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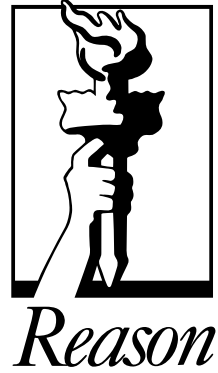
REBUILDING THE MARQUETTE INTERCHANGE VIA A PUBLIC-PRIVATE PARTNERSHIP

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EXECUTIVE SUMMARY

The Marquette Interchange is arguably the most important single component of Wisconsin's surface transportation infrastructure. Unfortunately, it is worn out and in urgent need of rebuilding. And because of the state's current budget-deficit situation, the total cost of rebuilding the Marquette — nearly \$1.5 billion, using realistic numbers — is beyond the state's means. Further, there is very little prospect of obtaining significant “extra” federal aid for this very large project. And any significant reallocation of existing federal dollars from other Wisconsin projects toward the Marquette would meet certain opposition.

This report proposes an alternative way of rebuilding the Marquette. Instead of scraping together the necessary tax funds by starving other needed transportation projects of funding, or stretching out the project over a decade or more (during which downtown Milwaukee would suffer greatly), we propose tapping private capital via a public/private partnership (PPP). The Marquette is a large and complex bridge. Major bridges are usually funded via long-term revenue bonds, to be repaid from tolls charged to users. This is a typical application of the PPP approach in transportation.

Public/private partnerships for large, complex infrastructure projects have been used for decades in Europe, and more recently in Australia and Latin America. During the 1990s they began to be used in the United States and Canada as well. PPP toll projects are in operation in California, Texas, and Virginia, as well as several Canadian provinces. Large urban toll projects in excess of \$1 billion are in operation or under construction in Melbourne, Paris, and Toronto. These projects, in particular, make use of fully automated tolling systems to generate revenue to pay for the facilities. These automated tolling systems are designed from the outset without any toll booths. All tolls are collected electronically, at normal highway speeds, either via a dashboard-mounted transponder (for regular users) or via license-plate imaging (for occasional users). All the inconvenience, traffic congestion, safety, and environmental concerns of traditional tolling would not occur on the Marquette.

For the Marquette, we have estimated the cost of a state-of-the-art automated tolling system (similar to that on Toronto's Highway 407) at \$28 million. That is less than two percent of the total cost of this nearly \$1.5 billion project. Also, the operating and maintenance costs of such a system are estimated to be a small fraction of the cost of operating conventional toll collection with toll booths. Further, this type of tolling system gives everyone access to the facility, whether they open an account and obtain a transponder or not.

Our preliminary analysis suggests that the entire reconstruction project could be funded via a toll revenue bond issue. A baseline toll revenue stream of \$165 million per year will support bonds in excess of the \$1.5 billion project cost. This revenue number is based on rush-hour bridge tolls of \$2 for cars and \$10 for trucks, comparable to tolls on major bridges nationwide. Off-peak rates on weekdays and all day on weekends and holidays were assumed to be 30 percent less.

Wisconsinites are reported to contribute more than 40 percent of Illinois' out-of-state toll revenues. Our proposal attempts to turn the tables by collecting \$17 to \$21 million each year from out-of-state users of the Marquette.

Ample legal authority exists at the federal level to carry out this project in the manner we have proposed. Federal surface transportation law provides for public/private partnerships, for using tolls to rebuild Interstate facilities, and for charging peak and off-peak toll rates. Indeed, the Federal Highway Administration encourages all three of these techniques. Wisconsin enacted a PPP law for transportation projects several years ago, but some fine-tuning would be needed to clarify the legal status of charging and enforcing electronic tolls and of using the design-build procurement method for such projects.

We recognize and empathize with the concerns expressed by highway user groups (auto clubs and trucking associations) about “double taxation” — i.e., paying both tolls and fuel taxes for the same highway facility. Our proposal therefore includes rebates of fuel tax liability incurred for the miles driven on the rebuilt Marquette. The proposed automated tolling system enables this to be done on an individual user basis in a reliable and cost-effective manner.

A public/private partnership is a viable approach for rebuilding and modernizing this vital component of Wisconsin's transportation infrastructure. It would permit the entire project to be completed in a four-year period, minimizing the period of disruption in downtown Milwaukee. And most important, **it would free up close to \$1.5 billion in federal and state transportation funds for other vitally needed transportation projects in the state, including the modernization of the Milwaukee-area freeway system.**

We hope Wisconsin's business and government leaders will embrace this new approach to meeting an urgent public need.

PART 1 — THE MARQUETTE RECONSTRUCTION DILEMMA

Introduction

No one disputes the economic importance of the Milwaukee freeways. They are the arteries and veins not only for Southeastern Wisconsin's economy but also for the economy of the entire state. The system provides the major truck and tourism routes to northern, central and eastern Wisconsin. Nearly 60 percent of all goods shipped by highway in Wisconsin use the Milwaukee freeway system. In addition, the motoring public uses the freeways to get to and from work and elsewhere. The Marquette Interchange is virtually the heart of this system, carrying more than 300,000 vehicles each weekday. More than 60 percent of the state's residents live in the eastern counties and rely on the Marquette to travel south and east. The fact that the Marquette is reaching the end of its service life and must be completely reconstructed presents a special challenge.

Owing to a state fiscal crisis, traditional funding sources may no longer be available, leaving the Wisconsin Department of Transportation (WisDOT) without the ability to pay for the reconstruction of the Marquette on time and with a design that the community supports. Funding options that involve higher taxes and/or increased borrowing by the state are impractical and politically unacceptable.

Many businesspeople are already nervous about the four-to-six-year disruption projected for Downtown Milwaukee as a result of the planned reconstruction. A protracted process or delays brought about by funding problems could have a devastating impact on Downtown, causing some businesses and organizations to flee. The City of Milwaukee and the Downtown in particular have a high-stakes interest in the Marquette getting done right and on time.

In order to protect the Milwaukee community, the Southeastern region, and the entire State of Wisconsin against failure on this project, we are submitting a serious alternative plan for financing the completion of the Marquette within the original construction schedule — without raising taxes.

A. Insufficient State and Federal Funds

Reconstruction of the Marquette Interchange is scheduled to begin in 2004. Cost projections range from \$760 million (on the low side, for a bare-bones initial project) to \$1.5 billion (as estimated by the Legislative Fiscal Bureau, for the full-blown interchange). Regardless of the exact dollar figure and project configuration, the state does not have the funds for a project of this magnitude.

Projected revenues in the state's segregated transportation fund are not even close to sufficient for financing the Marquette, let alone the major reconstruction program planned for the freeways of Southeastern Wisconsin. These funds represent the combined total of funds generated by the 28.1 cents/gallon state motor fuel tax, vehicle registration fees, and Wisconsin's share of federal fuel taxes. The federal funds are divided up by a formula worked out every six years by Congress when it reauthorizes the federal surface transportation program. In addition to the amount spelled out by formula, about 10 percent of the federal total is used for discretionary grants. There is fierce competition among states for these discretionary funds, and the likelihood of Wisconsin obtaining a significant discretionary grant for the Marquette project is small.

In addition, there is tremendous competition within the state for shares of Wisconsin's \$500 million-plus annual federal allocation. Any effort to pull dollars from out-state projects to pay for the Marquette will be met with a fierce political challenge.

The best overall assessment of Wisconsin's highway funding prospects was provided by the state's Transportation Development Association early in 2002:

Without a significant change in how transportation revenues are generated, Wisconsin's transportation needs will continue to exceed funding capacity at the state level. . . . Without an increased federal commitment, the \$6.2 billion estimated cost [of rebuilding the Marquette and modernizing the southeast Wisconsin freeway system] will need to be provided by the state.¹

While several transportation groups are lobbying for an increase in the federal fuel tax rate, the likelihood of a significant increase is small. Moreover, since many other states have grown faster than Wisconsin, the state will be fortunate to keep its current share of federal formula funds during the reauthorization process in 2003.

The fiscal news gets worse. The state gasoline tax, now 28.1 cents per gallon, is already among the highest in the country. Technological advances in vehicle efficiency and the use of alternative fuels mean that both state and federal gas taxes are generating less and less revenue per mile driven. Fuel alternatives, like ethanol, are taxed by the feds at a lower rate than gasoline, and states that are ethanol producers, like Wisconsin, receive less funding as a result.

Right now, Wisconsin is considered to be among the five highest-taxed states in the nation. Even if the Governor and the Legislature had the political will to raise the state gas tax, it's unlikely that they could politically approve more than a few cents per gallon. Over the last 23 years, the Legislature has raised the gas tax only six times, for a combined increase of 12 cents. Even a small increase in the gas tax could prove harmful to the state's economy. If some of the public reacts by using less fuel and buying some fuel out of state, the small tax increase could well generate less transportation revenue than projected.

Aware of the backlog of unfunded projects, highway officials and a handful of political leaders see a need for enormous amounts of capital, but no plausible way for government to raise the revenue. One strategy involves playing a zero-sum game, transferring motor vehicle sales tax revenue from the general fund to the transportation fund. If successful, full implementation of this plan would add nearly \$700 million each year to the transportation fund. The problem is that the most recently passed state budget came up \$1.1 billion short in the general fund. Tax revenues were insufficient to cover spending; so, rather than raise taxes, the Governor and the Legislature filled the hole with one-time tobacco settlement money won in a class action suit.

The consequences of such fiscal maneuvering are likely to turn up sooner than later. But the state also can expect chronic, long-term impacts. The transfer of vehicle sales tax revenue would exacerbate the problem by pushing the structural deficit numbers up another \$700 million per year. Keep in mind that the general fund pays for schools, shared revenue to local governments, corrections, and health care. The powerful interests associated with those programs are not going to let this kind of transfer slip through without a challenge.

The state budget outlook has not improved since the recent short-run fix. The projected general fund deficit for the 2003-05 biennium is \$2.8 billion. The Wisconsin Transportation Development Association has forecast a \$500 million annual gap between planned transportation spending and transportation revenues.

B. The Need for a Fresh Approach

Some problems can be put off indefinitely, but rebuilding the Marquette Interchange is not among them. The Marquette was constructed by means of obsolete concrete box girder and concrete voided slab technology. Over the years, the structures have been infiltrated by salt-laden water, which has accelerated the deterioration. The steel rebars in the box girders have been rapidly corroding, and resurfacing and patchwork have lost their effectiveness. Because the Marquette is a large and complex bridge, built entirely on elevated structures, there is little room for compromise with the law of gravity. If the structures are not rebuilt when rebuilding is absolutely required, they will eventually collapse. If the Marquette project is delayed owing to lack of funding, weight restrictions can't be far away.

