D10: Corridor Retail Employment Trends and Projections

Study Areas	1970	Average Annual Percent Change (%)	1980	Average Annual Percent Change (%)	1990	Average Annual Percent Change (%)	2000
Hardy Corridor	117,378	1.6	137,090	1.9	165,768	2.3	207,865
% of Study Area	53.1		40.9		39.2		37.3
West Belt Corridor	48,375	7.0	95,316	2.8	125,054	3.8	181,488
% of Study Area	21.9		28.4		29.6		32.6
Harris County	200,534	4.0	295,277	1.8	353,758	2.7	460,419
% of Study Area	90.7		88.0		83.6		82.6
Montgomery County	1,778	11.7	5,362	10.8	15,002	5.4	25,384
% of Study Area	0.8		1.6		3.5		4.6

The industrial sector is one of the largest employers in Houston. In projecting industrial growth, WSA assumed a rate much lower than the actual rate during the 1970s, because the early 1980s showed an increasing amount of available industrial space. This arose because of the decrease in energy sector employment following the 1980s oil and savings and loan crisis. Table D11 shows the industrial employment trends and projections.

Table D11: Corridor Industrial Employment Trends and Projections

Study Areas	1970	Average Annual Percent Change (%)	1980	Average Annual Percent Change (%)	1990	Average Annual Percent Change (%)	2000
Hardy Corridor	139,772	4.6	218,981	0.7	243,861	0.5	246,618
% of Study Area	55.3		39.3		37.6		36.4
West Belt Corridor	27,012	17.2	132,155	0.9	144,927	0.9	157,831
% of Study Area	10.7		23.7		23.2		23.3
Harris County	206,525	8.7	473,500	0.9	516,381	0.8	557,501
% of Study Area	81.7		85.0		82.6		82.4
Montgomery County	2,038	10.9	5,743	8.2	12,620	2.0	15,425
% of Study Area	0.8		1.0		2.0		2.4

Finally, office employment trends were considered and projected. Office employment was the largest sector within Houston. Using information from the Chamber, WSA projected strong office employment growth in the study areas (see Table D12). In particular, WSA predicted that the completion of the West Belt would generate demand for office space in its direct vicinity.

Table D12: Corridor Office Employment Trends and Projections

Study Areas	1970	Average Annual Percent Change (%)	1980	Average Annual Percent Change (%)	1990	Average Annual Percent Change (%)	2000
Hardy Corridor	200,863	4.9	323,919	3.8	471,707	3.4	660,668
% of Study Area	63.8		52.6		51.2		47.6
West Belt Corridor	52,698	12.7	173,688	5.7	301,305	5.6	518,094
% of Study Area	16.7		28.2		32.7		37.3
Harris County	295,192	6.3	544,057	4.2	821,363	4.3	1,253,388
% of Study Area	93.8		88.3		89.1		90.2
Montgomery County	1,745	16.7	8,178	9.0	19,401	5.5	33,234
% of Study Area	0.6		1.3		2.1		2.4

<u>Traffic and Revenue Predictions for the Hardy and Sam Houston West Sections</u>

Figures D14 and D15 provide the toll sensitivity curves for the West Belt and Hardy Toll Road, respectively. WSA used these curves as part of toll sensitivity tests to determine recommended toll rates. For the West Belt, it was shown that traffic demand was relatively stable at a rate of $0.091 per mile. For the Hardy Toll Road, it was shown that traffic demand was relatively stable at a rate of $0.073 per mile.

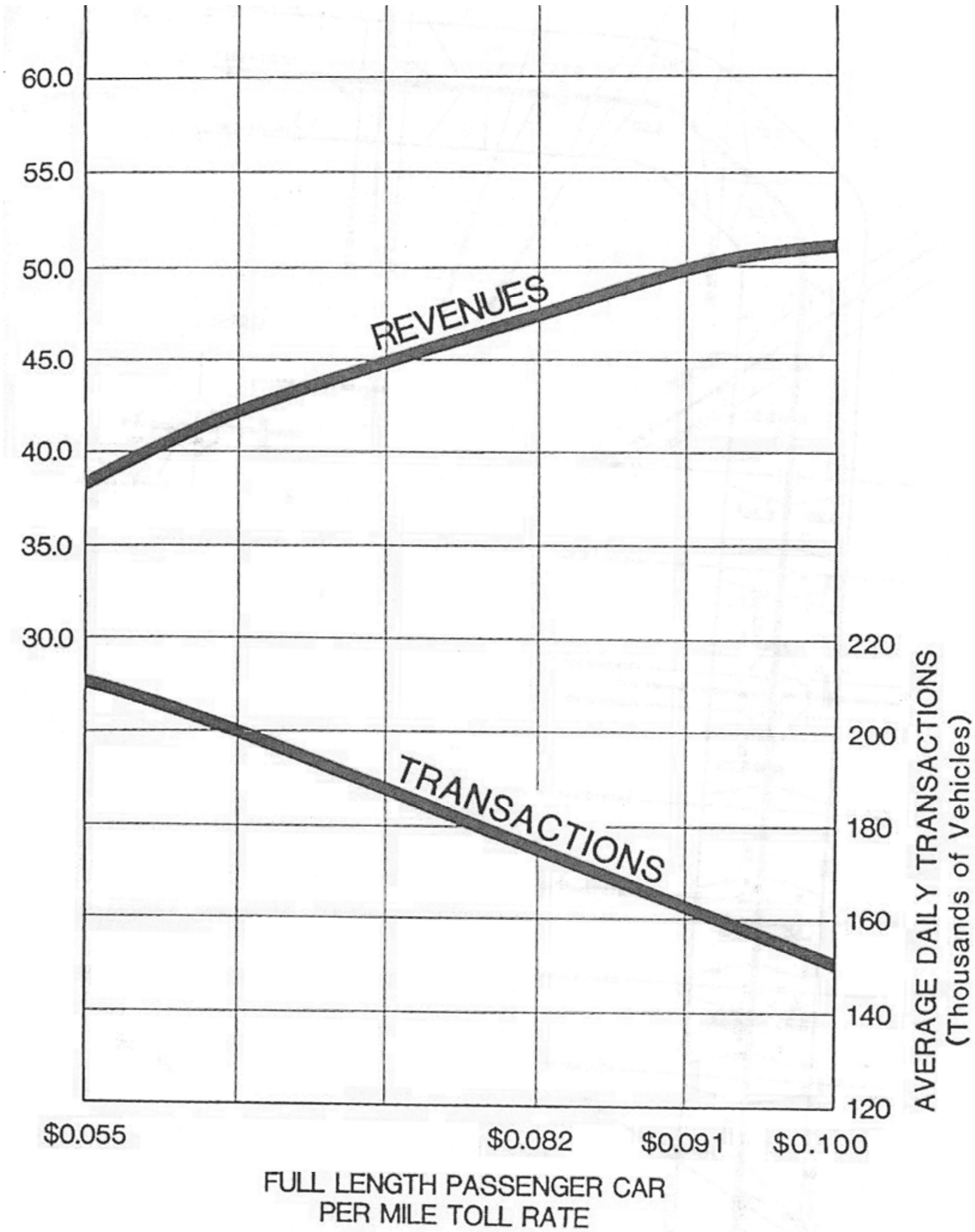

Figure D14: Toll Sensitivity Curve for the West Belt Toll Road (1988)

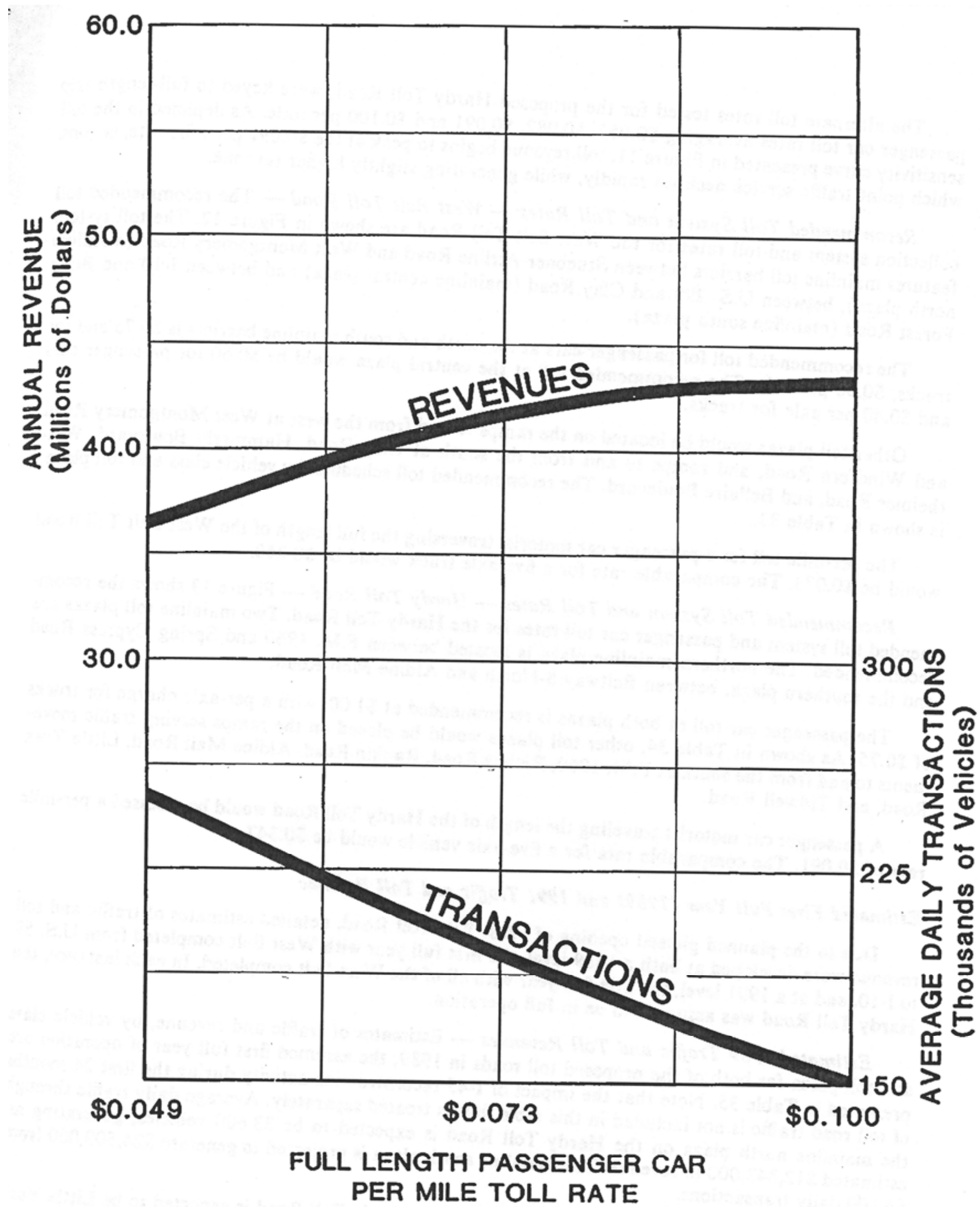

Figure D15: Toll Sensitivity Curve for the Hardy Toll Road (1988)

The figures show that the 2-axle passenger car rates equate $0.073 and $0.091 per mile for traveling the entire length of the West Belt and Hardy toll roads, respectively. The toll rates are summarized in Tables D13 and D14.

Table D13: Recommended Toll Schedule ($), West Belt Toll Road

Toll Plaza	Passenger Cars, Pickups, Vans, or Motorcycles and Trailers		Trucks and Buses				
	2-axle, 2 and 4-tire ($)	Each additional axle ($)	2-axle, 6-tire ($)	3-axle, single unit and vehicle combinations ($)	4-axle, single unit and vehicle combinations ($)	5-axle, single unit and vehicle combinations ($)	Each additional axle ($)
Mainline north	0.75	0.40	1.00	1.50	2.00	2.50	0.50
W. Montgomery Road	0.50	0.25	0.70	1.05	1.40	1.75	0.35
Windfern Road	0.35	0.20	0.50	0.75	1.00	1.25	0.25
Mainline Center	0.60	0.30	0.80	1.20	1.60	2.00	0.40
Clay Road	0.25	0.15	0.40	0.60	0.80	1.00	0.20
Hammerly Road	0.15	0.10	0.20	0.30	0.40	0.50	0.10
Mainline South	0.75	0.40	1.00	1.50	2.00	2.50	0.50
Westheimer Road	0.35	0.20	0.50	0.75	1.00	1.25	0.25
Bellaire Boulevard	0.25	0.15	0.40	0.60	0.80	1.00	0.20

Table D14: Recommended Toll Schedule ($), Hardy Toll Road

Toll Plaza	Passenger Cars, Pickups, Vans, or Motorcycles and Trailers		Trucks and Buses				
	2-axle, 2 and 4-tire ($)	Each additional axle ($)	2-axle, 6-tire ($)	3-axle, single unit and vehicle combinations ($)	4-axle, single unit and vehicle combinations ($)	5-axle, single unit and vehicle combinations ($)	Each additional axle ($)
Mainline north	$1.00	$0.50	$1.50	$2.25	$3.00	$3.75	$.75
F.M. 1960	0.75	0.40	1.00	1.50	2.00	2.50	0.50
Richey Road	0.50	0.25	0.70	1.05	1.40	1.75	0.35
Rankin Road	0.25	0.15	0.40	0.60	0.80	1.00	0.20
Mainline South	1.00	0.50	1.50	2.25	3.00	3.75	0.75
Aldine Mall Road	0.75	0.40	1.00	1.50	2.00	2.50	0.50
Little York Road	0.50	0.25	0.70	1.05	1.40	1.75	0.35
Tidwell Road	0.30	0.15	0.40	0.60	0.80	1.00	0.20

Using this recommended toll rate schedule, WSA then projected average daily traffic and annual toll revenue by vehicle class for the first full year of operation, 1989, and 1991. The years 1989 and 1991 were modeled to account for the phased opening of the West Belt. The first full year of operation for the West Belt between US59 and IH10 was 1989, and 1991 is the first full year of operation for the entire West Belt. It was assumed that the Hardy Toll Road was fully open in 1989. Table D15 summarizes the estimated average daily traffic and annual toll revenue by vehicle class and toll plaza. It was estimated that passenger cars, pick-ups, vans, motorcycles, and trailers would account for 91 percent of the revenue and 95 percent of total toll transactions.

Table D15: Estimated First Full Year, 1989, Average Daily Traffic and Annual Toll Revenue by Vehicle Class (Hardy and West Belt Toll Roads)

Toll plaza	Passenger Cars, Vans or Motorcycles, and Trailers		Trucks, Buses, and Trailers								Total	
			2-axle, 6-tire		3- axle		4-axle		5 or more axles			
	Avg Daily Trans. (ADT)	Annual Toll Revenue (ATR) ($'000)	ADT	ATR ($'000)	ADT	ATR ($'000)	ADT	ATR ($'000)	ADT	ATR ($'000)	ADT	ATR ($'000)
West Belt Toll Road												
Mainline South	53,020	14,514	1,980	723	630	345	280	204	390	356	56,300	16,142
Westheimer Rd	11,020	1,408	410	75	130	36	60	22	80	37	11,700	1,578
Bellaire Blvd.	6,030	550	220	32	80	17	30	9	40	15	6,400	623
Subtotal	70,070	16,472	2,610	830	840	398	370	235	510	408	74,400	18,343
Hardy Toll Road												
Mainline North	31,990	11,676	1,010	553	330	271	100	110	170	233	33,600	12,843
F.M. 1960	12,750	3,490	400	146	140	77	50	37	60	55	13,400	3,805
Richey Road	5,980	1,091	200	51	60	23	20	10	40	26	6,300	1,201
Rankin Road	7,040	642	220	32	80	18	20	6	40	15	7,400	713
Mainline South	61,010	22,269	1,930	1,057	640	526	200	219	320	438	64,100	24,509
Aldine Mall Rd	12,750	3,490	400	146	140	77	50	37	60	55	13,400	3,905
Little York Rd	21,970	4,010	700	179	240	92	70	36	120	77	23,100	4,394
Tidwell Rd.	8,120	889	230	34	80	18	30	9	40	15	8,500	965
Subtotal	161,610	47,557	5,090	2,198	1,710	1,102	540	464	850	914	169,800	52,235
Total	231,680	64,029	7,700	3,028	2,550	1,500	910	699	1,360	1,322	244,200	70,578

Table D16 summarizes the estimated average daily traffic and annual toll revenue by vehicle class and toll plaza for 1991 when the entire West Belt was open.

Table D16: Estimated 1991 Average Daily Traffic and Annual Toll Revenue by Vehicle Class (Hardy and West Belt Toll Roads)

Toll plaza	Passenger Cars, Vans or Motorcycles, and Trailers		Trucks, Buses, and Trailers								Total	
			2-axle, 6-tire		3- axle		4-axle		5 or more axles			
	Avg Daily Trans. (ADT)	Annual Toll Revenue (ATR) ($'000)	ADT	ATR ($'000)	ADT	ATR ($'000)	ADT	ATR ($'000)	ADT	ATR ($'000)	ADT	ATR ($'000)
West Belt Toll Road												
Mainline North	30,140	8,251	1,120	409	350	192	160	117	230	210	32,000	9,179
Montgomery Rd	24,840	4,533	930	238	300	115	140	72	190	121	26,400	5,079
Windfern	1,020	130	50	9	10	3	10	4	10	5	1,100	151
Mainline Center	58,310	12,770	2,170	634	680	298	310	181	430	314	61,900	14,197
Clay Road	11,780	1,075	430	63	140	31	60	18	90	33	12,500	1,220
Hammerly Rd	9,640	528	350	26	330	12	40	6	60	11	10,200	583
Mainline South	83,810	22,943	3,120	1,139	980	537	460	336	630	575	89,000	25,530
Westheimer Rd	12,900	1,648	480	88	150	41	70	26	100	46	13,700	1,849
Bellaire Blvd.	7,540	688	280	41	80	18	40	12	60	22	8,000	781
Subtotal	239,980	52,566	8,930	2,647	2,800	1,247	1,290	772	1800	1,337	254,800	58,569
Hardy Toll Road												
Mainline North	36,260	13,235	1,150	630	390	320	110	120	190	260	38,100	14,565
FM 1960	9,900	2710	310	113	110	60	30	22	50	46	10,400	2,951
Richey Rd	5,700	1,040	180	46	70	27	20	10	30	19	6,000	1,142
Rankin Rd	6,770	617	210	31	70	15	20	6	30	11	7,100	680
Mainline South	63,210	23,072	1,990	1,090	670	550	200	219	330	452	66,400	25,383
Aldine Mall Rd	12,460	3,411	400	146	140	77	40	29	60	55	13,100	3,718
Little York Rd	18,840	3,438	590	151	200	77	60	31	110	70	19,800	3,767
Tidwell Rd	4,930	540	170	25	50	11	20	6	30	11	5,200	593
Subtotal	158,070	48,063	5,000	2,232	1,700	1,137	500	443	830	924	166,100	52,799
Total	398,050	100,629	13,930	4,879	4,500	2,384	1,790	1,215	2,630	2,261	420,900	111,368

Figures D16 and D17 illustrate the assumed toll plaza configurations and the average daily plaza traffic expected during the design year 2007 for the West Belt and Hardy Toll Roads, respectively.

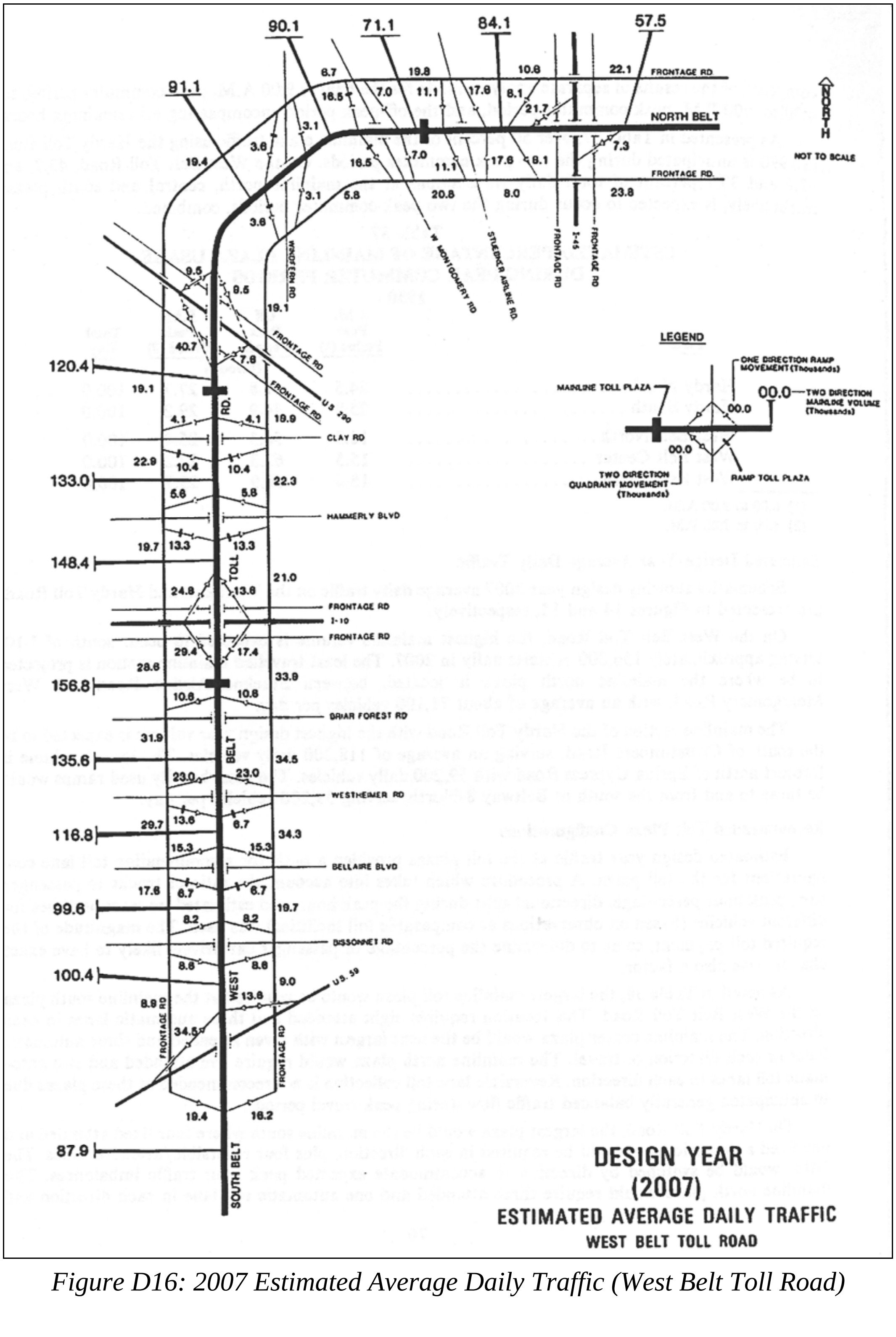

Figure D16: 2007 Estimated Average Daily Traffic (West Belt Toll Road)

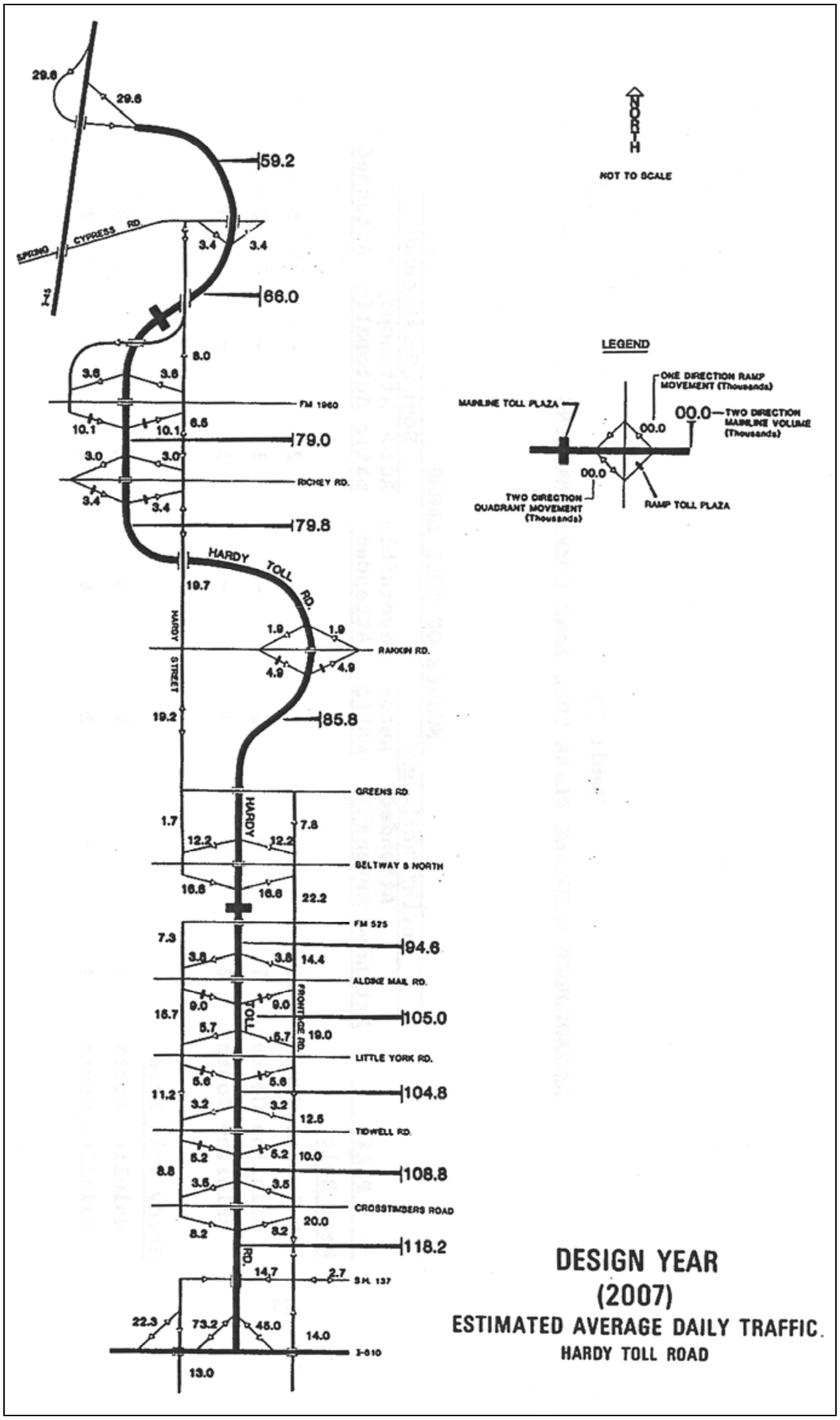

Figure D17: 2007 Estimated Average Daily Traffic (Hardy Toll Road)

WSA also estimated the percentage mainline plaza usage during the peak and off peak periods (see Table D17). As can be seen, WSA estimated that the peak period mainline plaza volumes would in most cases exceed 50 percent.

Table D17: Estimated Percentage of Mainline Plaza Usage during Peak Commuter Periods (1990)

Plaza	AM Peak Period[1] (%)	Off Peak Period (%)	PM Peak Period[2] (%)	Total Day (%)
Hardy North	24.5	47.8	27.7	100.0
Hardy South	25.9	44.9	29.2	100.0
West Belt North	18.3	56.3	25.4	100.0
West Belt Center	15.5	62.3	22.2	100.0
West Belt South	15.4	60.9	23.7	100.0

[1] 6:00 to 9:00AM
[2] 4:00 to 7:00 PM

WSA projected toll revenues for 1988 to 2007 (see Table D18). From 1988 to 1990, extra revenue was expected to be generated from the reconstruction activities on IH45 and the traffic diversion it would cause. Growth in revenue was also anticipated to result from normal traffic growth and induced growth caused by the availability of a new transportation facility.

Table D18: Estimated Annual Toll Revenue ($'000)

Year	Hardy Toll Road			West Belt Toll Road	Total
	Base Condition	Due to I-45 Reconstruction	Total		
1988	25,468	1,534	27,002	8,288	35,290
1989	53,235	3,110	55,345	18,343	73,688
1990	52,544	1,573	54,117	36,727	90,844
1991	52,799		52,799	58,569	111,368
1992	56,744		56,744	65,002	121,746
1993	60,118		60,118	71,174	131,292
1994	62,810		62,810	77,223	140,033
1995	64,995		64,995	82,630	147,625
1996	66,945		66,945	87,179	154,124
1997	68,608		68,608	91,109	159,717
1998	69,980		69,980	94,396	164,376
1999	71,380		71,380	97,325	168,705
2000	72,624		72,624	99,771	172,395
2001	73,526		73,526	101,767	175,293
2002	74,262		74,262	103,555	177,817
2003	75,005		75,005	105,108	180,113
2004	75,754		75,754	106,685	182,439
2005	76,512		76,512	108,027	184,539
2006	77,277		77,277	109,107	186,384
2007	77,692		77,692	110,198	187,890

Differences in Historical Trends and Actual Trends

In WSA's T&R projections, it was assumed that past economic, demographic, and transportation trends would continue into the future. This assumption is explored in the section below by comparing historical and actual trends.

<u>Economic and Demographic Characteristics</u>

Figures D18 and D19 show actual and forecasted population data for Harris and Montgomery County, respectively. From the Figures, it appears that WSA's predicted 1990 population estimates materialized, but that the 2000 population estimates were slightly under predicted. This under prediction could arguably result in an underprediction of transactions and revenue.

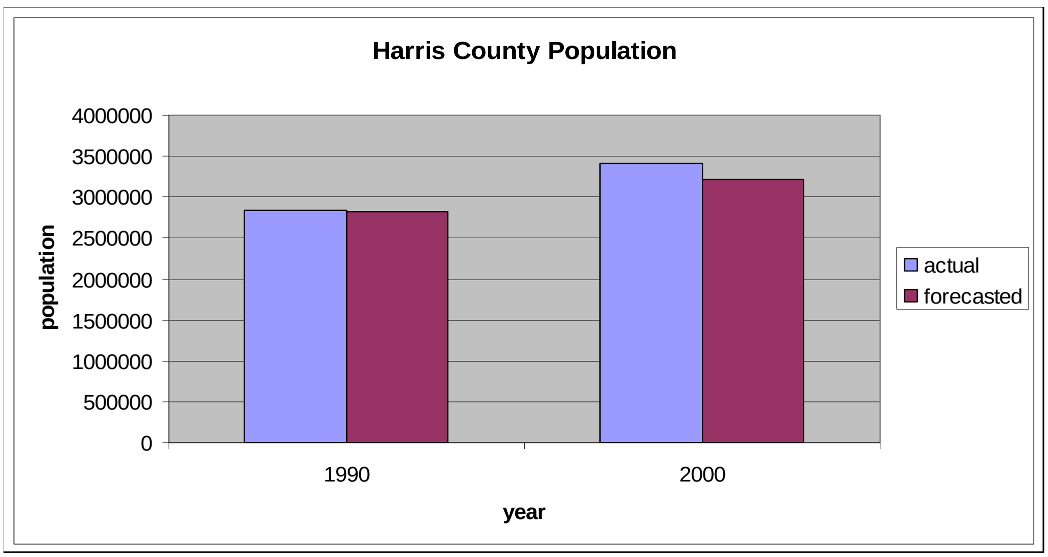

Figure D18: Forecasted and Actual Harris County Population

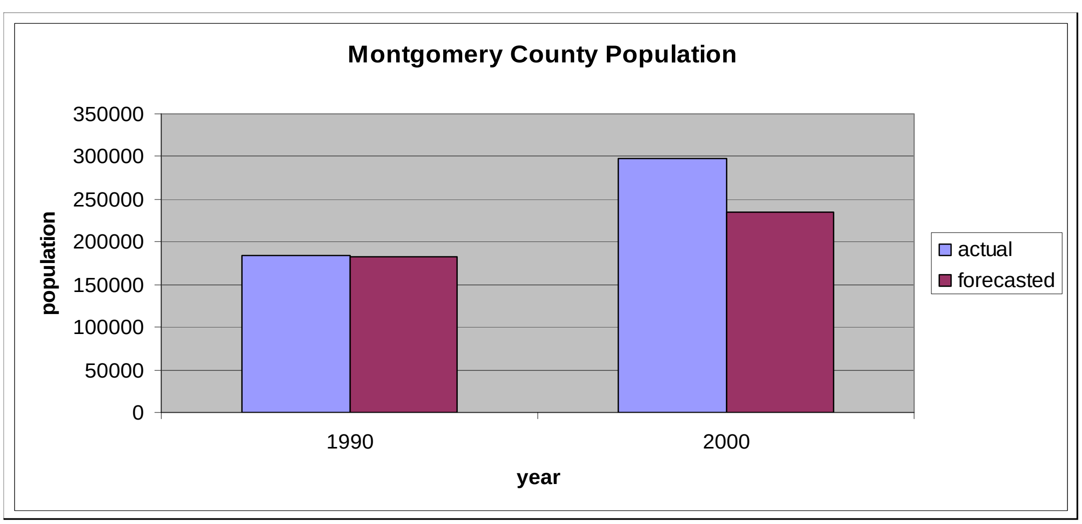

Figure D19: Forecasted and Actual Montomery County Population

The economic downturn of the mid to late 1980s is evident when reviewing the annual percentage population change in Harris and Montgomery County (Figure D20). In some years, population growth did not only slow, but the population actually decreased. Since the early 1990s, annual population growth has been fairly constant at around 5 percent for Montgomery County and 2 percent for Harris County.

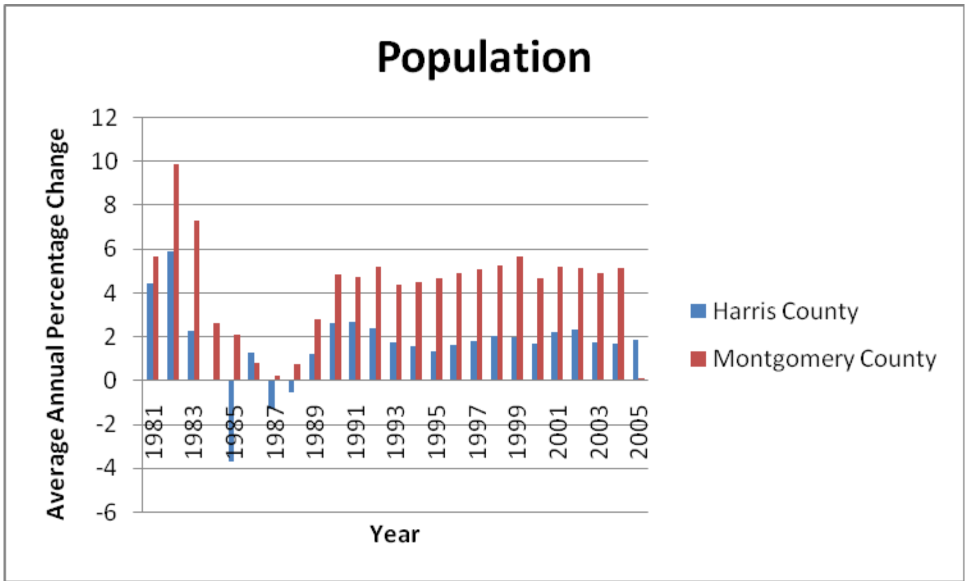

Figure D20: Percentage Change in Population for Harris and Montgomery Counties

Differences in Actual and Forecasted Traffic

This section analyses the differences in actual and forecasted revenue forecasted by WSA for the Hardy and West Belt Toll Roads and provides a qualitative discussion of the impact of certain factors on revenues.

<u>Actual and Forecasted Revenue for Hardy Toll Road</u>

Figure D21 shows that actual revenue never reached the projected levels. In fact, the difference has been quite substantial in most years, reaching almost $50 million in 1994. Specifically, revenues did not materialize as expected in the first five years of the road's operation, suggesting a difficult ramp-up period. Although the actual growth in revenue after 1994 seems to be similar to forecasted growth—as indicated by the slope of the two lines—collected revenue remains substantially lower than forecasted revenues.

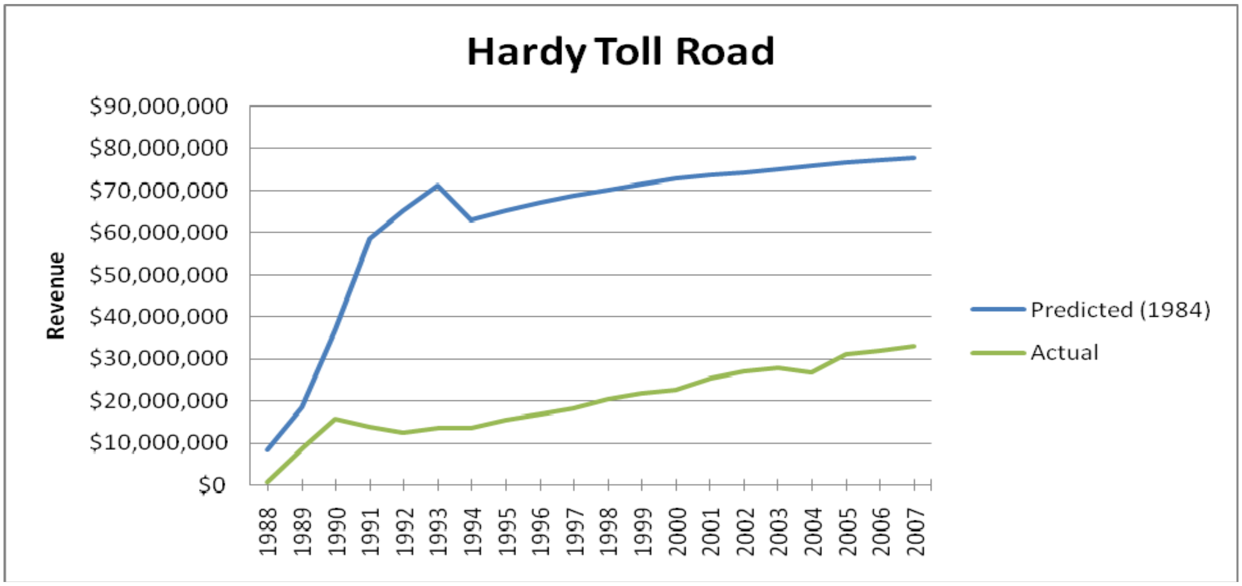

Figure D21: Forecasted and Actual Toll Revenues (Hardy Toll Road)

<u>Actual and Forecasted Revenue for West Belt Tollway</u>

Unlike the Hardy Toll Road, the West Belt Tollway has met and exceeded projected annual revenues (see Figure D22). However, in the first almost 10 years of the road's operation, revenue was slightly overpredicted, but the growth in revenue (as indicated by the slope of the lines) was similar to the predicted growth in revenues. Then, in the mid-1990s, as revenues were predicted to taper off, actual revenues increased substantially and exceeded forecasted revenues. As of 2007, the actual revenues were more than $75 million higher than what was predicted—that is 67 percent above what was predicted.