Building, operating, and maintaining highways is a capital-intensive business. Yet the state's ability to raise capital is limited to taxation and, to a certain extent, borrowing. Like anybody using a credit card, the state must pay back whatever it borrows, through taxes — only it costs more. The fact that the State of Wisconsin is already carrying \$1 billion in transportation-related debt means that its credit card is near its limit. Recent downgrades of Wisconsin's bond rating by Moody's and Standard & Poor are strong indications of the limitations on the state's capacity to borrow.

A business can raise as much capital as it needs as long as it can demonstrate a return on investment (ROI). It does so by attracting customers and linking the revenue stream of the enterprise to the investment through a mechanism called "price." The business sets the price after carefully considering the dynamic balance between various market forces such as supply, demand, competition, and substitutes. Ultimately, the consumer freely chooses whether or not to patronize the business or its competitor, or to select a substitute good or service, before voluntarily paying the price. Users pay the fair market value for what they consume — nothing more, nothing less.

By contrast, the present freeway system operates under a state monopoly. There is little competition. Lost in this system are the customers who want only to travel or ship commodities in the fastest, safest, cheapest and most reliable way.

Completely separated from the customer and the marketplace, the Legislature and Governor currently set the price. No highway is considered to have its own internal economics, and it is assumed that all highway segments have equal value. As a result, some users are overcharged and others are undercharged. The customer at the pump has only a vague idea of what he or she is paying for. The reality is most are paying for a highway in another part of the state that they may never even use.

As for financing, the state is at a complete loss. But denying the fiscal reality now is like drifting along in the calm Niagara current. By the time we get to the point of concern, our options will be severely limited — unless we prepare now.

PART 2 — THE PUBLIC/PRIVATE PARTNERSHIP (PPP) ALTERNATIVE

A. Basic Concept

To address the urgent need to invest in rebuilding the Marquette Interchange, Wisconsin should develop a public/private partnership alternative to the conventional, tax-funded, DOT approach.

Such ventures involve the investment of private risk capital to design, finance, construct, operate, and maintain a project for public use for a specific term during which a private investor collects revenues from the users of the facility. When the consortium's limited term of ownership expires, title to the project reverts to the government at no cost. By then, the consortium should have collected enough revenue to recapture its investment and turn a profit. This method acknowledges that incentives enable the private sector to develop and operate a high quality facility to meet needs defined by the public sector.

The public/private partnership model that would best apply to the Marquette Interchange is called Build-Operate-Transfer (BOT). It has a long history of successful use in major transportation infrastructure projects, as will be discussed below. The BOT approach enables direct private-sector investment in large-scale public works projects such as airports, roads, bridges, tunnels, power plants, and water/wastewater systems. Here's how it would work on the Marquette Interchange:

Build. A private company (or consortium) would be selected via competitive bidding for the award of a long-term franchise (called a "concession") agreement for the new Marquette Interchange. This legal agreement would spell out the respective roles of the state and the private firm in a public/private partnership to design, finance, build, operate, and maintain the project. Based on the concession agreement and the results of an investment-grade study of future traffic and revenues, the company would go to the capital markets and raise the nearly \$1.5 billion needed to do the project. It would select a design-build team and proceed to construct the project without delay.

Operate. The private developer would then own, maintain and manage the Marquette facility for the agreed-upon concession period (e.g., 30 years), recoup his investment, and make a profit through charges or tolls. Limits on the toll rates or the amount of profit would be built into the concession agreement. In effect, what used to be a government facility would now, for a specific period of time, be operated as a business, similar to an investor-owned utility operating under a long-term franchise from the state.

Transfer. After the concession period, the company or consortium would transfer ownership and operation of the Marquette Interchange facility back to the state, in good condition, at no charge.

The successful bidder and operator will determine the best way to cover their cost of capital and make a profit. The opportunity here is for a business/client relationship to form. The business can manage its capacity and costs by offering off-peak discounts to smooth out traffic flows and minimize congestion. The consumer can manage his or her cost by deciding what time to make certain discretionary trips.

There is no longer any need for the old-fashioned tollbooths encountered over the years in other states. The technology of toll collection (discussed in Part 3 of this report) has progressed to the point where a fare can be collected, easily and accurately, from a vehicle traveling at 70 miles per hour.

B. Global Use of Public/Private Partnerships in Highways

France, Italy, and Spain have opted to finance most of their motorway system by using tolls, rather than general tax revenue (as is common in the rest of Europe). However, instead of creating U.S.-type public toll authorities, those three governments have allowed for the creation of toll road companies, operating under BOT concession arrangements. In France, BOT policy succeeded in creating a motorway network in excess of 3,100 miles by 1980.² In the 1990s France opened the market to additional private-sector participation, primarily for urban additions to the motorway system. Spain's 1,250-mile toll motorway system was developed largely by a dozen private concessionaire companies during the 1960s and 1970s. It, too, is being expanded today. Italy also developed its national motorway network via tolls and BOT concessions.

In the late 1980s, Malaysia, Indonesia and Thailand began awarding BOT concessions to private firms. China drew on their experience to launch an extensive BOT tollway program in the 1990s. In parallel, Hong Kong embraced the BOT approach, holding competitions to select private firms to develop and operate major new tolled expressway, bridge, and tunnel projects. Australia first tried the BOT model to develop the new Sydney Harbor Tunnel. That project's success led to a number of other BOT projects, creating much of the modern expressway system of Sydney and, more recently, a critical link in the Melbourne system. Indeed, the BOT approach has become virtually standard practice for major highway projects in Australia's two largest cities.

The general success of BOT tollways in Europe, Asia, and Australia led the World Bank and other institutions to urge this model on the developing countries of Latin America during the 1990s. In response, Argentina, Brazil, and Chile developed successful BOT tollway programs. The emphasis in these countries has been primarily on upgrading existing (mostly two-lane) highways into modern, limited-access (four-lane) highways.

The BOT concession approach to highway modernization gained new adherents in Europe as the 20th century gave way to the 21st. In 2000, the first major U.K. highway BOT project was financed, the 27-mile, \$1.1 billion Midland Expressway. Germany had two BOT tunnel projects under construction as of the end of 2001 (in Rostock and Lubeck), while its first BOT bridge (linking Straslund to Rugen Island) was in the bid process. France has embarked on a new round of BOT projects, the largest of which is an ambitious \$2 billion project to complete the missing link in the A86 Paris ring road. The Greek government in 2001 launched a major effort to add or upgrade nearly 400 miles of tolled motorways, via \$1.7 billion worth of BOT concessions.

Australia also continues to make use of the BOT process. In 2000, it opened the \$450 million Sydney airport toll road, completed ahead of the 2001 Olympics to improve airport access. Also opening that year was the \$1.4 billion Melbourne CityLink, a new toll road that connects several existing freeways, none of which previously extended to the city's downtown. It is one of the world's first urban toll roads to be built without any toll booths at all. As of 2002, a similar toll tunnel is in the bidding process in Sydney.

Several points should be evident from the previous discussion. First, the BOT approach to financing improved highway infrastructure has a long history, dating back to the 1960s. Second, it has been used successfully in both developed and developing countries. Third, it is applicable to entirely new projects as well as the upgrading and modernization of existing highways. Fourth, the BOT mechanism has been used for both long-distance inter-city highways and for complex urban expressway projects — including tunnels and bridges. And fifth, there is significant private investment capital available for well-justified BOT highway projects. Indeed, projects of billion-dollar scale are well within the capacity of the global capital markets to finance.

C. U.S. and Canadian Experience with Highway Partnerships

By the late 1980s, it had become evident in many fast-growing states that revenues from fuel taxes were not keeping pace with inflation or increased rates of driving. Urban areas like Orange County in California; Denver in Colorado; Miami, Orlando, and Tampa in Florida; and Dallas and Houston in Texas began creating urban toll roads, using toll revenues and bond financing to add significantly to the amounts available from fuel-tax sources. In this context, the BOT model began to catch the attention of both highway developers and public policymakers. Both California and Virginia took pioneering steps to experiment with this approach.

The California legislature adopted AB 680 in 1989, creating a pilot program under which private firms would submit proposals for user-fee-funded transportation infrastructure projects, the best of which would be selected for

long-term concession agreements. A 1990 competition led to the selection of four winning proposals, for which 35-year agreements were negotiated in 1991. The first of these — tolled express lanes in the median of the existing SR 91 freeway — opened to traffic in December 1995. It was the first U.S. toll road to make use of variable pricing and all-electronic toll collection. The basic business model was to offer reliable time savings to commuters in a highly congested corridor. The official evaluation by California Polytechnic University found the concept to be highly successful.³ The second project, a new toll road in the eastern suburbs of San Diego (SR 125), won final approvals in 2001; construction is expected to begin by the end of 2002.

Virginia's legislature and DOT responded to an unsolicited 1986 proposal from a private firm to extend the existing Dulles Toll Road another 15 miles, from Dulles Airport to Leesburg. Legislation to permit the project was enacted in 1988, treating it as a utility to be regulated by the state's public utility commission (in contrast to California, where only the rate of return was to be capped, via provisions negotiated in each project's concession agreement). The project received final approvals in late 1991, and opened to traffic in 1995.

Inspired by the ability of California and Virginia to attract private capital via the BOT model, more than a dozen other states (including Wisconsin) enacted public-private partnership statutes during the 1990s. In addition, Virginia passed a new measure, under which future public-private toll roads would no longer be treated like public utilities and subjected to periodic rate hearings; rather, Virginia would make use of the traditional BOT approach under which regulation would be incorporated into the concession agreement for each project. Another feature included in a number of second-generation public-private partnership measures enables the state to issue requests for proposals (RFPs), inviting bids for specific projects, and to accept unsolicited proposals. Most state measures also permit a mix of private and public funds for such projects (making them public-private partnerships financially, as well as operationally), in contrast to the 1980s-era California and Virginia laws that required 100 percent private financing.

By early 2002, public-private transportation projects using some variant of a BOT concession had been developed and were in operation in eight states. Alabama has four toll bridges, which opened between 1994 and 1998. California, as noted, has the 91 Express Lanes in Orange County and a second project about to be financed in San Diego County. Missouri, North Dakota, and Puerto Rico have privately funded toll bridges in operation. South Carolina's Southern Connector, a partial beltway for Greenville, opened to traffic in 2001. The Texas Turnpike Division is also in the process of procuring more than \$1 billion of new public-private toll roads in the Austin metro area. And in addition to the successful Dulles Greenway, Virginia anticipates a 2002 opening of the Pocahontas Parkway, a \$335 million project to improve access to Richmond International Airport.