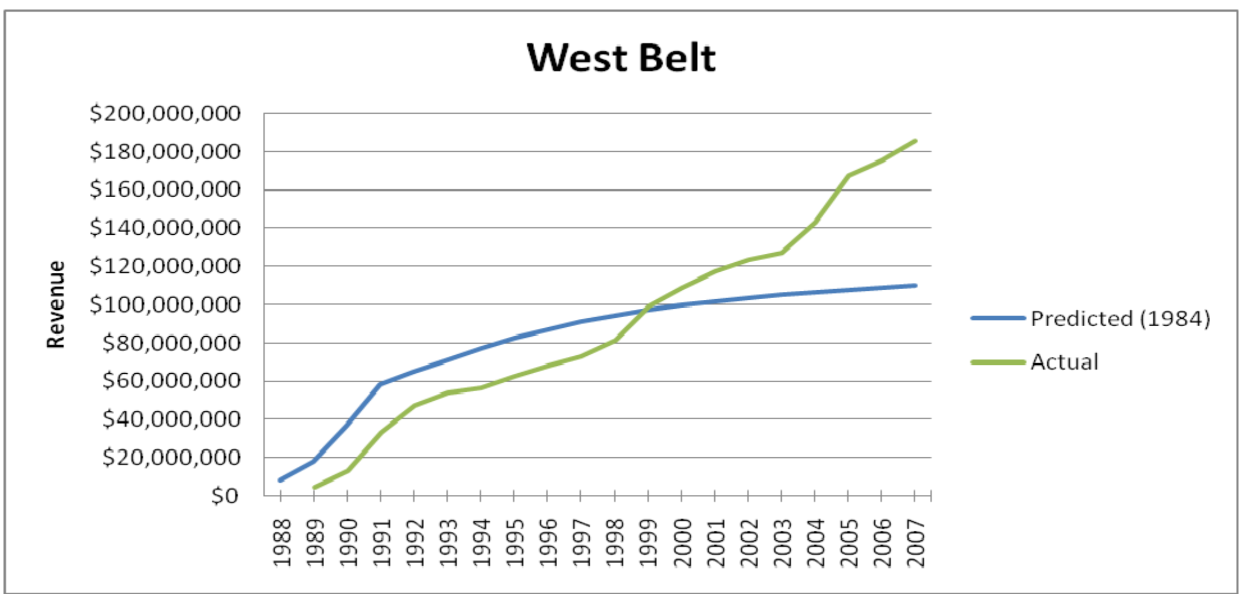

Figure D22: Forecasted and Actual Toll Revenues (West Belt Toll Way)

General Observations and Conclusions

WSA had predicted that the Hardy Toll Road would be the main revenue generator and that the West Belt would only be feasible during its first few years if the entire system's revenue was pooled. Almost exactly the opposite situation materialized. There are several reasons that can be offered to explain the discrepancy between the actual and predicted revenues. First, WSA's forecasts did not account for the improvements on US59 and IH45 that improved travel times on those routes. This resulted in lower usage as fewer vehicles diverted to the Hardy Toll Road. Second, the fact that Hardy did not connect into downtown may have also reduced its usage. Even if users saved time using the toll road, they would have had to merge into traffic once they reached the IH610 loop. For this reason, Hardy was not an attractive or alternate route that saved time for downtown destinations. The West Belt, on the other hand, did not have any direct competition from non-tolled alternatives and aided in congestion management.

Furthermore, the energy crisis of the mid to late 1980s also impacted toll road usage. This resulted in WSA revising their T&R forecasts downward in 1988 and 1989 to be more in line with what HCTRA had experienced in the first few years of operation.

Finally, the motorist surveys seemed to have been an important input in computing the value of time and diversion rates. It has been argued that WSA as an out-of-state company from Pennsylvania were trying to estimate value of time for Houstonian drivers without a good understanding of the area. This arguably could have introduced uncertainty about their estimates of drivers' willingness to use toll roads. However, this is highly speculative and because WSA's methodology and value of time estimates cannot be verified it is not clear how the forecasts were impacted, if at all.

April 1994 Bond Document

HCTRA sold more than $232 million worth of bonds in April 1994 to support the purchase of the Houston Ship Chanel Bridge from TTA and the construction of the Southern and Eastern Beltway[13].

Summary of the Projects[14]

The April 1994 bond issuance was for the purchase of the Jesse H. Jones Memorial Bridge (now called the Ship Chanel Bridge). The Jesse H. Jones Memorial Bridge was constructed by the TTA and opened on May 6, 1982. Some of the 1994 bond revenues were to pay off the outstanding bonds that were originally used to finance the bridge. The bonds also supported the construction of the Sam Houston Tollway South (SHT-South) and Sam Houston Tollway East (SHT-East). Figure D23 shows the original projects that were included in the 1994 bond issuance.

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13 The bond underwriters were Dillon, Read & Co. Inc. and Masterson Moreland Sauer Whisman Inc. HCTRA received bond ratings of an AA+/AAA from Standard and Poor's (S&P) and an Aa/Aaa from Moody's Investors Service, depending on the year the bonds mature. Because HCTRA was a public agency, the bonds were tax exempt.

14 Unless otherwise noted, the information and data in this section are from the 1994 Bond Document.

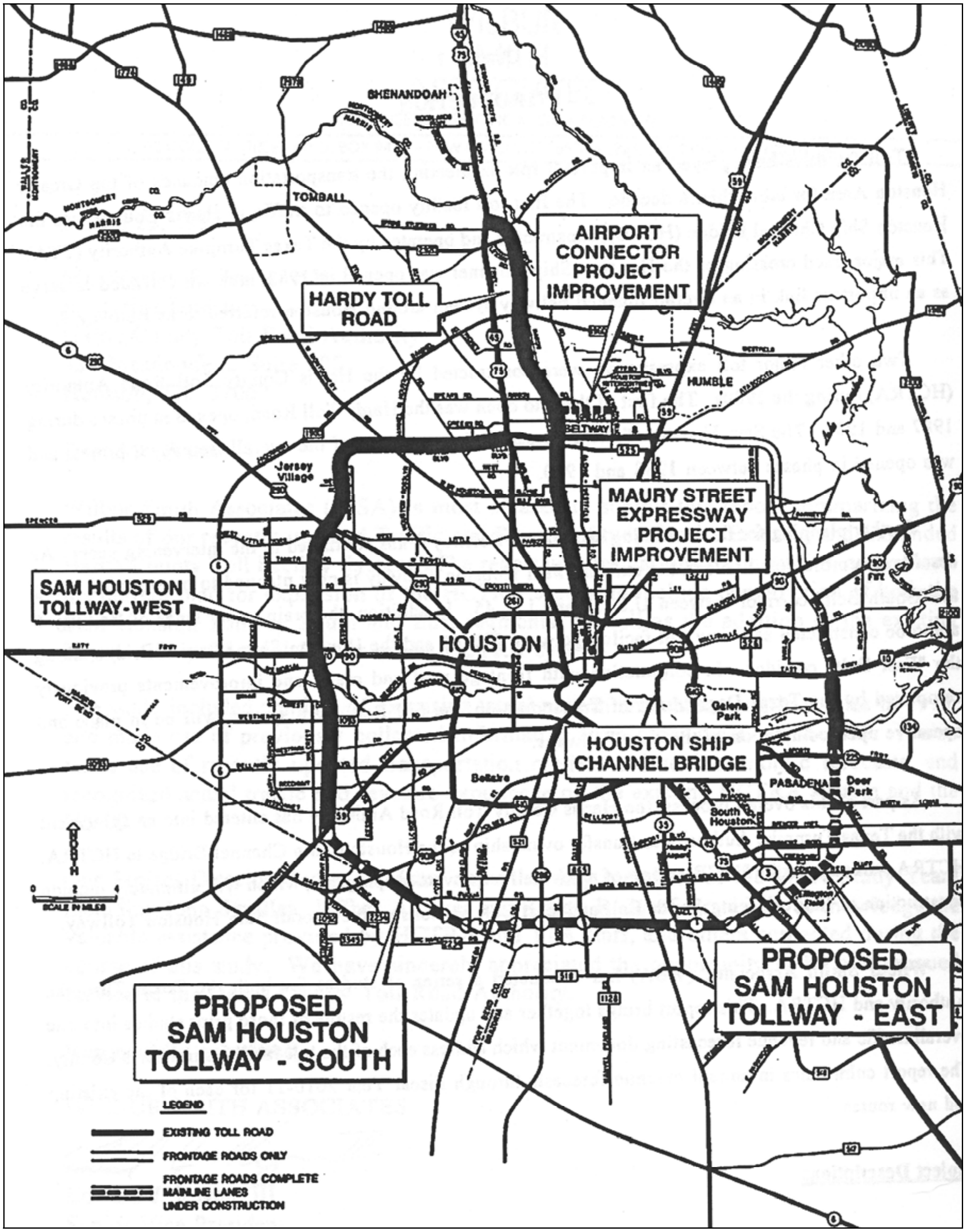


Figure D23: Projects Included in the April 1994 Bond Document

As part of the purchase of the Ship Chanel Bridge, HCTRA listed all their proposed projects that would constitute their *"entire system"* and pooled their debt. The agreement with TTA stated that as long as there was outstanding debt, the entire system would remain under HCTRA's control and would not be turned over to TxDOT.

Summary of the Existing Conditions[15]

Due to the downturn in the economy in the mid to late 1980s, WSA revised their projections in an updated T&R study dated June 27, 1989. The updated report reduced the T&R projections substantially from those presented in the 1984 report. The T&R report in the 1994 bond document adjusted the forecasts upwards again after traffic and toll predictions veered closer to the original 1984 forecasts. This section discusses traffic trends and characteristics of the HCTRA system, as well as additional motorist surveys that were conducted by WSA.

Traffic Trends and Characteristics

WSA reviewed the historical trends on Houston area freeways, the existing HCTRA system, and the Houston Ship Channel Bridge.

Area Freeways

Table D19 shows the average annual percentage change in traffic on all major competing or supporting freeways in the Houston area. The data was obtained from permanent recorder counts by TxDOT. Table D19 seems to suggest an overall positive trend in traffic volumes for all the freeways over the ten-year period from 1983 to 1993.

Table D19: Average Annual Percentage Change in Traffic on Area Freeways

	1983-1988	**1988-1993**	**1983-1993**
IH 45 north of Cypress Creek	1.1	2.2	1.9
US 290 at Cypress Creek	1.8	7	4.3
US 59 (SW Freeway) at Montrose	-0.3	0.8	0.2
IH 610 Northeast of Main	0.3	0.2	0.2
IH 10 (Katy Freeway) East of Taylor	1.9	2.3	2.3
IH 610 East Loop at Ship Channel	-1.3	1.4	0
US 59 Eastex	3.8	2.4	3
Gulf Freeway (US 45)	2.7	-0.6	0.8

Existing HCTRA System

The historical traffic trends on the existing HCTRA system was also reviewed in detail. WSA also reviewed the current toll rates. Table D20 summarizes the toll rates that applied at the time of the 1994 bond document.

[15] Unless otherwise noted, the information and data in this section are from the 1994 Bond Document.

Table D20: Toll Schedule Included in 1994 Bond Document

Toll Plaza	2-axle 2,4 & 6 tire ($)	Each additional axle ($)	3-axle single unit and vehicle combinations ($)	4-axle single unit and vehicle combinations ($)	5-axle single unit and vehicle combinations ($)	Each additional axle ($)
Hardy Toll Road						
North Mainline	0.75/ 1.00	0.50	2.25	3.00	3.75	0.75
FM 1960	0.75	0.40	1.50	2.00	2.50	0.50
Richey Road	0.50	0.25	1.05	1.40	1.75	0.35
Rankin Road	0.25	0.15	0.60	0.80	1.00	0.20
South Mainline	0.75/ 1.00	0.50	2.25	3.00	3.75	0.75
Aldine Mall Road	0.75	0.40	1.50	2.00	2.50	0.50
Little York Road	0.50	0.25	1.05	1.40	1.75	0.35
Tidwell Road	0.25	0.15	0.60	0.80	1.00	0.20
Sam Houston Tollway						
North Mainline	0.75/ 1.00	0.40	1.50	2.00	2.50	0.50
FM 249	0.50	0.25	1.05	1.40	1.75	0.35
Fallbrook /Gessner	0.35	0.35	0.20	0.75	1.00	0.25
Central Mainline	0.75/ 1.00	0.40	1.50	2.00	2.50	0.50
Clay Road	0.35	0.25	0.75	1.00	1.25	0.25
Hammerly Boulevard	0.35	0.15	0.60	0.80	1.00	0.20
North Mainline	0.75/ 1.00	0.40	1.50	2.00	2.50	0.50
Deerwood Exit	0.50	0.25	1.05	1.40	1.75	0.35
Westheimer Road	0.30	0.20	0.75	1.00	1.25	0.25
Bellaire Boulevard	0.25	0.15	0.60	0.80	1.00	0.20
Houston Ship Channel Bridge	1.50	-	2.75	3.50	4.50	1.00

WSA also analyzed the monthly traffic variations (see Figure D24). Both the Sam Houston and Hardy Toll Roads exhibit little monthly variation throughout the year, with only marginally lower traffic during January and to some extent February.

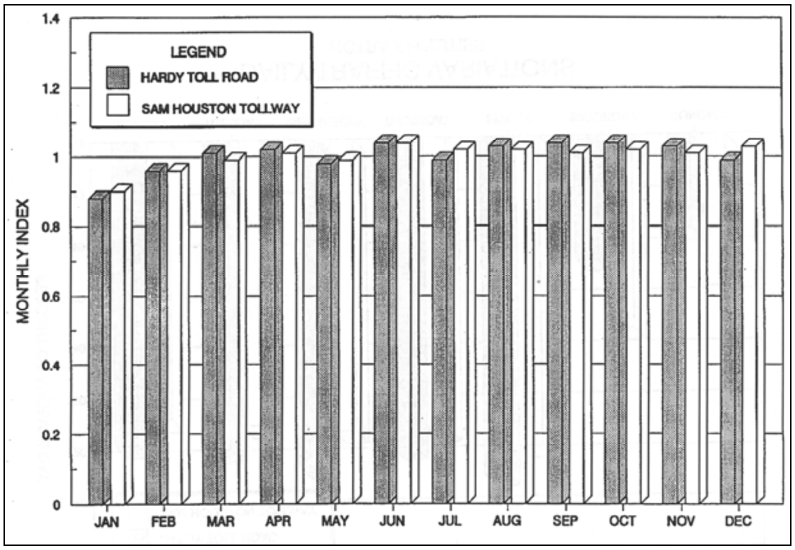


Figure D24: Monthly Traffic Variations (HCTRA Facilities)

Daily traffic variations (see Figure D25) reveal a clear weekday use pattern. This seems to suggest that the toll roads are mainly commuter routes. Because the Sam Houston Toll Road has a slightly higher percentage of shoppers compared to the Hardy Toll Road, its weekend indices are also higher.

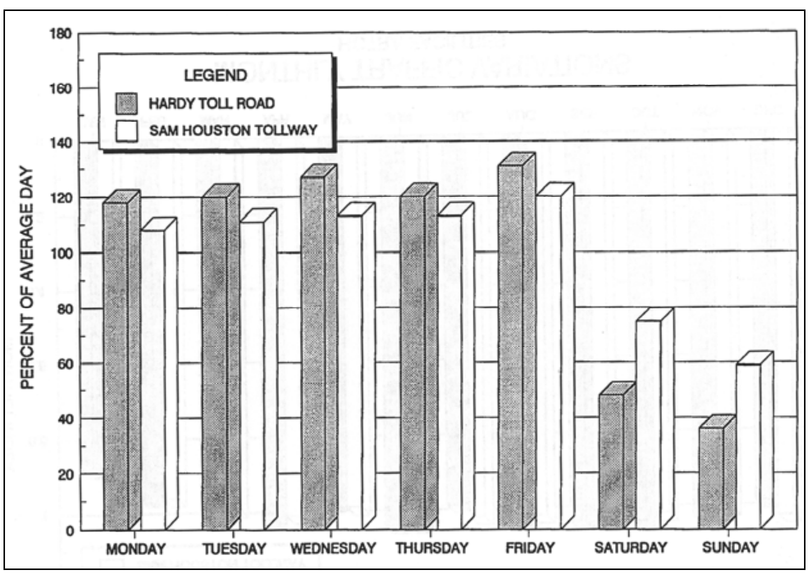


Figure D25: Daily Traffic Variations (HCTRA Facilities)

WSA also looked at a breakdown of the revenue and traffic shares by payment type (see Figure D26). In 1994, HCTRA had begun the use of EZ Tags that entitled drivers to pay a discounted rate at main lane plazas. This partly explains the low usage of EZ tags in Figure D26.

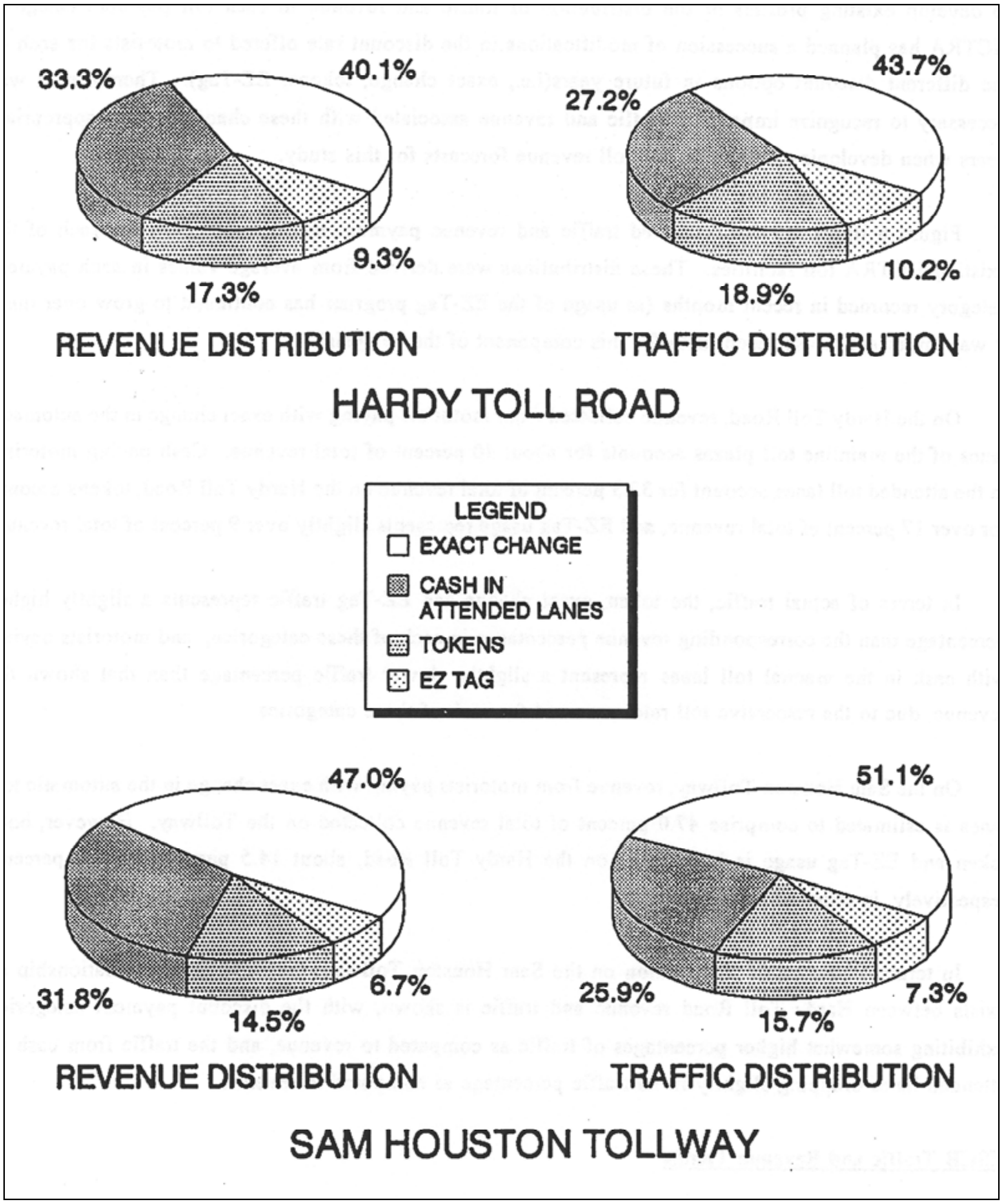


Figure D26: Distribution of Traffic and Revenue by Payment Type (HCTRA Facilities)

Ship Channel Crossing

The Houston Ship Channel Bridge and its T&R potential were studied extensively. Because there are a number of ways to cross the ship channel, WSA looked at the traffic trends at all of the potential crossings (see Table D21). The Houston Ship Channel Bridge appears to have a relatively stable growth rate. However, a very low percentage of trips that cross the ship channel use the bridge.

Table D21: Average Annual Percentage (%) Change in Traffic

Year	IH 610 East Loop HSCB	Washburn Tunnel	Houston Ship Channel Bridge	SH 146 at Baytown Tunnel	Total
1983-1988	(1.3)	(3.2)	8.8	1.6	(1.4)
1988-1993	1.4	5.8	6.5	1.9	2.9
1983-1993	0.0	1.2	7.6	1.7	0.7

WSA reviewed the annual transactions and revenue of the Houston Ship Channel Bridge (see Table D22). Both the average annual traffic and the annual toll revenue were growing. However, because of lower than projected traffic volumes, revenues were lower than anticipated. The TTA projections were thus over-optimistic when they bonded the construction of the bridge in 1979.

Table D22: Traffic and Revenue Indicators

Year	Annual Toll Transactions			Annual Toll Revenue ($)	Average Toll ($)
	Passenger Cars	Commercial Vehicles	Total		
1983	2,439,091	193,236	2,681,655	2,897,902	1.08
1993	5,211,982	379,695	5,591,677	9,371,758	1.68
Average Annual Growth (1983-1993)	7.9%	7.0%	7.8%	12.5%	

<u>Motorist Surveys</u>

WSA conducted motorist travel pattern and characteristics surveys in 1989 and 1993. The March 1989 surveys were conducted for TTA as part of the proposed SHT-East toll road, and therefore focused specifically on that corridor. The surveys in January and February of 1993 focused on the SHT-South corridor.

Figures D27 and D28 show the trip characteristics for the 1989 and 1993 surveys, respectively. The 1989 survey showed that a large percentage of drivers drove in that corridor at least five days a week. A large percentage of the respondents—51.5 percent in the case of the Houston Ship Channel Bridge—were commuting to or from work. The 1993 survey showed similar characteristics existed in the SHT-South corridor, with approximately 60 percent of the respondents making at least five trips a week and 48.1 percent traveling to or from work.

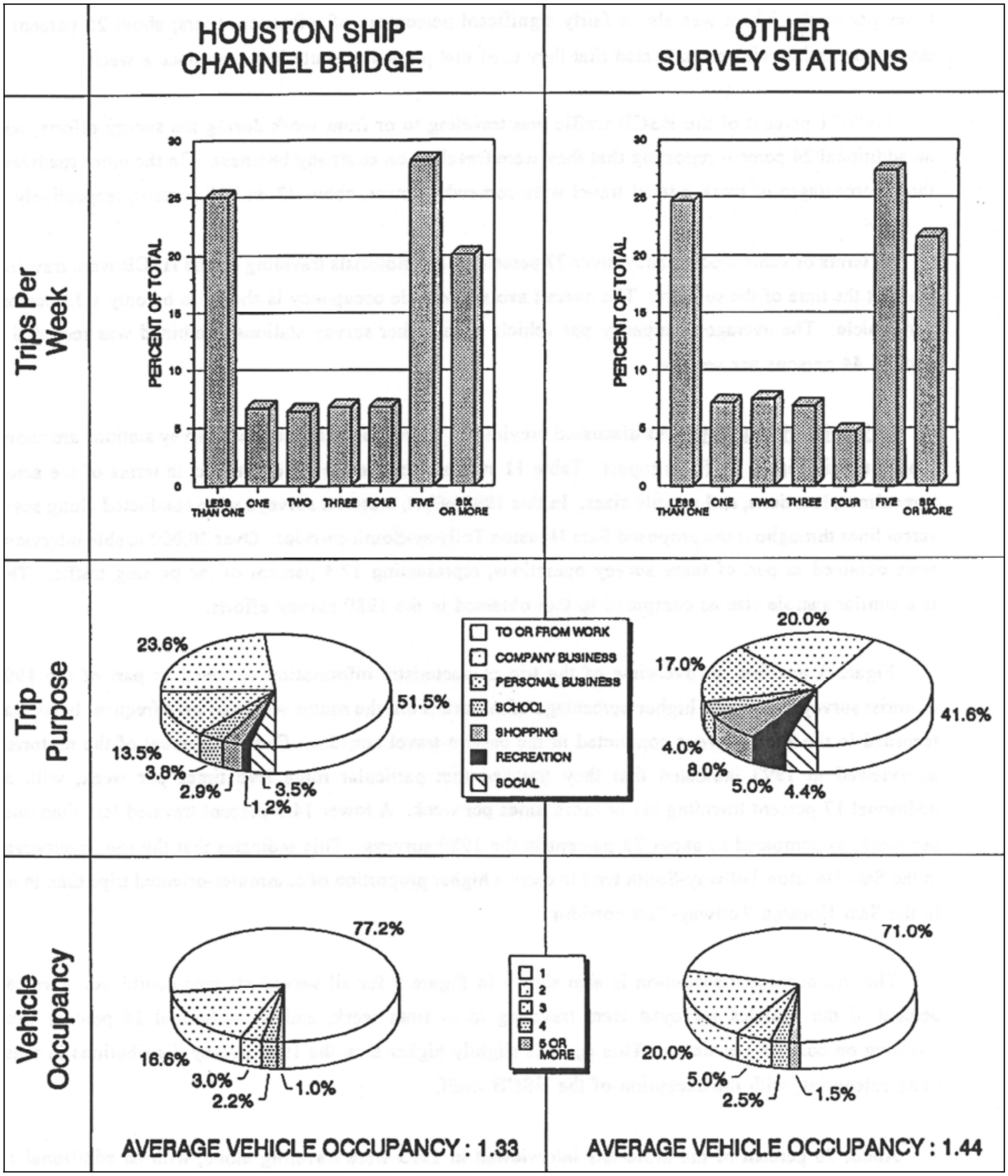


Figure D27: Trip Characteristics Overview (SHT-East)

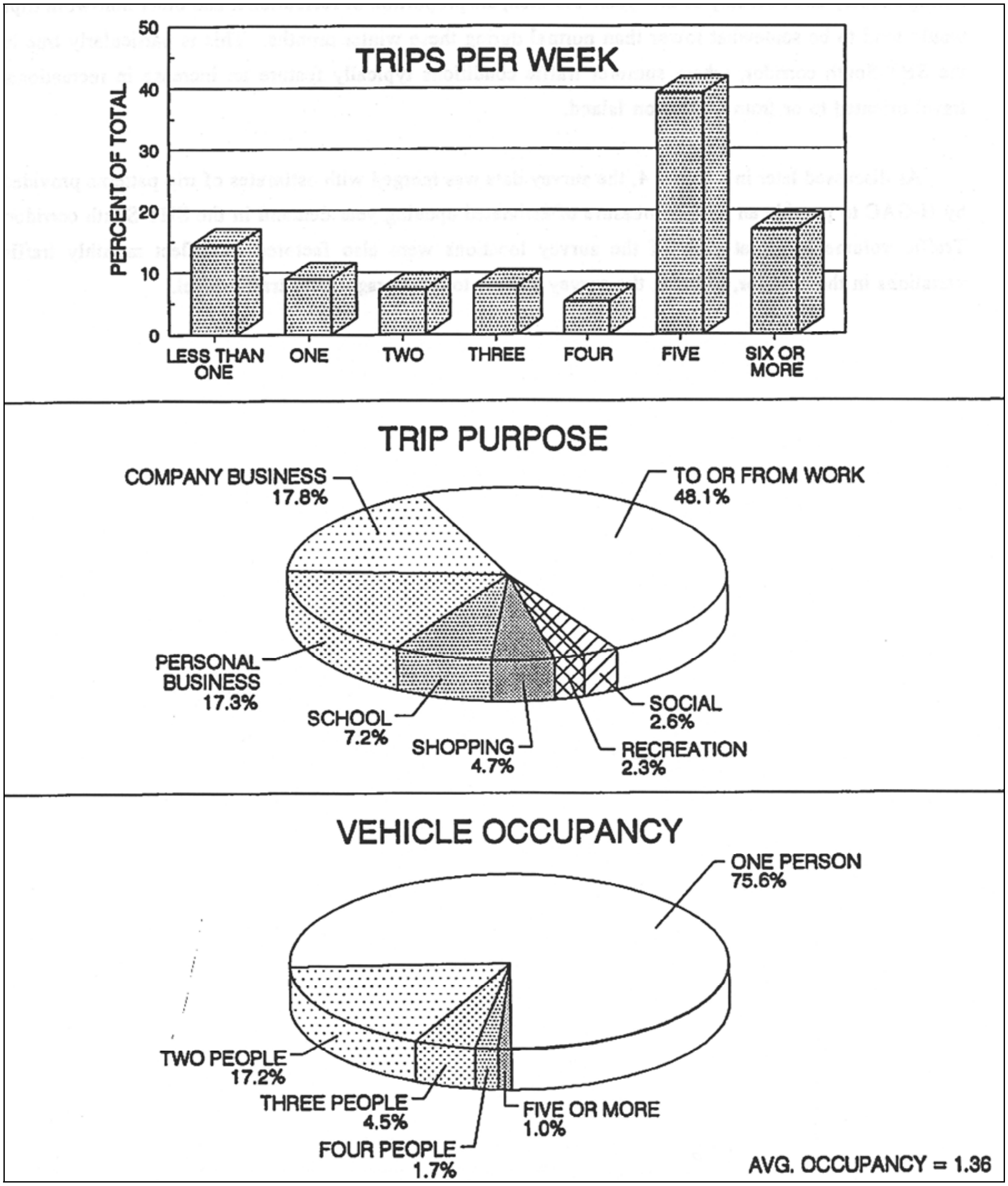


Figure D28: Trip Characteristics Overview (SHT-South)

Based on these survey results, WSA developed typical time-distance relationships and the time savings of using toll roads for certain origins and destinations. The estimated time savings were used to determine the diversion rates to the new toll roads. Table D23 shows examples of the time/distance savings that might occur when using a toll road. It should be noted that although time savings result in all cases, there is not necessarily a reduction in trip distance in all cases. The added mileage is negated by the increase in average speed.

Table D23: Typical Time-Distance Relationships

Between	Using	Travel			Savings	
		Distance (miles)	Time (minutes)	Average (mph)	Miles	Minutes
Jersey Village and Galveston	IH 45, SHT-South, Sam Houston Parkway	60	82	44	(8)	10
	IH 45, IH 610, US290	52	92	34		
Sugarland and NASA (LBJ Center)	Alt US 90, SHT-South, IH 45, NASA 1	39	49	48	4	17
	SH 6, FM 528, NASA 1	43	66	39		
Galveston and Houston Intercontinental Airport	IH 45, SHT-East, Beltway 8	60	75	50	(2)	7
	IH 45, IH 610, US 59	62	68	54		

Corridor Growth Analysis

Similar to the 1984 study, WSA reviewed the economic and demographic characteristics of the eight-county region using data from H-GAC (see Figures D29 and D30). This data was used together with the updated traffic trends and motorist surveys in the development of the trip tables. At the time of this report, Houston and the nation were recovering from a recession, although the recovery was slow. This manifested in the Houston economy and employment market flattening during the early 1990s. Houston's energy industry was affected, but not to the extent that occurred in the early 1980s.

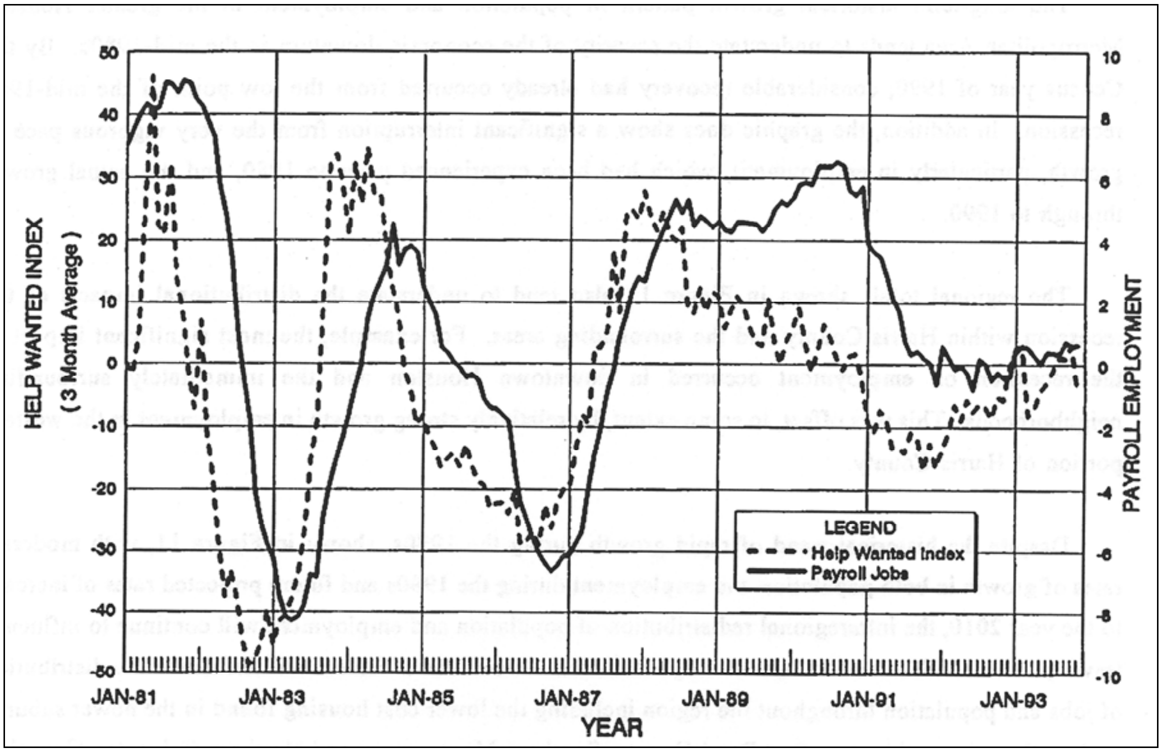


Figure D29: 12 Month Percent Change in Help Wanted Index and Jobs in Houston PMSA

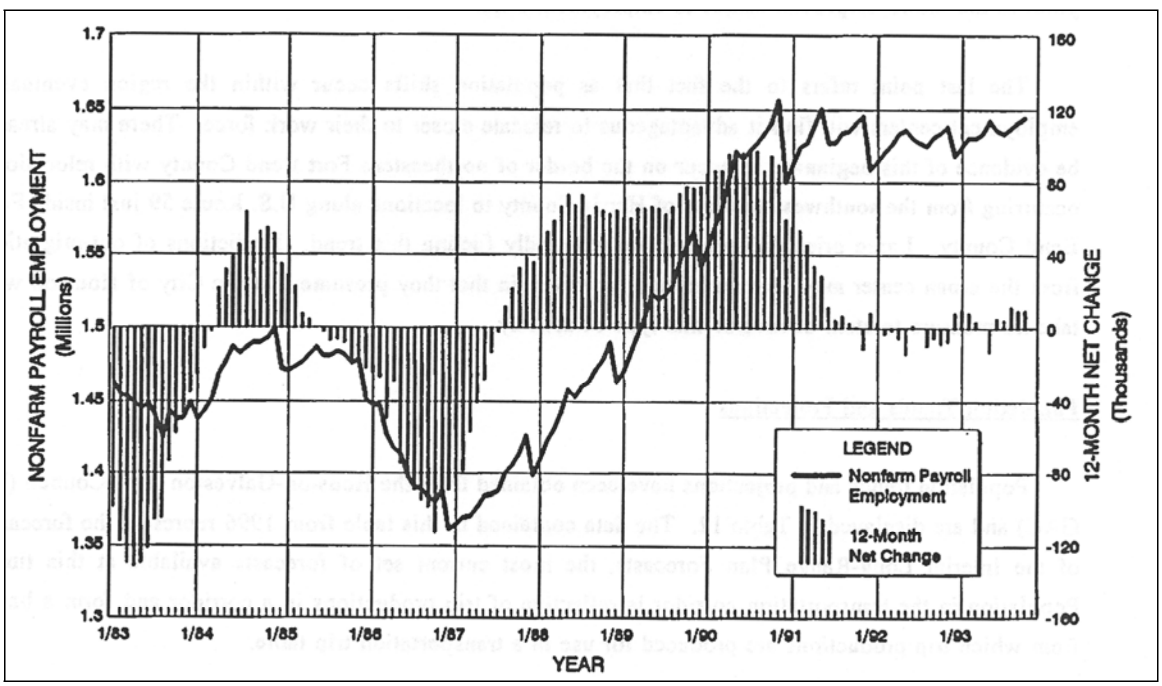


Figure D30: Houston Metropolitan Employment Trends

WSA obtained population and employment trends and projections until 2010 from H-GAC (see Figure D31 and Tables D24 and D25). The economic recession did not seem to have an impact on either population or employment in the area, and it was predicted that population would continue to grow at a similar rate until 2010, reaching over 5 million. Employment was predicted to reach almost 3 million by 2010.

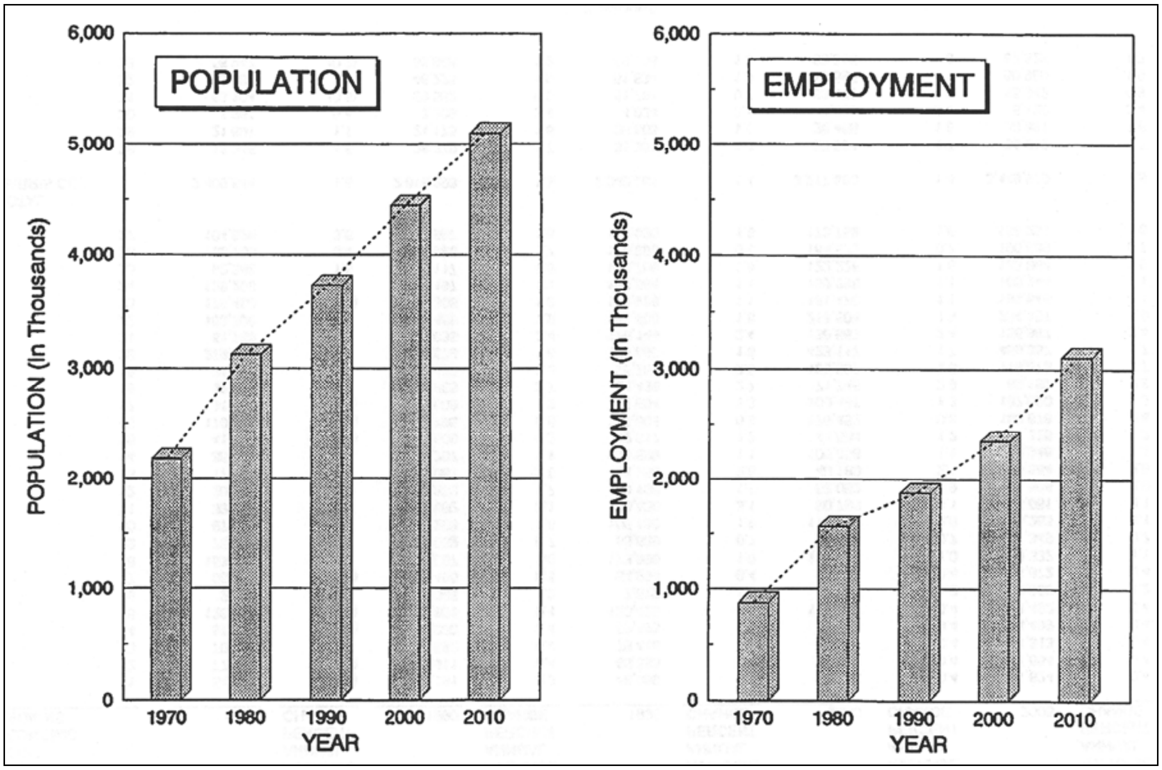


Figure D31: Long Term Regional Population Trends and Projections

Table D24: Population Trends and Projections

County	1980	Avg Annual Percent Change AAPC (%)	1990	AAPC (%)	1996	AAPC (%)	2000	AAPC (%)	2005	AAPC (%)	2010
Harris	2,409,544	1.6	2,818,293	1.3	3,048,261	1.4	3,217,690	1.4	3,449,970	1.5	3,707,869
Galveston	195,942	1	217,399	1.4	235,633	1.4	249,048	1.4	267,395	1.5	287,678
Brazoria	169,587	1.2	191,707	1.4	208,250	1.4	220,069	1.4	235,787	1.4	252,627
Fort Bend	130,846	5.6	225,421	2.7	264,211	2.7	293,757	2.7	335,433	2.7	383,099
Montgomery	128,487	3.6	182,201	2.6	212,066	2.6	234,854	2.6	267,067	2.6	304,001
Waller	19,978	1.5	23,297	2.6	27,142	2.6	30,051	2.6	34,130	2.6	38,763
Liberty	47,088	1.1	52,726	1.2	56,574	1.2	59,299	1.2	62,887	1.2	66,691
Chambers	18,538	0.8	20,088	2.3	23,055	2.3	25,271	2.3	28,345	2.3	31,793
Total	3,120,010	1.8	3,731,132	1.5	4,075,192	1.5	4,330,039	1.6	4,681,014	1.6	5,072,521

Table D25: Employment Trends and Projections

County	1980	Average Annual Percent Change AAPC (%)	1990	AAPC (%)	1996	AAPC (%)	2000	AAPC (%)	2005	AAPC (%)	2010
Harris	1,360,407	1.5	1,573,467	1.8	1,749,195	1.8	187,8911	1.8	2,056,844	1.9	2,254,464
Galveston	76,543	0.2	77,740	1.9	87,181	2.0	94,196	2.0	103,845	2.0	114,588
Brazoria	54,894	3.9	80,823	1.6	88,840	1.6	94,638	1.6	102,428	1.6	110,868
Fort Bend	33,033	5.9	58,532	4.2	75,101	4.3	88,713	4.3	109,287	3.4	134,698
Montgomery	20,821	10.2	55,128	3.4	67,300	3.4	76,884	3.4	90,833	4.3	107,334
Waller	5,397	3.7	7,778	2.2	8,869	2.2	9,680	2.2	10,801	2.2	12,048
Liberty	11,566	1.8	13,843	2.0	15,573	2.0	16,851	2.0	18,598	2.0	20,525
Chambers	7,580	0.2	7,441	2.4	8,558	2.4	9,398	2.4	10,562	2.4	11,870
Total	1,57,0241	1.8	1,874,752	1.9	210,0617	1.9	2,269,271	2.0	2,503,198	2.0	2,766,395

Summary of the Projected Traffic and Revenue

Based on the trip tables and the toll rate schedule, WSA projected annual revenue on the existing and expanded system. Toll usage in given corridors was predicted using the time-distance tables, the estimated value of time, and proposed highway improvements in the area that may divert toll users away from the toll roads. Figures D32 and D33 show the assumed toll rates for the HCTRA system.