When Congress created the Interstate highway program in 1956, significantly increasing federal highway aid (via an increased federal fuel tax), it prohibited the use of tolls anywhere on the federal-aid system (except for those highways, like the New York Thruway and the Pennsylvania Turnpike, that already existed as toll roads). That federal opposition to tolling began to be reversed in 1987, when Congress authorized a pilot program permitting federal assistance to new toll-road projects in nine states.⁴ A much greater easing took place with the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991. This measure permitted the use of tolls on federally aided highways in all 50 states, but not on the Interstates (except for rebuilding currently free bridges). ISTEA also permitted federal funds to be used on public-private partnership toll-road projects in any state that wished to do so.⁵

ISTEA also created a Congestion Pricing Pilot Program, which permitted states and metropolitan planning organizations (MPOs) to experiment with various forms of road pricing as a means of controlling traffic congestion. Up to three of those projects could be on urban Interstates, despite the continuation of the general ban on tolls on Interstates.

Under the Transportation Equity Act for the 21st Century (TEA-21) a new pilot program was created under which up to three states may apply to the Federal Highway Administration (FHWA) for permission to rebuild portions of their Interstate system using tolls. And the Congestion Pricing program was expanded and renamed the Value Pricing Pilot Program. Under the revised program, FHWA can enter into up to 15 agreements with state DOTs or MPOs to carry out pricing projects, and all 15 can involve pricing on urban Interstates.

The BOT model came to Canada in the mid-1990s, producing (thus far) one new toll bridge and three new toll highways. The bridge was the Northumberland Strait Crossing, a new five-mile bridge (replacing a ferry) that opened to traffic in 1997. Two of the highways were inter-city toll roads, Hwy. 104 in Nova Scotia (28 miles) and a 121-mile section of the Trans-Canada highway in New Brunswick. These three projects totaled \$1.3 billion in new investment.

The most dramatic project, however, is Highway 407 in Toronto, the world's first fully automated toll road. Designed as an east-west congestion-reliever in the city's northern suburbs, the urban nature of the project required numerous on-ramps and off-ramps. That made conventional toll booths and plazas either highly susceptible to evasion (people getting off to avoid the toll, then getting back on at the next on-ramp) or extremely costly to build and operate (if virtually every on-ramp were to be equipped to collect tolls conventionally). Advanced technology came to the rescue (as discussed in Part 3, below), providing a toll road that is open to all users but without any toll booths or toll plazas.

The initial 42 miles of Highway 407 were financed from the general fund of the province of Ontario. The project was developed, at a cost of \$1.3 billion, under a design-build-operate contract with a competitively selected private consortium. About a year after the tollway opened to traffic, Ontario's newly elected provincial government decided to privatize the project, by leasing it for 99 years (essentially, a long-term concession agreement) to the highest bidder. The successful bidder had to commit to completing the planned east and west extensions and to operating and maintaining the entire 68-mile corridor over the life of the agreement. The winning bidder paid \$2.8 billion for the 99-year lease, including the obligation to build the 26 miles of extensions (which have now been completed and are open to traffic).

PART 3 — 21ST-CENTURY TOLL TECHNOLOGY

A. First-Generation ETC

Toll collection began to change dramatically in the late 1980s with the advent of pioneering electronic toll collection (ETC) systems. These systems made use of a "toll tag" transponder mounted on dashboards or windshields. As the car drove beneath an overhead gantry, the tag was interrogated via a radio signal to provide its unique account number, thereby permitting the user's prepaid toll account to be debited for the amount of toll due at that tolling point.

First-generation systems spread rapidly through existing turnpikes, toll roads, toll bridges, and tunnels during the 1990s. By the end of the decade, ETC was operational on most toll facilities in the country. In some congested urban areas, such as New York City, the fraction of rush-hour transactions being handled by ETC tags approached two-thirds. Such rapid acceptance led to greatly reduced lines and congestion at toll plazas. As of late 2000, about half of all toll transactions in the country were being handled electronically. The figure has undoubtedly increased since then.

That basic model — prepaid accounts that are debited at the time of use; radio-frequency transponder mounted on the dashboard — has become known as first-generation ETC. For the most part, it was retrofitted into existing toll plazas as a way of increasing the throughput of conventional toll lanes. Whereas manual toll collection can handle 250-400 vehicles/lane/hour, and coin machines can handle 400 to 800 per hour, first-generation ETC increases the throughput to between 1,000 and 1,500, depending on the speed permitted (which is generally between 5 mph and 35 mph in such toll lanes, for safety reasons).

B. Open-Road Express-Toll Systems (ETX)

While first-generation ETC has made toll plazas less congested, it marks only the beginning of an ongoing toll-collection revolution. A number of new toll roads were designed and built during the 1990s, in places such as California, Oklahoma, and Texas. The designers took advantage of the fact that the technology works reliably at high speeds (e.g., 65 mph) to design the new toll roads with mainline express toll collection, sometimes referred to as electronic toll express (ETX). Instead of a mainline barrier toll plaza, the road is designed with a gantry spanning the main lanes, on which the needed antennas and enforcement equipment (typically video cameras) are mounted. All vehicles with dashboard tags simply drive beneath the gantry at normal highway speeds, and their toll accounts are debited accordingly. ETX permits throughputs of 2,000 to 2,500 vehicles per hour.

Enforcement is typically handled by a combination of highway patrol cars (visually observing that a car passing under the gantry lacks a windshield-mounted tag) and video imaging of the license plate number of vehicles from which no valid tag ID number is obtained as it passes under the gantry. State law in such states permits the mailing of a citation to the untagged vehicle's registered owner. Effective legislation also provides for the vehicle owner to be penalized for nonpayment of the toll and fined in a timely manner.

C. Automated Tag-Only Systems

A third level of automated tolling is represented by new toll roads designed from the outset to use only electronic toll tags. In such systems, to make use of the road, one must open an account and purchase a tag. These systems dispense with both the capital and operating costs of off-line toll booths — but at the price of non-universal access. Thus, such systems are most appropriate in urban areas where many other roadway choices are available.

Two such projects exist in the United States, one in operation and the other under construction. The first is the 91 Express Lanes, a 10-mile congestion-relief toll road built in the median of an existing congested commuter freeway, SR 91 in Orange County, California (discussed previously in Part 2). Drivers are notified in advance, via changeable message signs, what the toll will be, before they make the decision to use or not use the Express Lanes.

The second project is the Westpark Tollway, now under construction in Houston. It will be a four-lane, all-electronic toll road, extending 22 miles from the inner beltway West Loop (I-610) to the outermost beltway, TX 99, the Grand Parkway. Unlike the 91 Express Lanes, which has no intermediate access points along its 10-mile length, the Westpark will have eight interchanges. Thus, the tolls will be charged on a per-mile basis, with gantries picking up each tag's account number at the point of entry and again at the point of exit, calculating the miles driven, and from that computing the toll to be deducted from the tag-holder's account.

D. Fully-Automated Open-Road Urban Systems

The ultimate in user-friendly toll systems would be one that permitted anyone to use the roadway, whether or not he or she had opened an account or had a transponder, without having to slow down or make use of any toll booth. That unrestricted access has actually been realized in two major projects, and it is being built into two others.

One existing project is the \$1.4 billion Melbourne CityLink, which opened in 2000 in Australia's second-largest city. The privately developed and operated project links three major radial freeways that approach but had stopped short of the city's central business district. Using mostly elevated and tunneled sections, the project connects them into a seamless network, greatly relieving traffic congestion. Some 250,000 trips per day are now taken via the 14-mile tollway, and there are 819,000 e-TAGS in service. Tolls are collected via gantries that span the width of the tollway at several key points.

The CityLink's tolling system relies primarily on the windshield-mounted e-TAGS, similar to the transponders in wide use in this country. Those without tags are permitted to use the tollway, but their license plate images are captured on video. Such persons have 24 hours to call developer/operator Transurban's 800 number and pay by credit card. If they fail to do so, they are sent a citation by mail. Occasional users (including rental car customers) may also purchase, in advance, a day pass to make use of the CityLink on certain days. When such usage is pre-arranged, those license numbers are entered into the system's computers and are recognized by the system as non-violators on the days in question. Day passes can also be purchased at Transurban offices, post offices, Shell service stations, and rental car companies.

A somewhat different technical approach to fully automated tolling is represented by Highway 407 Electronic Toll Road in Toronto. This 42-mile⁶ east-west urban toll road crosses the northern portion of urban Toronto. Knowing that it would have 32 interchanges along those 42 miles, its designers rejected toll booths as completely unworkable. They, too, opted for a transponder-based system for regular users. As on Houston's Westpark, the tag is read via overhead gantry on the on-ramp and again on the exit ramp, and the toll is calculated based on the number of miles driven. Those without a transponder (and therefore without a prepaid account) have a digital image of their license plate captured by the toll system. An automatic license plate recognition system deciphers the plate number in most cases (with human back-up), and looks up the vehicle owner in a set of motor vehicle department databases. A billing system then creates a bill, which is sent to the owner at the end of the month. There is an escalating set of penalties for non-payment. In addition, because collecting tolls via the imaging and billing process is much more costly than using transponders and prepaid accounts, a surcharge is applied to the toll that a transponder patron would pay, to cover the extra cost of giving the non-subscriber the convenience of not having to enroll in the transponder program.

Fully automated tolling, with no toll booths and all tolls collected at highway speeds, is a proven technology, in daily use on two of the world's largest urban tollways. Each of the two existing systems has been selected for a second major urban installation. Thus, fully automated tolling is ready to make its U.S. debut.

PART 4 — MARQUETTE TOLLING SYSTEM: CONCEPT AND COSTS

The only way to toll the Marquette Interchange successfully is to use the most modern open-road, all-electronic toll collection methodology available. This technology was developed for tolling the Highway 407 ETR in Toronto, Ontario; it has also been used in other applications where open-road, non-stop, highway speed dedicated short-range communications is required.

This technology is commercially available and well-proven. In addition, it is the standard technology already used by the trucking industry for its major weigh-station preclearance programs, including the Heavy Vehicle Electronic License Plate (HELP) program (PrePass[®]) and the Advantage I-75 (now NorPass) program. It is also being used exclusively for all international border crossing preclearance programs between the United States and Canada and Mexico.

The following sections provide a preliminary Toll Operations Plan for tolling the Marquette Interchange once it is reconstructed. A description of the primary systems that would need to be deployed is also included. Cost estimates are also provided for deploying the toll system, as well as its operations and maintenance.

A. Toll Operations Plan

There are a number of entry/exit points along the northern leg of this project. However, we have assumed that tolling the major interchange would provide the core of the toll collection. We have provided incremental costs for the inclusion of additional toll points for the northern section should there be a plan developed to toll it. These incremental costs include the toll points and the fiber optics communications links that tie these nodes into the central communications backbone. There should be no other capital costs for the tolling, as the current back office should be capable of handling the additional transactions.