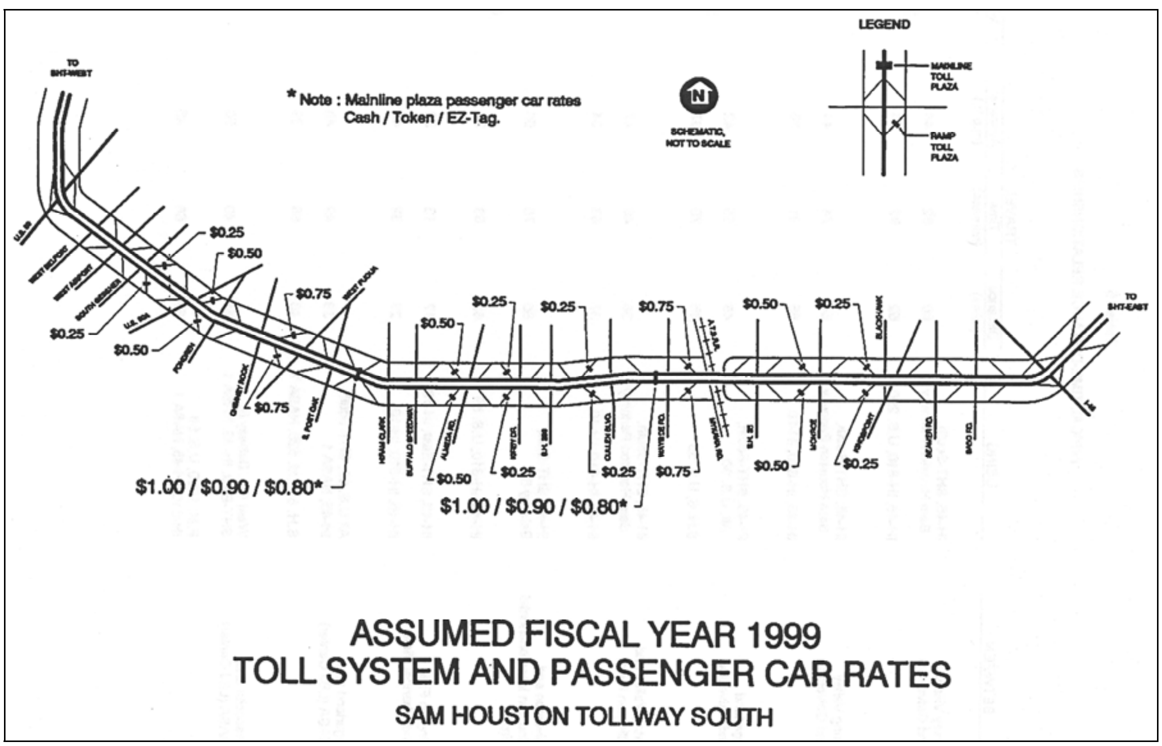


Figure D32: Assumed Fiscal Year 1999 Toll System and Passenger Car Rates (Sam Houston Tollway South)

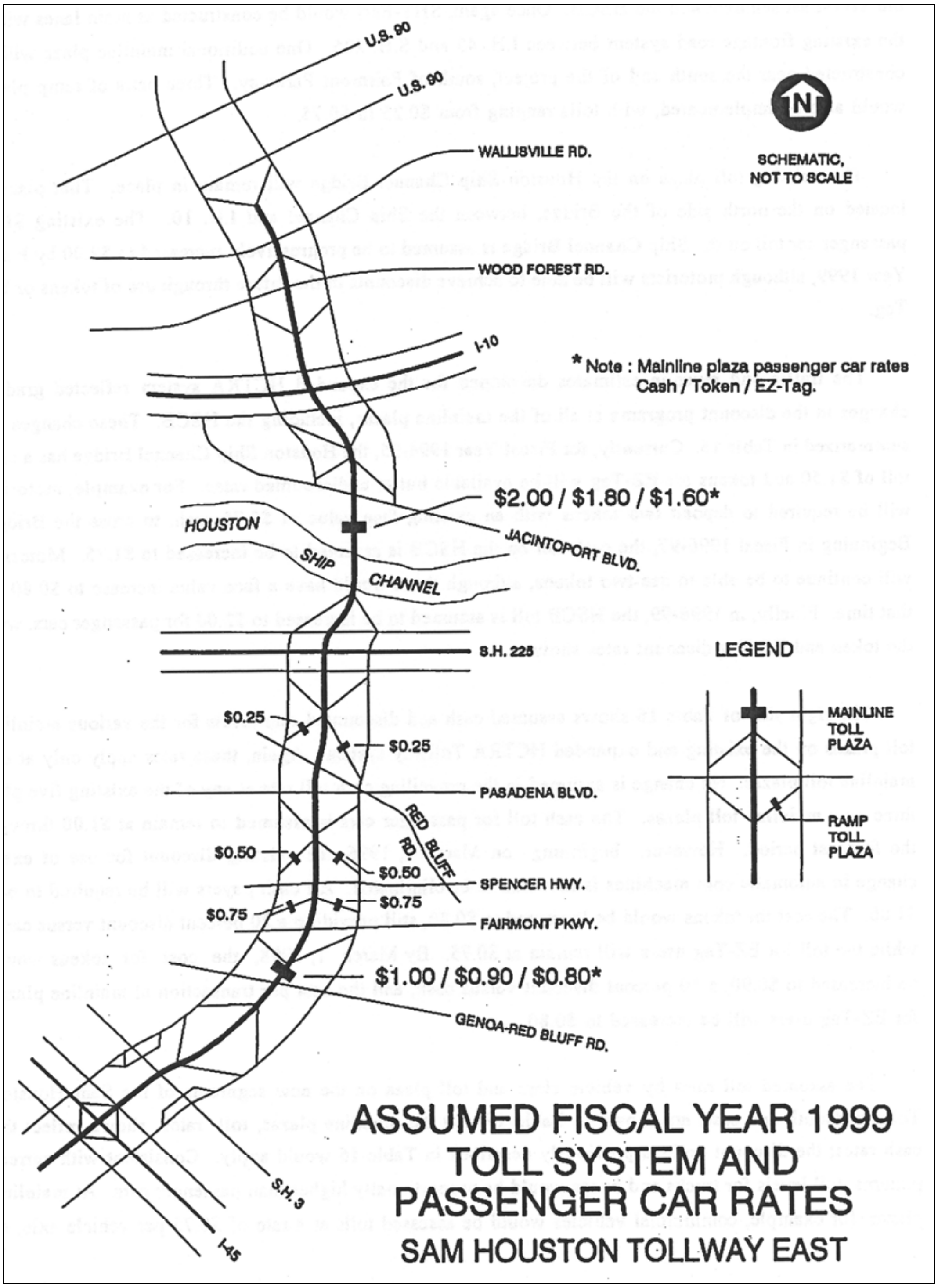


Figure D33: Assumed Fiscal Year 1999 Toll System and Passenger Car Rates (Sam Houston Tollway East)

The toll rates on the mainline plazas are summarized in Table D26. Note that there was a discount for EZ tag or token users when passing through a mainline plaza and the exact change discount was to be phased out in 1996.

Table D26: Mainline Plaza Passenger Car Rates

Fiscal Year	Houston Ship Channel Bridge			All Other System Mainline Plazas			
	Cash ($)	Tokens ($)	EZ Tag ($)	Cash ($)	Exact Change ($)	Tokens ($)	EZ Tag ($)
1994-95	1.50	1.50	1.50	1.00	0.75	0.75	0.75
1995-96	1.50	1.50	1.50	1.00	0.75	0.75	0.75
1996-97	1.75	1.60	1.50	1.00	1.00	0.80	0.75
1997-98	1.75	1.60	1.50	1.00	1.00	0.80	0.75
1998-99	2.00	1.80	1.60	1.00	1.00	0.90	0.80

Traffic and Revenue Projections

Given the projected economic and demographic trends, and the assumed toll rate schedule, WSA forecasted average daily traffic for 1999 (see Figures D34 through D37). It was noted that these numbers represented the average daily traffic and that the average weekday totals would be higher. The volumes on the SHT-South were expected to be lower than the existing volumes on the Sam Houston Tollway–West (SHT-West), because of a lack of existing development.

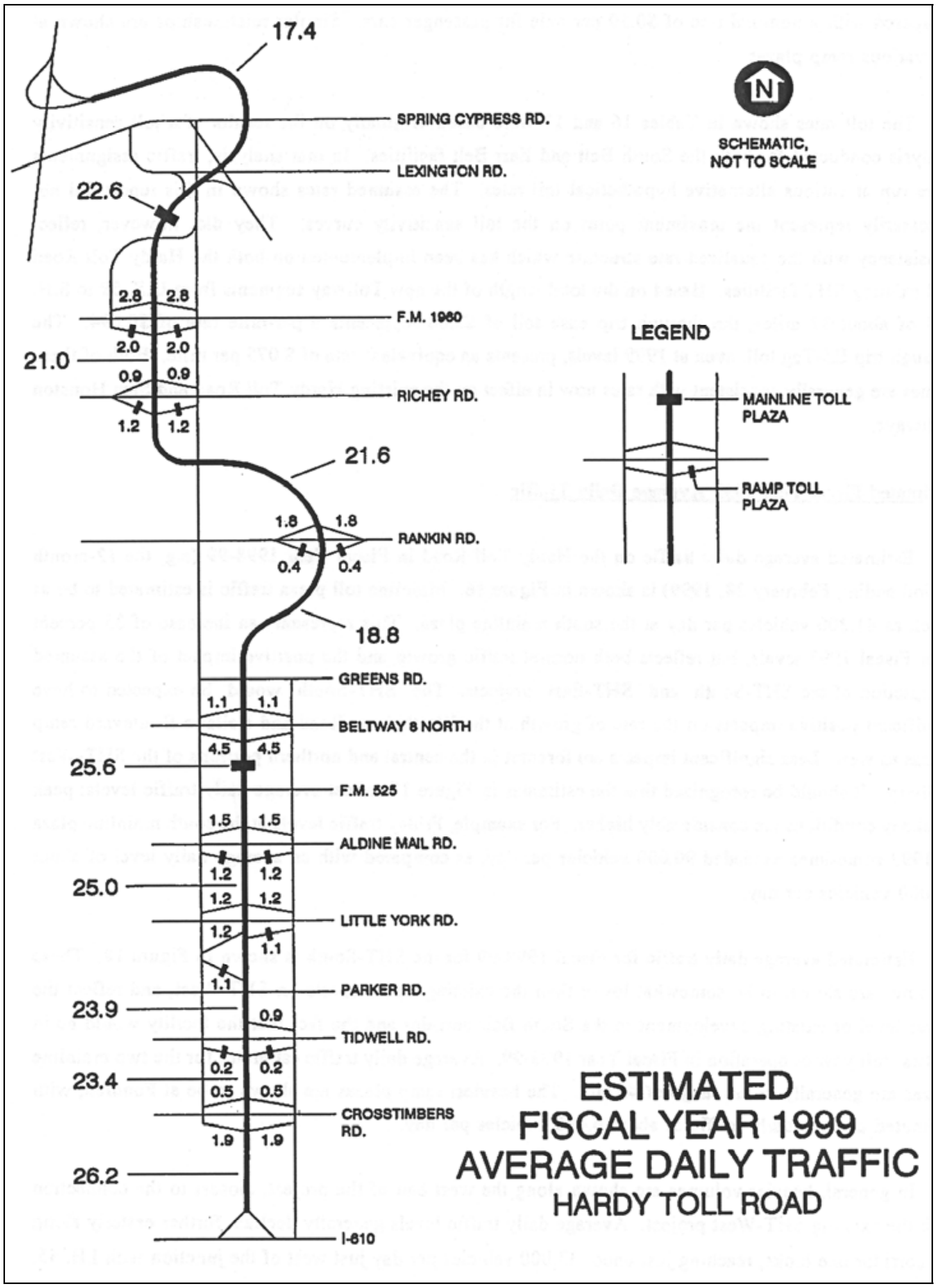


Figure D34: Estimated Fiscal Year 1999 Average Daily Traffic (Hardy Toll Road)

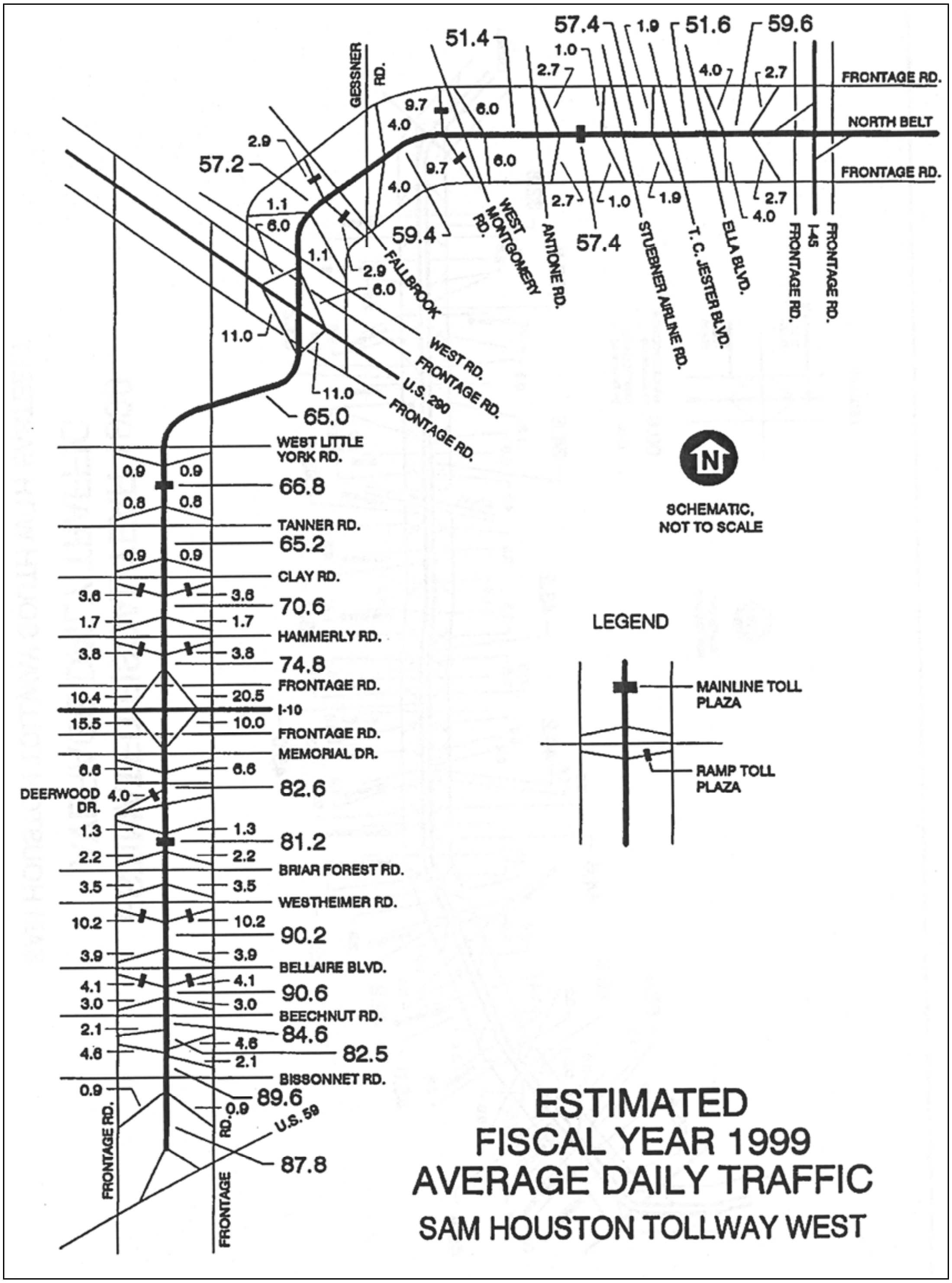


Figure D35: Estimated Fiscal Year 1999 Average Daily Traffic (Sam Houston Tollway West)

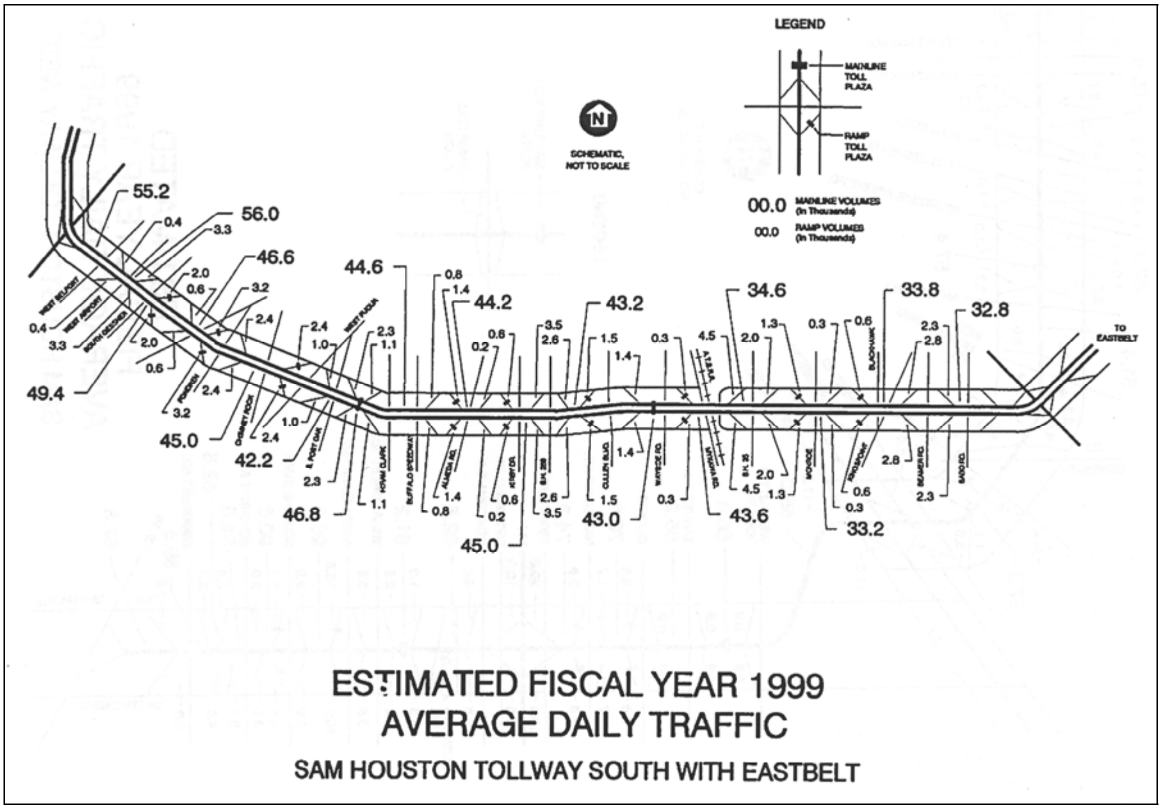


Figure D36: Estimated Fiscal Year 1999 Average Daily Traffic (Sam Houston Tollway South with East Belt)

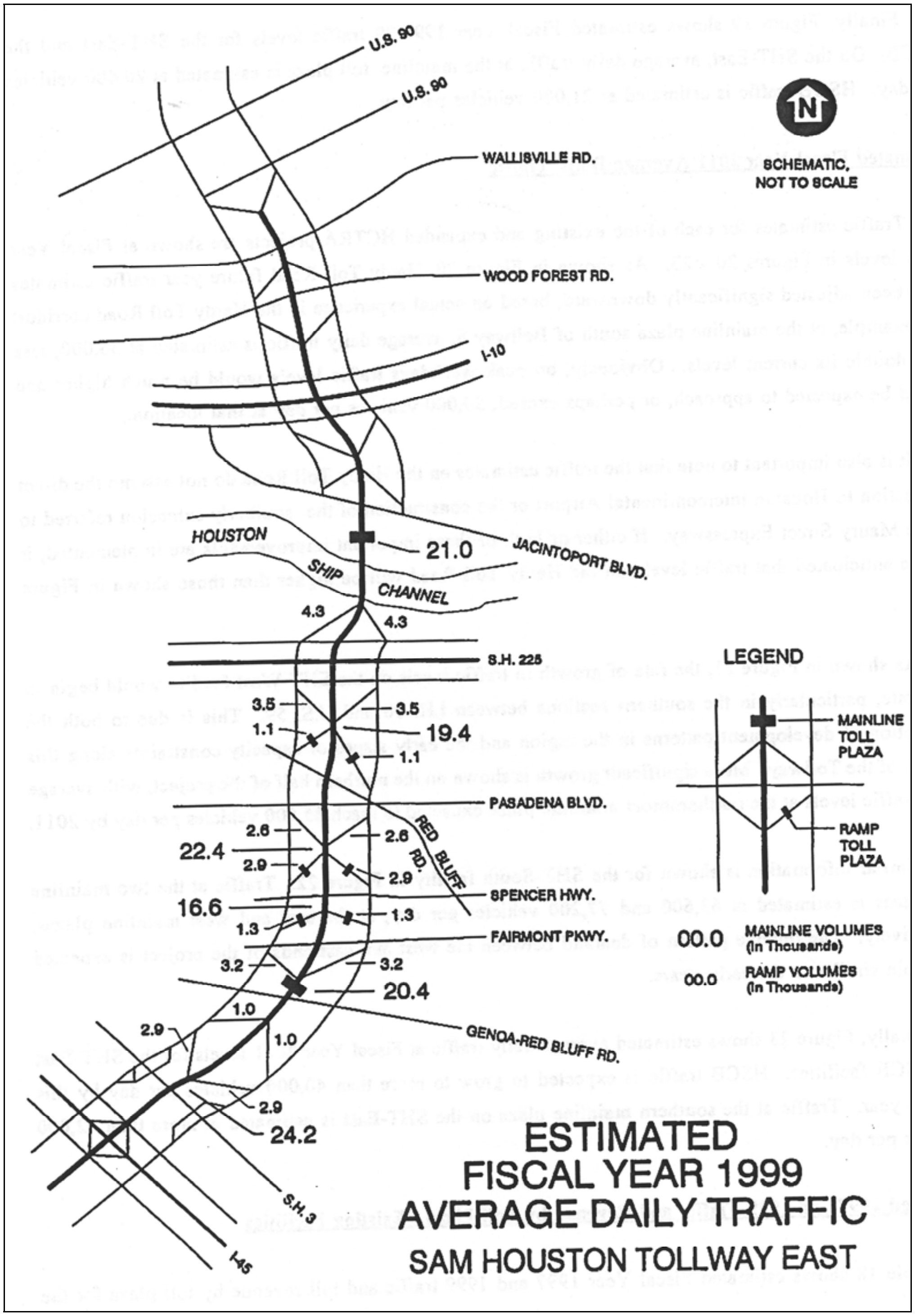


Figure D37: Estimated Fiscal Year 1999 Average Daily Traffic (Sam Houston Tollway East)

Figures D38 through D41 show the average daily traffic estimates along the various components of the system for 2011. It should be noted that the Hardy estimates do not include traffic on the airport connector nor do they assume the southern extension into downtown—known as the Maury Street Expressway—in their forecasts.

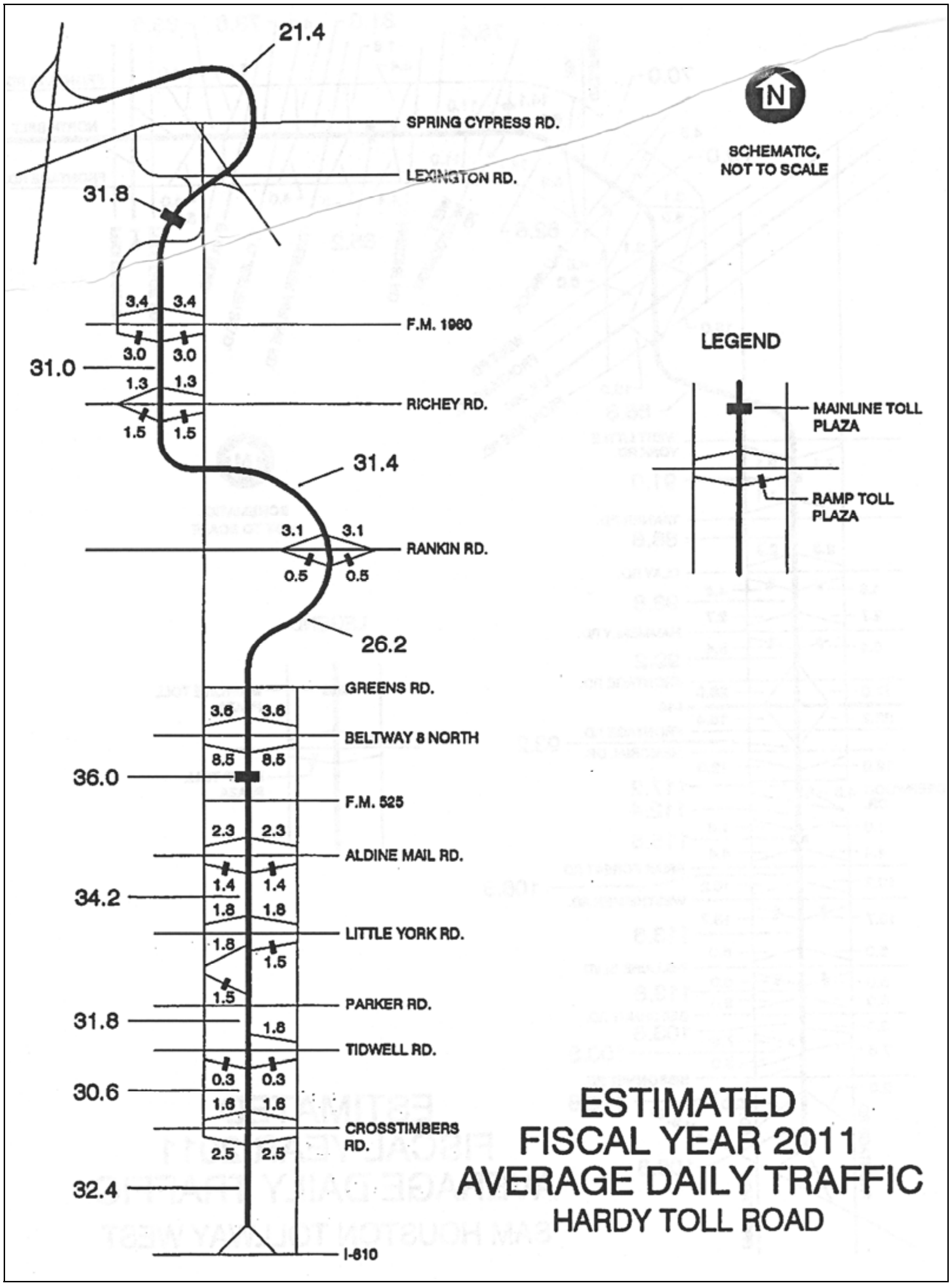


Figure D38: Estimated Fiscal Year 2011 Average Daily Traffic (Hardy Toll Road)

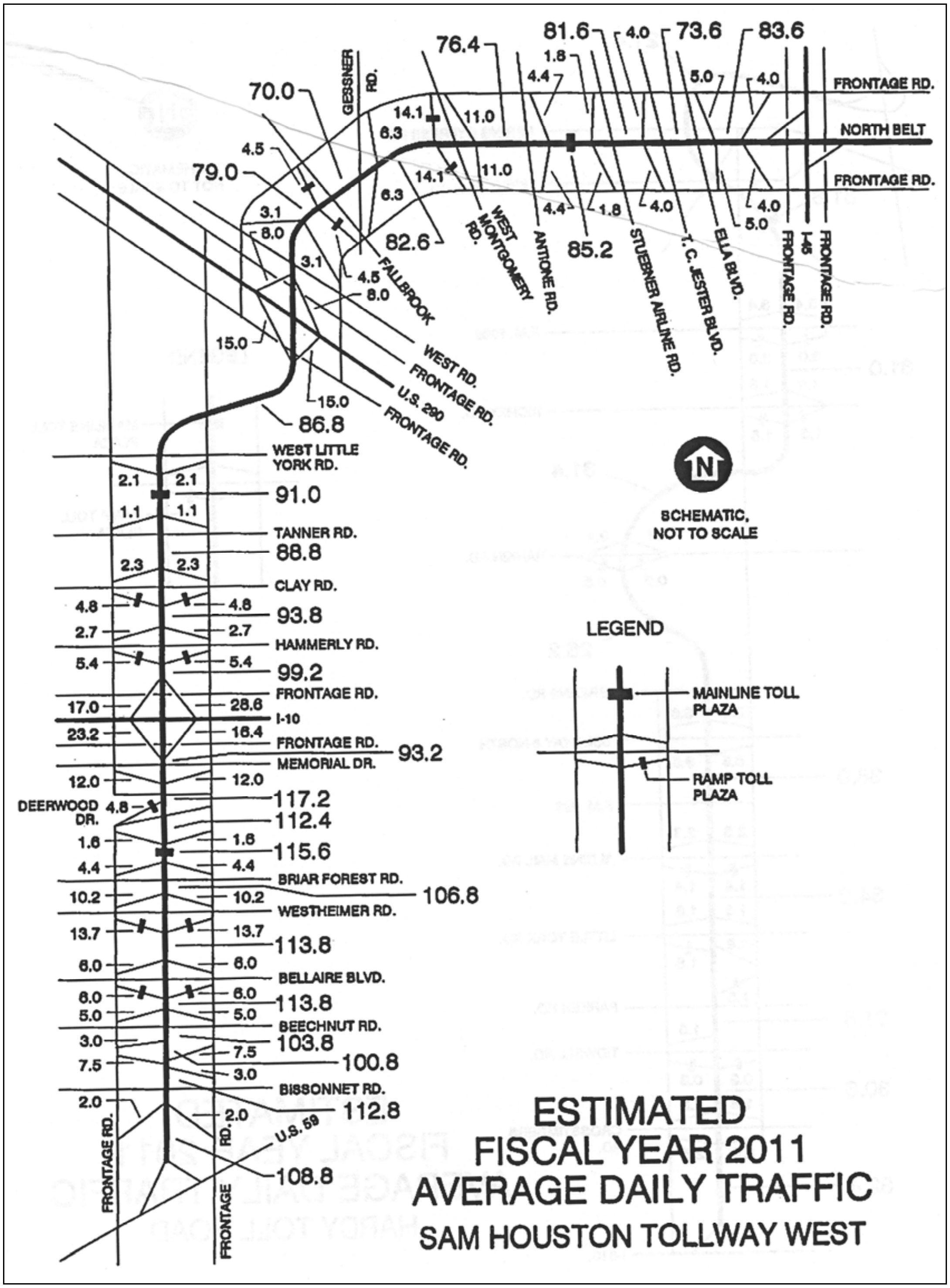


Figure D39: Estimated Fiscal Year 2011 Average Daily Traffic (Sam Houston Tollway West)

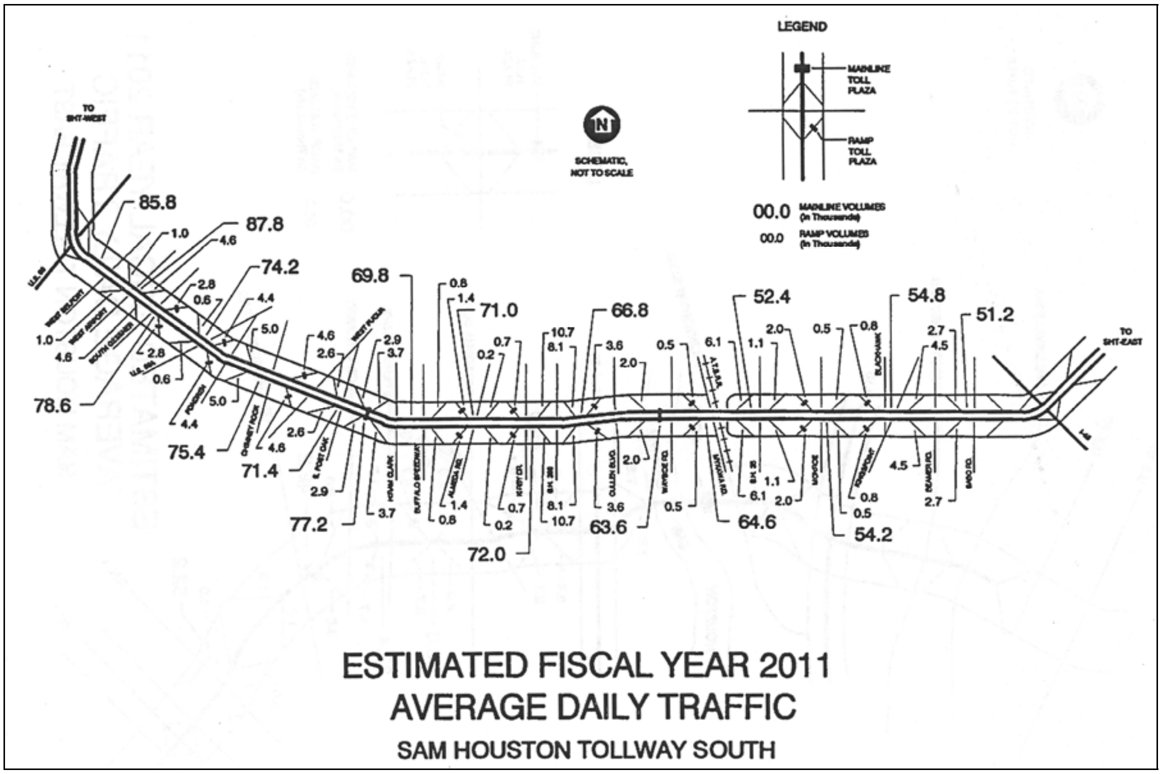


Figure D40: Estimated Fiscal Year 2011 Average Daily Traffic (Sam Houston Tollway South)

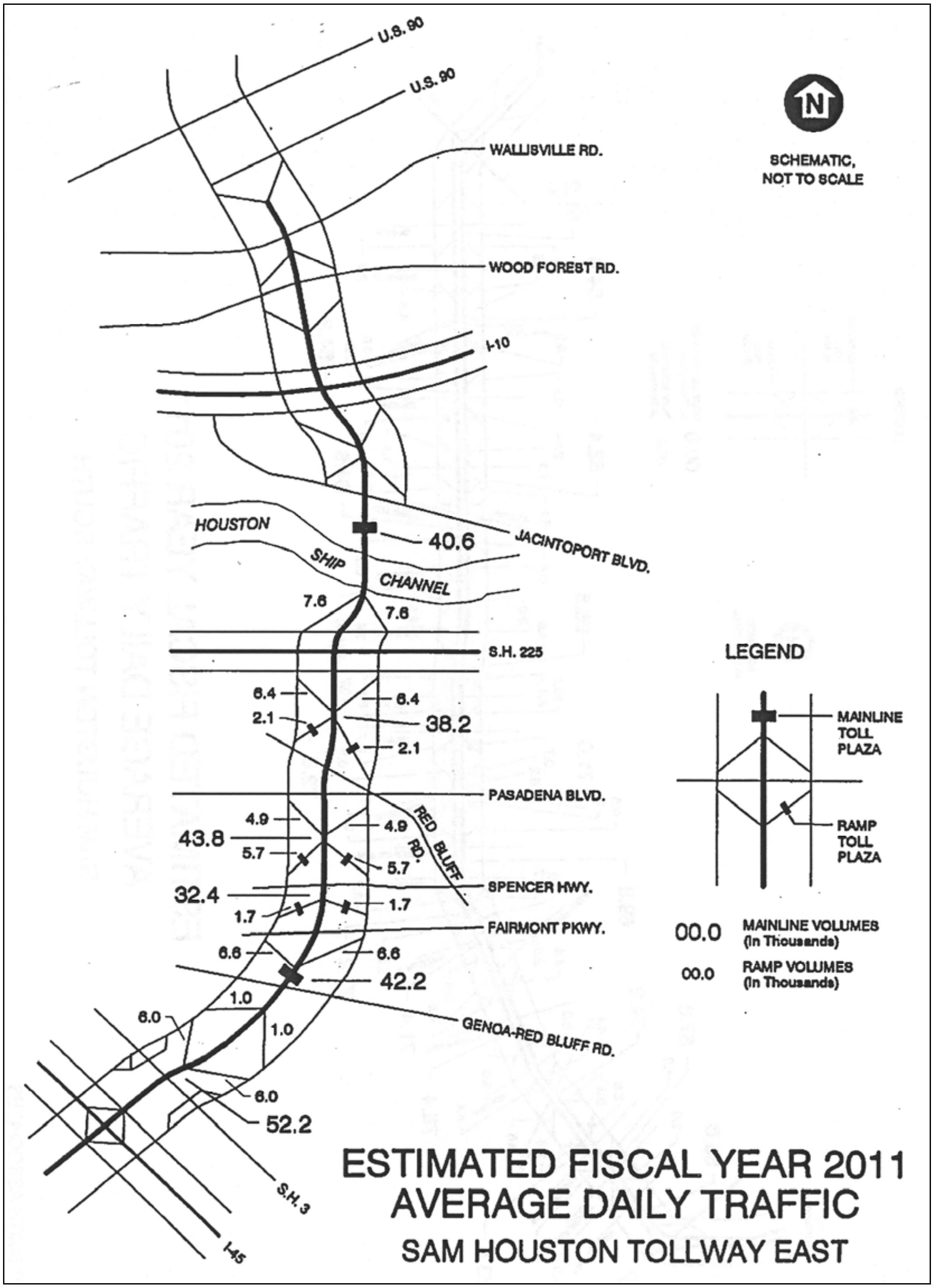


Figure D41: Estimated Fiscal Year 2011 Average Daily Traffic (Sam Houston Tollway East)

The annual revenue estimates for the entire proposed HCTRA system are summarized in Table D27 for 1994 to 2011. The decline in Houston Ship Channel Bridge revenue from 1995 (i.e., total TTA and HCTRA revenue) to 1996 is due to the opening of the Baytown Bridge, which was expected to divert traffic away from the Houston Ship Channel Bridge.

Table D27: Summary of Annual Revenue Estimates

Fiscal Year (ending Feb. 28)	Hardy Toll Road	SHT West	SHT South	SHT East IH 45- SH 225	Houston Ship Channel Bridge		Total
					TTA	HCTRA	
($'000)							
1994	13,704	56,201	-	-	9,670	-	69,905
1995	14,516	59,468	-	-	1,911	9,286	83,270
1996	15,449	62,448	-	-	-	10,397	88,294
1997	16,871	68,056	-	6,288	-	11,233	102,448
1998	17,593	73,194	14,849	6,917	-	13,016	125,569
1999	18,785	78,498	33,158	8,850	-	14,487	153,778
2000	19,529	81,696	36,191	9,735	-	15,501	162,652
2001	20,151	84,427	38,984	10,611	-	16,509	170,682
2002	20,842	87,481	41,323	11,460	-	17,512	178,618
2003	21,468	90,390	43,389	12,262	-	18,637	186,146
2004	22,167	93,491	45,469	12,998	-	19,755	193,780
2005	22,764	96,034	46,988	13,648	-	20,841	200,275
2006	23,380	98,869	48,162	14,330	-	21,988	206,729
2007	23,961	101,528	49,366	15,047	-	23,087	212,989
2008	24,624	104,345	50,494	15,649	-	24,241	219,353
2009	25,165	106,631	51,648	16,275	-	25,453	225,172
2010	25,789	109,251	52,828	16,926	-	26,726	231,520
2011	26,304	111,565	53,849	17,582	-	28,008	237,308

Differences in Actual and Forecasted Revenue

This section analyzes the differences in actual and forecasted revenue forecasted by WSA for the:

- Hardy Toll Road,
- Sam Houston Tollway-West,
- Houston Ship Channel Bridge,
- Sam Houston Tollway-East,
- Sam Houston Tollway-South, and
- the HCTRA system.

It also provides a qualitative discussion of the impact of certain factors on revenues.

Actual and Forecasted Revenue for Hardy Toll Road

Figure D42 graphs the revenue streams predicted in 1984 and 1994 and compares it with actual revenues collected. It is interesting to note that the actual Hardy Toll Road revenue has exceeded the 1994 forecasted values in every year, while it consistently fails to meet the values predicted in 1984. This seems to indicate that WSA was probably too conservative in their 1994 forecasts given their experience with the 1984 forecast.

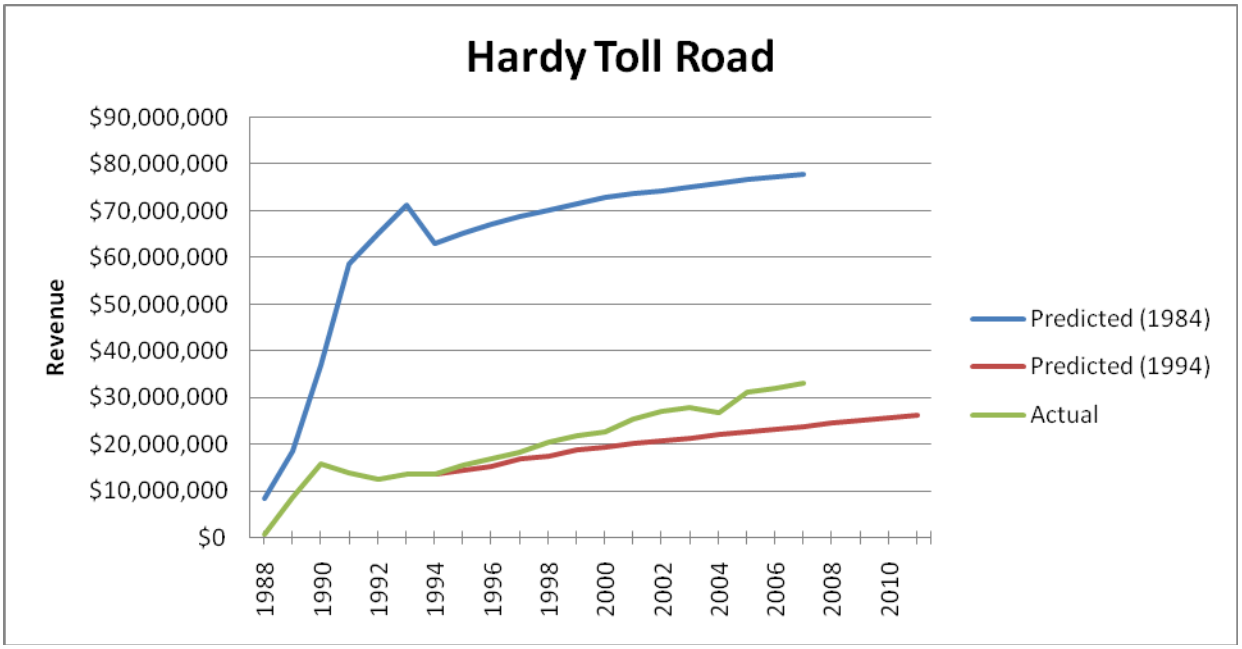


Figure D42: Actual and Forecasted Revenue for Hardy Toll Road

<u>Actual and Forecasted Revenue for Sam Houston Tollway-West</u>

Figure D43 shows that actual revenues on the Sam Houston Tollway-West have exceeded the 1994 forecasts. It has also exceeded the 1984 WSA forecasts since approximately 1999—during the first few years actual revenues were lower than forecasted revenues. While both the 1984 and 1994 T&R forecasts assumed a tapering off in revenues, revenues have in fact continued to increase substantially.

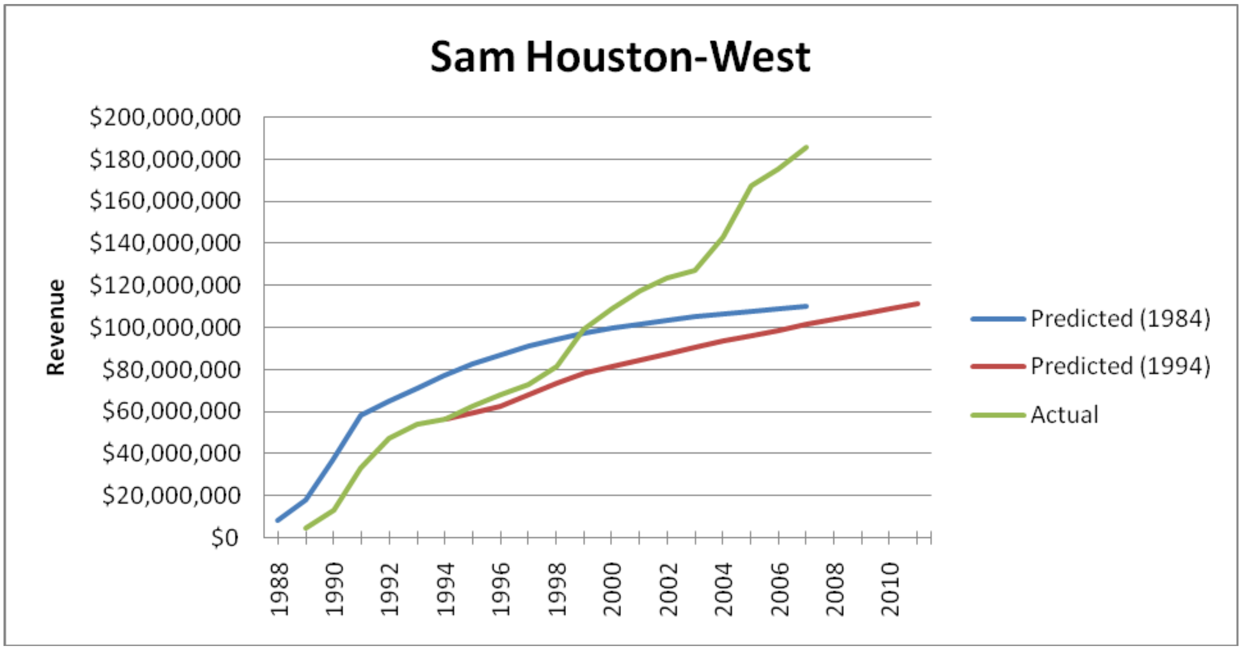


Figure D43: Actual and Forecasted Revenue for Sam Houston Tollway West

<u>Actual and Forecasted Revenue for Houston Ship Channel Bridge</u>

From Figure D44, it is evident that actual revenues have met or exceeded the revenues forecasted in the 1994 T&R with the exception of a few years (i.e., 2003 to 2006) when lower than forecasted revenues were collected.

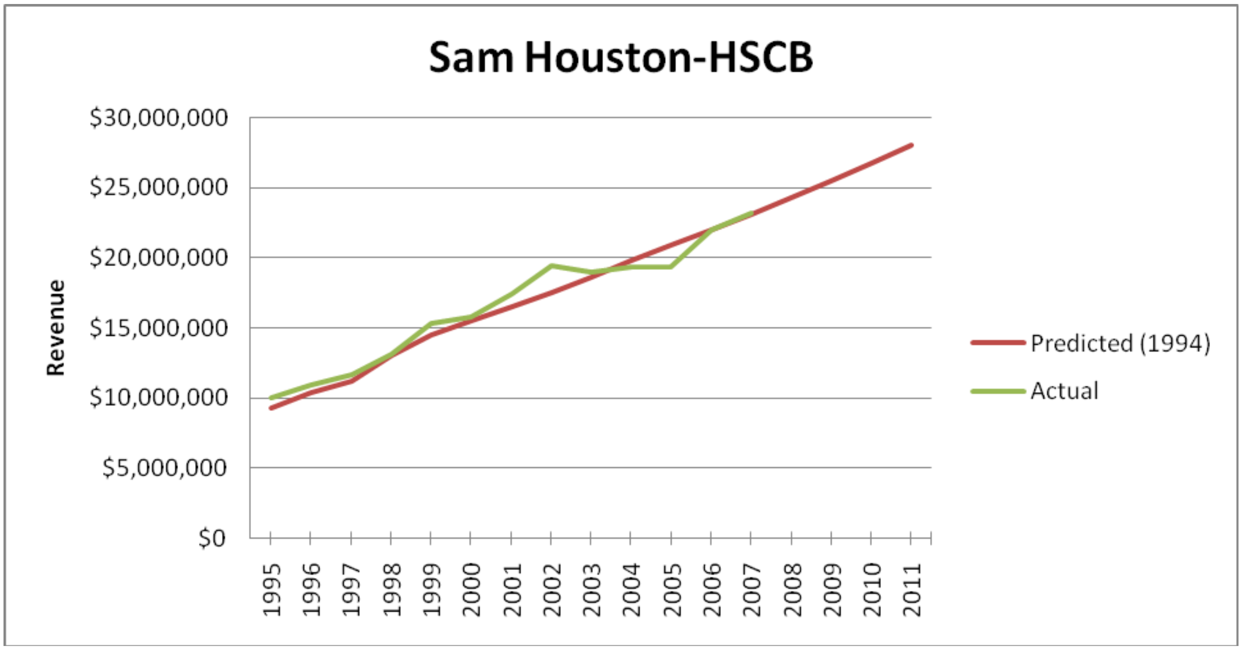


Figure D44: Actual and Forecasted Revenue for Houston Ship Chanell Bridge

Actual and Forecasted Revenue for Sam Houston Tollway-East

The actual revenue collected on the Sam Houston-East section has consistently exceeded the forecasted revenues (see Figure D45). As can be seen, actual revenue growth has outpaced the forecasted growth and as a result the difference between the actual and forecasted revenues continues to increase with each passing year. In 2007, the difference between actual and forecasted revenues amounted to more than $5 million.

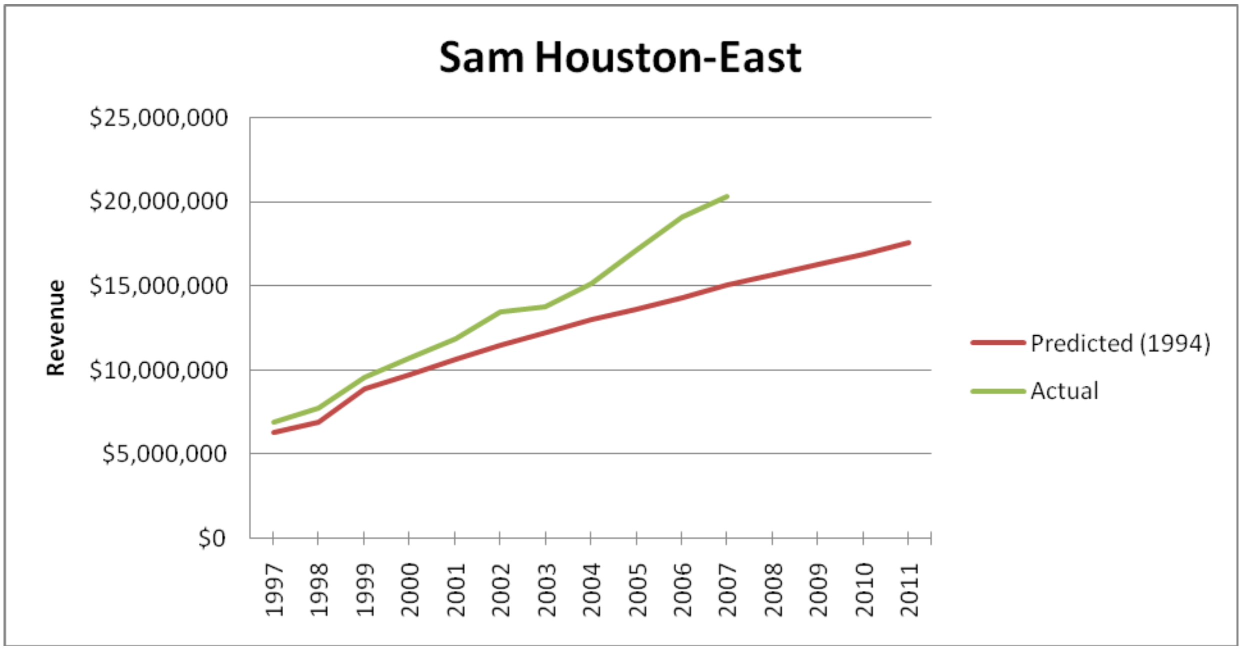


Figure D45: Actual and Forecasted Revenue for Sam Houston Tollway East

Actual and Forecasted Revenue for Sam Houston Tollway-South

With the exception of a period roughly between 2002 and 2004, when actual revenues were lower than what was forecasted in the 1994 T&R, actual revenues have been higher than the forecasted revenues on the Sam Houston Tollway-South section (see Figure D46).

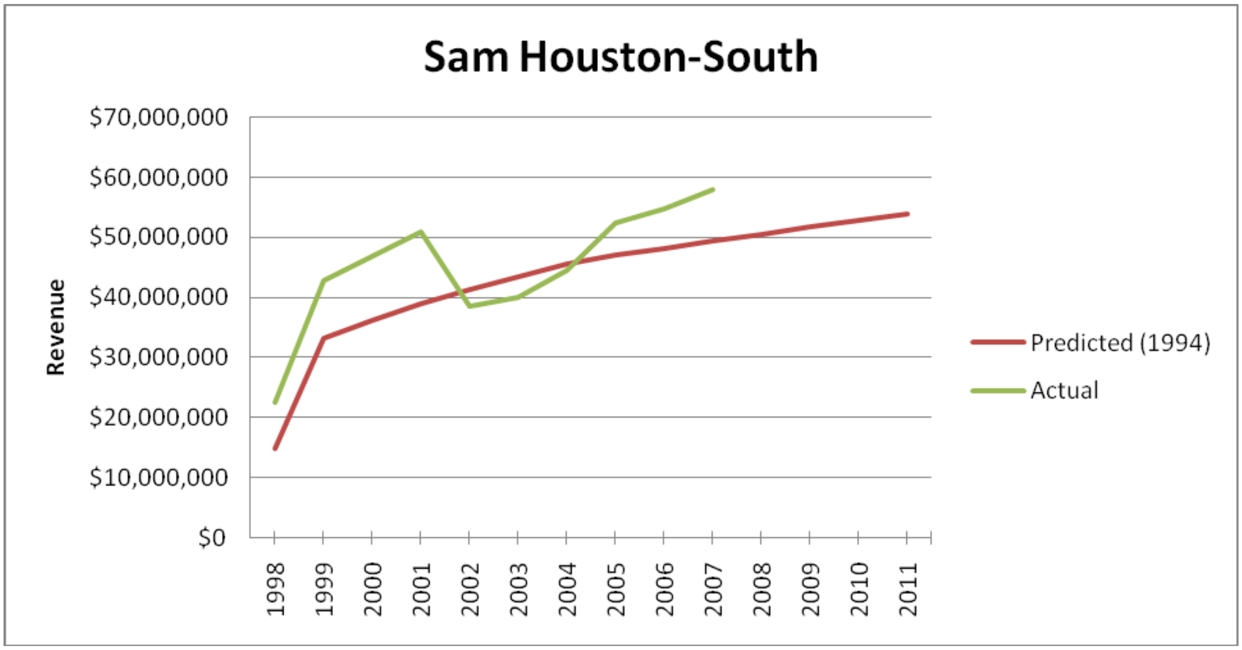


Figure D46: Actual and Forecasted Revenue for Sam Houston Tollway South

Actual and Forecasted Revenue for HCTRA System

Figure D47 illustrates that for the HCTRA system as a whole, actual revenues have exceeded the forecasted revenues of both the 1984 and 1994 T&R studies. In other words, the sections that exceeded their forecasts more than compensated for the over predicted revenue values on other sections of the system, such as the Hardy Toll Road. The discrepancy between forecasted and actual revenues can be partly explained by enhanced connectivity of the HCTRA system to the non-tolled freeway system and the construction on IH10/Katy Freeway. Also, the substantial increase in revenues in 2005 is attributable to the opening of the Westpark Toll Road, which was not considered in the 1984 or 1994 T&Rs.

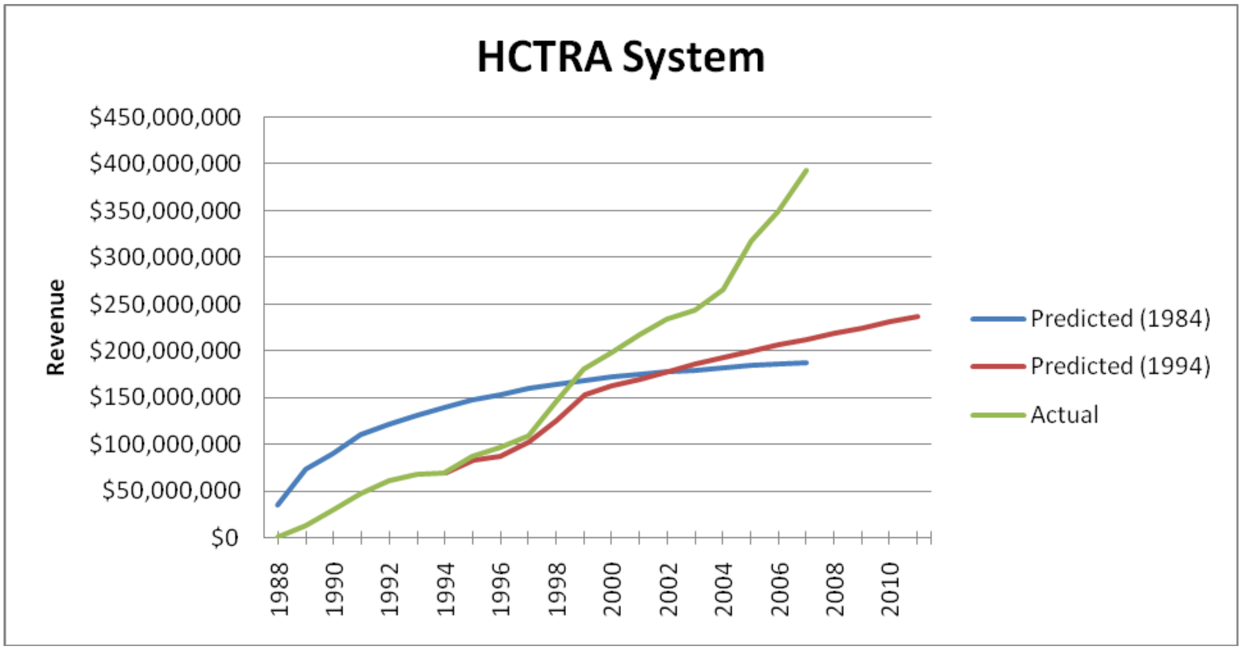


Figure D47: Actual and Forecasted Revenue for HCTRA System

General Observations and Conclusions

WSA overpredicted the revenues on both the Hardy Toll Road and the Sam Houston-West sections in their 1984 T&R. In the 1994 T&R, the forecasts were adjusted downwards. With the exception of a few years in the case of the Houston Ship Channel Bridge and the Sam Houston-South sections, this resulted in the under prediction of revenues on all the sections and the HCTRA system as a whole. It thus appears that WSA was probably too conservative in their 1994 forecasts given their experience with the 1984 forecast.

In addition, a number of specific factors seem to have contributed to increase usage and thus revenues on the HCTRA system, i.e., enhance connectivity to the non-toll freeway system in Houston, the construction on IH10/Katy Freeway, an expanded network, the growth in the suburbs, and the increase in EZ tag usage. Specifically, HCTRA's toll road system was expanded with the completion of the airport connector and the south and east sections of the Sam Houston Tollway. This provided greater connectivity within the system, which resulted in additional time savings to users. Also, high growth in the suburbs, particularly in western Houston and in Fort Bend County, resulted in increased usage because of the time savings the toll road offered. Finally, the introduction of EZ tags also enhanced toll road usage, because EZ tag users received a discount and were not required to stop, resulting in additional time savings.

2002 Westpark Traffic and Revenue Study

As mentioned earlier, HCTRA's debt was pooled in 1994 and as a result bonds are not issued any longer to fund a particular project. Thus T&R studies are no longer required for individual projects when new bonds are issued. However, because the Westpark Toll Road represented a large investment, an investment grade T&R study was completed for this toll road by WSA in 2002. This T&R was thus used to justify a toll road in the METRO-owned corridor and former rail line and to help determine a possible toll schedule. WSA noted that:

"In general, overall demand in this travel corridor would likely exceed the amount of capacity being provided, especially over the long term. However, the facility is designed to fit within the constrained available right of way, and cannot be expanded to accommodate that demand. Therefore, demand will need to be managed through variable toll pricing if the facility is to succeed in expanding accessibility."

Summary of Existing Conditions[16]

This section summarizes the background information that WSA included in their 2002 Westpark T&R study.

Corridor Traffic Overview

At the time of this T&R, WSA staff was also performing a T&R study for the extension of this route into Fort Bend County and a review of the IH10 managed lanes, which was going to be constructed as part of the IH10 improvement program. WSA thus collected a substantial amount of travel data, including:

- travel volumes on alternative competing facilities,
- travel speeds/times on alternative competing facilities,
- origin/destination surveys, and
- joint stated preference survey to estimate driver's value of time.

WSA also contracted with a regional economist to provide new population and economic forecasts to develop the future year trip tables.

WSA's collected data revealed that traffic on IH10 west of SH6 had grown on average about 3.3 percent between 1990 and 2000, resulting in an increase from 96,000 vehicles per day in 1990 to about 128,000 vehicles per day by 2000. IH10 west of Beltway 8 saw slightly lower increases in traffic, averaging about of 2.4 percent per year. Traffic growth had been highest around the Grand Parkway SH99, which is located at the far west end of the proposed Tollway. Traffic growth here had averaged 12 to 15 percent per year, partly because of strong economic and residential growth in this region. Table D28 shows the average annual daily traffic trends at selected locations in the overall corridor.

16 Unless otherwise noted, the information and data in this section are from the 2002 Westpark Traffic and Revenue Study.

Table D28: Annual Average Daily Traffic Trends for Selected Area Highways

Year	IH-10		Westheimer Road		US 59		SH 6		Grand Parkway	
	West of Beltway 8	West of SH 6	West of SH 6	West of FM 1464	At Hillcroft	East of Beltway 8	North of FM 1093	South of FM 1093	North of FM 1093	South of FM 1093
1990	160,000	96,000	11,900	12,300	163,000	217,000	34,000	27,000	-	-
1991	168,000	103,000	18,600	14,300	149,000	113,000	37,000	30,000	-	-
1992	169,000	115,000	20,000	13,900	149,000	124,000	39,000	31,000	-	-
1993	183,000	115,000	18,000	12,200	198,000	156,000	42,000	33,000	-	-
1994	197,000	117,000	18,100	12,600	221,000	170,000	48,000	39,000	-	-
1995	179,000	113,000	17,800	12,200	235,000	181,000	41,000	39,000	-	-
1996	189,000	125,000	23,000	12,800	247,000	193,000	52,000	42,000	15,000	5,700
1997	198,000	127,000	23,000	12,800	271,000	209,000	49,000	39,000	18,100	5,700
1998	216,000	135,000	25,000	13,300	309,000	284,000	58,000	45,000	21,000	7,900
1999	194,000	127,000	26,000	14,600	273,000	258,000	53,000	41,000	24,000	8,400
2000	200,000	128,000	25,000	14,600	281,000	272,000	55,000	41,000	26,000	9,100
Average Annual Percent Change (%)										
1990-1995	2.3	3.3	8.4	-0.2	7.6	7.3	3.8	7.6	-	-
1995-2000	2.2	2.5	7	3.7	3.6	8.5	6.1	2.4	14.7	12.4
1990-2000	2.3	2.9	7.7	1.7	5.6	7.9	4.9	5	-	-

WSA also reviewed the total transactions on the Sam Houston Tollway. Table D29 shows that traffic was growing rapidly, with the Sam Houston-South section showing an average annual growth rate of 11 percent in the five years prior to this study. The Tollway over all showed a steady pattern of growth, with 1997 being the only year in which growth was less than 5 percent. The strong growth, according to WSA, would *"be served by the Westpark Toll road,"* which would be in the same corridor serviced by the Sam Houston Tollway.

Table D29: Average Annual Daily Traffic Trends, Sam Houston Tollway (Original Sections)

Fiscal Year	North Section	Central Section	South Section	Sam Houston Total	Percent Change (%)
1991	27,679	42,359	63,063	133,101	-
1992	52,777	58,933	73,874	185,584	39.4
1993	58,198	63,156	87,651	200,005	7.8
1994	64,463	63,366	83,460	211,289	5.6
1995	75,934	73,656	90,448	240,038	13.6
1996	81,773	79,195	96,323	257,291	7.2
1997	84,736	77,341	101,009	263,086	2.3
1998	83,682	85,248	114,546	283,476	7.8
1999	110,429	108,527	137,488	256,444	25.7
2000	127,386	119,784	152,394	399,564	12.1
2001	138,500	131,784	162,502	432,786	8.3
Average Annual Percent Change (%)					
1991-1996	11.6	13.3	8.8	14.1	
1996-2001	11.1	10.7	11.0	11.0	
1991-2001	17.5	12.0	9.9	12.5	

Vehicle Travel Speeds

WSA reviewed travel speeds for the IH10 corridor and selected other routes. In the AM period (i.e., 6:00 a.m. to 7:35 a.m.) two elapsed runs produced an average of one hour in travel time for the 23-mile trip. This translated into an average speed of approximately 25 miles per hour for the 23 miles. Congestion routinely occurred in the easternmost 15 to 17 miles of the corridor, resulting in even lower speeds for this segment. For the PM period, congestion occurred at specific points on the route—for example, just past IH610 and at SH8. From these points onward traffic moved at a lower speed all the way to Pin Oak Road. Most of the trips in the PM period averaged 35 to 45 minutes for the 23-mile trip. WSA noted that while congestion routinely occurred on IH10, the planned expansion program for IH10 could alleviate some of the congestion.

Travel Pattern and Characteristic Surveys

Extensive travel pattern and characteristic surveys were conducted in the Westpark Corridor and at entry ramps along IH10. Twenty locations[17] were chosen for the surveys—4 on arterial routes located west of SH6 and 16 on entry ramps along IH10. From Figure D48, it is evident that most of the trips were identified as "journey to work" during the peak periods, representing 68 percent of the responses for the IH10 and Sam Houston Stations (IH10/SH6) and 76 percent of the responses for the Westpark stations. In the off-peak, however, "journey to

[17] In addition, WSA took 1999 data that were collected for HCTRA and factored it to current traffic levels to be used in the 2002 study. The travel pattern surveys were conducted at different screen lines in the corridor in 1999.

work" represented only 35 percent and 49 percent of the responses, respectively for the IH10/SH6 and Westpark stations. The next main trip purpose was personal business—24 percent in the case of the IH10/SH6 stations and 18 percent in the case of the Westpark station—in the off-peak period (see Figure D48).

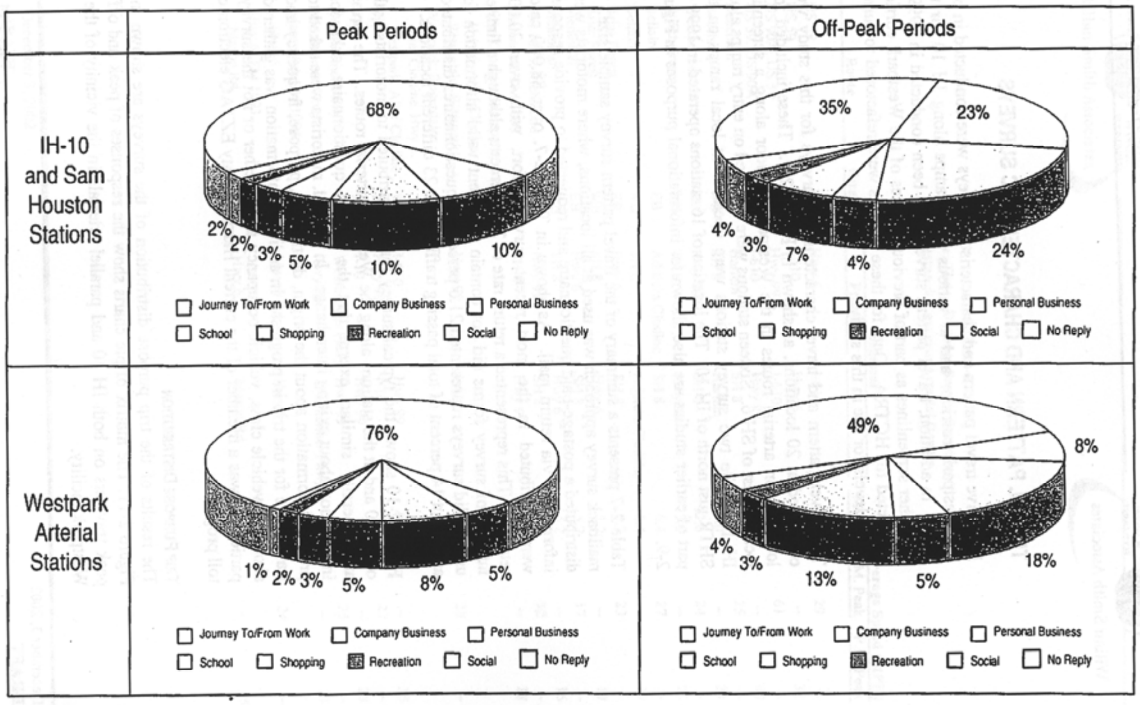


Figure D48: Trip Purpose Distribution

Trip frequency was also reviewed. As can be seen in Figure D49, the reponses for the IH10/SH6 and the Westpark stations are very similar in the AM peak period, as well as in the PM peak period.

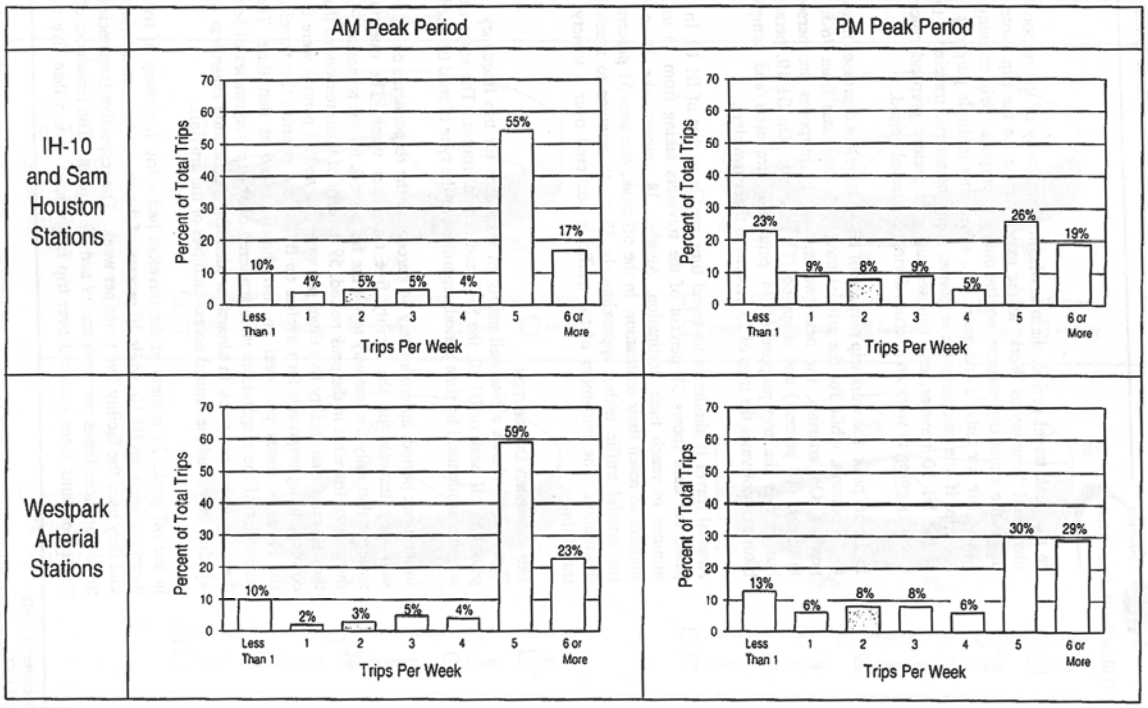


Figure D49: Trip Frequency Distribution

Stated Preference Survey

WSA also conducted a stated preference survey for the 2002 T&R study. Data was collected at various sites for two days in August 2001. The questionnaire comprised four main sections:

- context questions—to collect information about a traveler's most recent trip in the corridor,
- project questions—to collect information about the drivers' likely use of corridors after they were provided information about proposed improvements,
- stated preference questions—after selecting a route, nine questions were administered regarding future travel choices under a variety of configurations, and
- debrief questions—to provide insight as to why choices were asked.

Figure D50 illustrates the survey responses. More than 50 percent of the respondents indicated their trip purpose to be commuting to and from work. However, more than 20 percent of the respondents traveled during the shoulder periods, i.e., during a two-hour window on either side of the peak. This indicated that the peak hour would have a wider distribution than is normally expected, i.e., the peak hour would be longer.

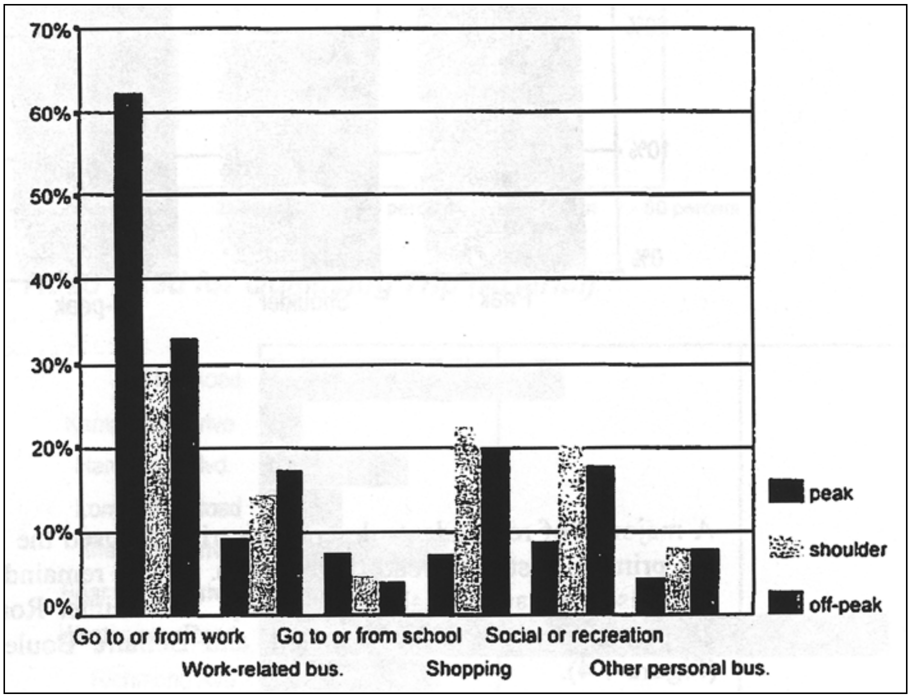


Figure D50: Trip Purpose by Travel Period

Approximately 75 percent of the survey respondents indicated that they would use the newly configured Katy Freeway[18] for their trip if it was available. However, about 16 percent of the arterial users indicated that they would choose Westpark. As can be seen in Figures D51 and D52, this translated into slightly more than 11 percent of the respondents traveling on local roads north of Katy Freeway diverting to Westpark and about 70 percent of travelers south of Westheimer Road diverting to Westpark. More than half of the survey participants who used the Katy Freeway indicated they would continue to do so. However, the percentage of respondents that used an arterial and chose Katy Freeway, and those who used an arterial and chose Westpark were similar—approximately 16 percent.

Table 4-3
Primary Road Used by Future Road Choice

	Katy	Westpark	Total
North of Katy	88.6%	11.4%	100.0%
Katy	86.1%	13.9%	100.0%
Memorial to Westheimer	47.0%	53.0%	100.0%
South of Westheimer	29.6%	70.4%	100.0%
Total	74.6%	25.4%	100.0%

Figure D51: Primary Road Used by Future Choice

[18] Katy Freeway is part of IH10 and is colloquially known as “the Katy Freeway” to Houstonians.

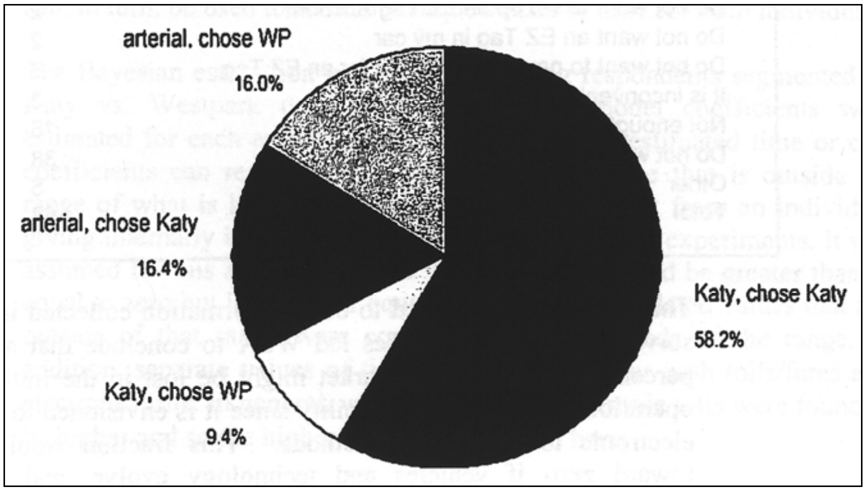


Figure D52: Primary Road Used by Future Road Choice

As can be seen in Figure D53, the main reason for not choosing Westpark was "not wanting to pay a toll."

Table 4-4
Reasons For Not Choosing Westpark

	Count	Percent
Do not want to set up an EZ Tag Account	2	3.4%
Do not want an EZ Tag in my car	2	3.4%
Do not want to pay a monthly fee for an EZ Tag	6	10.3%
It is inconvenient	3	5.2%
Not enough time savings	16	27.6%
Do not want to pay a toll	38	65.5%
Other	5	8.6%
Total	58	100.0%

Figure D53: Reasons for Not Choosing Westpark

Economic and Demographic Characteristics

WSA undertook a comprehensive demographic and economic review of the area. As noted earlier, Harris County and Houston has experienced continued population and economic growth throughout the twentieth century. Highway development within Houston and Harris County also contributed to increased suburbanization within the region. WSA noted that the construction of new freeways in the late 1990s opened up new growth possibilities. The Sam Houston Tollway, for example, made large parcels of land that was previously undeveloped economically viable for development. The Sam Houston Tollway was the new growth magnet for development, including the northwest corner of the Beltway. Figure D54 illustrates the new residential development that had occurred between 1996 and 2000 in Harris and Fort Bend

Counties. As was noted in the T&R, a number of residential developments had occurred in proximity to the proposed Westpark tollway.