The premise behind the tolling scheme is provided below. Though detailed evaluation may later suggest that this Toll Operations Plan be modified to better meet traffic and funding requirements, this initial tolling scheme is adequate for estimating traffic and revenue at the project feasibility level.

The initial Toll Operations Plan for the major interchange connecting the two freeway corridors provides for four toll points, as shown in Table 1.

TABLE 1 PROPOSED MARQUETTE TOLLING POINTS

Toll Point	Location	Toll Direction
1	Between Wells and State Streets	Southbound
2	Between 2nd and 3rd Streets	Westbound
3	North of South Menomonee Canal	Northbound
4	Near 18th Street	Eastbound

At these points the inbound traffic will have been collected into three or four mainline lanes. Tolling inbound traffic at these locations will ensure that every vehicle using this major interchange will be tolled once on the inbound trip into the interchange (outbound tolling could be implemented just as easily if there is a preference for this.). Once detailed drawings are obtained, final placement of the toll points can be made. In each case the roadway would be fitted with overhead gantries or sign bridges from which the tolling system would operate.

B. Toll System Elements

Major system elements include roadside components (at the toll points), back-office systems (systems monitoring and operations, account management, billing and other customer services), and a dedicated communications system linking roadside and back office systems. Cost estimates are provided separately for each of the primary subsystems.

Roadside cabinets house the computers and other electronics that control and monitor each toll point. Co-located with this equipment is the link to the communications network. Toll transaction data collected at each toll point flow from each toll point to the central operations center. Diagnostic commands and tag status data are sent from the central computer system to each roadside system.

During construction, provisions for power at each toll point need to be provided. The Operations Center will also need to be located somewhere near the right of way, and a fiber optic network (including nodes at each toll point and at the operations center) would be required. The operations center ideally would be near an exit from the interchange where customers could have easy walk-in access; however, this is not absolutely necessary as most business will be conducted through the Internet and telephone systems.

A typical toll point will have one or two overhead gantries or sign bridges. Components of the tolling system mounted on these gantries include the following:

- The radio frequency (RF) communications for transponder toll collection and transponder tracking.
- Vehicle detection equipment to determine classifications and locations of vehicles in the roadway and to trigger the cameras.
- Supplemental lighting to allow quality imaging day or night in all lighting conditions.
- Cameras to image license plate areas on passing vehicles. To handle tractor-trailers as well as passenger vehicles, both front and rear license imaging is desirable.

In the Operations Center transaction data are collected from the individual toll points and posted to accounts. Images of the license plates of vehicles without transponders are read, and this information is used to determine the vehicle's owner for billing purposes. Tolls are debited from the accounts of those customers who have enrolled in the tolling program and have transponders. These accounts are automatically replenished, by means of a credit card rebilling or an automatic bank draft from a checking account, when they reach a pre-set minimum threshold.

C. Toll System Capital Costs

A high-level summary of the budgetary costs of the system described above is presented in Table 2 on the next page. Considerable latitude must be taken in using these estimates. Notes to the table are provided beneath the table.

D. Northern Section Toll Collection

Tolling for the roadway north of the main interchange is a bit more challenging. This tolling scheme could require toll points for traffic both entering and exiting the project. One possible solution would be to collect main-line tolls on the main north-south artery near the northern end of this segment of the project, toll the Fond Du Lac Avenue legs, and ignore other entrances and exits. This approach would add three or four gantries and roadside electronics. There should be no significant impact on the back office operations.

Since the tolling system is expected to account for a small portion of the overall cost of this project, one could also consider a more complex tolling concept for this portion of the road. With open-road ETC this would be possible. However, the Toll Operations Plan has to be simple enough for the public to understand. Until we have more detailed information on the corridor, it would be fruitless to investigate more complex options. We will simply note here that the cost of adding each additional toll point would be a gantry (\$250,000), the local electronics (\$700,000), communications nodes (\$100,000), and fiber optic cables (@ \$20.00 per meter one direction distance from the nearest point on the fiber network — for a complete fiber loop). In short, the cost per additional toll point would be just over \$1 million.

E. Toll System Operating and Maintenance Costs

Maintenance is an ongoing cost for toll collection operations. As a budgetary estimate, we use an annual 12 percent of the original capital cost, not including the contingency. Based on the above Acquisition and Installation costs, maintenance will run approximately \$3 million per year, including spares. Since the operating company will perform

TABLE 2 TOLL SYSTEM CAPITAL COST ESTIMATE

System Component (Quantity)	Unit Cost	Extended Cost
Over Road Gantries (8)	\$250,000	\$2,000,000
Roadside Systems (4)	\$700,000	\$2,800,000
Communication Nodes (5)	\$100,000	\$500,000
Fiber Network (1)	\$500,000	\$500,000
Backup Electric Generator (1)	\$250,000	\$250,000
Central Computer System (1)	\$2,500,000	\$2,500,000
System Software (1)	\$3,000,000	\$3,000,000
Installation, Integration & Test (1)	\$4,000,000	\$4,000,000
Transponders (200,000)	\$40	\$8,000,000
Traffic Management System	\$2,000,000	\$2,000,000
Contingency (10% of total)	\$2,555,000	\$2,555,000
Total		\$28,105,000

Notes:

- 1) *Gantry and roadside system design and span will determine the final gantry cost.*
- 2) *We have assumed a two-gantry per tolling point solution (similar to the H-407 ETR). A one-gantry solution should be considered to reduce costs and visual impacts of the tolling system.*
- 3) *Roadside systems costs will be a function of the number of lanes. An average of three lanes per toll point is considered here.*
- 4) *Roadside systems include uninterruptible power systems (UPSs) but no emergency power backup such as backup generators. A local power analysis should be conducted to determine the proper strategy for providing necessary power in all situations.*
- 5) *Communications nodes include environmentally conditioned cabinet, switch and UPS.*
- 6) *Fiber is priced at \$10.00 per meter. A fault-tolerant loop configuration is assumed. Assumed total fiber network length is 25 miles.*
- 7) *Once detailed requirements are defined a better cost estimate for a backup power generator can be developed.*
- 8) *Central Computer system includes complete host processor, OCR functionality and workstations for customer service representative (CSR) functions.*
- 9) *System Software includes operating systems, core DBMS license and the custom toll management software.*
- 10) *Installation, Integration & Test includes all program management and support functions including safety and quality assurance through the design, development, integration deployment and final acceptance testing.*
- 11) *An initial buy of 200,000 transponders is projected for the program.*

all maintenance and the above cost estimate is a commercial price with margins and profit built in, there are opportunities for ongoing savings in this area.

If there are ultimately 250,000 transponders in circulation and they have a five-year battery life, then 50,000 will be replaced in an average year. (In fact, this will not be uniform, as many people will get tags in the first year of the program and there will necessarily be a big replacement program in year five.) If these replacement transponders were to be purchased as new, the price would be \$2 million. A Failure Modes and Effects Analysis (FMEA) of a tag shows that, other than the battery and the case, the expected life of the components in a tag exceeds 100 years. Tags can be refurbished with a new battery and a new case and reused for toll collection with almost no added risk. The current cost of refurbishment is less than \$15 per transponder. Using refurbished transponders brings the cost down from \$2 million per year to less than \$750,000. Although shown as an annual cost, there should be almost no non-warranty replacements in the first five years of operations.

Staffing for the daily operations includes the following categories with an assumed headcount:

- General Management (2)
- Public Relations and Marketing (2)

- Customer Service (30)
- System Operations (5)
- Finance and Administration (2)

Rounding up to 45 staff members and assuming a \$70,000 fully burdened cost per employee, this totals \$3.15 million in annual operating costs for staffing.

The smallest operating cost will be the normal office operating costs for rent, utilities, office supplies, postage, legal and accounting, etc. The space rental should be less than \$7.00 per foot, including some build out and upgrades. Thus, 6,000 square feet would cost around \$40,000 per year. Utilities, office supplies, postage, legal and accounting support should cost less than \$30,000 per month. Thus, a budgetary \$360,000 should generously cover these items.

Adding these items together provides the annual operating cost estimate for running the toll collection operation.

TABLE 3 TOLL SYSTEM OPERATING & MAINTENANCE COSTS

Operating Element	Annual Cost
Systems Maintenance	\$3,000,000
Transponder Replacement	\$750,000
Operating Staff	\$3,150,000
Office Rent	\$40,000
Office Expenses	\$360,000
Total Annual Operating Costs	\$7,300,000

This operating cost compares generally with industry operating costs for this type of facility.

Working this value from the other direction, assuming 300,000 transactions per day for 365 days per year, the operating cost per transaction is under \$0.07. Again this is an acceptable number on a per-transaction basis.

As the program becomes better defined, all of these cost figures need to be analyzed and evaluated with the object of scrubbing excess costs and increasing the efficiency of the operating company.

F. Tolling Out-of-State Users

A challenge for all-electronic toll systems is serving occasional users, especially those from out-of-state. As discussed in Part 3, the systems in Toronto and Melbourne make use of the video camera systems already needed for enforcement purposes to provide a way of billing occasional users whose vehicles do not carry a transponder. The license plate image is used to obtain the vehicle owner's name and address from the department of motor vehicles (DMV) for billing purposes. But how can such bills be collected from out-of-state users? Won't those users simply ignore them?

Toronto's Highway 407 provides a useful model of how to deal with this issue. The Ontario government made agreements with the adjacent provinces of Manitoba and Quebec, adjacent states Michigan and New York, and nearby Ohio. Under those agreements, Toronto not only has access to those provinces' and states' DMVs, but those states and provinces also backstop the enforcement of the payment obligation through denial of re-registration.

Given that the Marquette is part of Wisconsin's Interstate system, the largest fraction of out-of-state users would likely be from Illinois. For decades Wisconsin motorists and truckers heading into Illinois have paid tolls to make use of portions of the Interstate that are tolled in that state. The Illinois State Toll Highway Authority (ISTHA) reports that, in 2001, 43 percent of its out-of-state revenues came from Wisconsin-registered vehicles, amounting to some \$31.7 million.⁷ With tolls on the Marquette, Wisconsin could begin to collect revenue from Illinois vehicles. Using data from the Southeastern Wisconsin Regional Planning Commission (SEWRPC) on the extent of out-of-region traffic using the Marquette, and our estimate of the percentage of this represented by trucks, we estimate that between \$16.6 million and \$21.2 million per year of Marquette toll revenue would come from out-of-state users.

Out-of-state users probably cannot be charged rates different from those charged to Wisconsin users. This issue arose recently in Massachusetts where the Massachusetts Turnpike Authority had proposed offering toll discounts for state residents who pay via the Authority's Fast Lane transponder. After neighboring state tolling officials raised concerns that the program may violate the interstate commerce clause of the U.S. Constitution, the Authority agreed to

extend the same discount to out-of-state users.⁸ Nevertheless, it should be noted that since most out-of-state users will not bother to obtain transponders, because they only use the Marquette occasionally, they will pay via the video tolling system. Since there will be a surcharge for using that method of payment, due to higher costs, the average out-of-state user will most likely pay more than the average in-state user. This difference has been taken into account in developing the \$17-21 million estimate above.

PART 5 — FINANCIAL FEASIBILITY OF PPP REBUILD

Would toll revenues be sufficient to pay for the entire cost of rebuilding the Marquette? This section addresses that question. First, it defines the total cost of the project, including the proposed automated tolling system. Then it makes preliminary estimates of the traffic that can be expected to use the rebuilt interchange and the associated revenue. Finally, it estimates the magnitude of the toll revenue bond issue that that revenue stream could support.

A. Reconstruction Costs

The proposed action is to reconstruct the Marquette Interchange and adjacent sections of I-94, I-43 and I-794, defined by the Southeastern Wisconsin Regional Planning Commission and the Wisconsin Department of Transportation as the Marquette project. The deteriorated condition of the Marquette bridges requires prompt attention. The project scope includes rebuilding mainline roadway and structures, modifying access to improve safety and operational performance, improving access, and enhancing aesthetics. WisDOT's original proposal was to construct the core and north leg before embarking on the east and west legs of the Marquette. Since then, the Governor and WisDOT have scaled back the project even more, cutting off the north leg at Walnut Street, instead of North Avenue.

Unlike the exclusively government financed model WisDOT plans to use to reconstruct the Marquette Interchange (while waiting for funds to become available), the PPP/BOT model makes it possible to significantly condense the construction schedule. Under PPP/BOT, all the financing is available up front, thereby minimizing what would otherwise be a period of protracted construction, disruption, and unpredictable funding. Obtaining the financing up front brings certainty and predictability to the project, enabling a much tighter construction schedule than WisDOT's traditional approach.

The project segments needing to be reconstructed, as described by WisDOT, are as follows:

- The core, extending to the Burnham Canal to the south, 25th Street to the west, the Milwaukee River to the east, and State Street to the north (including the Plankinton Ave interchange, 11th Street re-route & 13th Street exit).
- The north leg, extending from State Street to North Avenue (including the Walnut Street interchange).
- The east leg, extending from the Milwaukee River to the Lake Interchange.
- The west leg, extending from 25th Street to 35th Street.

Key design and safety elements to the reconstruction of the Marquette Interchange, as outlined by WisDOT, are as follows:

- All the left-hand entrance and exit ramps within project area will be replaced by right-hand entrance and exit ramps for safer and more efficient traffic flow.
- All the Marquette Interchange system ramp structures will be built to accommodate two-lane ramps.
- Auxiliary lanes will be provided on each of the four approaches of the interchange for safe merging.
- Substandard vertical bridge clearances will be improved or eliminated.

The estimated construction cost for the entire project is summarized in Table 4, on the next page.

The total project capital cost is the sum of the adjusted construction cost from Table 4 plus the toll system capital cost from Table 2. That total is \$1.486 billion.

**TABLE 4 MARQUETTE INTERCHANGE CAPITAL COST ESTIMATE
(IN YEAR 2001 MILLIONS OF DOLLARS)**

	Total Costs	Construction and Right-of-Way Costs	Utility Costs	Design Costs
Core (with Plankinton Ave interchange 11th Street re-route and 13th Street exit)	\$666	\$596.9	\$19.2	\$49.9
North Approach (with Walnut Street interchange)	\$165	\$147	\$5	\$13
East Approach (Lake interchange)	\$183	\$162	\$6	\$15
West Approach	\$120	\$109	\$3	\$8
Project Cost (2001 dollars)	\$1,134			
*Adjusted Total Project Cost (with 15% contingencies & 3% inflation)	\$1,458			

Source: WisDOT & FHWA Environmental Assessment (October 2001).

*WisDOT states that they have applied a standard contingency factor to these figures, but has not revealed the percentage. To be conservative, our analysis adds 15 percent for contingencies and adjusts for 3 percent annual inflation, as recommended by the Legislative Fiscal Bureau. In calculating inflation, it was assumed that costs would be spread out equally over the four-year construction period. To avoid applying inflation to costs that will have already been paid, approximately one fourth of the costs were netted out for each of the last four years prior to calculating inflation.

B. Traffic and Revenue Estimation

(1) Estimated Traffic

This discussion is based on data provided by the Wisconsin DOT, but all interpretation of the data is the responsibility of the authors. Current (2001) weekday traffic using the entire Marquette averages 314,300 vehicles. But since the basic toll system design assumes that only the Core Interchange is tolled, our traffic and revenue analysis is based only on traffic making use of the Core. WisDOT figures for 2005 project average weekday Core traffic of 285,000.

A more detailed traffic study would attempt to project traffic for the entire planning period, building a year-by-year model of traffic and revenue over a 20- to 25-year period. Since Marquette traffic is projected to grow, but only slowly, our analysis will focus only on near-term traffic levels, taking them as a baseline. The purpose of this very preliminary analysis is simply to see if this project can be financed using toll revenues, not to work out the details of a financing plan. Modest annual growth in traffic levels will only strengthen the financial case; it is not necessary to include it in this kind of initial assessment.

Using data that break out peak-hour (morning, mid-day, and afternoon) traffic from off-peak and weekend traffic, and also data for trucks vs. cars (which pay different rates of tolls), we come up with the breakdown of baseline traffic shown in Table 5. In these calculations, we assume that a standard year consists of the equivalent of 250 days with typical weekday traffic conditions and 115 days with weekend/holiday traffic conditions.

The initial column shown in Table 5 is the amount of traffic expected to use the Marquette in the absence of tolls. It is a well-known phenomenon that demand for a highway or bridge is reduced when a toll is charged for its use. The fraction of traffic not using the facility because of the toll is called the "diversion rate." Estimation of the diversion rate for a tolled facility is generally a sophisticated exercise involving survey work and simulation modeling as part of an investment-grade traffic and revenue study. The cost of such a study is \$500,000 to \$750,000, vastly beyond the means of this very preliminary study. Lacking the resources for such a study, we must rely instead on educated guesswork, tempered by informed local knowledge.

First, we can look separately at through (long-haul) traffic versus relatively local traffic. Most *through* traffic that currently uses the Marquette is unlikely to divert to surface streets, for two reasons: first, the perceived large time

penalty that would be involved; second, for many out-of-area drivers, lack of familiarity with alternative routes. Most long-haul traffic on I-94 already bypasses the Marquette by using the I-43/I-894 route. North-south long-haul traffic on I-43/I-94 has no other practical way to cross the Menomonee River.

Estimating the diversion rate of local traffic is more complicated. Most of the diversion of north/south trips will go to 6th Street and Water Street (which becomes 1st Street and Kinnikinnic Avenue to the south, while feeding into Brady Street to the North). Some increase in use of Michigan, State, Wells, Kilbourn, McKinley, and even North Avenue as east/west diversion routes can be anticipated. However, once frugal motorists experience the limited capacity and slower speeds on these local streets, most will eventually pay the toll because they place a greater premium on their time.

It is unlikely that a significant number of trips originating on the South Side will divert from I-94 to Layton Avenue in order to access the Lake Parkway and Hoan Bridge, since (for most trips) this alternative leads the driver right back into the Marquette. An examination of WisDOT's origin/destination data bears this out, revealing that nearly 70 percent of the current trips using the Hoan Bridge originate or terminate at points north, west, and south of the Marquette Interchange. Since this option would take most drivers back through the Marquette, there is no reason to divert away from I-94. In addition, the congestion at the entrance and exit at the south end of the Lake Parkway, plus its lower speed limit (40 mph), provide a further disincentive to using this route.

Another important local issue concerns the possible impact of traffic on the other major freeway interchange, the Zoo Interchange. One way of estimating this impact is to review what SEWRPC expects to happen during the reconstruction of the Marquette, when the latter's capacity is severely restricted. SEWRPC estimates that 5,300 vehicles per day will be diverted to the Zoo Interchange during that period. That represents an increase of about four percent in the Zoo's daily traffic. This is likely to be a worst-case estimate of diversion once the new Marquette is fully open and operating with tolls, since the dollar value of the time penalty paid by drivers diverting to Zoo while the Marquette is under construction should be considerably in excess of the \$2 cost of a relatively uncongested trip on the new Marquette. Moreover, within a few years of the opening of the new Marquette, the Zoo Interchange itself will be under reconstruction, diverting some of its normal traffic to the Marquette, thus helping to familiarize new users with the latter's no-hassle tolling system.

TABLE 5 BASELINE (2005) TRAFFIC ON CORE MARQUETTE INTERCHANGE*

	Annual Traffic (000)				
	Total Yrly. Demand	Peak & Off-Peak	Heavy & Light	Diversion Rate (%)	Tolled Traffic
Week Days	71,250	28,500 (P)	1,282 (H)	10%	1,154
(285K ADT)			27,218 (L)	20%	21,774
		42,750 (O)	3,420 (H)	15%	2,907
			39,330 (L)	25%	29,498
	<i>Subtotal</i>	<i>71,250</i>	<i>71,250</i>		<i>55,333</i>
Weekend Days	30,630	15,315 (P)	689 (H)	15%	586
(266K ADT)			14,626 (L)	25%	10,970
		15,315 (O)	1,225 (H)	20%	980
			14,090 (L)	30%	9,863
	<i>Subtotal</i>	<i>30,630</i>	<i>30,630</i>		<i>22,399</i>
	Annual Total		101,880		77,732

*Legend: ADT = average daily traffic; P = peak, O = off-peak; H = heavy vehicle, L = light vehicle.

It is important to remember that the driver's choice is usually an economic decision. Though some may choose to make a political statement and avoid the tolls at any cost, experience has shown that such people are few. And while Milwaukeeans are noted for being frugal, most will ultimately act as economically rational consumers. While a few may spend 30 extra minutes on crowded city streets to avoid a \$2 toll (which implicitly values their time at \$4/hour), most will not make that choice, once they realize the cost of that decision. When tolling is first implemented, many will experiment with alternatives, leading to initial diversion rates somewhat higher than those we have assumed. However, the situation will eventually stabilize at a somewhat lower diversion rate, as people come to appreciate the value of saving time by using the newly rebuilt facility.