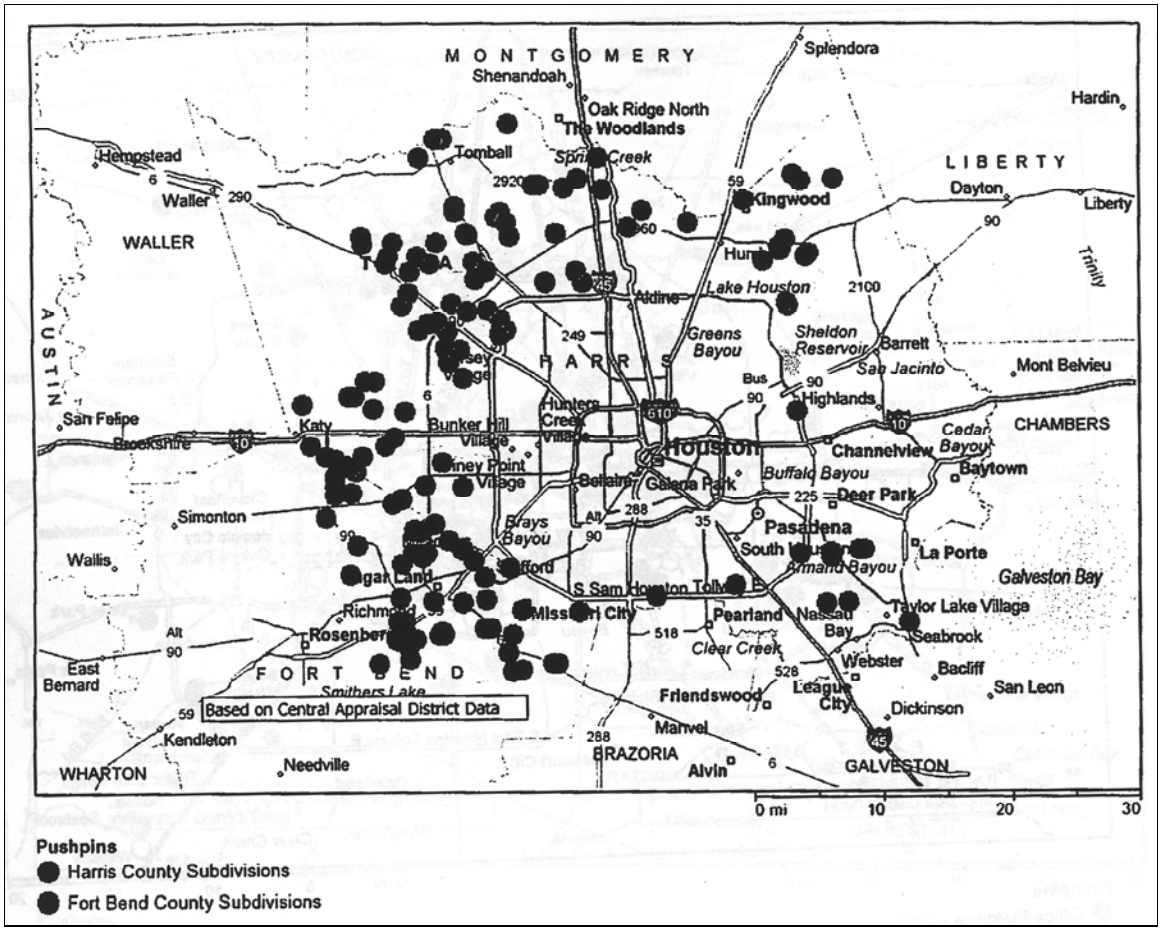


Figure D54: New Residential Subdivisions in Fort Bend and Harris Counties (1996-2000)

However, notwithstanding the sizeable growth in Harris County, the T&R also reported major non-market constraints to growth. For example, regional flood plains restrict development on large land areas in the region. Another non-market issue was ownership patterns that according to the T&R, made it almost impossible for developers to acquire sufficiently large areas of land. The latter had led in large part to the westward growth that was seen around Houston. The report also noted sizeable areas in Harris County's north western portion, where thousands of acres of small broken parcels would "escape the suburban push." However, the eastern portion of Fort Bend County—which would be served by the toll road as it would terminate close to this boundary—had many large parcels of land that could be *"transformed into master-planned communities if the toll road ultimately crosses the Brazos River."* If this occurred, according to the T&R study *"the master planned communities within the toll road corridor would be unsurpassed anywhere within the Houston metropolitan area."*

The T&R predicted general spatial trends for the central metropolitan statistical area (CMSA). Population and employment growth was predicted to occur in the western portion of the CMSA, although it was predicted that Houston's highways would induce high density residential and commercial development within the central city. Scattered growth was predicted to occur throughout the region, but the largest growth was anticipated to occur between SH6, FM 1960, and the Grand Parkway to the west of Houston.

Figures D55, D56, and D57 illustrate the office, warehouse, and retail development that occurred within Harris County between 1996 and 2000. The study forecasted moderate growth for the next five years, mostly because of the post 9/11 slowdown, which had a temporary negative impact on the U.S. and regional economies. The T&R report also cautioned about not being misled by recent headline news stories, such as the collapse of Enron and other energy trading enterprises. Specifically, "unspectacular" growth was predicted for the 12 months following the T&R. However, it was anticipated that the economy would then gain momentum due to growth in the non-energy sector. In the long run, the economic outlook was positive, although this was caveated due to the sheer size of the metropolitan area. The report warned that the size of the economy would impose burdens and cause the overall growth rate to decline. It was noted that this phenomenon was not unique to Houston, but was occurring in many major urban areas, including the Sunbelt cities. Houston's economy was anticipated to diversify and reduce its dependence on energy. However, it was felt that this would not be as rapid in the next 20 years as compared to the previous 15 years. The economy was predicted to comprise a 60:40 non-energy:energy ratio by 2020.

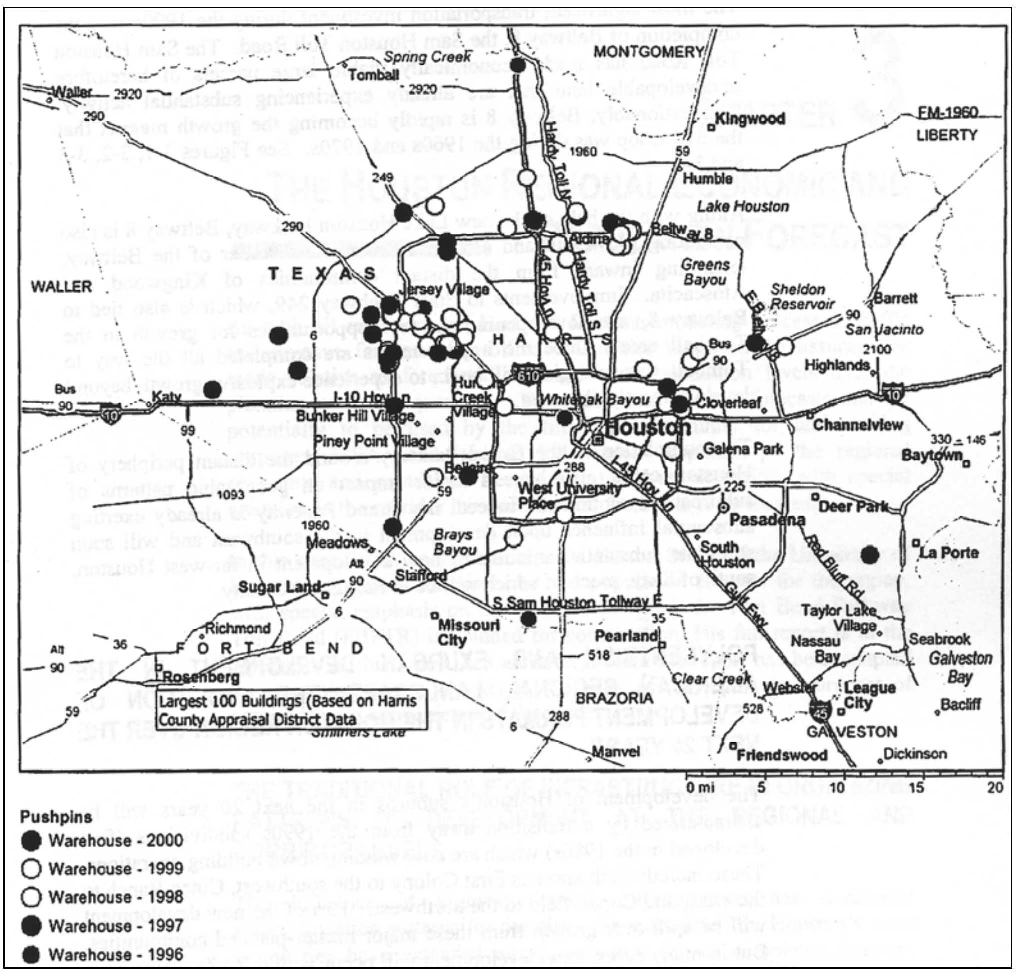


Figure D55: New Warehouse Buildings in Harris County (1996-2000)

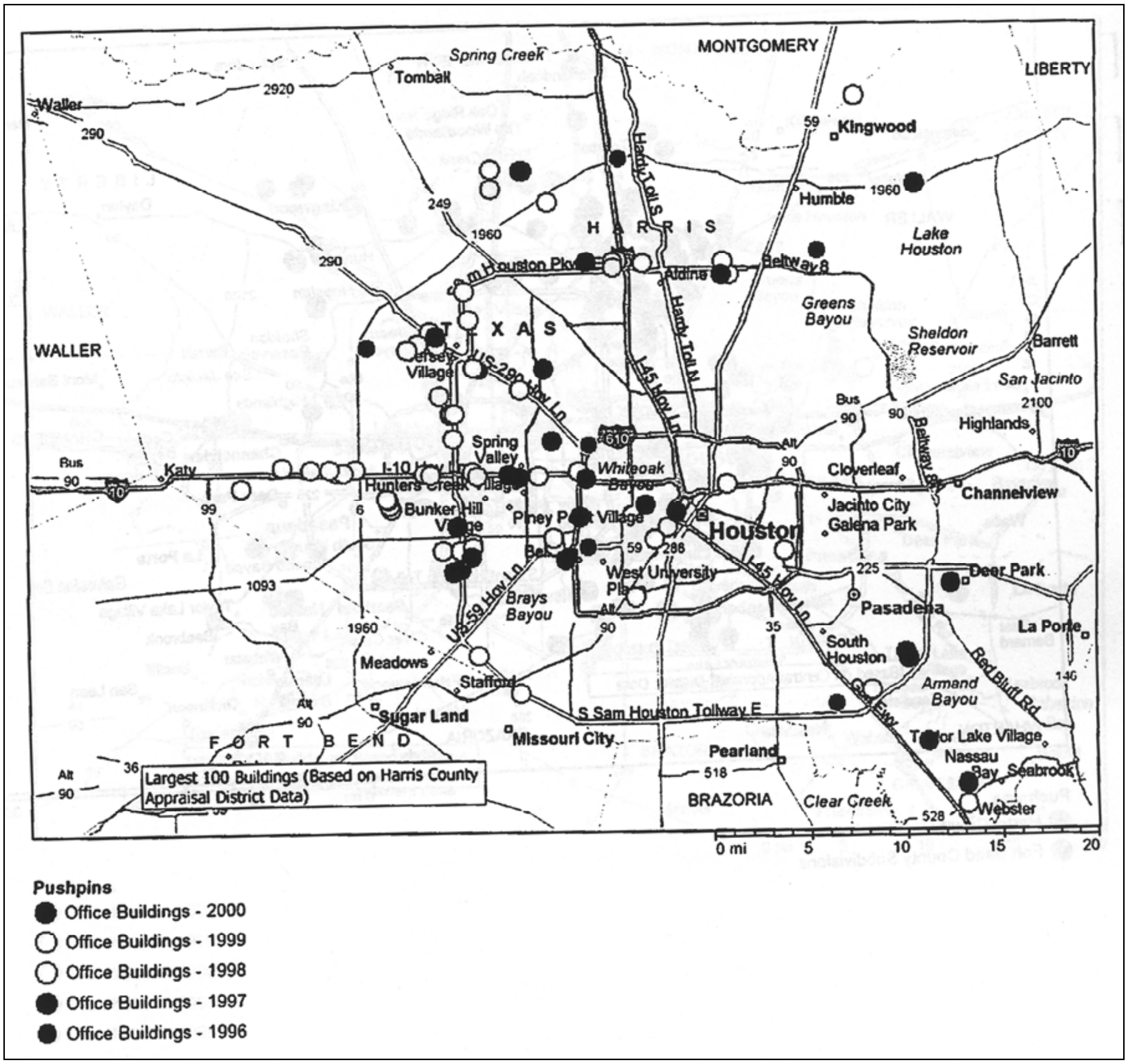


Figure D56: New Office Buildings in Harris County (1996-2000)

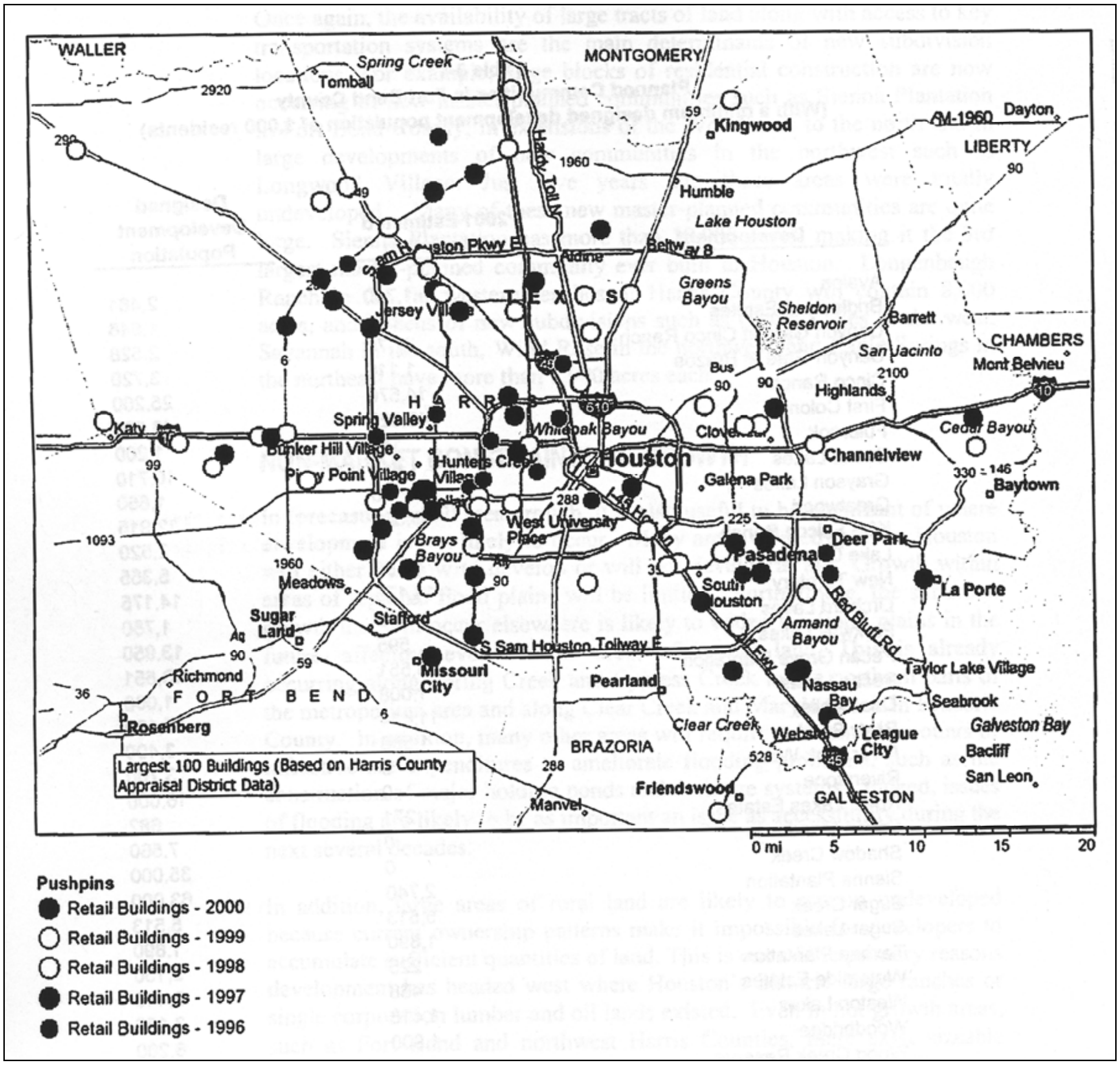


Figure D57: New Retail Buildings in Harris County (1996-2000)

Historic population, employment, inflation, and income data were reviewed for the five-year period 1997 to 2002. The following trends emerged:

- population grew by 13.1 percent,
- real per capita income grew by 6.9 percent,
- inflation grew by an average annual 2.2 percent,
- overall the economy grew by 11.4 percent, and
- employment grew by 13 percent.

The largest employment growth occurred in the construction sector (25 percent), services sector (18.5 percent), and finance, insurance, and real estate sector (16.8 percent). Growth was expected to continue in the near-term, although the T&R indicated that some sectors would slow down. Table D30 provides the historic and projected population and employment values included in the T&R study.

Table D30: Historic and Projected Population and Employment Values

Year	Population	Employment
1997	3,829,300	1,894,500
1998	3,964,900	1,992,300
1999	4,057,800	2,029,100
2000	4,177,644	2,080,500
2001	4,262,308	2,118,100
2002	4,329,602	2,139,987
2003	4,402,725	2,189,329
2004	4,487,722	2,257,535
2005	4,587,350	2,315,800
2006	4,685,970	2,361,296
2007	4,761,089	2,417,987

As can be seen in Table D31, employment was expected to continue to grow alongside population.

Table D31: Historic and Projected Employment and Population Growth

Year	Employment	Population	Employment Growth (%)	Population Growth (%)
1980	1,399,200	2,768,300	7.11	4.24
1985	1,479,000	3,204,600	1.12	2.97
1990	1,611,200	3,322,000	1.73	0.72
1995	1,766,300	3,590,800	1.86	1.57
2000	2,080,500	4,177,644	3.33	3.07
2005	2,315,880	4,587,350	2.17	1.89
2010	2,603,998	5,087,259	2.37	2.09
2015	2,899,350	5,556,380	2.17	1.78
2020	3,131,939	5,944,628	1.56	1.36

The population values were also allocated and projected for the eight counties that constitute the Houston Galveston Area Council region. Table D32 provides the historic and projected population values by county. As can be seen, population was projected to increase steadily over the five-year time periods until 2020. Overall, population was anticipated to increase by almost 20 percent in Houston between 2000 and 2020.

Table D32: Historic and Projected Population

County	Population								
	Year								
	1970	**1980**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
Brazoria	108,312	169,587	191,707	205,492	241,767	270,280	305,968	341,637	37,8192
Chambers	12,187	18,538	20,088	21,320	26,031	30,772	38,175	47,380	59,009
Fort Bend	52,314	130,962	225,431	263,046	354,452	463,962	52,6470	621,556	715,481
Galveston	169,812	195,738	217,399	223,609	250,158	270,793	300,270	327,018	350,700
Harris	1,741,913	2,409,547	2,818,199	2,988,793	3,400,578	3,629,038	3,917,759	4,155,414	4,325,074
Liberty	33,014	47,088	52,726	57,454	70,154	82,059	99,710	122,911	147,522
Montgomery	49,479	127,222	182,201	218,204	293,786	368,238	457,528	552,979	647,085
Waller	14,285	19,798	23,390	25,824	32,663	40,516	51,849	66,083	82,478
Houston	1,232,802	1,595,138	163,0553	1,701,590	1,935,631	2,041,206	2,159,440	2,250,567	2,313,411

Similarly, employment was expected to grow until 2020. Overall, employment was anticipated to increase by almost 27 percent in Houston between 2000 and 2020 (Table D33).

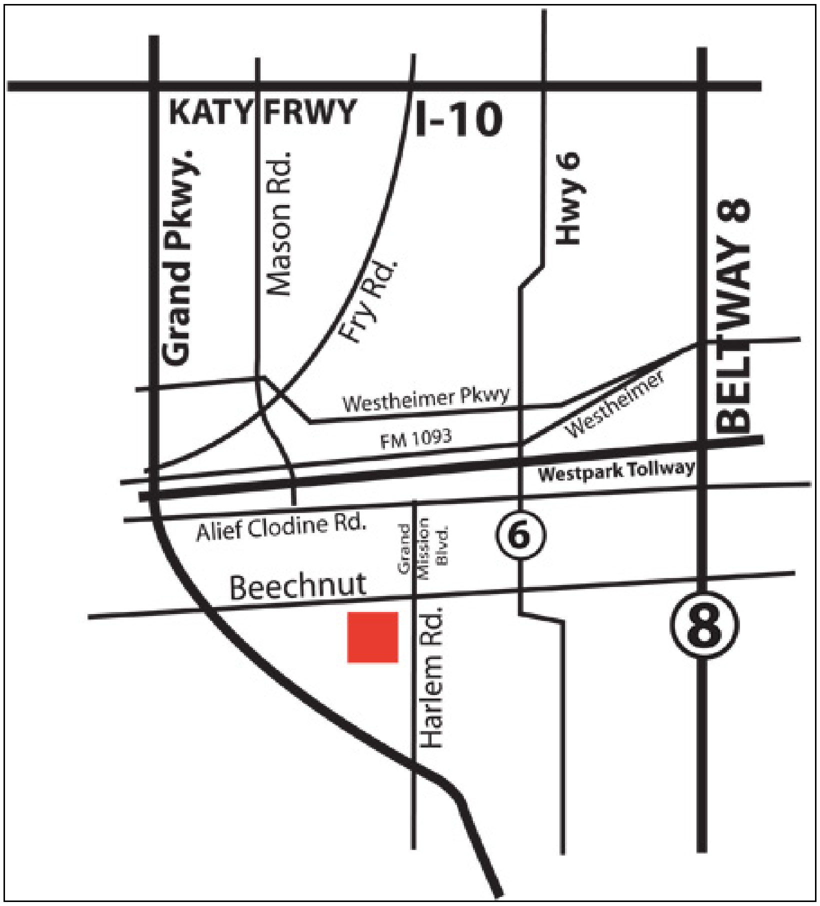
Table D33: Historic and Projected Employment

County	Employment								
	Year								
	1970	1980	1990	1995	2000	2005	2010	2015	2020
Brazoria	33,873	68,052	71,209	72,783	78,293	83,025	92,670	104,005	114,619
Chambers	3,509	7,482	6,070	6,950	8,376	9,872	12,261	15,664	19,619
Fort Bend	14,159	37,545	50,731	62,165	108,450	156,938	109,291	263,353	311,157
Galveston	58,934	72,799	80,517	84,174	95,136	103,275	114,625	127,064	137,336
Harris	772,907	1,384,104	154,4670	1,626,271	1,867,088	2,019,184	2,218,400	2,415,004	2,552,106
Liberty	7,919	13,854	14,303	15,014	18,091	20,756	24,493	30,311	37,311
Montgomery	9,403	26,388	43,426	54,829	90,584	126,563	165,380	207,056	247,824
Waller	3,438	5,899	7,640	8,408	9,955	11,644	14,257	18,129	22,029
Houston	685,122	1,084,380	1,168,059	1,210,482	1,334,858	1,394,723	1,492,696	1,610,967	1,690,022

Differences in Historical Trends and Actual Trends

The Westpark Toll Road has only been open for three years and thus it is a little premature to compare the differences in actual and predicted population and employment values as the data used would be mid-census estimates. For example, the economic and demographic data available for review are estimates released by the U.S. Census and the Texas State Data Center since the road opened mid census. However, the U.S. has experienced a slowdown economically since the opening of the Westpark Tollway with gas prices reaching record highs of over $4.00 a gallon in 2008 and the sub-prime housing dilemma.

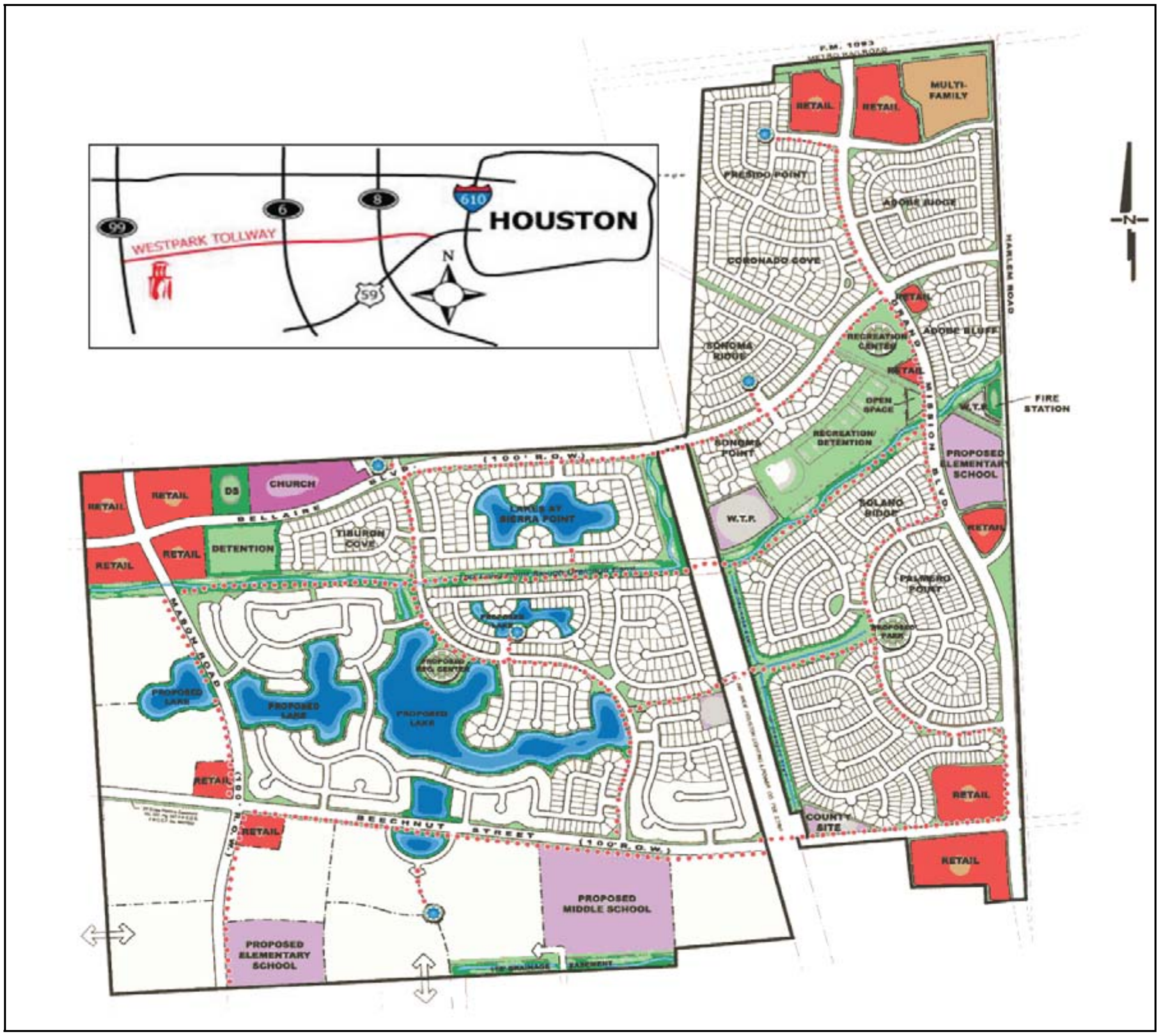
On the other hand, the number of housing developments in and around the Westpark Toll Road corridor has increased substantially. For example, in 2004 Centex proposed to develop 355 homes at Bradford Park on the corner of Beechnut and Harlem Road. Figure D58 shows this location in relation to Westpark (Fox and Jacob Homes).



Source: Fox & Jacobs Homes

Figure D58: Bradford Park Development Location Map

Furthermore, developers McGuyer and David Weekley Homes are also planning a master planned community on a 588-acre plot at the Westpark Tollway and Grand Mission Boulevard exit. With increasing land prices, the developer also purchased an additional 688 acres in 2004 (Sarnoff, 2004). The latter development will have 3,000 homes and 30 acres of commercial frontage along the Westpark Toll Road (David Weekley Homes). Figure D59 shows this development in location to the Westpark Tollway, as well as the proposed development's layout.



Source: David Weekley Homes

Figure D59: David Weekly Master Planned Community Map

Sarnoff (2004) noted that because of the Westpark Tollway, developers had *"scooped up"* virtually all of the available land in the area. In November 2000, voters in Fort Bend County authorized bonds to extend Westpark to the Grand Parkway. However, it is premature to comment on whether, or if, these factors have or may have an impact on the Westpark Tollway.

Differences in Actual and Forecasted Traffic

This section analyzes the differences in actual and forecasted traffic and revenue provided by WSA for the Westpark Tollway in the 2002 T&R and provides a qualitative discussion of the impact of certain factors on traffic and revenues.

<u>Summary of the Projected Traffic and Revenue</u>

Table D34 provides the traffic and revenue predictions for the Westpark Toll Road that were developed in the T&R study.

Table D34: Estimated Annual Transactions and Toll Revenue

Year	Annual Transactions	Annual Toll Revenue (2001 Dollars)	Annual Toll Revenue (Current Year Dollars)
2005	53,560,100	40,901500	47,43,3200
2006	54,915,850	41,813,700	49,745,300
2007	49,508,800	37,371,500	45,533,500
2008	51,231,400	38,596,333	48,307,633
2009	52,954,000	39,821,166	51,081,766
2010	54,767,600	41,046,000	53,855,900
2011	57,419,880	42,959,560	57,387,920
2012	60,163,160	44,873,120	60,919,940
2013	62,906,440	46,786,680	64,451,960
2014	65,649,720	48,700,240	67,983,980
2015	68,393,600	50,613,800	71,516,000
2016	69,611,700	51,538,300	75,767,620
2017	70,830,400	52,462,840	80,019,240
2018	72,049,100	53,387,360	84,270,860
2019	73,267,800	54,311,880	88,522,480
2020	74,486,500	55,236,400	92,774,100
Average Annual Percent Change			
2005-2010	0.41	0.07	2.26
2010-2015	4.57	4.28	5.84
2015-2020	1.72	1.76	5.34
2005-2020	2.22	2.02	4.57

The Westpark Toll Road has not been open for very long with the result that only three years of data could be analyzed. However, Figures D60 and D61 clearly illustrate that the toll road has not met the forecasted transactions or revenues projected for the ramp-up period. The difference between actual and forecasted traffic and revenue is, however, starting to narrow as of the end of 2007. It is also interesting to note that Westpark is considered to be congested during the peak hours. This has resulted in an attempt by HCTRA during 2007 to implement a considerable toll rate increase[19] in an effort to shift peak users to the shoulder and off-peak periods, thereby alleviating congestion and ensuring a better level of service. Tolls were to be raised from $1 to $2.50 during rush hour periods from 6:00 to 9:00 a.m. and from 4:00 to 7:00 p.m. (Murphy, 2007). This was not well received by the general public. After the public outcry the Commissioner's court on June 15, 2007 rescinded and instead voted to raise tolls on all HCTRA facilities by 25 cents beginning September 2007 (Harris County, 2007).

[19] The Commissioners Court voted to implement a congestion charge on the Westpark Tollway in 2007. WSA was asked to review ways to lower peak hour usage on the heavily congested Tollway. WSA recommended a toll of $2.50 to $3 to reduce peak hour usage below Westpark's capacity of 3,600 vehicles an hour at 50 miles per hour.

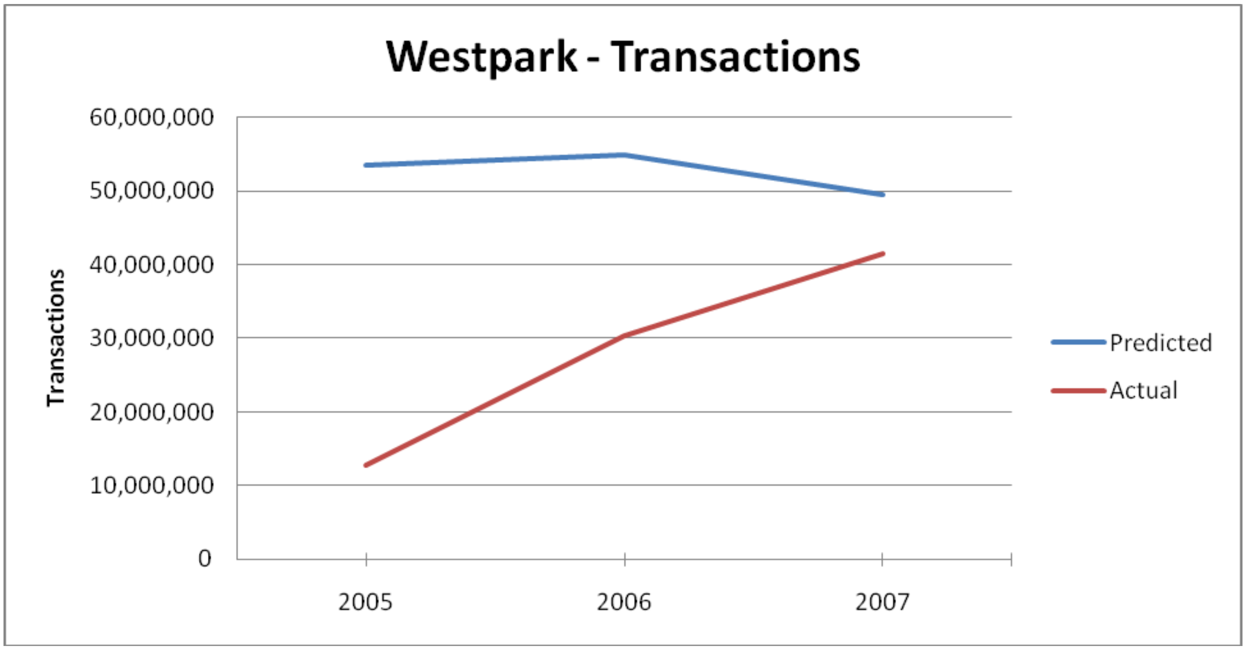


Figure D60: Actual and Forecasted Transactions on Westpark Tollway

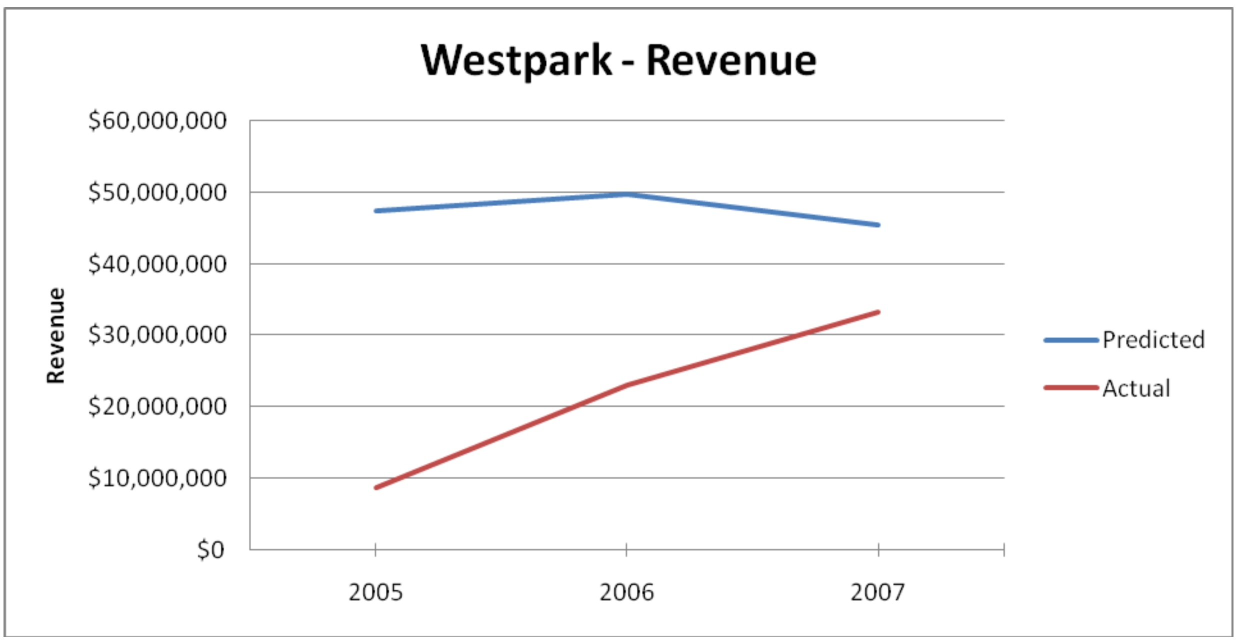


Figure D61: Actual and Forecasted Revenue of Westpark Tollway

<u>Pricing Scheme</u>

One factor that could have contributed to the difference between actual and forecasted transactions and revenues is the toll rate schedule that HCTRA adopted for the Westpark Tollway. WSA recommended a discounted toll rate for the off peak periods. However, HCTRA adopted a uniform toll rate for the whole day. It can be speculated that a lower off-peak rate would have diverted some peak users to the off-peak periods, resulting in a higher level of service on the toll road. However, the extent of the impact on the total number of transactions and actual revenues are unclear.

General Observations and Conclusions

The Westpark Toll Road has not been open for very long. It is conceivably still in the ramp-up phase, which is typically the most uncertain period in terms of forecasted traffic and revenues. Actual transactions and revenues have not met the forecasted transactions or revenues projected by WSA, but it looks as though the difference between the actual and forecasted values are narrowing as of the end of 2007. The Toll Road must have benefited from the fact that it opened during a time when the competing facility—i.e., IH10—was undergoing extensive reconstruction to widen it. Also, large residential developments are planned and being constructed in Fort Bend County to the west of the Toll Road that could result in increased demand and usage of the facility in the future. Usage is further facilitated by the extension that was built by the Fort Bend Toll Road Authority (FBTRA) to allow these developments easy access to the toll road. However, of concern is the fact that the toll road already experiences significant congestion levels during peak periods. Without an appropriate increase in toll rates, the level of service on the road will continue to worsen and probably impact future usage, especially once the reconstruction of IH10 is completed.

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Appendix E: Dallas Outer Loop

Initial Feasibility and Historical Perspective

The plan for an outer loop around the city of Dallas and its suburbs first began in the late 1950s. The first proposed alignment for the road was included in the Dallas Area Master Plan in 1957. Originally the road was to follow the existing Campbell Road in Richardson and Plano and then intersect with SH78 in Garland. The proposed road was to be an eight-lane freeway with frontage roads. The state's governing transportation board at the time—the Highway Commission—approved the acquisition of the right-of-way and the cities in the area began to aggressively pursue the development of the road.

However, before the first right-of-way could be acquired, TxDOT, the cities, and the public had to agree on a final alignment. Members of the public felt that the existing Campbell Road was sufficient and were vocal about choosing another alignment for this outer loop. Officials of Richardson, Garland, and Plano, however, anticipated that the new loop would be an economic stimulant, increasing economic activity and development. Ultimately, the officials realized that a united front was needed to ensure the construction of the road.

Officials from the City of Richardson suggested a route that is about a mile north of Campbell Road traversing mainly privately owned land. The exact alignment was to be determined, but this area was deemed a viable alternative. Subsequently, the two mayors—and later the city councils—of Richardson and Plano negotiated a shift in the border between the two cities to the centerline of the road's final alignment. The city officials conceded, but the exact alignment of the road would still face opposition from homeowner and environmental groups.

One way in which the cities hoped to contain right-of-way acquisition costs was by receiving land donations from private individuals and businesses. Right-of-way donations were not legal at that time, which forced local officials to go to Washington, D.C. to lobby for new legislation. After a change in federal law, right-of-way donation became legal. This allowed the cities to move forward with their plans for the road. In 1979 the cities of Richardson, Plano, Garland, Dallas, and Carrollton (which became involved in the late 1970s), along with Dallas County and Collin County passed a resolution for a final road alignment. Even though the right to began acquisition of the needed right-of-way had been approved in the mid-1960s, actual acquisition did not begin until the late 1970s or early 1980s.

While the cities negotiated the final alignment, TxDOT had been trying unsuccessfully to secure the needed funding for the road. TxDOT addressed the funding shortfall by dividing the planned Loop 9 road into two different segments. The first segment—now designated SH161—would run from IH20 to IH635 in Dallas. The second segment—now designated SH190—would run from IH35 in Carrollton to SH78 in Garland. This report focuses only on the second segment, which after a few more name changes would eventually become the President George Bush Turnpike (PGBT).