This kind of assessment led to the diversion estimates shown in Table 5, for heavy and light vehicles, during peak and off-peak conditions, on weekdays and on weekends. The right-hand column presents estimates of the final baseline numbers of toll-paying vehicles in each category that were used to generate revenue estimates. It should be noted that the diversion estimates in Table 5 would be somewhat higher if our proposal had involved a conventional toll system, with toll plazas, toll booths, and the traffic congestion and other problems that come with such a system. But fully automated electronic toll collection systems such as that proposed for this project are relatively painless, from both a use and a payment perspective. The diversion estimates used in this analysis reflect this convenience provided to patrons of the facility.

(2) Bridge Toll Rates

Given its \$1.5 billion price tag and complex configuration, the new Marquette is best thought of as a large and very complex bridge. Historically, most major bridges in the United States have been financed via tolls. Table 6 lists the current toll rates, for cars and big-rig trucks, on America's major toll bridges (defined here as those doing \$5 million or more per year in toll business). All figures in Table 6 are the rates for one (one-way) crossing. Thus, for bridges that charge tolls in only one direction (as in New York City and the San Francisco Bay Area), the toll charge shown is one-half the posted, round-trip rate. As can be seen, the average bridge toll for cars is about \$2 and the average for 18-wheel trucks is just over \$10. These numbers give us a starting point for estimating the possible revenue from the new Marquette.

(3) Estimated Toll Revenues

We will assume that these rates — \$2 for light vehicles and \$10 for trucks — apply during peak hours on weekdays. Consistent with the value pricing principles being encouraged by the Federal Highway Administration (and now in use on bridges and tunnels in New York and Florida), we will further assume that discounts apply during off-peak hours on weekdays and during all hours on weekends and holidays. A 30 percent off-peak discount would mean tolls of \$1.40 for cars and other light vehicles and \$7 for trucks during those hours. This kind of pricing structure has the virtue of encouraging people to shift non-essential trips away from the peak hours, thereby reducing congestion during rush hours. Reduced congestion means less stop-and-go driving, which also means reduced vehicular emissions.

We can then apply the proposed peak and off-peak toll rates to the traffic numbers for each category of traffic in the last column of Table 5. This yields a projected baseline-year toll revenue number of \$165 million. Toll revenue for 2025 is more speculative. Using WisDOT projections of traffic for the Core Interchange in 2025 and unindexed toll rates yields revenue of \$187 million for that year. However, most new toll facility franchise agreements today provide for indexing toll rates to adjust for inflation (as is done for Wisconsin's gasoline tax, and for the same reason: to keep pace with the growing real cost of maintenance and eventual reconstruction). A more detailed traffic and revenue study would produce a year-by-year revenue forecast using an assumed rate schedule; those numbers would be considerably higher in the out years.

C. Project Financing

As with most infrastructure assets, the financeability of a toll road or bridge is based on the amount of capital it can support. This is assessed by conducting a discounted cash flow analysis that is driven by two main factors: projected cash flows and the cost of capital

(1) Projected Cash Flows

The most significant aspect of the proposed toll road's cash flows is the expected revenue. In arriving at an expected revenue line, capital providers will typically use a traffic and revenue consultant. This expert estimates the

TABLE 6 TOLL RATES ON MAJOR U.S. BRIDGES

State	Bridge/Tunnel	Auto toll/crossing	5-axle Truck toll/crossing
CA	Golden Gate	\$1.50	\$4.50
	SF/Oakland Bay Bridge	\$1.00	\$4.62
	San Mateo Bridge	\$1.00	\$4.62
	Carquinez Bridge	\$1.00	\$4.62
	San Rafael Bridge	\$1.00	\$4.62
	Dumbarton Bridge	\$1.00	\$4.62
	Benicia Bridge	\$1.00	\$4.62
DE	Delaware Memorial Bridge	\$1.50	\$7.50
FL	Sunshine Skyway	\$1.00	\$2.50
	Pinellas Bayway	\$0.68	\$1.58
	Cape Coral Bridge	\$1.00	\$4.00
	Midpoint Memorial Bridge	\$1.00	\$4.00
LA	Lake Ponchartrain Causeway	\$3.00	\$15.00
	Crescent City Connection	\$1.00	\$2.50
IL	Rock Island Bridge	\$0.50	\$2.00
MD	Preston Lane Bridge	\$1.25	\$5.00
	Baltimore Harbor Tunnel	\$1.00	\$4.00
	Fort McHenry Tunnel	\$1.00	\$4.00
	Francis Scott Key Bridge	\$1.00	\$4.00
MA	Tobin Memorial Bridge	\$2.00	\$6.00
	Sumner Tunnel*	\$3.00	\$7.50
	Callahan Tunnel*	\$3.00	\$7.50
	Ted Williams Tunnel*	\$3.00	\$7.50
MI	Ambassador Bridge	\$2.50	\$18.00
	Detroit-Windsor Tunnel	\$2.50	\$29.60
	Mackinac Bridge	\$1.50	\$10.00
	Blue Water Bridge	\$2.00	\$12.50
NJ	Betsy Ross Bridge	\$1.50	\$11.25
	Ben Franklin Bridge	\$1.50	\$11.25
	Commodore Barry Bridge	\$1.50	\$11.25
	Delaware Water Gap Bridge**	\$1.25	\$16.25
	Eastern-Phillipsburg Bridge**	\$1.00	\$16.25
	I-78 Toll Bridge**	\$1.00	\$16.25
	Trenton-Morrisville Bridge**	\$1.00	\$11.25
	Walt Whitman Bridge	\$1.50	\$11.25
NY	Peace Bridge	\$1.25	\$11.00

	Triborough Bridge	\$3.50	\$19.00
	Bronx-Whitestone Bridge	\$3.50	\$19.00
	Throg's Neck Bridge	\$3.50	\$19.00
	Queens-Midtown Tunnel	\$3.50	\$19.00
	Brooklyn-Battery Tunnel	\$3.50	\$19.00
	Verrazano Narrows Bridge	\$3.50	\$16.50
	Henry Hudson Bridge	\$1.75	\$9.50
	Marine Parkway Bridge	\$1.75	\$9.50
	Cross Bay Bridge	\$1.75	\$9.50
	George Washington Bridge	\$3.00	\$15.00
	Goethals Bridge	\$3.00	\$15.00
	Outerbridge Crossing	\$3.00	\$15.00
	Lincoln Tunnel	\$3.00	\$15.00
	Holland Tunnel	\$3.00	\$15.00
	Tappan Zee Bridge	\$1.50	\$10.00
	Mid-Hudson Bridge	\$1.00	\$7.50
	Newburgh-Beacon Bridge	\$1.00	\$7.50
PR	Teodoro Moscoso Bridge	\$1.50	\$10.00
RI	Newport Bridge	\$2.00	\$5.00
SC	Hilton Head Bridge	\$1.00	\$3.25
TX	Houston Ship Channel Bridge	\$1.75	\$5.00
	McAllen International Bridge	\$1.50	\$10.00
VA	Chesapeake Bay Bridge & Tunnel	\$10.00	\$30.00
	Coleman Bridge	\$2.00	\$4.00
	Average Toll	\$1.95	\$10.17

**effective July 2002*

***effective Nov. 2002*

Sources: International Bridge, Tunnel & Turnpike Association and various toll agency web sites.

revenue that could be produced from existing traffic in the corridor, and then estimates future traffic and revenue. The future forecast is typically heavily driven by the economic forecast for the region. This affects the ability for tolls to increase over time. All of these factors will affect the revenue growth rate and thus the amount of capital that can be raised.

The next most important factor is the operations and maintenance (O&M) costs of the road. Capital providers will require comparative analyses to confirm the reasonableness of forecast O&M costs. This is often achieved by having a consulting engineer produce a report confirming the O&M forecast. The consultant will analyze the history of the relevant project and compare it to similar projects. The consultant may also review actual quotes for portions of the operations. If operations are going to be fully outsourced, the consultant will review whether the outsourcing agreement is reasonable and that the operator has sufficient experience.

Another important consideration, if the public-private partnership involves ownership or a long-term lease of the facility, is taxation. Depending on the form of the PPP, taxation may include federal income tax, state income tax, and local possessory interest taxes (similar to property taxes). Corporate taxation is often complex, and capital providers will typically consult taxation specialists to ensure that potential taxation liabilities are being correctly analyzed. Taxation cash flows represent a project cash flow "leakage" and thereby restrict the amount of capital that can

be raised to finance the toll road. Some states and cities have passed laws giving tax relief to infrastructure projects. The most common form of relief is exemption from possessory interest taxes.

The cash flows that remain after deducting O&M and taxation from project revenues represent cash available for capital providers. It is these cash flows that are analyzed by capital providers when determining the amount of capital they are prepared to invest.

When taxable or tax-exempt bond financing is used, the capital providers will often look to a rating agency such as Fitch, Moodys, or Standard & Poors to provide an indication of the risk associated with the capital being raised. A major component of this risk analysis is based on understanding the cash flow risks discussed above.

(2) Cost of Capital

While the above discussion concentrated on the expected cash available for capital servicing, it did not focus on pricing the risk associated with the cash flows. As the riskiness of the asset increases, so too does the required return that capital providers seek in order to justify the investment. This return will compensate the investors for assuming the risk inherent in the asset and will place them at a particular point on the risk-return curve. Thus AAA bonds are at the least risky end of the price curve, BBB bonds are in the middle, BB and other subordinated bonds are further towards the risky end of the price curve, with equity (in a private taxable financing) being the most risky portion of capital and thus requiring the highest return on its capital.

In analyzing the amount of capital a project can raise, the financial advisor, working with capital providers, will initially analyze the maximum amount of senior debt that can be raised by the project. Generally this is debt that has credit ratings of BBB- or higher. Once this is determined, the maximum level of subordinate debt that can be raised will be analyzed. This will often reflect current capital market conditions. Finally, if the financing is a private financing, the level of equity that can be raised will be determined. All three types of capital will be added together, resulting in the total capital that can be raised for a particular project.

If the total capital that can be raised for the project exceeds the total development cost, then the project can be financed 100 percent based on revenues and will not require any governmental assistance. If the capital that can be raised is less than the construction cost, then governmental assistance will be required.

(3) Marquette Financing

Based on the assumed net revenue projections contained in this paper, we have analyzed the amount of capital that can be raised under both a tax-exempt and private sector financing structure.

TABLE 7 FINANCING ASSUMPTIONS

	Taxable	Tax-Exempt	Comments
Annual Opening Revenue ⁹	\$156 million	\$156 million	
Revenue Growth rate	2.95%	2.95%	Annual tolls are assumed to escalate by the long-term inflation rate (3%). There is also a small amount of growth attributable to traffic increases.
Annual O&M	\$7.3 million	\$7.3 million	From Table 3, which provides toll system O&M costs only. It is assumed that ordinary highway maintenance would be provided by the State of Wisconsin.
O&M Growth rate	3.00%	3.00%	O&M is assumed to increase annually at the rate of inflation
Taxes	Applicable Federal and Wisconsin State Taxes	None	
Construction Costs ¹⁰	\$1,458 million	\$1,458 million	Assumed to be spent uniformly over 4 years

U.S. toll projects are typically financed using tax-exempt toll revenue bonds. These bonds are issued directly or indirectly by the relevant city or state agency, and are used to finance the construction of the asset. This form of financing prohibits the use of equity capital and generally the amount of capital that can be raised is constrained by the coverage ratios on these bonds. The tax-exempt nature, results in a cost of capital (i.e. interest rate) that is up to 30 percent lower than the equivalent amount of capital raised via taxable debt.

Table 8 shows that the Marquette Interchange could be 100 percent financed through its own revenues using tax-exempt municipal bond financing.

TABLE 8 TAX-EXEMPT BOND FINANCING

Sources of Funds	US \$ M	Percentage
Senior Muni Bonds - Current Interest Bonds	1,705	82.6%
Senior Muni Bonds - Capital Accretion Bonds	360	17.4%
Total	2,065	100.0%
Uses of Funds		
Uses of Funds	US \$ M	Percentage
Deposit to Construction Fund	1,377	66.6%
Deposit to Debt Service Reserve	103	5.0%
Deposit to Prepaid Debt Service Reserve	353	17.1%
Bond Insurance	87	4.2%
Underwriters Discount	52	2.5%
Other Financing Fees	20	1.0%
Surplus Fund Issues	73	3.5%
Total	2,065	100.0%

TABLE 9 TAXABLE FINANCING

Sources of Funds	US \$ M	Percentage
Senior Taxable Current Interest Bonds	1,360	67%
Senior Taxable Capital Accretion Bonds	179	9%
Equity Capital	485	24%
Total	2,024	100.0%
Uses of Funds		
Uses of Funds	US \$ M	Percentage
Deposit to Construction Fund	1,378	68.1%
Deposit to Debt Service Reserve	77	3.8%
Deposit to Prepaid Debt Service Reserve	410	20.2%
Bond Insurance	88	4.4%
Underwriters Discount	51	2.5%
Other Financing Fees	20	1.0%
Total	2,024	100.0%

In contrast to the tax-exempt form of financing, private sector equity investment in toll roads is common overseas but not very common in the United States. The main reason for this is the low cost of capital inherent in tax-exempt financing (as described above) as well as the depth of the U.S. municipal bond market. Typically, private sector investors are attracted to such investments by the long-term and relatively stable nature of projected cash flows. However, while the amount of capital raised under a tax-exempt financing structure is typically constrained by the coverage ratios in the initial years, private sector investment fully values all project cash flows. In other words, equity providers are prepared to value 100 percent of the cash flow, whereas bond buyers (including municipal bonds) only value the first 50-70 percent of cash flows.

Table 9 shows that the project could be financed 100 percent through its own revenues, using a private financing structure.

An analysis of Tables 8 and 9 indicates that the tax-exempt financing structure raises slightly more capital than the taxable financing structure. This is a fairly common observation that arises primarily because of the lower cost of capital inherent in this form of financing.

PART 6 — LEGAL FEASIBILITY ISSUES

A. Federal Issues

(1) Tolling Authority

The entire BOT approach to rebuilding the Marquette Interchange is premised on charging tolls for using the new Marquette. This raises the question of the legal status of charging tolls on a portion of the Interstate highway system. As noted earlier, the general rule is that, except for those portions of the Interstate system originally developed as toll roads or turnpikes (e.g., the New York Thruway), tolls may not be charged on this system. States wishing to impose tolls were required to request permission from the Secretary of Transportation and, if permission were granted, to repay the amount of federal funding previously invested in the section of Interstate in question. Since 1991, that situation has changed dramatically, thanks to provisions included in the ISTEA and TEA-21 reauthorizations of the federal surface transportation program.

Under today's federal highway law, there are separate provisions under which tolls could be used to rebuild the Marquette, as follows.

ISTEA Public/Private Partnership Provisions

Section 1012 of ISTEA encourages states to work with the private sector under arrangements such as BOT, with tolls used as a funding source. While this provision applies to currently non-tolled federal highways (except Interstates), it explicitly permits the reconstruction of currently non-tolled bridges on the Interstate system as toll bridges. Moreover, such projects need not be funded exclusively with tolls. Federal funds, to the extent they are available, may be used for up to 80 percent of the cost of such projects, with private capital providing the rest.

Value Pricing Pilot Program

In TEA-21, Congress expanded ISTEA's congestion pricing pilot program into a larger Value Pricing Pilot Program. Under its provisions, in Section 1216(a), the Federal Highway Administration can enter into value-pricing agreements with up to 15 state DOTs to implement projects that involve the use of road pricing to address problems of traffic congestion. These provisions explicitly permit such projects to be carried out on urban Interstates that currently are not tolled; two such projects have been in operation for several years, on I-10 in Houston and I-15 in San Diego. Similar projects are being considered in Dallas, Denver, Houston, Miami, and other metro areas.

Interstate System Reconstruction & Rehabilitation Pilot Program

Section 1216(b) of TEA-21 authorizes up to three states to rebuild sections of their Interstate system using tolls. To be authorized by the Secretary of Transportation under this program, a state DOT must be able to show that current federal and state funds are not sufficient to carry out the planned reconstruction. For urban Interstates, the relevant MPO must be involved.

All three of these approaches are potentially applicable to the Marquette project. The first depends on the Federal Highway Administration accepting the definition of the entire project as a "bridge." It clearly includes major bridges across the Menomonee and Milwaukee Rivers, and much of the remainder is elevated above surface streets. If only

a portion of the project met FHWA's definition of "bridge," only that portion could be tolled. On the other hand, federal funds might be available to cover the portion of the project's capital costs not recoverable from tolls.

If the project were pursued under the Value Pricing Pilot Program (VPPP), the entire project could be tolled. Since the emphasis of that program is on managing traffic congestion, the use of fully automated tolling and variable pricing (to shift a portion of the traffic from peak to off-peak times) would be highly positive factors in FHWA's selection process. The Marquette project would dwarf all the previous VPPP projects, making it a showcase for that program.

No state has thus far applied or been approved for an Interstate reconstruction project under the Reconstruction Pilot Program. The one state that made a serious effort to do so backed off, in the face of a coalition of trucking and taxpayer groups that vigorously opposed the idea. Since the BOT approach to rebuilding the Marquette requires tolls in order to work, it is likely to be doable only if highway user groups and taxpayer organizations can be persuaded that it is the best available alternative for bringing about an essential project. Thus, the previous failed attempt to use this Pilot Program should not be relevant to considering this course. The only drawback is that, since there have been no actual applications by state DOTs, Congress may not include this Pilot Program in the 2003 reauthorization legislation.

(2) Federal Funding Participation

The most important federal funding mechanism is the public-private partnership (PPP) provisions of ISTEA, under Section 1012. The use of such "innovative financing" provisions by a state DOT in no way reduces a state's transportation funding. That funding level is set by a formula worked out by Congress each time the federal surface transportation program is reauthorized. Wisconsin gets its allotted share and is free to use those funds as it chooses, within the broad funding categories spelled out in the statute.

Section 1012 permits the blending of federal, state, and private funds for such projects. For Interstate bridge projects being rebuilt via a public-private partnership, the maximum federal share is 80 percent. States can substitute private funds (e.g., the result of a bond issue backed by toll revenues) for the state match they would otherwise have to provide. Thus, if Wisconsin were to devote a major portion of its federal allocation to the Marquette project, it could be financed 80 percent federal and 20 percent private. Tolls could be quite low under that alternative, since the bonds supported by toll revenues would have to cover only 20 percent of the project's \$1.5 billion cost (\$300 million). But the downside for Wisconsin would be having to dedicate over \$1.2 billion in federal funds to this single project. Since Wisconsin's total federal transportation funds amount to only slightly more than \$500 million per year (much of it earmarked for other purposes, such as transit), this would not be a feasible plan. Since our preliminary numbers suggest that the entire \$1.5 billion Marquette project could be financed by private capital, going that route would free up \$1.5 billion in federal and state funds for use on other pressing transportation needs in Wisconsin.

The bottom-line point is simply that use of a public-private partnership expands the total funds available for a highway project by the amount of the toll revenue bond issue. It is a net addition of investment capital for the state's highway system.

B. State Issues

(1) Public/Private Partnerships

Wisconsin enacted a statute several years ago to permit experienced private consortia to enter into public/private partnerships with the Wisconsin Department of Transportation as envisioned by this report. The relevant statute is section 84.01(30). It provides for build-operate-lease and build-operate-transfer agreements, and it appears to provide the basic legal framework required for the proposed Marquette Interchange project. However, a project as large and complex as this one has never been attempted under this law. It will probably need some fine-tuning, in particular to address the issues set forth below.

(2) Tolling Authority

Is charging tolls on freeways legal in Wisconsin? This is similar to the question recently posed to the state's attorney in Tennessee. In September of last year, Attorney General Paul Summers issued his opinion stating, "The Legislature has vested counties with broad powers to build, repair and maintain public roads. . . . Nowhere in this broad grant is there conferred the ability to charge tolls or fees on county or state highways." Mr. Summers further explained that authorizing legislation would be necessary.

The situation in Wisconsin might very well be the same: While there is no specific state prohibition, it is highly unlikely that any entity would proceed to implement any type of tolling on highways without specific authorization to do so from the legislature and governor. To move forward without authorization would be an open invitation to litigation that could tie up the Marquette project for months or even years. Legislation should be sought to authorize the use of tolls on Wisconsin Interstates and highways, perhaps limited to projects being pursued under the PPP law.

(3) Design/Build Legality

The procurement method known as Design/Build (DB) is increasingly used for large-scale construction projects. In contrast with the traditional procurement method used by public agencies in Wisconsin (Design-Bid-Build), DB makes use of a single company or consortium of companies to take on turnkey responsibility for such a project, from initial design through construction. The major advantages of DB include:

- Obtaining a more buildable design, since the designers work with the constructors from the start; this greatly reduces costly change orders during construction.
- Saving considerable time, since construction typically can begin before final design work is completed.
- Cost savings, owing to both of the above factors.
- Guaranteed cost and schedule, with financial penalties for failure to meet those guarantees.

This last point is especially important for projects funded by revenue bonds. Design-build is virtually the only way in which investors can obtain a guaranteed construction cost. Hence, it has become virtually a requirement for large projects funded by toll revenue bonds to be developed using DB.