The alignment approved in 1979 was undergoing environmental clearance at the time funding was reviewed. Although the key cities approved the alignment, some cities were facing opposition from homeowners[1] that would be affected. The opposition in Carrollton was

[1] Though residential land owners were opposed to the road's construction, the business leaders in the area overwhelmingly supported the construction of SH190. In particular, the North Dallas branch of the Chamber of Commerce was very vocal about the need for better mobility in the area. Also, the Dallas County Mobility

particularly heated. The entire city council was eventually ousted for their support of the 1979 alignment. The right-of-way acquisition period was very long. By the mid-1980s some of the required land parcels had been donated or acquired and other parcels were in litigation. Eventually, the alignment was selected, the planning was complete, and the design was underway. Construction was set to begin in 1987 in Garland.

Although TxDOT divided the planned road in 1977 in two segments—SH 161 and SH190—to decrease the cost of the project, the cost of only SH190 turned out to be very high. Thus, 10 years after this decision, TxDOT was still unable to fund the construction of even the SH190 segment. According to the key SH190 proponent in the City of Richardson, Judson Shook, preliminary calculations suggested that based on previous years' funding levels, the road would not be completed until 2027 or 2028. It was believed that demand for the road necessitated an earlier construction date, so the idea of tolling the road to accelerate its construction was reviewed.

The governing transportation committee in Texas at that time was the Texas Transportation Commission. This three-member board could designate the road a Texas Turnpike Authority (TTA) project instead of a TxDOT project. The TTA was established in the early 1950s, and had already successfully constructed, operated, and tolled the Dallas-Fort Worth Turnpike and the Dallas North Turnpike (DNT)[2]. The TTA was regarded an efficient and effective agency. Local officials felt that if the project was reassigned to the TTA, the chances of the road being constructed were much larger. Also, the cities had been arguing about which segment, and thus which city, should receive funding first. The TTA was able to garner the cities' support to convert the project to a toll project by agreeing to build, fund, and open the road as one segment. The business interests in the area advocated for increased mobility regardless of whether it was non-tolled or tolled. With the support of the local cities and businesses, the TTA convinced the Texas Transportation Commission to designate SH190 a TTA project in the early 1990s.

The TTA accelerated the construction deadline for the completion of the road dramatically from a possible 2027 or 2028 date to the late 1990s. TxDOT had already completed an initial design for the expressway, and few changes were required when the road was converted to a toll project[i]. A two-person committee was formed comprising of the then TTA executive director, Jim Griffin, and the then TxDOT executive director, Arnold Oliver. In June 1994, TTA hired Wilbur Smith and Associates (WSA) to conduct a T&R study for SH190. The study results, dated August 1995, concluded that the road would be feasible if the following requirements were met:

- The road had to include a segment from IH35E to IH635,
- The road had to intersect with the existing DNT, and
- TxDOT needed to donate the funding previously spent on the road—approximately $300 million—to TTA and possibly loan the agency some additional funds.

Coalition supported this and other transportation improvements in the area. This coalition was composed of business and political stakeholders (Griffin, 2008).

2 The Dallas-Fort Worth Turnpike opened in 1957 and was operated as a toll road until 1977 when the bonds were repaid and the road was turned over to the State Highway Department—TxDOT's predecessor. The original, 9.8-mile DNT opened in 1968 and ran from Cedar Springs Avenue to Inwood Road, just south of I635. At this time, the DNT had just been extended 4.6 miles. This extension, called Phase I, opened in 1987 and ran from I635 to Trinity Mills.

The first requirement increased the length of the road and thus the cost, but also increased the road's connectivity to other heavily trafficked routes in the area. This increased connectivity resulted in higher forecasted traffic levels, and thus forecasted revenue levels. The second requirement would link the new toll road to the existing TTA system. As both roads would have the same operator[3] and toll collection system the link made sense. The last requirement was more involved. TxDOT has funded SH190 prior to TTA's involvement in the road. Thus, by the time the road was assigned to the TTA, TxDOT had spent approximately $300 million on the road. The passage of the federal transportation bill, Intermodal Surface Transportation Efficiency Act (ISTEA), in 1991 allowed a project to be funded by a combination of federal, state (e.g., TxDOT), and TTA sources. WSA concluded in their 1995 T&R that the road would not be feasible without additional funding sources other than the traditional toll financing method (i.e., revenue bonds). At this time, the DNT's existing revenue stream was not considered as backing for the new SH190 road.

The federal government provided TxDOT with $135 million for the project that TxDOT then loaned to the TTA[4]. TxDOT also agreed to build the DNT and SH190 interchange and the I75 and SH190 interchange. The TTA contributed half of the funding for the interchange with the DNT, but it is unclear how the I75 interchange was funded[ii]. The TTA sold $580 million in revenue bonds on December 12, 1995. The revenue from the bond issue was used for the construction of SH190 ($450 million) and for re-paying TTA's existing bonds ($130 million).

Right-of-way acquisition began nearly 40 years prior, but the process of acquiring right-of-way had accelerated in the 10 years before. The cities were incredibly successful in negotiating right-of-way donations. The total donated right-of-way was valued at $113 million. When the City of Richardson originally proposed the route just north of Campbell road, they entered into a discussion with Dallas billionaire, Herbert Hunt. Hunt owned large tracts of land that would be needed for the proposed alignment and officials from the City of Richardson convinced him to donate land valued at $13.3 million through his family company, Rosewood Property Company. Land was also donated by:

- "the University of Texas at Dallas,
- Dallas oil-baron, John "Jack" Jackson,
- Raymond D. Nasher of North Park,
- Dalmas Construction,
- the Excellence in Education Foundation,
- the Valwood Improvement Authority, and
- the Hunt family and Caruth trusts."

The right-of-way that was not donated was acquired by the cities and counties.

Nearly 40 years after the road had been included in the Dallas Area Master Plan, construction began on May 2, 1996. At this time, state legislation was passed that changed the

[3] SH190 would intersect with the second extension of the DNT. The second extension, i.e., Phase II, was 6.8 miles and ran from Trinity Mills northward to SH121. The financing of the interchange between the DNT and SH190 is discussed later.

[4] The TTA was required to pay interest on this loan.

road name from SH190 to the President George Bush Turnpike (PGBT). For construction purposes the PGBT was divided into four segments[5]. The various segments are illustrated in the Figure E1.

Figure E1: Segments of the President George Bush Turnpike (PGBT)

When the TTA took responsibility for the project, NEPA had already granted a Record of Decision for all segments of the route, with the exception of Segment 4. The change from a non-toll to a toll road, however, required a supplement to the original approval. This supplement included the opening toll rates, toll collection locations, and the additional right-of-way needed for the toll plazas. The supplement did not raise any concerns in terms of NEPA or encountered any public opposition, and was quickly approved[iii]. However, environmental concerns would later delay the progress on Segment 4. As mentioned earlier, a fifth segment was also added later.

Segment 4, which ran between I35E and I635, traverses through an area with many wetlands, so most of the road was built as a bridge. The TTA was also required to make additional adjustments for endangered species in the area[6] and conduct wetland mitigation. Also, the alignment of Segment 4 needed to be adjusted to preserve a local amusement park, i.e.,

5 A fifth segment was financed and constructed at a later date.

6 An endangered salamander species was found in the area.

Sandy Lake Park. Segments 3 and 5 were built on unstable soils that had a tendency to move. Segment 3 was thus built with cement instead of asphalt. After a retaining wall collapsed during the construction of Segment 5, additional precautions were taken to address the soil movements. The TTA also formed an environmental team to address the growing environmental concerns[iv]. The opening of Segment 4 was eventually delayed because of environmental concerns.

Besides the design changes resulting from the environmental and soil concerns, a few additional design changes were made after the road was financed. A major change was two overpass bridges that had to be widened at the cities' request for additional roadway capacity. This increased the cost with about $4 million[v].

There was little political or public opposition during the road's construction. The PGBT traversed through some residential developments, and residents complained about the 24 hour work days. The TTA, however, had already notified the city of this work plan and chose to proceed with the construction schedule[vi]. The economic climate, land use, and congestion levels was conducive to road expansion. The area was sprawling and a number of businesses were locating in the area. Congestion levels were high and drivers needed to get to DFW (and in turn SH121). The environment was conducive to the opening of the PBGT[vii].

Segment 1 opened in two sections: A and B. Both sections were opened in 1998. Segment 2 opened in 1999 from Preston Road to Campbell Road. Segment 3 opened in 2000 from Campbell Road to SH78. Segment 4 opened in 2005. The main line toll rate collected at four plazas was $0.50. Some of the ramps were also tolled. The cost to drive the total length of the road was $2.00.

Unique to this road in the TTA system was the toll tag technology that was adopted. The DNT had toll tag-only lanes, but the new PGBT's toll tag-only lanes allowed motorists to drive through the lanes at an impressive 45 miles per hour. The toll collection system was also different: a passive sticker replaced the box transponder that required a battery to operate.

The TTA was a statewide toll authority. In 1991, the state legislature considered making the TTA part of TxDOT. At that time, the idea was struck down, but the idea lingered around for the next six years until the TTA was finally restructured in 1997. In 1995, some discussion was initiated about allowing regions to have toll authorities. It was argued that these authorities would be run by local officials completely independent of TxDOT. Regional toll authorities had tremendous support among local politicians who saw them as a means to keep toll revenues collected from roads in their jurisdictions in their region's transportation budget. Also, most of the high ranking TTA officials supported the idea with Dallas County Judge Jackson being accredited as the real champion of the idea.

In 1994, George W. Bush was elected governor. Bush, together with key local Dallas residents[7], was determined to restructure the TTA and create a regional authority in the Dallas area. Former TTA board member, Philip Montgomery, formed a group called "Tollways for North Texas (TNT)." The TNT managed to organize local businesses in the area to support the concept of a regional toll authority. The local MPO, as well as representatives from Collin, Dallas, Denton, and Tarrant counties, also participated in this group.

The idea of a Dallas area toll authority led to a four-county agency. The four counties—i.e., Collin, Dallas, Denton, and Tarrant—were all experiencing tremendous growth and were in desperate need of new roads. A four-county agency thus seemed the best option as it allowed the counties to pool their resources and address the area's growing congestion problems.

[7] David Laney was on the Highway Commission and Jere W. Thompson was the head of the TTA.

Judge Jackson and Collin County Judge Ron Harris negotiated a solution that all 52 local governments agreed upon. This solution was instrumental in moving the regional toll authority forward from a dream to an achievable concept. The TTA board voted on the matter in 1996, passing it narrowly. In 1997, state legislation[8] was passed that created the North Texas Tollway Authority (NTTA) and also abolished the existing TTA. In the future, the TTA would be a division within TxDOT. Some controversy erupted over how the available TTA funds—$35 million—would be divided between the agencies, i.e., the newly formed NTTA and TxDOT. The debate over whether the funding collected in the region should stay in the region or be transferred to TxDOT was very divisive. A state auditor eventually made a decision based on the documentation of the TTA's assets. Ultimately, TxDOT received $14 million (or 40 percent) of the $35 million. The NTTA, as the owner of the DNT and the PGBT, was to retain $21 million. Again, Judge Jackson and Judge Harris, as well as the new NTTA chairman Jere W. Thompson (previously the director of the TTA), were instrumental in the creation of the agency. For the remainder of this section, the TTA will be referred to as the NTTA for consistency and the PGBT will be referred to as SH190. This is appropriate as the NTTA was formed at the time when the feasibility of constructing SH190 as a toll road was analyzed.

Traffic and Revenue Reports

SH190 opened in five segments. Segments I to IV were financed with the 1995 bond issuance and later refinanced with the 1997A bond issuance. Segment V was financed with the 1998 bond issuance. However, Segment IV required additional funds and thus additional bonds were issued in 2003. Below is a list of the bonds and the T&R documents[9] for SH190. All the T&R reports were done by WSA:

- Series 1995: Funded Segments I to IV and included the 1995 T&R report.
- Series 1997A: Refinanced Series 1989. The bond document includes the 1995 T&R report and a letter with revised assumptions10.
- Series 1998: Funded Segment V. The 1998 T&R report used the same forecast methodology as the 1995 T&R with slightly revised assumptions, as well as updated demographic information.
- Series 2003A: Provided additional funding for Segment IV. The T&R report is a brief document, using the same methodology as the 1995 T&R report, but highlighting any differences from the 1998 T&R report.

Only the 1995 and 1998 T&R reports were reviewed in this research study, because these reports were included in the Series 1995 and 1998 bond issuances that were used for funding Segments I to V. As mentioned, the same methodology was used in both T&R reports. Table E1 summarizes the assumed characteristics of each Segment included in the T&R reports

[8] Senate Bill 370.

[9] All the T&R reports were done by WSA.

[10] Examples of these revised assumptions are a new opening schedule and the inclusion of new ramps. Also, the segments were changed from IA and IB to IA, IB, and IC and from II to IIA and IIB.

Table E1: SH190 Segments Included in T&R Reports

1995 T&R Segments			1997 T&R Segments		
Segment	**Borders**	**Scheduled Opening**	**Segment**	**Borders**	**Scheduled Opening**
IA	Midway Road to Preston Road	Mar-98	IA	Midway Road to Preston Road	Nov-98
IB	Preston Road to US75	Mar-98	IB	Preston Road to Coit Road	Jun-99
			IC	Coit Road to US75	Dec-99
II	US75 to SH78	Jul-99	IIA	US75 to N. Garland Road	Dec-99
			IIB	N.Garland Road to SH78	Apr-00
III	Midway Road to I35E	Jul-01	III	Midway Road to I35E	Jul-01
IV	I35E to I635	Jul-04	IV	I35E to I635	Jul-04
			V	I635 to Belt Line Road	Jan-02

1995 NTTA Bond Document[11, viii]

The NTTA sold bonds in 1995 to fund the construction of the first four segments of SH190. As mentioned in the historical section, the NTTA aspired to construct all segments at the same time to avoid concerns about preferential treatment by the cities. Also, simultaneous construction would allow the road to open faster, which would result in overall higher traffic volumes. The objectives of the T&R report were to:

1. project traffic and revenue levels for SH190 Segments I through IV,
2. examine and select a toll collection method for SH190,
3. assess toll sensitivity by examining various toll pricing scenarios,
4. determine the impact of SH190 on DNT toll revenue levels, and
5. assess the impacts of implementing HOV lanes along SH190.

The segments changed in the 1997 T&R report.[12] This analysis refers to the segments included in the original 1995 T&R. Table E1 provides the segment characteristics and Figure E2 illustrates the location of the different segments included in the 1995 T&R study.

[11] Unless otherwise noted, the information and data in this section are from the 1995 NTTA Bond Document.
[12] However, a new T&R report was not completed using these new segment designations.

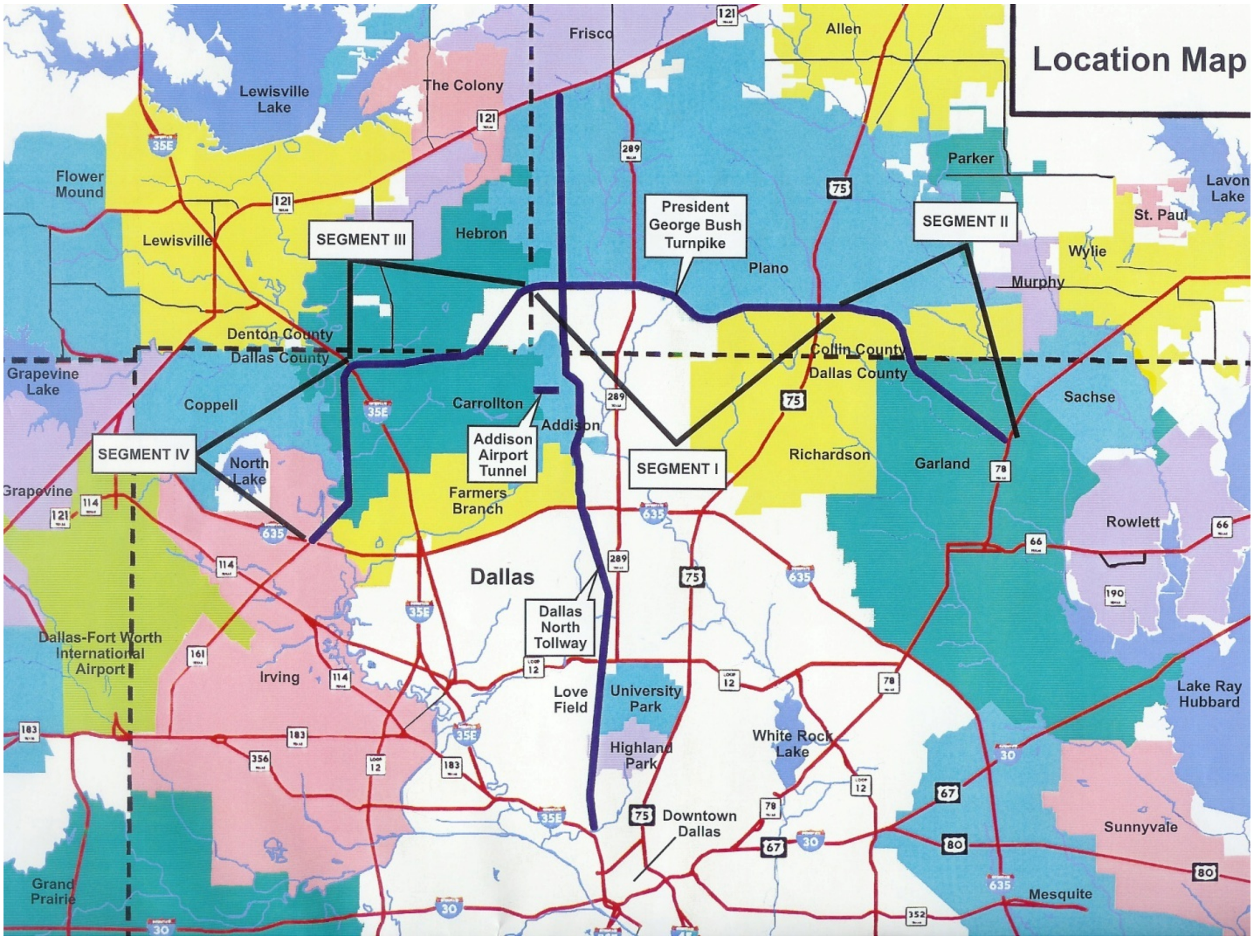

Figure E2: SH190 Segments Funded by the 1995 NTTA Bond Document

A major objective of SH190 was to relieve congestion in the cities of Richardson, Plano, Dallas, and Carrolton. The toll road serves as an outer loop—the inner loop being I635—around Dallas, connecting the Dallas area suburbs. SH190 also intersects with major Dallas area routes—i.e., US75 (Central Expressway), the DNT, and I35—and some minor routes—SH78 and Preston Road. Figure E3 shows the cities in the SH190 corridor.

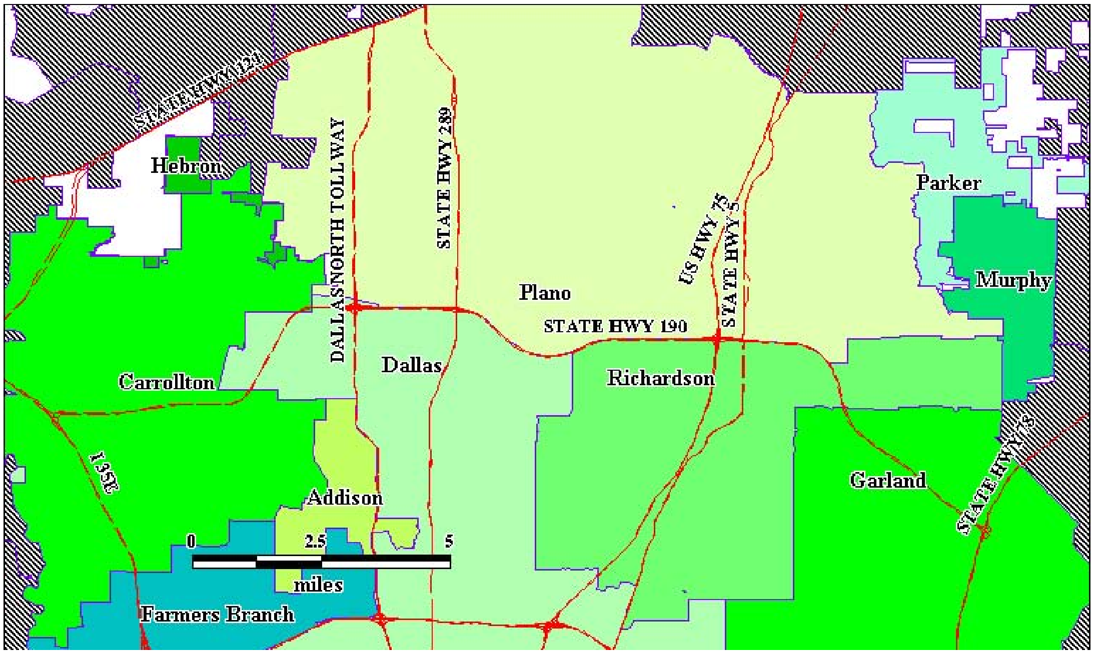

Figure E3: Cities served by the SH190 Corridor[ix]

The full and partial interchanges that were planned and included in the T&R are listed in Table E2.

Table E2: Planned Interchanges

Full Interchanges	Partial Interchanges
Preston Road	Coit Road
Josey Lane	Midway Road
Old Denton	Rosemead Parkway
Sandy Lake	Marsh Lane
Beltline Road	Frankford Road
Valwood Parkway	Kelly Boulevard

It was anticipated that the road will divert traffic away from the mostly parallel I635, as well as Beltline Road, FM544, and SH121. The cost estimates included in the bond document for the construction of the four segments are listed in Table E3.

Table E3: SH190 Project Costs

Toll Plazas	$ 12,401,000
Screen Walls	$ 11,000,000
Toll Collection System	$ 8,816,000
Structures	$ 4,775,000
Roadway Resurfacing	$ 3,516,000
Roadway Widening and Improvements	$ 18,050,000
Fencing	$ 224,000
Roadway Extensions and Enlargements	$ 17,100,000
Total	$ 75,882,000

It was anticipated that tolls will be collected at 4 mainline plazas and 13 ramps. The ramp locations are listed in Table E4.

Table E4: Ramp Locations

Ramp Locations	
East of Blackburn Road	East of Midway Road
West of Shiloh Road	West of Marsh Lane
East of Renned Road	West of Kelly Boulevard
East of Jupiter Road	West of Josey Lane
West of Custer Road	South of Belt Line Road
West of Independence Parkway	South of Valwood Parkway
West of Preston Road	

Summary of the Existing Conditions[13, x]

This section discusses the characteristics of the Dallas region, the local transportation system, and the existing system's T&R levels.

Dallas

WSA reviewed current land development, major employers, and land use in the SH190 corridor. The land development in the corridor was found to be closely linked to the area's major

[13] Unless otherwise noted, the information and data in this section are from the 1995 NTTA Bond Document.

employers as most of the land bordering SH190 was owned by 12 major corporations (see Table E5).

Table E5: Major Land Owners in S.H. 190 Corridor

Land Owners	
Caruth	Southern Pacific
Del Briar Investment	TI Employee Pension Fund
Hilwood Development Corporation	University of Texas at Dallas
Hunt Petroleum Corporation	TI/Hitachi
Legacy Capital Partners	DSC Communication
Rosewood Property Company	Texas A&M University

The level of development in the SH190 corridor varied by city, but the land use was dominated by upscale apartments, office developments, industrial areas, and residential homes. In particular, the City of Carrollton was surrounded by industrial and high density developments. In a portion of the SH190 corridor development was restricted, because of existing railroad right-of-way.

Population and employment growth rates were assumed to be key predictors of traffic growth. WSA thus reviewed historical population values and growth rates (see Table E6). The current and forecasted employment values and growth rates are provided in a subsequent section.

Table E6: Historical Population Figures and Growth Rates

Study Area		1970 Population	Average Annual Population Growth Rate (%)*	1980 Population	Average Annual Population Growth Rate(%)**
Collin County		66,930	8.0	1,445,776	6.2
	Plano	17,877	15.0	72,331	5.9
Denton County		75,633	6.6	143,126	6.7
	Carrollton	13,855	11.3	40,595	7.3
Dallas County		1,327,695	1.6	1,556,419	1.8
	Garland	81,437	5.5	138,857	2.7
	Richardson	48,437	4.1	72,496	0.3
	Irving	97,260	1.2	109,943	3.5
	Dallas***	N.A.	-	N.A.	-
	West Rowlett	N.A.	-	N.A.	-
	Coppell	1,728	8.3	3,826	15.6
	Farmers Branch	27,492	-1.0	24,863	0.7
	Sachse	777	4.9	1,640	15.7

*1970 to 1980

** 1980 to 1990

*** only area north of LBJ Freeway

WSA also reviewed the following growth indicators:

- *Age Distribution:* WSA reviewed the 1990 age distribution of Dallas, Denton, and Collin Counties. WSA also examined the forecasted age distribution in 2010 in an attempt to identify any trends or anomalies. In all three counties, the 55 to 64 age group was expected to grow 4 to 8 percent and the 0 to 17 age group was expected to decrease by 2 to 8 percent. The age group that impacts traffic demand the most is the 25 to 45 age group. In all three counties, this age group was forecasted to decrease by approximately 2.4 percent.
- *Median Household Effective Buying Income:* WSA provides the median incomes, as well as the percent change in median income, for Collin, Denton, and Dallas counties, as well as the cities of Richardson and Plano from 1984 to 1993. It was found that the project corridor exhibits a higher average income than both the state and country.
- *Retail Sales Trends:* Retail sales numbers were again listed for Collin, Denton, and Dallas counties, as well as the cities of Richardson and Plano from 1984 to 1993. The data were obtained from the 1982 and the 1987 Census of Retail Sales numbers. Most of the counties and cities mirrored the national trend, except for Plano, which had higher retail sales trends.
- *Motor Vehicle Registration Trends:* WSA provided the number of new vehicles registered in the counties of Dallas, Denton, and Collin from 1985 to 1993. After a decreasing trend in the late 1980s, the number of new registrations began to increase in 1992. In addition, WSA reviewed the truck registration trends in the three counties. The truck registration trends in Dallas and Denton counties mirrored the auto car trends, albeit at lower volumes. However, truck registrations in Collin county differed from the auto car trends, exhibiting almost no growth.
- *Energy Considerations:* WSA noted that since 1979, the real cost of fuel had been declining. At the same time, traffic demand in the DFW area seemed to be inelastic and unaffected by the increases in fuel costs[14] during 1990. While acknowledging that fuel supply could be impacted dramatically by external and unpredictable factors, WSA assumed that the fuel supply will not be affected.

The listed indicators, together with the population factors, were included in the T&R's overview of the area's historical trends.

Local Transportation System

A key component of WSA's analysis was a detailed review of existing traffic conditions. WSA used their prior 1994 field survey data, as well as local historical traffic and transportation statistics. In particular, the local MPO—the North Central Texas Council of Governments (NCTCOG)—provided the annual and monthly traffic counts from their permanent traffic counters in the city to the consultant. The TTA provided the consultant with traffic counts for the DNT. Finally, WSA conducted manual counts in the future roadway corridor to estimate the demand for the road and the potential diversion rate.

[14] However, if fuel prices do increase sufficiently, traffic demand and thus revenue levels could be impacted.

Data from four permanent counters was collected at the locations listed in Table E7.

Table E7: Location of Permanent Traffic Counters

Counter Number	Permanent Counter Location	Annual Traffic Volume in 1993 (vehicles)	Annual Daily Traffic Growth (%)*	Average Annual Growth (%)**
1	I635 east of I35E	228,832	5	2
2	I35E north of US67	151,752	2	1.2
3	US75 south of SH121	53,209	8	6.1
4	Dallas North Tollway	215,473	6	7

* From 1992 to 1993
** From 1990 to 1995

Counter Number 1 was the closest to the corridor and thus regarded to best represent future traffic patterns on SH190. However, the traffic growth rates do not necessarily present the growth in demand as the corridor is heavily congested, thereby suppressing traffic growth. Nevertheless, Counter Number 1 had the highest daily traffic volumes. Counter Number 2 exhibited more variable growth rates over the last ten years compared to Counter Number 1. The consultant noted that the traffic growth in this corridor—where Counter Number 2 is located—has begun to plateau. Counter Number 3 exhibited constant high growth rates over the last ten years. However, traffic volumes were also the lowest at this location, so that the growth rates have to be considered in relation to the overall daily traffic volumes. Counter Number 4 was located on the only operational toll facility in the area. The growth rates in this corridor exhibited the most variability, but WSA predicted that this was attributable to the opening schedule of the DNT phases. However, an increase in traffic was recorded at this count location in nine of the past ten years[15].

WSA also reviewed the monthly traffic patterns, which revealed that in general traffic volumes were the lowest in January and the highest in June. Though Counter Number 1 exhibited some seasonal variation, Counter Number 4 on the toll facility was the only location that showed large seasonal differences. Counter Number 4 recorded the lowest traffic volumes in January (the same as the other three counters), but recorded the highest traffic volumes in December. Figure E4 illustrates the monthly variations recorded by the four traffic counters in 1993 with the average monthly traffic volume equaling 100.

15 From 1983 to 1993.

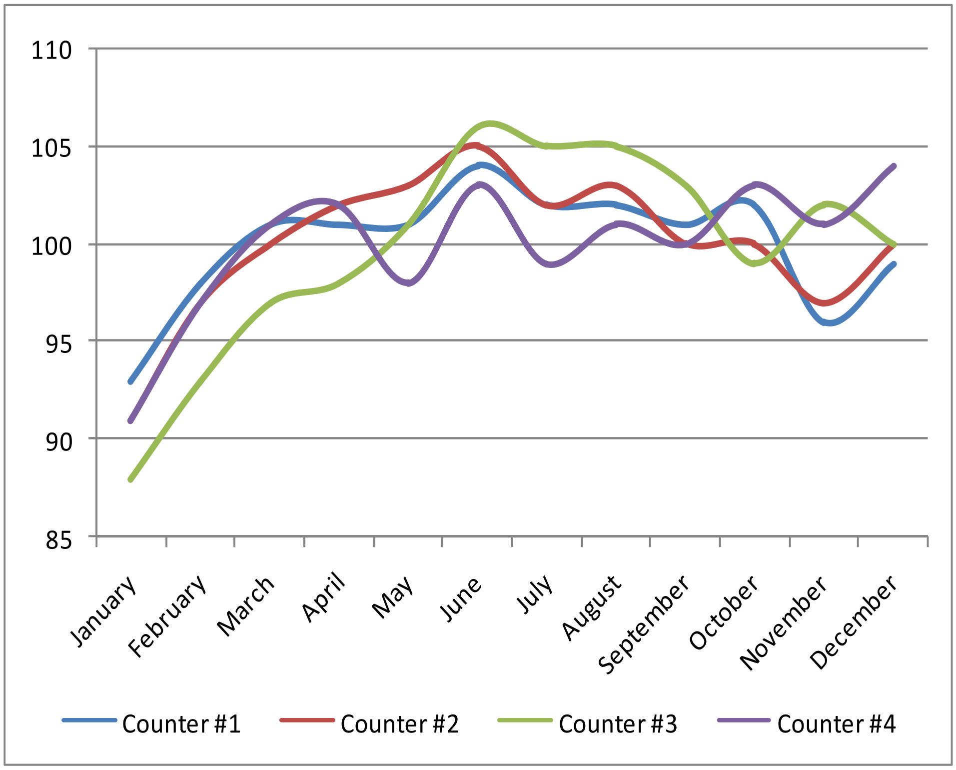

Figure E4: Seasonal Variations by Traffic Counter

In addition to analyzing the traffic count data obtained, WSA also conducted a traffic survey in the project corridor. The survey effort began in August 1994 with the distribution of mail-back survey cards at selected locations across the metroplex. Information collected included:

- trip origin,
- trip destination,
- trip purpose,
- trip frequency,
- vehicle occupancy, and
- the time of day the trip was undertaken.

The objective of the survey was to estimate the traffic that could potentially be diverted to SH190. WSA developed four "screenlines." These screenlines aimed to record all traffic entering a particular section of the project area. The screenlines are described below, as well as illustrated in Figure E5.

- Screenline A—survey stations left of Josey Lane,
- Screenline B—survey stations east of Coit Road,
- Screenline C—survey stations east of North Garland Road,

- Screenline D—survey stations on north-south routes, and
- additional survey locations on the on-ramps at I635, I35E, and US75.

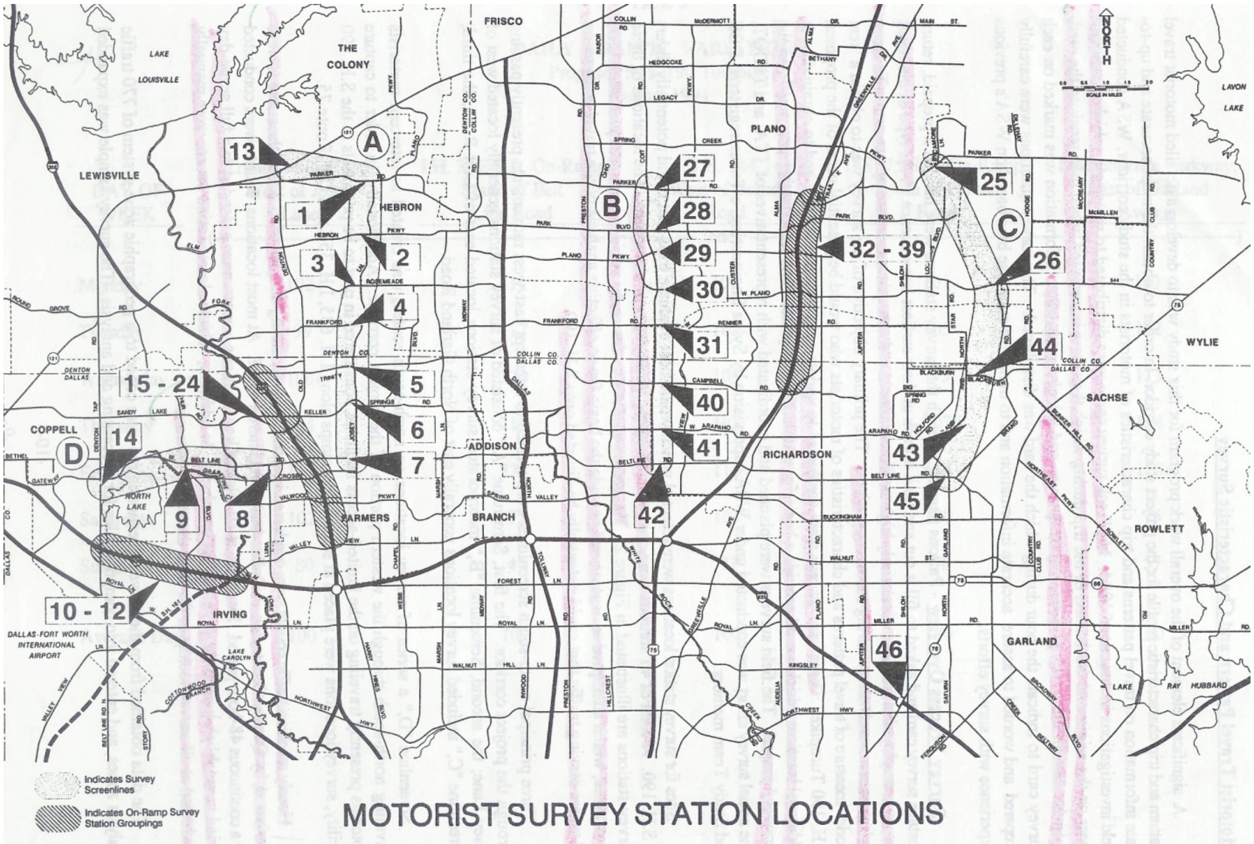

Figure E5: Locations where Mail-back Cards were Distributed

In addition to distributing mail-back cards, hourly machine traffic counts and vehicle classification counts were conducted in both directions during card distribution hours. In most locations, the traffic counts were conducted for 48 hours. However, at 10 key locations, selected by WSA for their relation to SH190, the traffic counts were conducted for a seven-day period. Table E8 summarizes the general characteristics of the mail-back card survey.

Table E8: Mail-back Card Survey

Number of Stations	45
Total Number of Vehicles during Operation Hours	343,345
Total Number of Cards Distributed	247,870
Total Number of Returned and Useable Cards	60,830
Sample (%) of Passing Traffic	17.7
Sample (%) of Distributed Cards	24.5

The vehicle classification counts revealed that passenger cars accounted for more than 97 percent of the traffic. The survey collected information about the respondent's trip purpose. The motorists were asked to select one of six trip purposes. Figure E6 illustrates the percentage of trips reported by trip purpose.

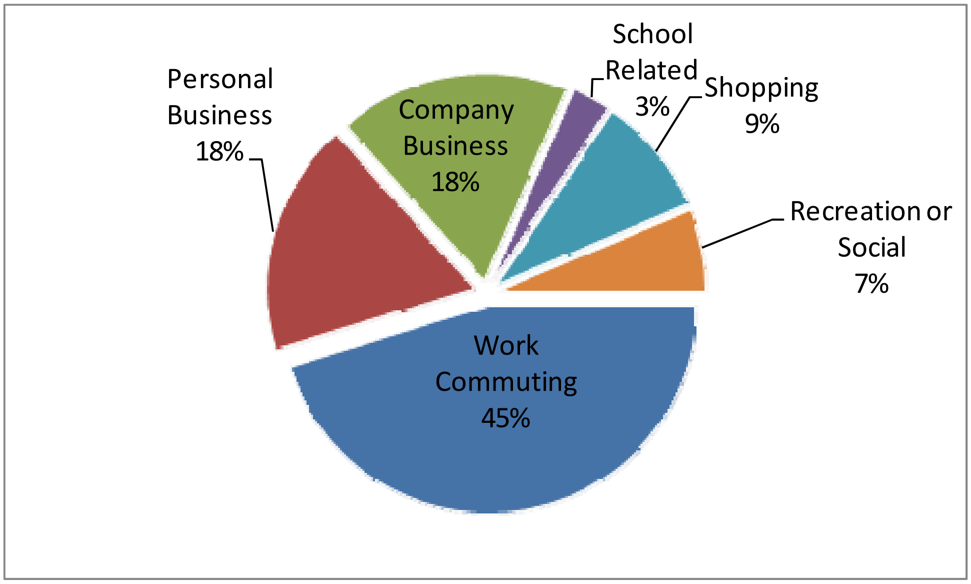

Figure E6: Trip Purpose Distribution

The survey also revealed that in the project corridor, approximately 63 percent of the trips were commuting trips. WSA noted that respondents surveyed at traffic count locations nearer to the downtown area had a slightly different trip purpose distribution. These stations recorded even higher percentages of commuting trips.

The survey also collected trip frequency and vehicle occupancy information. The trip frequency distribution is provided in Figure E7.

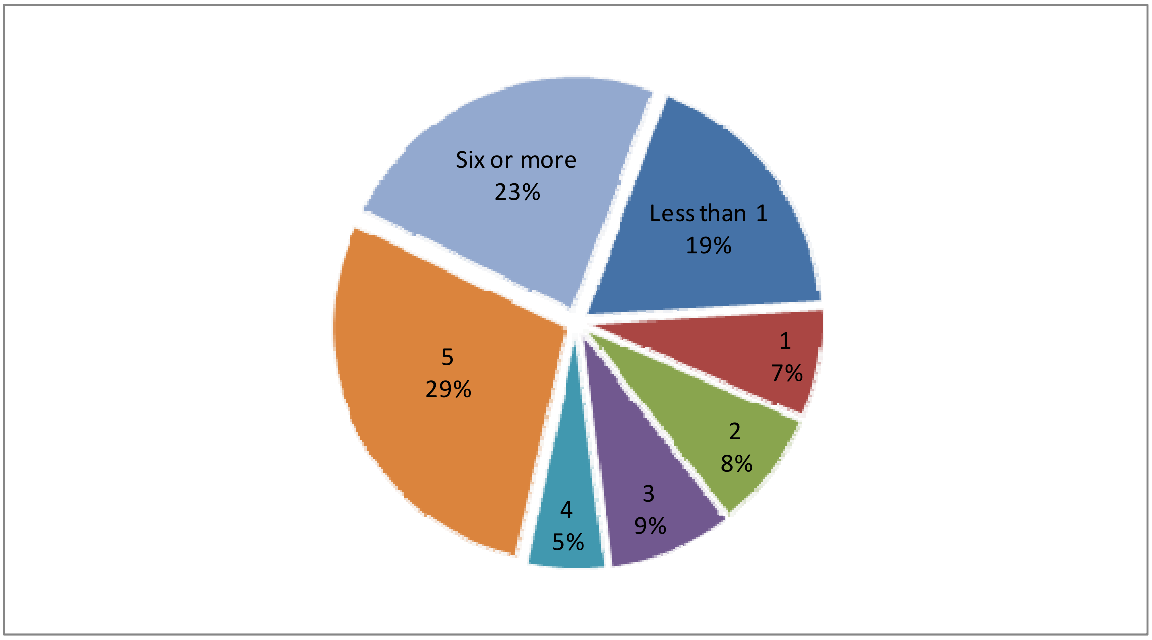

Figure E7: Trip Frequency Distribution

The large percentage (i.e., 29 percent) of respondents that indicated a trip frequency of 5 or more trips a week also supported the hypothesis that SH190 would attract large numbers of commuters. Furthermore, the vehicle occupancy distribution (see Figure E8) being dominated by single occupant vehicles (i.e., 76 percent) provided additional supported for the hypothesis of largely commuter traffic using the corridor.

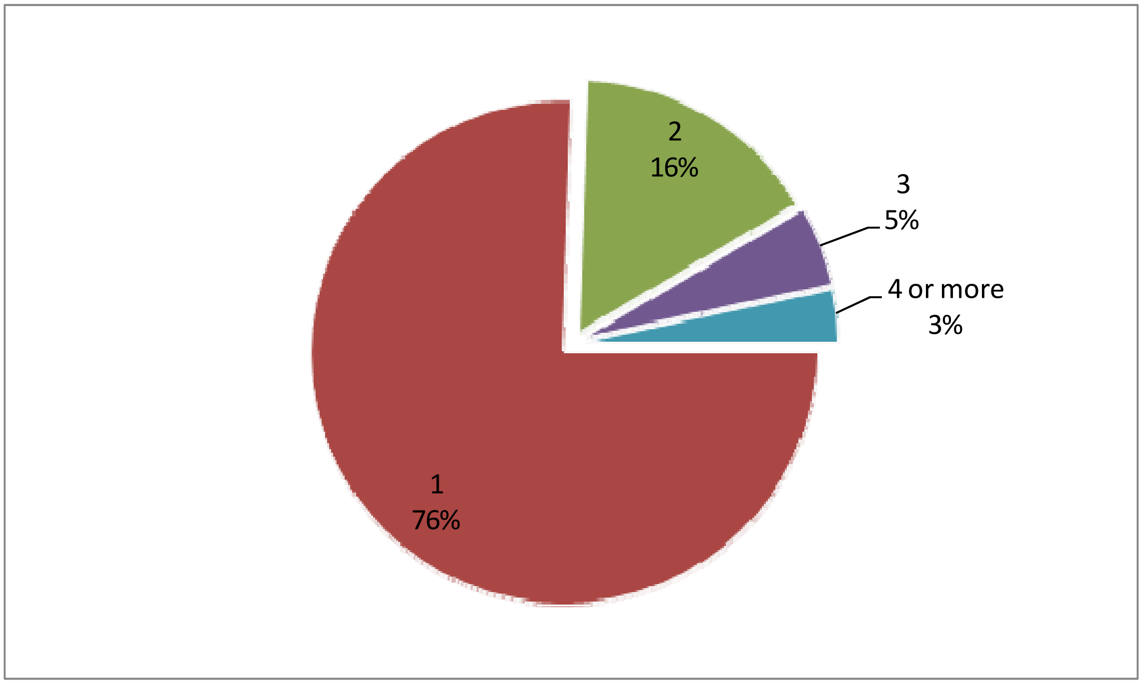

Figure E8: Vehicle Occupancy Distribution

Next, WSA conducted travel time runs to compare the time and distance on existing alternative routes[16] with the predicted time and distance on SH190.[17] The start and end distances, the travel time, and the calculated average speed are provided in Table E9.

Table E9: Time-Distance Relationships during the A.M. Peak

Start	End	Route	Distance (miles)	Time (minutes)	Average Speed (mph)
Lewisville (SH121 and I35E)	Richardson (Renner Road and Shiloh Road)	Existing	23	43	32
		SH190	24	32	46
Carrollton (Belt Line Road and Josey Lane)	Plano (Spring Creek Road and US75)	Existing	17	34	30
		SH190	18	26	42
DFW Airport	Plano (Park Blvd. and US75)	Existing	29	54	32
		SH190	30	40	45
Plano (Preston Road and Parker Road)	Garland (Garland Road and Belt Line Road)	Existing	16	37	26
		SH190	14	23	37

In all four cases, the average speed was higher using SH190, ranging from 11 mph to 14 mph faster than the existing alternatives. In all four cases, the SH190 thus resulted in significant time savings, ranging from 8 to 14 minutes.

Toll Transactions on Existing NTTA System

The bond document included information on the existing NTTA toll system to establish the reputation of the toll authority, but it was not discussed in any detail in the T&R report. The NTTA system was only discussed as part of the overall local transportation system.

16 All alternative routes were within two miles of SH190. Although not included in this section, the bond document does provide the exact routes driven in each case.
17 During the AM peak only.

Summary of the Projected Traffic and Revenue[18, xi]

The historical trends already discussed, the area's expected future population and employment [19]growth rates, and the local area's adapted traffic models and trip tables, formed the basis for WSA's T&R projections for SH190.

Dallas

WSA predicted population, employment, and other growth indicators for the major cities in the project corridor. The bond document noted that population is used to estimate trip production in the trip tables and employment is used to estimate trip attractions. Thus, both are key factors in the forecasting of future demand for the SH190. The population and employment forecasts used by WSA are listed in Table E10.

Table E10: Forecasted Population and Employment

Study Area		2010 Population	Average Annual Population Growth Rate (%)*	2010 Employment	Average Annual Employment Growth Rate (%)*
Collin County		566,060	3.0	226,070	4.3
	Plano	244,971	3.3	122,757	3.9
Denton County		478,600	2.8	128,750	3.3
	Carrollton	102,714	1.1	65,316	0.1
Dallas County		2,144,870	0.7	1,838,550	1.7
	Garland	198,287	0.5	90,756	1.2
	Richardson	85,083	0.6	92,337	2.4
	Irving	198,748	1.2	161,587	2.0
	Dallas**	193,775	1.2	112,947	0.9
	West Rowlett	40,510	4.5	7,204	2.7
	Coppell	41,134	5.4	12,020	8.6
	Farmers Branch	27,515	0.1	79,510	-0.2
	Sachse	18,830	5.0	2,681	5.2

* 1990 to 2010
** Only for area north of LBJ Freeway

18 Unless otherwise noted, the information and data in this section are from the 1995 NTTA Bond Document.
19 The demographic inputs to the trip tables and models—i.e., population and employment—were from the 1990 Census and the latest Transportation Improvement Program for the Dallas-Fort Worth Metropolitan area.

WSA also forecasted population and economic growth rates for a two-mile corridor on either side of SH190. These forecasts are provided in Table E11.

Table E11: Forecasted Population and Employment in the Project Corridor

Corridor Zones*	Population			Employment		
	1990	2010	Average Annual Percent Change (%)	1990	2010	Average Annual Percent Change (%)
Collin County	106,065	144,083	1.5	51,733	106,089	3.7
Denton County	52,347	98,911	3.2	6,146	16,444	3.6
Dallas County	182,888	284,603	2.2	130,653	168,200	1.3

* Defined as a two mile area on either side of SH190

The employment forecasts considered NCTCOG's trip tables, as well as WSA's assessment of any new developments that could have an impact on employment levels. WSA also listed major impending roadway projects in the SH190 corridor that could result in traffic not diverting to SH190. Finally, WSA also listed the following major land use projects in the corridor:

- *Breckenridge:* A 1,600-acre area that will house industrial, commercial, and eventually residential developments in the coming years. This land is one of the largest undeveloped areas in Richardson, but could grow to have a population of 14,300 people.
- *DSC Communication Corporation:* A 490-acre area in Plano that will be the new location of the DSC offices. The final employee count will be 6,600.
- *Texas Instruments/Hitachi Joint Venture:* A 1,200-acre area that will be developed into a semi-conductor plant in Richardson. When completed the plant will be 138 acres and provide employment to 700 employees.
- *Texas Instrument Employee Pension Trust:* A 120-acre site that was for sale at the time of the bond document.
- *Rosewood Property Company:* The acreage was not available, but industrial development was anticipated on the land.
- *JC Penney Financial Service/ACRO Exploration:* The acreage was not provided, but the new offices were estimated to house about 2,000 new employees.
- *University Property:* 340 acres, mainly in the City of Richardson, were owned by the University of Texas at Dallas and Texas A&M University. Land values will largely determine when these acres will be developed.
- *Major Apartment Projects:* No acreage was provided, but new apartment complexes could house over 1,500 people.

The development schedule for these projects varied and the risk of delays was also noted. It was anticipated that these facilities would impact the traffic levels on SH190 in future operational years.

Projections for the Existing NTTA System

WSA and the NTTA have a long working relationship. WSA has prepared numerous T&R projections for the Authority and did not conduct a new forecast in this bond document for the existing NTTA system (the DNT and the Addison Airport Toll Tunnel [AATT]). Instead, WSA noted that as the two toll roads intersect, increased traffic on one will have a positive impact on the traffic of the other. WSA thus predicted that the existing NTTA system will experience an increase in traffic volumes and revenue after SH190 opens. The forecasted revenue on the existing system resulting from the opening of SH190 between 1998 and 2020 is provided in Table E12.

Table E12: Estimated Toll Revenue Impacts Attributable to SH190

Year	DNT	Addison Airport Tunnel	Year	DNT	Addison Airport Tunnel
1998	1,251	-104	2010	1,216	-696
1999	1,405	-130	2011	1,216	-696
2000	1,502	-130	2012	1,216	-696
2001	931	-583	2013	1,216	-696
2002	978	-630	2014	1,216	-696
2003	998	-594	2015	1,216	-696
2004	1,260	-577	2016	1,216	-696
2005	1,308	-635	2017	1,216	-696
2006	1,290	-624	2018	1,216	-696
2007	1,271	-648	2019	1,216	-696
2008	1,252	-669	2020	1,216	-696
2009	1,232	-690			

Traffic Forecasts for SH190, Segments I through IV

In previous T&R reports for the NTTA, WSA has worked with the Dallas MPO's traffic model and collected extensive traffic surveys and counts. For this T&R study, WSA began with the NCTCOG traffic model, which they had used previously for their 1992 T&R report. The model inputs included the 1986 and 2010 network systems and trip tables. The 1996 base year network was created by adjusting the 2010 network to represent the actual built network characteristics.[20]

WSA reviewed the NCTCOG information for the cities of Garland and Rowlett as the project corridor runs through these cities and supplemented the information with additional data. Based on the area's Transportation Improvement Program (TIP), WSA created new networks for years: 1998, 1999, 2001, and 2004. Each network included those SH190 segments that would become operational during that year. The 2004 network was thus the first network with the entire SH190 operational. For comparison, WSA also created no-build networks[21] for the same years.

At the time of the T&R report, the NTTA was considering implementing dynamic pricing. The 1986 trip table, however, only had daily traffic volumes. WSA divided the daily traffic volume trip table into A.M. peak, P.M. peak, and off-peak trip tables. The demographic inputs—i.e., population and employment—from the 1990 Census and the latest TIP for the Dallas-Fort Worth Metropolitan area were then used to adjust the 1986 trip table to 1990 conditions. WSA subsequently converted the 1990 trip tables to 1994 trip tables[22]. The 1994 trip tables were revised using previously collected survey data[23]. WSA also updated the 2010 trip tables—used previously in their 1992 T&R report—given revised 2010 demographic forecasts.

In addition to dynamic pricing, NTTA was considering implementing HOV lanes. Thus, the trip tables were further subdivided into single occupancy (SOV) trips and high occupancy vehicle (HOV) trips for each time period, resulting in six trip tables for each year. The 1994 trip table was used to calibrate the model, using WSA traffic survey data. The various model runs used the 2004 SOV and HOV trip tables (separately) in different scenarios, including:

- no build condition, i.e., no SH190,
- non-toll condition, and
- various toll pricing strategies, i.e., mainline passenger car toll ranging from $0.50 to $1.50 in $.025 increments, which resulted in the selection of an optimum toll rate.

The model forecasted traffic levels on SH190 in the trip assignment step. The toll was implemented as a time penalty. This assignment process dynamically takes account of growing congestion on alternative routes. Thus, if the non-tolled route's congestion levels increase then the travel time on the non-tolled route will also increase. The toll paid—implemented as a time penalty—will become relatively smaller, resulting in the increased attractiveness of the toll road. WSA repeated this trip assignment process for the 1998, 1999, 2001, and 2010 trip tables under the three scenarios listed above.[24] The output is forecasted traffic volumes on SH190 for the four years. WSA extrapolated the 2010 traffic volumes to 2020 levels.[25]

WSA assumed in their model predictions that the following 12 conditions will be met:

1. "The opening schedule will be as … [tabled previously in this Appendix].

[20] These characteristics include actual speeds or roadway capacity, confirming that the link is actually built and operational, as well as other factors.
[21] Networks without SH190.
[22] 1994 is the base year in the WSA model.
[23] Model generated data were replaced with count data where count data were available.
[24] Using the optimum toll rate from the range of toll rates tested.
[25] 2020 is the design year for traffic.

2. *The location of interchanges and general route alignment will be as discussed in this [T&R] report.*

3. *The recommended toll collection concept and toll schedule will be adopted as shown in this [T&R] report, and the same toll rates will remain in effect throughout the forecast period.*

4. *Capacity constrained diversion traffic assignments were developed assuming a six lane facility.*

5. *Traffic and toll revenue estimates are based on the assumption that the necessary improvements would be implemented on the proposed facility to meet future year traffic demands.*

6. *Existing toll rates on the DNT and Addison Airport Tunnel are assumed to remain in effect throughout the forecast period.*

7. *Improvements to the present highway system in the travel corridor will be limited to those currently scheduled in the Transportation Improvement Program prepared by NCTCOG and TxDOT, and no competing limited-access highways will be constructed in the turnpike corridor.*

8. *A fully-attended system of toll collection is assumed at all toll plaza locations.*

9. *In accord with the policy on all toll facilities operated by the Authority, the S.H. 190 Turnpike will be well-maintained, efficiently operated, and effectively signed, to encourage maximum usage.*

10. *Economic growth in the travel corridor and the prospects of future expansion generally will follow the assessment described in this [T&R] document.*

11. *Motor fuel will remain in adequate supply, and future increases in fuel price will generally occur in proportion to the overall rate of inflation.*

12. *No local, regional, or national emergency will arise which would abnormally restrict the use of motor vehicles."*

Some of these assumptions were specific to the road (e.g., the opening dates), but the majority are project neutral and are listed in most of WSA's NTTA T&R reports.

WSA reviewed the planned improvements to the traffic network in the DFW area. These improvements were included in the 1994 DFW TIP and in NCTCOG's Mobility 2010: The Regional Transportation Plan. The planned improvements by the state were obtained from TxDOT. A total of 37 projects were considered with completion dates ranging from 1994 to beyond 2002.

WSA also conducted a toll sensitivity analysis of the 2004 model outputs. One of the earlier tested scenarios included a range of mainline toll rates from $0.50 to $1.50 (in $0.25 increments). Assuming higher toll rates for higher axle counts, WSA tested both peak and off-peak period toll sensitivity. The peak periods comprised 6 hours and the off-peak period comprised the remaining 18 hours. The ramp tolls were assumed to be lower than the mainline tolls. The resulting per-mile toll associated with a mainline barrier toll rate that ranged from $0.50 to $1.50 is provided in Table E13.

Table E13: Barrier Toll Rate and Per-Mile Toll Rate

Mainline Barrier Toll Rate ($)	Per-Mile Rate ($)
0.50	0.076
0.75	0.114
1.00	0.154
1.25	0.189
1.50	0.227

The toll sensitivity curves were provided in the T&R report, but were not replicated in this appendix. However, the peak period curve shows increasing revenue with increasing toll rates beyond a peak period toll rate of a $1.50. WSA suggested an optimum toll rate of $1.50. In the case of the off-peak period curve revenue started to reach a plateau at the $1.00 and $1.25 toll rate. WSA estimated that the optimum off peak toll rate is $1.00, but recommended the use of a $0.75 toll rate as the curve is moderately flat[26]. Although WSA conducted this toll sensitivity analysis, the recommended toll rates were based on the current DNT toll rate policy. This resulted in a mainline and ramp toll rate of $0.50 and $0.25, respectively[27].

WSA also recommended that the toll collection system used on the DNT be implemented on SH190. This will ease operations for the NTTA and facilitate inter-operability at the DNT and SH190 intersection. Four mainline toll barriers and various toll ramps were recommended for the barrier toll collection system. This translates into one mainline barrier per segment, which facilitates the different opening dates of the various segments.

Exceptions to the barrier system were the non-toll exits at I635, I35E, US75, and SH78. These exceptions resulted from an earlier TTA decision. These non-toll exits resulted in some inequality in the toll rate per mile. WSA corrected this by increasing the toll rate on the Belt Line Ramp to $0.50 instead of $0.25.

WSA estimated opening year average daily traffic volumes by ramp and plaza for the segment's opening year and for the year 2020. It was noted that these volumes would be slightly higher on a weekday and slightly lower on a weekend. A summary of the average daily traffic volumes by segment are provided in Table E14.

Table E14: Estimated Average Daily Traffic in Opening Year

Segment	Average Daily Traffic			
	1998	1999	2001	2004
IA	10,800	12,400	20,200	22,000
IB	37,000	54,800	63,600	70,400
II		63,200	66,000	69,200
III			50,800	62,600
IV				41,000
Total	47,800	130,400	200,600	265,200

[26] The off-peak period curve is flatter than the peak period curve for all toll rates.
[27] Translating into a through trip cost of $2.00 or $0.076 per mile.

After segment III opens in 2001, the peak volume appeared to be concentrated around US75. In 2004, this same location was forecasted to experience a traffic volume of more than 72,000 vehicles per day. Few through trips were predicted for SH190. Instead SH190 was expected to serve as a beltway, resulting in shorter trips. WSA conducted a corridor share analysis to test the reasonableness of their forecasted 2004 average daily traffic volumes. WSA used four screenlines—one for each segment—to determine the existing traffic volumes on the routes from which future SH190 traffic was expected to divert from. WSA divided the traffic between the new SH190 and the other existing routes. The results are shown in Table E15.

Table E15: Corridor Share Analysis

		Percent of Corridor Traffic (%)		Difference (%)
		1994	2004	
Screenline 1—Segment II				
	Park Boulevard	2.3	3.0	0.7
	SH190	0.0	11.2	11.2
	Belt Line Road	6.3	4.3	-2.0
	I635	41.6	33.6	-8.0
	Other Routes	49.8	47.9	-1.9
	Total	100	100	-
Screenline 2—Segment II				
	SH121	3.1	4.8	1.7
	Park Boulevard	5.7	4.1	-1.6
	SH190	0.0	7.1	7.1
	Belt Line Road	4.3	3.0	-1.3
	I635	47.1	47.4	0.3
	Other Routes	39.8	33.6	-6.2
	Total	100	100	-
Screenline 3—Segment III				
	SH121	6.1	6.3	0.2
	Hebron Parkway	3.8	2.3	-1.5
	SH190	0.0	8.8	8.8
	Belt Line Road	7.4	4.3	-3.1
	I635	50.2	50.5	0.3
	Other Routes	32.5	27.8	-4.7
	Total	100	100	-
Screenline 4—Segment IV				
	SH190	0.0	16.9	16.9
	I35E	76.2	67.4	-8.8
	Josey Lane	18.3	13.8	-4.5
	Other Routes	5.5	1.9	-3.6
	Total	100	100	-

Based on WSA's estimates of corridor demand, Segment IV had the highest traffic diversion rate and Segment II had the lowest traffic diversion rate. These rates were, however, not adjusted for the traffic volumes on the segments, so they were not an indicator of how traffic on the four segments is distributed. Table E16 provides the percentage traffic on each segment in 2004, based on the original WSA forecast and the corridor share analysis, as well as the difference between the two forecasts.

Table E16: Comparison between Original and Corridor Share Forecasts

Segment	Original WSA Forecast		Corridor Share Forecast		Difference (Original—Corridor Share)	
	Average Daily Traffic	Percent of ADT (%)	Average Daily Traffic	Percent of ADT (%)	Average Daily Traffic	Percent of ADT (%)
I	92,400	35	46,000	24	46,400	11
II	69,200	26	56,000	29	13,200	-3
III	62,600	24	53,600	28	9,000	-4
IV	41,400	16	35,600	19	5,800	-3
Total	265,600	100	191,200	100	74,400	

The 2020 traffic forecasts are provided in Table E17.

Table E17: Estimated Average Daily Traffic in 2020

Location	Average Daily Volume (vehicles)
Four Mainline Toll Plazas	85,000 to 105,000
Segment Volumes	slightly below 100,000
Peak Load Point	136,000

WSA also forecasted the opening year revenue for each of the segments. However, these forecasts were not adjusted for ramp-up effects and are an entire year of revenue. However, a segment could be operational for only six months in the opening year, reducing the revenue by 50 percent. Table E18 provides WSA's opening year revenue forecasts by segment.

Table E18: Estimated Annual Toll Revenue in Opening Years

	Annual Toll Revenue ($)			
Segment	**1998**	**1999**	**2001**	**2004**
IA	1,021,840	1,178,060	1,932,040	2,111,278
IB	6,157,405	9,023,412	10,692,040	11,931,175
II		10,003,073	10,692,040	11,931,175
III			9,045,385	11,404,963
IV				8,379,153
Total	7,179,245	20,202,545	32,168,400	44,869,449

As mentioned earlier the revenues above do not account for any ramp-up effects. The ramp-up period of a toll road is particularly uncertain and often results in significantly lower revenues during the first five years. WSA thus revised the estimated annual revenue to account for ramp-up (see Table E19).

Table E19: Estimated Annual Toll Revenue with Ramp-up Effects

Year	Annual Revenue ($ million)	Year	Annual Revenue ($ million)
1998	6,275	2009	57,113
1999	7,236	2010	60,444
2000	11,384	2011	62,081
2001	30,766	2012	63,761
2002	31,955	2013	65,488
2003	32,913	2014	67,261
2004	42,613	2015	69,082
2005	45,526	2016	70,953
2006	48,181	2017	72,847
2007	50,991	2018	74,847
2008	53,965		

WSA also forecasted daily traffic volumes and revenues given the implementation of HOV lanes on SH190. The addition of HOV lanes was proposed, but never implemented. These forecasts were included in the T&R report, but are not duplicated in this appendix.

Differences in Historical and Actual Trends

A comparison between historical and actual trends is complicated by the fact that few historical trends were considered.

<u>Demographic Trends</u>

The only demographic trends WSA reviewed were historical population values. The forecasted population growth rates compared with actual population trends are included in the next section. The growth indicators WSA reviewed were age distribution, median income, retail sales, motor vehicle registrations, and energy conditions. The trends in some[28] of these indicators are discussed below.

The change in median household income between 1990 and 2004 in the SH190 corridor is illustrated in Figure E9.

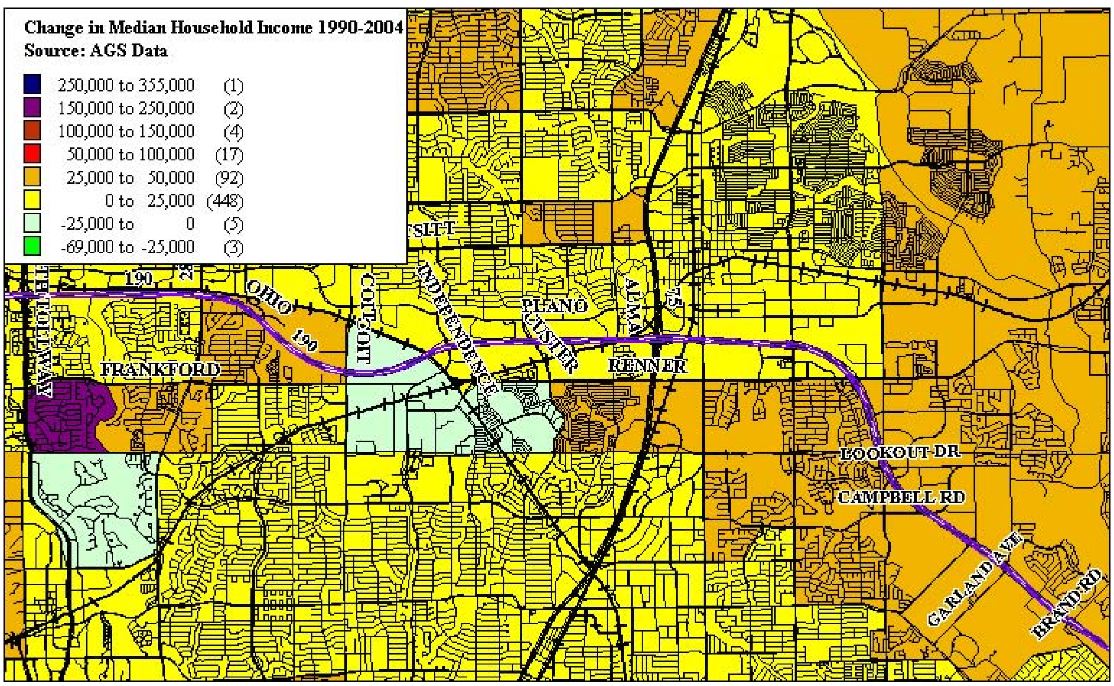

Figure E9: Change in Median Household Income in the SH190 Corridor[xii]

Figure E10 illustrates the trend in the median household income for Dallas, Denton, and Collin Counties. The first two values are from WSA's 1995 report and the last two values are from the Census Bureau.

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[28] The age distribution, retail sales, and motor vehicle registration trends could not be compared as data were unavailable.

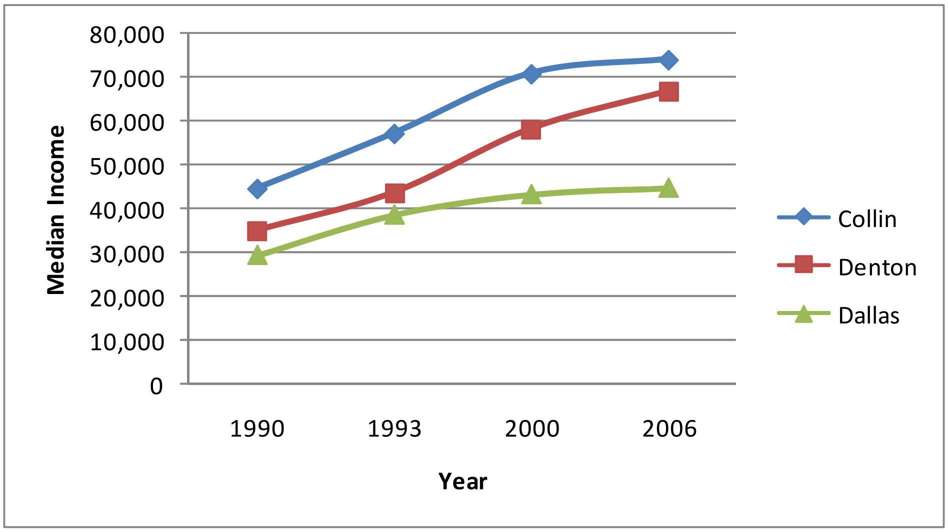

Figure E10: Median Household Income[xiii]

Figure E10 shows that median household income has increased substantially since WSA's 1995 report.

The energy situation has changed dramatically since WSA's 1995 assessment. At that time, the real cost of oil was actually decreasing year to year. For comparison, in early 2008 oil prices have reached $130 a barrel as opposed to $15 a barrel in 1995. This impacts fuel prices and potentially traffic volumes on SH190.

Existing Local System and NTTA System Growth Trends[29]

Updated information for the traffic counts used by WSA is not available, but WSA did undertake another mail-back card survey during their 2007 T&R report for NTTA. From this survey, updated trip purpose, trip distribution, and trip frequency information are available. Although the survey locations were not the same as in the 1995 study, WSA did distribute cards on the DNT and SH190 routes. WSA's analyzed the survey information:

- for the peak and off-peak periods,
- for mainlines and ramp plazas,
- by cash and Tolltag responses, and
- for the DNT and SH190 routes.

The information illustrated in this section is for the mainline, peak period, cash SH190 respondents. These survey responses were compared with the earlier survey results. Table E20 compares the 1995 and 2005 survey findings relating to trip purpose.

[29] Unless otherwise noted, the information and data in this section are from the 1995 NTTA Bond Document and the 2007 SH121 report as referenced.

Table E20: Trip Purpose Comparison

Trip Purpose	1995	2005	Difference (1995 and 2005)
	Percent		
Work Commuting	45.3	66.4	21.1
Personal Business	18.1	12.2	-5.9
Company Business	18	9.8	-8.2
School Related	3	3.2	0.2
Shopping	9.2	1.6	-7.6
Recreation or Social	6.4	6.8	0.4

WSA noted numerous times that a major objective of SH190 was to relieve commuter congestion. The 2005 survey revealed a much higher percentage of commuting trips compared to the 1995 values used as an input to forecast traffic on SH190. It is unclear what the impact of this variable was on the forecasted traffic and revenue levels, but the data does seem to validate the hypothesis of SH190 commuter route.

Table E21 compares the 1995 and 2005 survey findings relating to trip frequency.

Table E21: Trip Frequency Comparison

Number of Trips/Week	1995	2005	Difference (1995 and 2005)
	Percent		
Less than 1	18.5	18.7	0.2
1	7.4	6.5	-0.9
2	8.1	10	1.9
3	8.5	9.8	1.3
4	5.3	5.3	0
5	28.8	34.9	6.1
Six or more	23.4	14.8	-8.6

In general, there seems to be very little difference between the trip frequency reported during 1995 and the 2005 surveys. However, a higher percentage of respondents indicated making their trip five times a week (34.9 percent in 2005 compared to 28.8 percent in 2005), while a lower percentage indicated making trips six or more times per week (14.8 percent in 2005 compared to 23.4 percent in 1995). This survey finding substantiates the trip purpose findings. Commuting trips are usually made five times a week, and as a higher percentage of commuting trips were reported, a higher percentage of five trips per week can be expected.

Finally, Table E22 summarizes the survey findings on trip occupancy

Table E22: Vehicle Occupancy Comparison

Vehicle Occupancy	1995	2005	Difference (1995 and 2005)
	Percent		
1	75.5	83.3	7.8
2	16	11.7	-4.3
3	5.1	2.5	-2.6
4 or more	3.4	2.5	-0.9

From Table E22, it is clear that a higher percentage of respondents indicated SOV use in 2005 compared to 1995, while all the remaining categories of vehicle occupancy recorded lower percentages in 2005 compared to 1995. Again, this concurs with the increasing commuting trips reported.

WSA did forecast the revenue impact of the construction of SH190 on the existing NTTA system, but the consultant did not provide revised revenue forecasts for the existing system. As it is not possible to distinguish the trips associated with SH190 on the DNT and other components of the NTTA system from the NTTA's revenue reports, this estimate could not be verified. Finally, the T&R report did not document the assumed growth rates of the current system, so again forecasted and actual growth rates could not be compared.

Differences in Actual and Forecasted Traffic

In this section, the forecasted traffic and revenue is compared with actual traffic and revenue and the differences are discussed. An attempt is also made to highlight the impact of estimates for, for example, ramp-up on the road's actual traffic volumes and revenue.

Dallas Area Assumptions

The demographic forecast included predicted average annual growth rates for population and employment between 1990 and 2010. Table E23 compares the projected and actual population growth rates at the county level.

Table E23: Forecasted and Actual Average Annual Population Growth Rates[xiv]

County	WSA Projected Growth Rate (%) 1990 to 2010	Actual Growth Rate (%) 1990 to 2000
Collin County	6.4	3.9
Dallas County	1.8	0.7
Denton County	4.7	2.8

As can be seen from Table E23, WSA's projected population growth rates were much higher than the actual growth rates for all three counties. Figure E11 illustrates where population growth occurred in the SH190 corridor between 1990 and 2000.

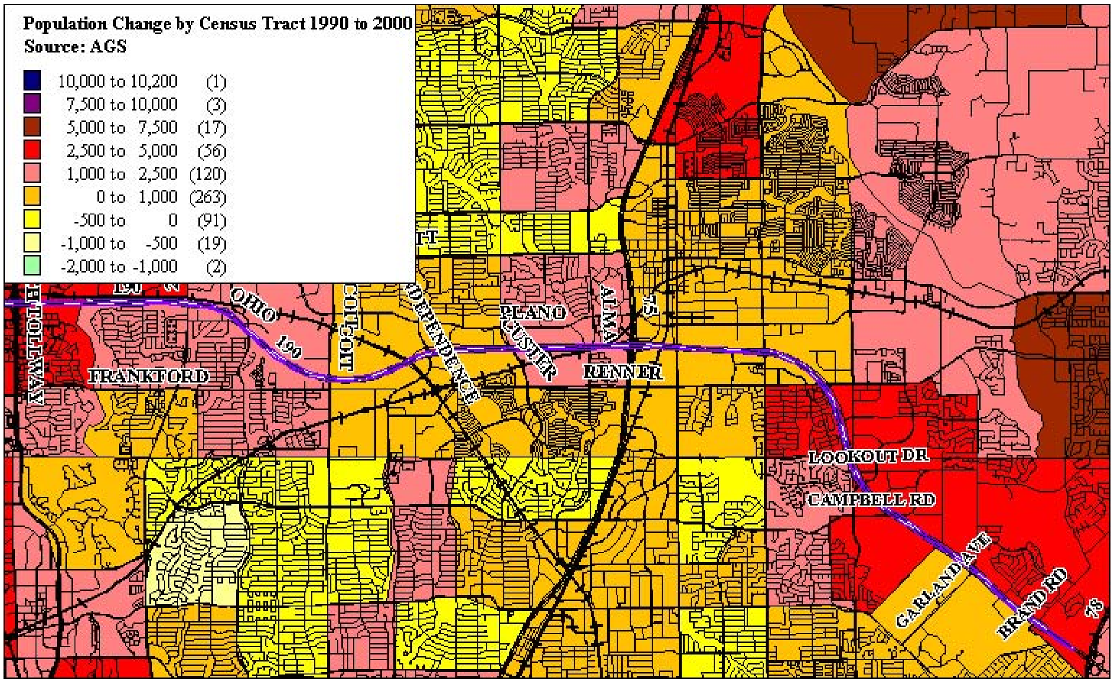

Figure E11: Population Growth in the SH190 Corridor[xv]

As mentioned earlier, population values are used to forecast trip productions in an area. The overestimation of population growth rates would thus arguably overestimate the demand and thus forecasted usage of the facility. Table E24 compares the predicted and actual average annual employment growth rates at the county level between 1990 and 2010.

Table E24: Forecasted and Actual Average Annual Employment Growth Rates[xvi]

County	WSA Projected Growth Rate (%) 1990 to 2010	Actual Growth Rate (%) 1990 to 2000
Collin County	4.3	6.4
Dallas County	1.7	1.8
Denton County	3.3	4.7

As is evident from Table E24, the employment growth rates projected by WSA were lower than the actual growth rates in Collin and Denton County. However, in the case of Dallas county the forecasted employment growth rate is similar to the actual growth rate. Employment is a key indicator in the estimation of trip attractions, and thus, the higher the employment the more trip attractions in the county. In general, there is some correlation between population and employment growth rates. In this case, however, the population forecasts were higher and the employment forecasts were lower. The ultimate impact on toll road usage could thus have balanced out, but without a clear understanding of how these values were used in the estimation process, the differences in the actual and forecasted growth rates can only be noted.

Traffic Projections for SH190, Segments I through IV

WSA listed twelve assumptions that were the basis of their forecasts. An important assumption that impacted the traffic on SH190 was the proposed opening schedule. The actual opening schedule is compared with the assumed 1995 and 1997 opening schedule in Table E25.

Table E25: Actual and Assumed Opening Schedule[xvii]

Segment	Borders	1995 Scheduled Opening	1997 Scheduled Opening	Actual Opening Date
Phase IA	Midway Road to Preston Road	Mar-98	Nov-98	Dec-98
Phase IB	Preston Road to Coit Road	Mar-98	Feb-99	Jun-99
Phase IC	Coit Road to US75		Aug-99	Dec-99
Phase IIA	US75 to North Garland Road	Jul-99	Aug-99	Dec-99
Phase IIB	North Garland Road to SH78		Oct-99	Apr-00
Phase III	Midway Road to I35E	Jul-01	Jul-01	Jul-01
Phase IV	I35E to I635	Jul-04	Jul-04	Jan-06

The delayed opening dates must have resulted in lower traffic and revenue, but it is not clear by how much. In the case of the Phase IIB and Phase IV segments, the opening was delayed substantially. It should be noted that the 1997 bond document revised the opening schedule, but even these dates were ultimately optimistic in all cases except the Phase III segment.

WSA's Average Annual Daily Traffic (AADT) forecast was for each segment's opening year, making a comparison between forecasted and actual AADT somewhat problematic. Nonetheless, available forecasted and actual AADT values are compared in Table E26 and Figure E12. However, it should be noted that the actual values include volumes from Segment V, which were not included in the forecast.

Table E26: Actual versus Forecasted AADT[xviii]

Year	Average Annual Daily Traffic (AADT)	
	Forecasted	Actual
2000	-	120,312
2001	200,600	197,518
2002	-	323,249
2003	-	341,392
2004	265,200	350,704
2005	-	387,454
2006	-	472,916

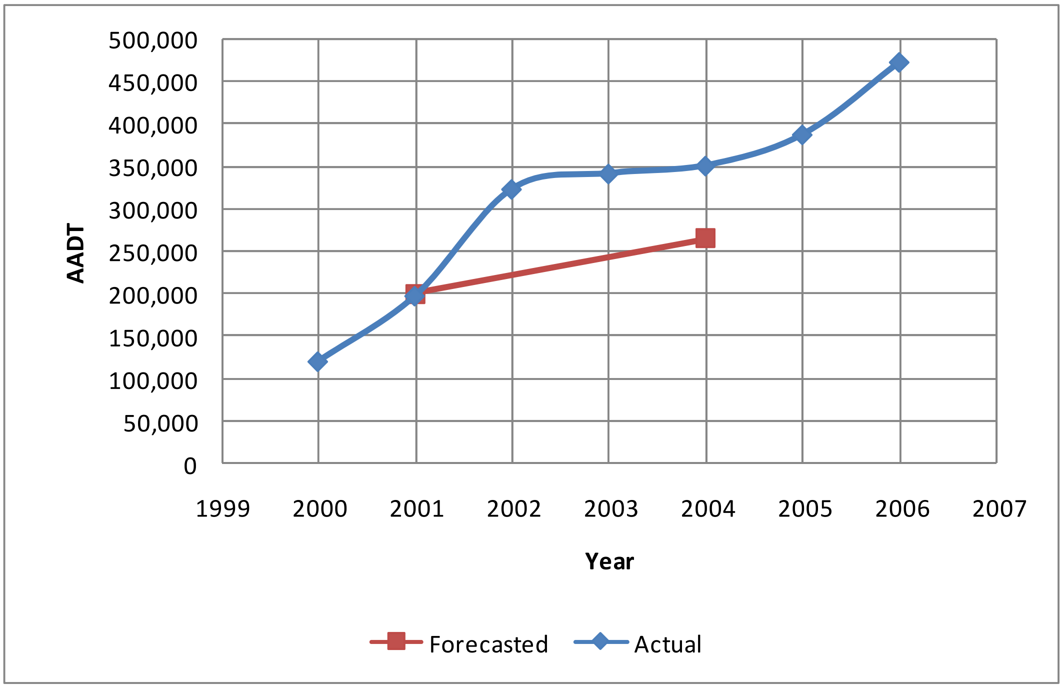

Figure E12: Actual versus Forecasted AADT

From the above Table and Figure it is evident that only two data points can be compared: the AADT for 2001 and 2004. Although it seems that the actual traffic has exceeded the forecasted traffic, both years—but especially 2004—include traffic on Segment V that was not accounted for in the forecast.

WSA conducted two revenue forecasts: a revenue estimate that ignored any ramp-up effects for 2001 and 2004, and a ramp-up adjusted revenue estimate for 1998 to 2028. Again, the actual revenue values include revenue from Segment V whereas the forecasted revenue did not consider Segment V. Figure E13 illustrates the differences between actual and forecasted revenues.

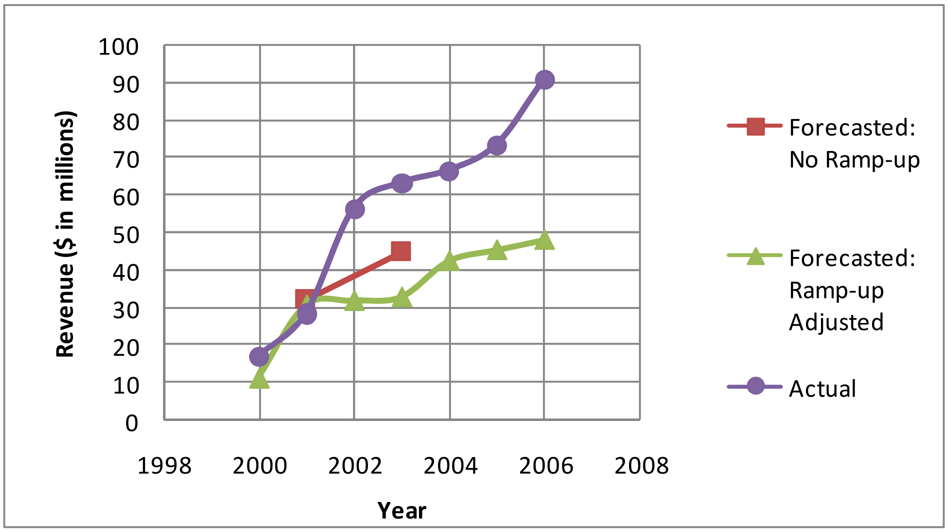

Figure E13: Actual and Forecasted Revenue[xix]

In most years, the actual revenue has been growing at about the same rate as the ramp-up adjusted forecasted revenue (as is evident by the slope of the lines). The exceptions are years 2002 and 2003. Segment V opened in December 2001, so the dramatic increase in revenue in 2002 could be attributable to the opening of Segment V.

Ramp-up and Opening Schedule

WSA mentioned that ramp-up effects were considered in the final revenue forecast, but this statement was not elaborated. However, combined with the delayed opening schedule, it is arguable that both ramp-up and the delayed opening must have impacted actual revenues during the first two to three years.

ETC effect

WSA did not mention whether the use of ETC tags was considered in the traffic and revenue forecasts of SH190. ETC tags facilitate faster travel times and is often argued reduce users' sensitivity to the charged toll, thus potentially resulting in increased usage. The use of ETC on SH190 would thus arguable have had a positive impact on traffic volumes and revenues.

Annualisation Factor

WSA offers no explanation of how AADT were converted to annual totals. Often the conversion from daily to annual values can be tainted by the use of an inappropriate annualisation factor. This can, however, only be noted as WSA did not provide the annualisation factors that were used in their forecasts.

General Observations and Conclusion

WSA forecasted only AADT for selected years, resulting in only two data points—i.e., 2001 and 2004—as of yet that can be compared. Furthermore, no annual volumes were provided. Table E27 and Figure E14 thus provide the ratio of actual to forecasted revenues instead of actual to forecasted usage.

Table E27: Ratio of Actual to Forecasted Revenue[xx]

Year	Ratio
2000	1.52
2001	0.93
2002	1.77
2003	1.92
2004	1.57
2005	1.62
2006	1.89

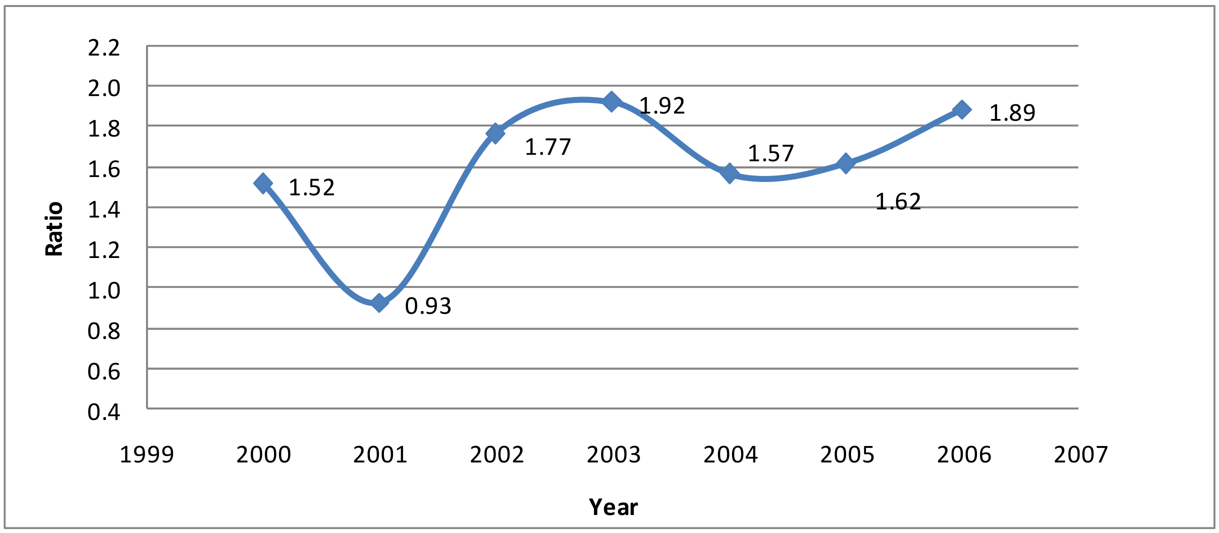

Figure E14: Ratio of Actual to Forecasted Revenue

Given that the actual revenues include revenue from Segment V that was not included in the WSA forecasts, the above Table and Figure have to be interpreted with some caution. However, it appears that WSA underestimated revenues in 2000 and slightly overestimated revenues in 2001. In December 2001, Segment V opened. From 2002 onwards it is thus not an apples-to-apples comparison.

NTTA 1998 Bond Document

The 1998 Bond Document funded Segment V of SH190 and included an updated T&R forecast for Segment V. However, most of the assumptions used in the 1995 T&R report were also used in the 1998 T&R report. Thus, this section of the appendix focuses only on those assumptions that differ from the assumptions that were included in the 1995 T&R report.

SH190, Segment V[30, xxi]

Segment V in the City of Irving linked Segment IV to the north end of SH161. Users of Segment V could also reach SH183 through its connection with SH161. The 3.7-mile route was anticipated to have ramps at San Jacinto, Royal Lane, Gateway Road, and Las Colinas Boulevard. Segment V would increase the length of SH190 to 30.5 miles. Figure E15 illustrates the location of Segment V.

Figure E15: SH190, Segment V Funded by the 1998 Bond Document

It was anticipated that Segment V would provide a faster commuting route and a link to the DFW airport from eastern Dallas and Tarrant Counties. Also, the construction of this segment would help complete the outer loop around the Dallas area. The road was expected to divert traffic from major highways—e.g., I635, SH114, and SH183—and from major arterials—e.g., Belt Line Road, MacArthur Boulevard, Valley View Lane, and Luna Road. No cost estimates were included in the bond document for the construction of the segment.

[30] Unless otherwise noted, the information and data in this section are from the 1998 NTTA Bond Document.

Summary of the Existing Conditions[31, xxii]

Again, this section only discusses the information that differs from the information that was discussed with regards to the 1995 T&R report.

Dallas

In the 1995 T&R report, WSA listed population growth rates for 1970 to 1980, 1980 to 1990, and 1990 to 2010. In the 1998 T&R, WSA listed population growth rates for 1990 to 1995, 1995 to 2005, 2005 to 2010, and 2010 to 2020. WSA provided more detailed employment growth rates in the 1998 T&R report as well. The 1998 report included employment growth rates for 1990 to 1995, 1995 to 2005, 2005 to 2010, and 2010 to 2020. The 1995 study only provided employment growth rates for 1990 to 2010. The revised historical population and employment growth rates are provided in Table E28. The future growth rates are discussed in a subsequent section.

Table E28: Average Annual Population and Employment Growth Rates

Study Area		**Average Annual Population Growth Rate (%)**	**Average Annual Employment Growth Rate (%)**
		1990 to 1995	**1990 to 1995**
Dallas County		0.7	2.0
	Irving	1.4	2.7
	Study Corridor	1.3	2.7
Denton County		3.0	4.4
Tarrant County		1.3	1.6

WSA discussed the existing land use in the proposed Segment V corridor and the City of Irving. The land use in Irving was dominated by residential developments[32]. The City of Irving experienced dramatic growth in past decades, mostly spurred by the development of the Dallas Fort Worth (DFW) Airport. The other major traffic generator in the area was the Las Colinas area, which houses a large share of the employment in Irving.

Local Transportation System

Overall, the annual traffic growth trends described in the 1998 T&R study were duplicated from the 1995 T&R report. However, WSA conducted additional field surveys in October 1996 and April 1997. The data collection effort comprised the distribution of mail-back cards and machine traffic counts at ten survey stations. The survey locations formed two screenlines as follows:

- Screenline G—six survey locations for motorists traveling north-south in the Segment V corridor.

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31 Unless otherwise noted, the information and data in this section are from the 1998 NTTA Bond Document.

32 About 22 percent of the land use comprised single-family developments and 4.3 percent was multi-family developments.

- Screenline F—four survey locations for motorists traveling on SH183

Table E29 summarizes the general characteristics of the mail-back card survey.

Table E29: Mail-back Card Survey

Number of Stations	10
Total Number of Vehicles during Operation Hours	68,250
Total Number of Cards Distributed	49,642
Total Number of Returned and Useable Cards	9,844
Sample (%) of Passing Traffic	14.4
Sample (%) of Distributed Cards	19.8

Information on trip purpose and vehicle occupancy was collected. Figure E16 illustrates the percentage of trips reported by trip purpose.

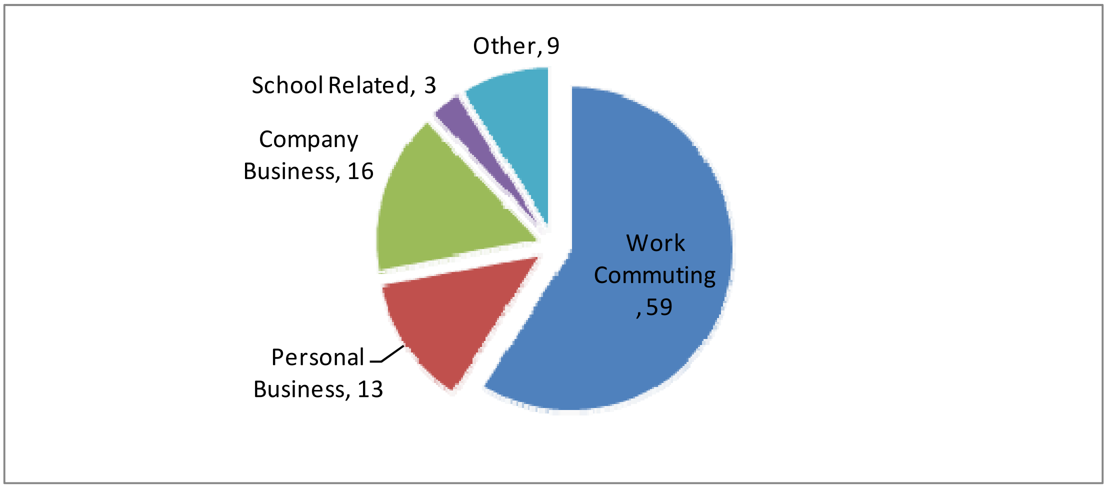

Figure E16: Trip Purpose Distribution

Figure E17 shows a higher percentage of commute trips compared to 1995 (59 percent compared to 45 percent in the 1995 T&R report). Similarly, a higher percentage of respondents indicated single occupant vehicle use (81 percent) in the 1998 T&R report compared to the 1995 T&R report (76 percent).

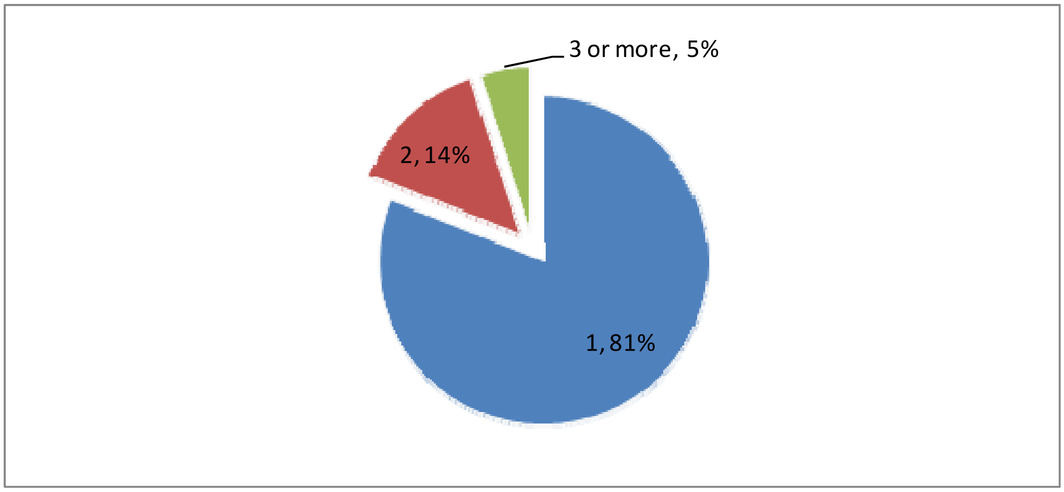

Figure E17: Vehicle Occupancy Distribution

Even though the survey response distributions were different (as noted), the overall trends and conclusions regarding trip purpose and trip occupancy were the same in the 1998 T&R report as in the 1995 T&R report. In other words, the majority of the trips are commuter trips and single occupant vehicles are the dominant mode. Furthermore, the trip frequency information indicated that 59 percent of the respondents made five or more trips per week. Only 15 percent of the respondents indicated that they made less than one trip a week. Finally, the vehicle classification counts revealed that passenger cars represent 99 percent of the traffic volume.

For Segment V, WSA developed four additional travel time runs. The alternative non-SH190 routes[33] were chosen based on existing traffic flows and logical route choices. The start and end distances, the travel time, and the calculated average speed are provided in Table E30.

[33] Although not included in this section, the bond document does provide the exact routes driven in each case.

Table E30: Time-Distance Relationships during the A.M. Peak

Start	End	Route	Distance (miles)	Time (minutes)	Average Speed (mph)
Lewisville (I35E at SH121)	Arlington (I30 at SH60)	Existing	25.2	30.5	50
		SH190	21.8	21.7	60
Plano (US75 at FM544)	Fort Worth (I30 at I820)	Existing	40.6	51.6	47
		SH190	40.6	40	61
Farmers Branch (I635 at the DNT)	Arlington (I20 at SH360)	Existing	29.6	39.8	45
		SH190	27	31	52
Plano (SH121 at the DNT)	Irving (Segment V at Belt Line Road)	Existing	21	28.6	44
		SH190	19.6	18.8	63

In all four cases, the average speed was higher using SH190, ranging from 7 mph to 19 mph faster than the existing alternatives. In all four cases, the SH190 thus resulted in time savings, ranging from about 9 to 12 minutes.

Toll Transactions on Existing NTTA System

As in the 1995 T&R report, WSA did not refer to the historical traffic growth rates on NTTA's existing system.

Forecasted Traffic and Revenue[34, xxiii]

The 1998 forecasts used the 1990, 1995, 2000, 2010, and 2020 NCTCOG trip tables and zonal socioeconomic data sets as a basis. The future land use assumptions were based on discussions with city and regional agencies, as well as other organizations such as the area's Chamber of Commerce.

Dallas

The demographic forecasts reported in the 1995 T&R report were revised as summarized in Table E31.

[34] Unless otherwise noted, the information and data in this section are from the 1998 NTTA Bond Document.

Table E31: Forecasted Population and Employment Growth Rates in the Project Corridor

Study Area		Average Annual Population Growth Rate (%)			
		1995 to 2005	2005 to 2010	2010 to 2020	1995 to 2020
Dallas County		0.8	0.8	0.5	0.7
	Irving	1.3	1.3	0.8	1.1
	Study Corridor	1.2	1.2	1.2	1.2
Denton County		2.8	2.8	2.6	2.7
Tarrant County		1.3	1.3	1.0	1.2
Study Area		**Average Annual Employment Growth Rate (%)**			
		1995 to 2005	**2005 to 2010**	**2010 to 2020**	**1995 to 2020**
Dallas County		1.6	1.6	1.2	1.4
	Irving	2.0	2.0	1.6	1.8
	Study Corridor	2.0	2.0	2.9	2.4
Denton County		3.0	3.0	4.2	3.5
Tarrant County		2.3	2.3	1.9	2.2

Employment growth was expected to exceed population growth in most areas, especially the study corridor. These values were based on NCTCOG's forecasts. However, WSA did conduct a more detailed inventory of the employment in the corridor by market area (see Table E32).

Table E32: Employment in Immediate Study Corridor*

Employment Market Area	Average Annual Employment Growth Rate (%)	
	1990 to 2010	2010 to 2020
Belt Line/183	1.4	1.0
Centerport	3.2	1.1
DFW Airport	2.1	2.5
Freeport	3.0	3.1
Las Colinas Urban Center	2.4	-0.6
Park West	4.7	6.6
Stemmons Crossing	8.3	4.1
Valley Ranch	3.0	19.3
Valwood	0.9	1.2
Walnut Hill Business Park	1.6	0.0
Stemmons Crossing	1.3	0.9

* Corridor is defined as area bordered SH121, SH183, I35E, and I635

The T&R report noted that when the corridor population and employment information were examined at the traffic zone level, overall trip growth mimicked the demographic information. The 1995 T&R report listed other growth indicators, such as age distribution, median household effective buying income, retail sales trends, energy considerations, and motor vehicle registration trends, but these were not mentioned in the 1998 T&R report.

WSA evaluated future land use in the area, because the Segment V corridor was relatively undeveloped. Potential future trip generators were identified as follows:

- *Las Colinas Urban Center:* This is a mixed land use development with 35,000 employment positions. It was stated that the current employment could increase by three to five times.
- *SH114 Corridor:* As most of the SH114 corridor was expected to be developed in the coming years, employment and population in this area were also expected to grow.
- *Regional Activity District:* The district was scheduled to develop as a high intensity and mixed use activity corridor. As the district was undeveloped, it raised the potential for large population and employment growth.

However, a portion of the Segment V corridor would not be zoned for residential use. This is the result of a potential new runway location for DFW Airport. If the new runway is built, the flight path would be over this portion of the SH190 corridor.

Projections for the Existing NTTA System

WSA revised their projections for the NTTA system considering the following scenarios:

1. A no-build scenario,
2. A segment I-IV build scenario, and
3. A segment I-V build scenario.

Based on these projections, the expected impact of Segment V on the DNT can be determined (see Table E33 and Figure E18). Ramp-up effects were also accounted for.

Table E33: Revised Estimated Toll Revenue of NTTA System

Year	Revenue ($'000)				
	DNT	Addison Tunnel	DNT with Segment V	DNT without Segment V	DNT Increase Attributable to Segment V
1998	58,573	-	58,952	58,952	0
1999	62,966	2,604	70,714	70,714	0
2000	64,305	2,779	84,014	84,014	0
2001	64,562	2,451	90,125	90,125	0
2002	69,573	1,670	109,171	103,154	6,017
2003	70,989	1,894	112,596	105,465	7,131
2004	71,961	2,089	121,312	113,212	8,100
2005	71,435	1,804	131,395	121,608	9,787
2006	72,918	1,956	135,465	125,139	10,326
2007	73,668	2,009	139,615	128,722	10,893
2008	73,668	2,070	143,910	132,469	11,441
2009	74,427	2,131	148,405	136,387	12,018
2010	75,065	2,118	152,900	140,278	12,622
2011	74,898	2,156	156,329	143,114	13,215
2012	75,699	2,195	160,896	147,060	13,836
2013	76,509	2,234	165,645	151,158	14,487
2014	77,326	2,273	170,584	155,417	15,167
2015	78,151	2,313	175,725	159,845	15,880
2016	78,985	2,353	181,048	164,451	16,597
2017	79,827	2,393	186,508	169,239	17,269
2018	80,678	2,434	192,107	174,219	17,888
2019	81,537	2,475	197,847	179,401	18,446
2020	82,405	2,517	203,734	184,795	18,939
2021	83,282	2,557	209,641	190,210	19,431
2022	84,156	2,595	215,629	195,712	19,917
2023	85,031	2,631	221,695	201,300	20,395
2024	85,906	2,665	227,831	206,967	20,864
2025	86,783	2,697	234,032	212,709	21,323
2026	87,660	2,727	240,287	218,516	21,771
2027	88,537	2,757	246,590	224,384	22,206
2028	89,423	2,787	252,941	230,313	22,628

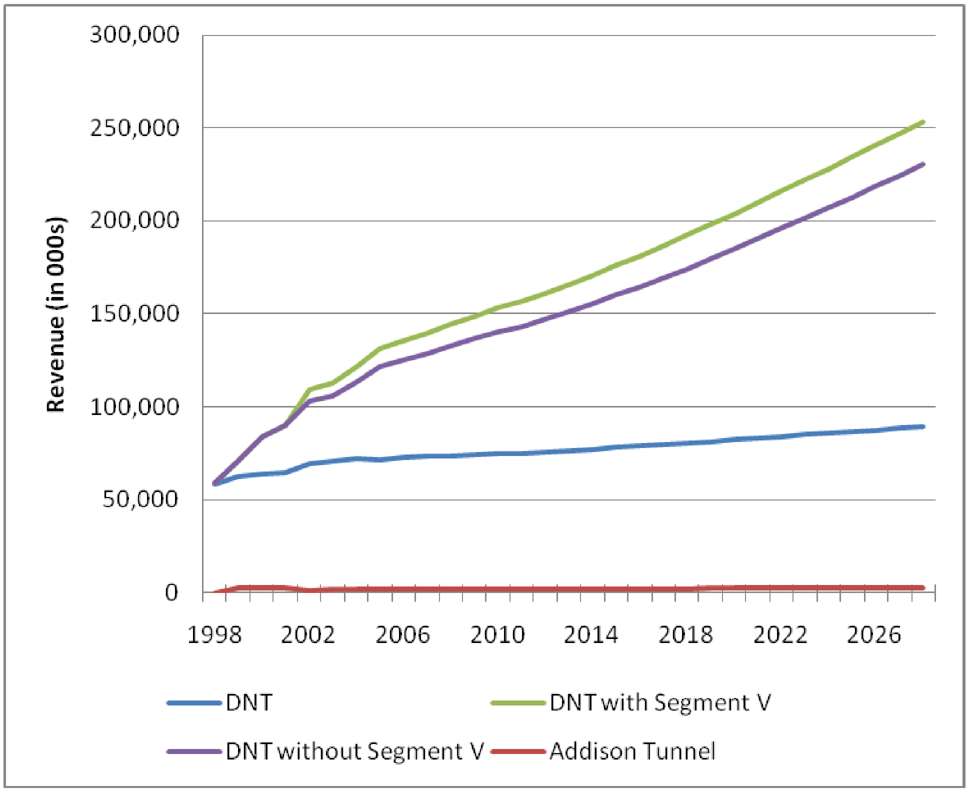

Figure E18: Projected NTTA System Revenue

It is evident from the Table and Figure above that the construction of SH190 was anticipated to have a positive impact on the revenues of the DNT.

<u>Traffic Projections for SH190, Segment V</u>

The same methodology was used in forecasting traffic and revenue for Segment V as was used in the 1995 T&R report. The data, trip tables, networks, and models were the most recent NCTCOG updates. The 1998 forecasted traffic volumes[35] were also based on 12 assumptions. Most of the 1998 assumptions were exactly the same as the 1995 assumptions, with the exception of assumption 1, 3, 4, and 5. The 1998 assumptions were as follows[36]:

1. *"The opening schedule is now as listed in the Table below.*

[35] Diverted volumes were based on the time-distance relationships discussed earlier and diversion rates. The forecasted values also included the expected induced trips.

[36] The numbering is different than in the 1995 T&R report.

Proposed Opening Schedule

Segment	***Borders***	***1995 Scheduled Opening***	***1998 Scheduled Opening***
Phase IA	*Midway Road to Preston Road*	*Mar-98*	*Nov-98*
Phase IB	*Preston Road to Coit Road*	*Mar-98*	*Jun-99*
Phase IC	*Coit Road to US75*		*Dec-99*
Phase IIA	*US75 to North Garland Road*	*Jul-99*	*Dec-99*
Phase IIB	*North Garland Road to SH78*		*Apr-00*
Phase III	*Midway Road to I35E*	*Jul-01*	*Jul-08*
Phase IV	*I35E to I635*	*Jul-04*	*Jul-04*
Phase V			*Jan-02*

2. *The location of interchanges and general route alignment will be as discussed in this [T&R] report.*
3. *The interchange at SH183 and SH161 only directly connects to SH183 access to and from the west.*
4. *The T&R forecasts are based on a 10 percent toll rate increase as well as the removal of the southbound exit ramp north of MacArthur Boulevard. The toll rates for the resulting NTTA system will increase by 10 percent in January 2002.*
5. *The same modeling technique used in the 1995 study was used in this study.*
6. *Capacity constrained diversion traffic assignments were developed assuming a six lane facility.*
7. *Improvements to the present highway system in the travel corridor will be limited to those currently scheduled in the Transportation Improvement Program prepared by NCTCOG and TxDOT, and no competing limited-access highways will be constructed in the turnpike corridor.*
8. *A fully-attended system of toll collection is assumed at all toll plaza locations.*
9. *In accord with the policy on all toll facilities operated by the Authority, the S.H. 190 Turnpike will be well-maintained, efficiently operated, and effectively signed, to encourage maximum usage.*
10. *Economic growth in the travel corridor and the prospects of future expansion generally will follow the assessment described in this document.*
11. *Motor fuel will remain in adequate supply, and future increases in fuel price will generally occur in proportion to the overall rate of inflation.*
12. *No local, regional, or national emergency will arise which would abnormally restrict the use of motor vehicles."*

Given these assumptions, WSA conducted another toll sensitivity analysis. The same analysis methodology was used as in the 1995 T&R report, but updated project configurations, new models, new trip tables, and a 10 percent toll increase was used in the 1998 T&R report. Based on WSA's analysis, it was concluded that a toll rate increase of between 10 and 15 percent will generate the optimum toll revenue. Also, WSA noted that the toll sensitivity on Segment V was higher than on Segment I to IV.

The T&R forecasts for 2002, 2004, 2005, and 2020 are provided in Table E34. These forecasts do not account for any ramp-up effects.

Table E34: Forecasted Traffic Volumes for Segment V

Toll Plaza	Average Daily Traffic ('000s)				Average Toll Rate ($)*		Annual Toll Revenue* ($'000s)	
	2002	2004	2005	2020	2002	2005	2002	2005
North of Royal Lane	1.2	4.6	4.8	13.4	0.280	0.280	122.8	494.3
South of Gateway Drive	1.6	2.4	2.5	4.4	0.561	0.561	327.4	511.6
Barrier Plaza 10	31.4	37.3	39.6	75.4	0.561	0.561	6,246.2	8,104.4
Total	34.2	44.3	46.9	93.2	-	-	6,875.4	9,110.3

* Not listed for 2004 and 2020

The 2002 to 2028 revenue forecasts are listed in Table E35.

Table E35: Estimated T&R for Segment V

Revenue ($'000)					
Year	**Segment V***	**SH190 with Segment V**	**Year**	**Segment V***	**SH190 with Segment V**
1998	-	379	2014	14,769	90,985
1999	-	5,144	2015	14,769	95,261
2000	-	16,930	2016	15,433	99,710
2001	-	23,113	2017	16,051	104,288
2002	6,017	37,928	2018	16,613	108,995
2003	7,131	39,713	2019	17,111	113,835
2004	9,110	47,262	2020	17,541	118,812
2005	9,612	58,155	2021	17,970	123,802
2006	10,140	61,336	2022	128,878	18,390
2007	10,647	64,688	2023	134,033	18,802
2008	11,180	68,172	2024	139,260	19,203
2009	11,739	71,847	2025	144,552	19,593
2010	12,290	75,717	2026	149,900	19,970
2011	12,868	79,275	2027	155,296	20,334
2012	13,473	83,002	2028	160,731	20,684
2013	90,985	14,106			

* Adjusted to reflect ramp-up effects.

Differences in Historical Trends and Actual Trends

Most of these trends were discussed in the section on the 1995 bond document. As mentioned before, the only demographic trend WSA examined was population values, which were discussed in the 1995 T&R section earlier. Also, it should be noted again that the growth indicators discussed in the 1995 section—e.g., age distribution, retail sales, etc.—were not mentioned in the 1998 T&R report. Finally, WSA did not examine or reference traffic trends on the existing NTTA system.

Differences in Actual and Forecasted Traffic

In this section, the forecasted traffic and revenue is compared with actual traffic and revenue and the differences are discussed. An attempt is also made to highlight the impact of estimates for, for example, ramp-up, on the road's actual traffic volumes and revenue.

Projections for Existing DNT

As mentioned earlier, WSA forecasted revenue on the DNT given three scenarios: a no-build scenario, a SH190 with Segments I to IV, and a SH190 with Segments I to V. The results are summarized and compared with the actual revenue on the DNT in Table E36 and Figure E19.

Table E36: Forecasted and Actual Revenue on the DNT[xxiv]

Year	Revenue ($ million)			
	No-build	With Segments I to IV	With Segments I to V	Actual
2000	64.3	84.0	84.0	75.9
2001	64.6	90.1	90.1	76.4
2002	69.6	109.2	103.2	78.6
2003	71.0	112.6	105.5	81.1
2004	72.0	121.3	113.2	86.6
2005	71.4	131.4	121.6	91.2
2006	72.9	135.5	125.1	92.8

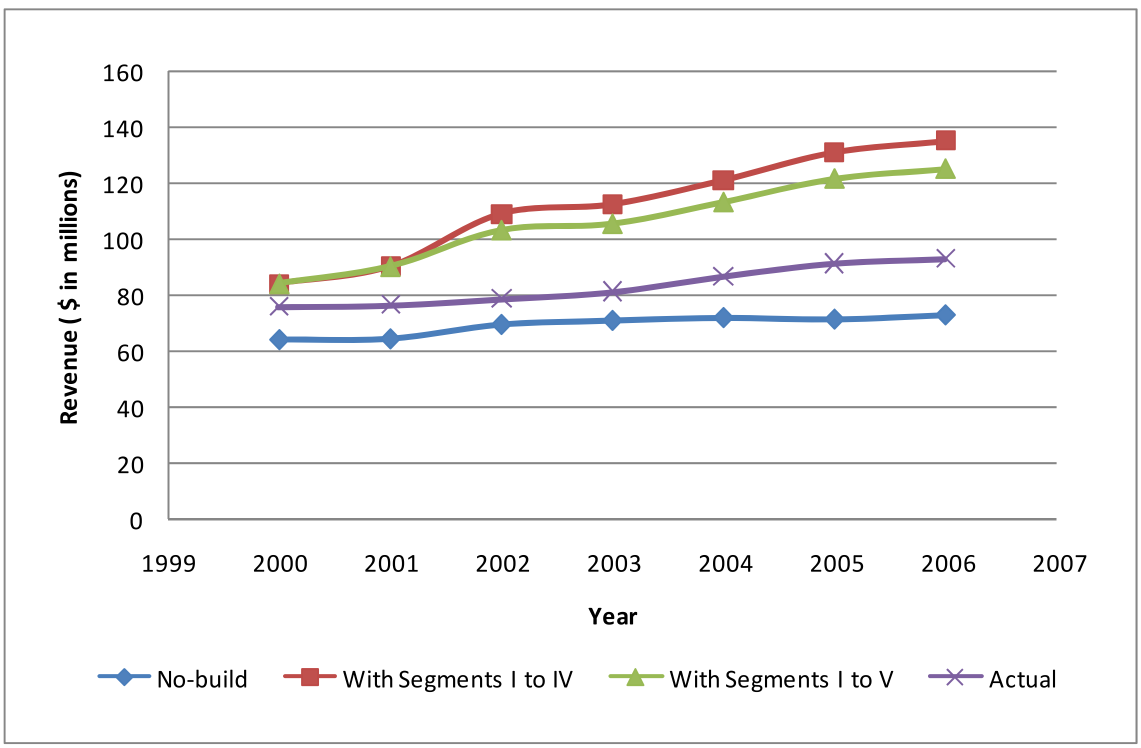

Figure E19: Forecasted and Actual Revenue on the DNT

From the Table and Figure above, it seems that the revenue impact of the opening of SH190 on the DNT was overestimated. Revenue on the DNT has been growing at a steady rate and has not seen dramatic increases as segments of SH190 opened to operations.

Traffic and Revenue Projections for SH190, Segment V

The actual AADT and revenue for SH190 was summarized and discussed in the 1995 T&R section earlier in this appendix. Further analysis of the actual and forecasted AADT values is not possible, because the actual AADT values are only available for the whole road—i.e., not by segment—while WSA's forecast in the 1998 T&R study was for Segment V only.

Figure E20 illustrates WSA's revenue forecasts included in the 1995 T&R report (adjusted for inflation) for SH190 Segment I to IV, the revenue forecasts for SH190 with Segment V (adjusted for inflation) included in the 1998 T&R report, and the actual revenues of SH 190 Segments I to V.

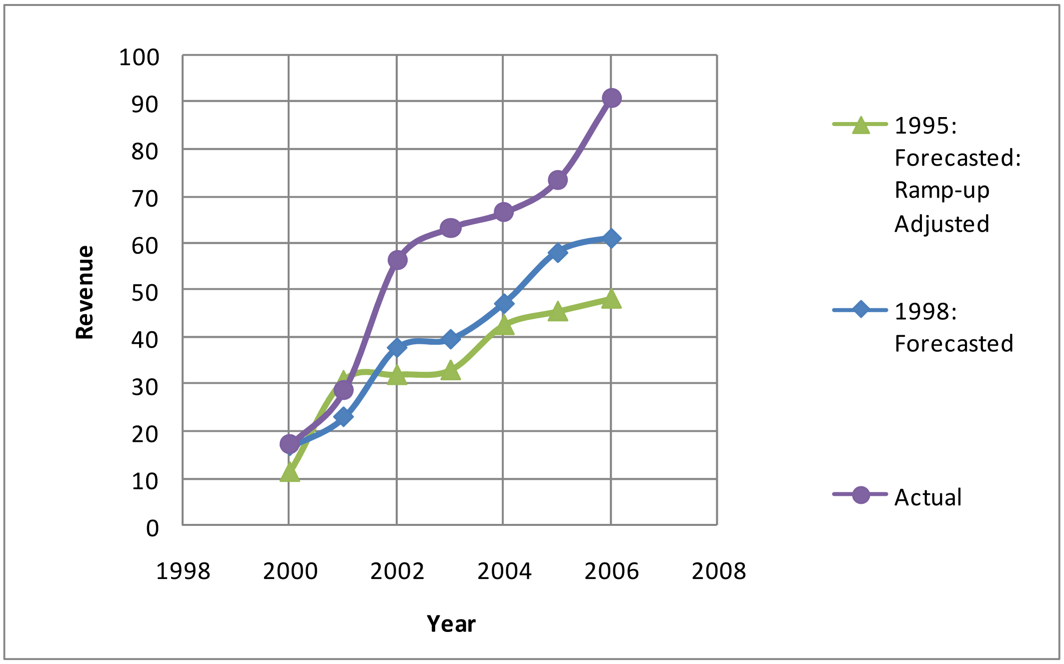

Figure E20: Actual and Forecasted Revenue on SH190[xxv]

The Figure above shows that actual revenues on SH190 were substantially higher than forecasted by WSA. WSA assumed that Segment IV would open mid-2004 as demonstrated in the steep increase in revenues between 2004 and 2005. The opening of Segment IV was, however, delayed until January 2006 (demonstrated by the steep increase in actual revenues between 2005 and 2006). Overall, the actual revenue on SH 190 has been much higher than forecasted in the 1998 T&R study (also see Figure E21).

Figure E21 provides the ratio of actual to forecasted revenue (included in the 1998 T&R report) for SH190.

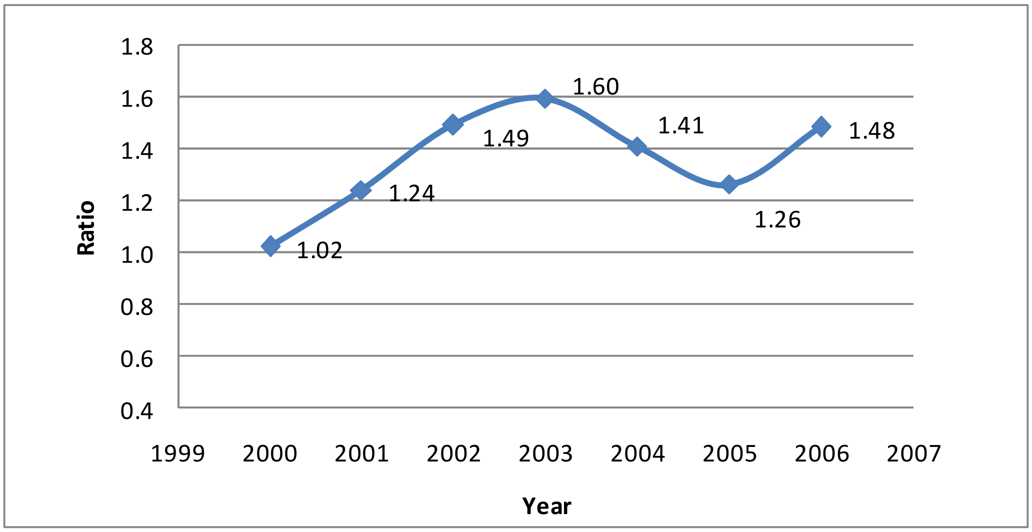

Figure E21: Ratio of Actual to Forecasted Revenue[xxvi]

From the Figure it is clear that actual revenues for SH190 exceeded projections in every year. In fact, in 2003, actual revenues were 60 percent higher than what was originally forecasted.

Opening Schedule

As discussed earlier in this section, WSA assumed a specific opening schedule of the various SH190 segments in the 1998 T&R. Even though the 1998 opening schedule was the third revision, it still differed from the actual opening dates in the case of some segments. Segment I, II, and III opened on schedule but the opening of segment IV was severely delayed (see Table E37). Again, traffic and revenue levels would be negatively affected by delayed openings, thus exacerbating the under-estimating of WSA's forecasted traffic and revenue levels.

Table E37: Assumed and Actual Opening Schedule

Segment	Borders	1995 Scheduled Opening	1998 Scheduled Opening	Actual Opening Date
Phase IA	Midway Road to Preston Road	Mar-98	Nov-98	Dec-98
Phase IB	Preston Road to Coit Road	Mar-98	Jun-99	Jun-99
Phase IC	Coit Road to US75		Dec-99	Dec-99
Phase IIA	US75 to North Garland Road	Jul-99	Dec-99	Dec-99
Phase IIB	North Garland Road to SH78		Apr-00	Apr-00
Phase III	Midway Road to I35E	Jul-01	Jul-08	Jul-01
Phase IV	I35E to I635	Jul-04	Jul-04	Jan-06
Phase V			Jan-02	Dec-01

Ramp-up Effects and Other Factors

As pointed out earlier, most of the other factors that could have impacted the WSA's forecasts were discussed earlier in the appendix, in the 1995 T&R report section. These factors included ramp-up effects, ETC usage, and the annualisation factor. There was no difference in any of these factors between the 1995 and 1998 T&R reports.

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[i] Personal Interview with Jim Griffin, 2008.
[ii] Shelton, 2008
[iii] Personal Interview with Jim Griffin, 2008.
[iv] Shelton, 2008
[v] Personal Interview with Jim Griffin, 2008.
[vi] Personal Interview with Jim Griffin, 2008.
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