Certain Wisconsin counties and state agencies, including the Department of Transportation, have authority for design/build projects under Section 84.11, but this provision appears to apply only to local bridge construction and reconstruction. The statute spells out that “local” excludes bridges on the state trunk highway system (such as the Marquette is). Therefore, legislative authorization to make use of DB on PPP projects would be in order.

(4) Electronic Toll Enforcement

The automated toll collection system proposed for this project collects tolls in two ways. Regular users of the Marquette enroll in the automated tolling program by establishing a pre-paid toll account. This typically includes (1) providing the operator of the facility with his or her vehicle and billing information, as well as some automated method for replenishing a pre-paid toll account when the balance reaches a pre-established threshold, and (2) installing the transponder provided by the operator on the customer’s vehicle. Occasional users (those not enrolled in the automated tolling program) are also allowed access to the roadway. These users must be tolled in a different manner.

To toll occasional users, the operator must record the license-plate information of all vehicles using the facility that do not have transponders. This information is then used to identify the registered owner of the vehicle, who is then billed the toll for the trip, plus a surcharge to cover the cost of billing. The surcharge is also justifiable by the convenience it provides to these users: they can use the facility whenever they wish to without having to enroll in the program (set up an account, obtain a transponder, etc). Violations are therefore limited to those who abuse the system by refusing to pay the tolls and the administrative fee assessed to them, or those who actively try to avoid being tolled when using the facility.

Since there is no way the operator can cancel the service (as the phone company would if you didn’t pay your bill), the operator has to have some way of keeping people from abusing the system. This is accomplished via a toll enforcement program that focuses on those who abuse the system. To be effective, the operator must be able to impose a real penalty on the owners of vehicles identified as abusing the system. This requires legislation that allows for the imposition of accelerated penalties for abuse (e.g., \$50, \$125, \$250 for failing to respond to first, second, and third payment notices). To work, this means that the state must be able to deny the renewal of the license plate and/or operator’s license of the owner of the vehicle whose tolls and administrative fees have not been paid. Obviously, checks and balances are required for such legislation to be effective, such as providing people with a process for challenging any tolls and administrative fees imposed. But in the real world, the private developer will not be able to proceed with such a facility unless such enforcement legislation is in place.

PART 7 — POLITICAL FEASIBILITY ISSUES

A. Eliminating Double Taxation

There is a long history of opposition by highway user groups to expanded use of tolls. Groups like the American Automobile Association and the American Trucking Associations point out that there is something inherently unfair about asking their members to pay twice for using certain roads — the ones with tolls. By “double taxation,” highway user groups mean having to pay both fuel taxes and tolls to use certain roads, while they are free to use all other roads by paying only fuel taxes.

At least two U.S. toll roads — the Massachusetts Turnpike and the New York State Thruway — have acknowledged this point, at least to a modest extent. The Massachusetts road has a little-publicized program called the Turnpike Fuels Excise Refund Program, under which users can submit documentation of their use and claim a refund of the estimated fuel tax paid for the miles they drove on the Turnpike. And the Thruway exempts trucks traveling on its routes from having to pay the regular state weight/distance tax (which is 5 cents/mile for conventional 18-wheel tractor/trailers of 80,000 lbs.).¹¹

These existing refund programs do not take advantage of today’s electronic toll collection technology to accomplish the rebating of fuel taxes. As discussed in Part 3, these systems can be designed to keep track of toll-road usage, by tolling point and/or miles driven, for each specific user, as identified by account number or license plate number. Indeed, such information gathering is the essential ingredient in being able to charge the toll electronically. This makes it possible to automate the process of granting rebates of imputed fuel tax paid for miles driven on the tolled facility.

To implement the principle of “no double taxation” on the new Marquette, we propose a system to rebate fuel taxes paid by regular users. These would be all owners of light vehicles (cars and light trucks such as SUVs and pickups) and trucks who open an account and install a dashboard electronic tag. Users would receive rebates based on the average rate of fuel consumption for their category of vehicle. Based on the most recent available data, the current average fuel consumption for the U.S. vehicle fleet is:

Cars	21.6 mpg ¹²
Light trucks	17.1 mpg ¹³
Trucks	5.8 mpg ¹⁴

The approximate mix of light vehicles today is 60 percent cars and 40 percent light trucks. Both the state gasoline tax and the state diesel tax are currently 28.1 cents per gallon.

Overall, the new Marquette as defined by Wisconsin DOT includes 6.3 centerline miles of roadway. A one-way through trip would, on average, traverse one-half this distance, or 3.15 miles. Local trips that use the Marquette to access downtown Milwaukee would, on average, be shorter than this, but we will use the simplifying assumption that each trip counts as 3.15 miles for purposes of the rebate. It is a simple matter then to compute the fuel-tax rebate per trip, and to convert this to an annual figure for regular daily users (250 weekdays per year). This is done in Table 10. Assuming that two-thirds of all vehicles using the Marquette are tag-holders entitled to rebates, the final column shows the total amount to be paid out as rebates in the baseline year.

TABLE 10 FUEL-TAX REBATES

Vehicle type	Miles/ gallon	Gallons/ trip	Rebate/ trip (cents)	Annual rebate (\$)	Daily vehicles	Annual Total (\$)
Car	21.6	0.14	3.934	\$9.835	106,590	1,048,313
Light truck	17.1	0.18	5.058	\$12.64	71,060	898,198
Truck	5.8	0.53	14.893	\$37.23	12,350	459,790
Total					190,000	2,406,301

These rebates are but a small fraction of the amount of the toll per trip. But that only serves to illustrate how costly it is to produce a major transportation project like the replacement of the Marquette. Drivers paying fuel taxes may easily cover the costs of building and maintaining ordinary highway miles, but these taxes come nowhere near to covering — on a per-mile basis — the very large costs of a \$1.5 billion bridge project. This is precisely why major bridges have always been funded by tolls; they are beyond the capacity of ordinary highway user taxes to cover. And from the standpoint of the Wisconsin DOT's state highway fund, the \$2.4 million in annual fuel tax rebates is but a small price to pay for the major infusion of funds provided by the tolls, which will make it possible to complete this project in a timely manner.

B. Protecting Privacy

Privacy is an issue that must be addressed whenever automated systems are used to toll or otherwise monitor vehicles. There are three primary areas of concern with automated toll systems of the kind proposed for the Marquette:

- The toll system “tracking” vehicles and recording this information
- Security and use of customer information (both facility use and billing)
- Use of video cameras at tolling points

Strict controls on the collection, management, and use of all user trip, billing, and other information are typically imposed on the operator, as part of the concession agreement. Data collected are accessed only on a need-to-know basis (managers typically do not have access to this information) and used only for the purpose for which the information is collected. Care is also taken in the installation and operation of all video cameras to ensure that vehicle license data are collected to enable billing those vehicles without a transponder and that other information is not collected. This can even be done in an automated manner by using software to isolate the license plate in the picture and purge all other information.

For those individuals who are truly concerned that their privacy is threatened despite these safeguards, an anonymous-account option can also be provided. Under this option, the customer (or a proxy) opens a toll account without providing personal information, making a cash deposit for pre-paid tolls. The transponder is installed on the vehicle, but only the account number is known to the system. The individual customer is then responsible to ensure that the transponder is properly mounted on the vehicle and that adequate funds are in the account to pay any tolls incurred when using the facility. This enables those customers to use the facility and pay tolls, just like other transponder-holders with pre-paid accounts, and to do so in an anonymous manner.

C. Getting Out-of-State Users to Pay

For years Wisconsin residents have resented having to pay tolls on I-94 (the Tri-State Tollway) when they enter Illinois on this important Interstate highway. Our research showed that, according to the Illinois State Toll Highway Authority, Wisconsin residents currently pay nearly \$32 million per year in tolls to that agency, while Illinois drivers may pay little or nothing to use Wisconsin highways (unless they buy fuel within the state).

Under our proposal, Wisconsin would begin to recover some of its highway costs directly from drivers from Illinois and other states. We find that 4.2 percent of the traffic using the Marquette comes from out of state, and that between 25 and 50 percent of that non-Wisconsin traffic consists of trucks (which pay much higher toll rates than cars). Most out-of-state users — because they would not be regular daily users of the Marquette, like local commuters — would be charged via the video tolling system, which carries a per-use surcharge because it is much more costly to use than the electronic toll collection transponders used by regular customers. Those two factors — a large fraction of trucks and a large fraction of video billing — produce our estimates of between \$16.6 million and \$21.2 million per year in out-of-state toll revenue.

In short, between 10 and 13 percent of the tolls will be paid by out-of-state users, making them important contributors to the rebuilding of the Marquette Interchange.

D. Other Issues

(1) Highway Funding Shortfall

As discussed earlier, the Milwaukee freeways are now reaching the end of their service life. Reconstruction of the first segment called the “Marquette Interchange” is scheduled to begin in 2004. The Marquette alone is projected to cost nearly \$1.5 billion, but a serious government plan to pay for it has yet to emerge.

Soon after, a number of other freeway segments will come due for reconstruction. The Southeastern Wisconsin Regional Planning Commission has been designing alternatives whose costs are projected to reach \$6.2 billion. The public demand for these projects is high, but, again, the proponents have no idea how to pay for them.

According to the Wisconsin Transportation Development Association there is a \$500 million annual gap between transportation “needs” and anticipated revenues in the state transportation fund. No one expects an influx of new federal dollars into Wisconsin. In fact, most are anticipating a reduction.

Wisconsin is considered to have the third highest taxes in the United States. The primary sources of revenues for the transportation fund are the motor fuel tax and vehicle registration fee. Since Wisconsin’s fuel tax is already among the highest in the country, it is an unlikely option for any new revenues. To close the gap would require an increase of 17 cents per gallon. If the registration fee were to be used, the fee would have to climb by \$170. Since the current fee is now only \$45, the prospect of any significant increase in these taxes is unlikely.

The only new state funding idea to surface so far is a proposal to transfer the auto sales tax revenue from the general fund to the transportation fund. Fully implemented, this transfer could put as much as \$700 million into the transportation fund. The hook is that such a transfer would leave an equivalent hole in the general fund, which pays for schools, health care, shared revenue, and corrections. In addition, the state’s general fund already has a built-in structural deficit that will soon have the Governor and Legislature looking for \$2.8 billion in cuts and/or new revenues. It is unlikely that they’ll be looking to transfer money out of the general fund into the transportation fund.

(2) Political Changes

In January 2003, the Governor will be looking to reduce, not increase, Wisconsin’s tax burden. He will also be looking to get the Marquette Interchange rebuilt. Under the traditional WisDOT approach, these would be conflicting goals, but that would not be true under our proposed PPP/BOT approach. Attracting private capital up front, to be financed by tolls when the project is completed, eliminates the need for traditional taxpayer funding.

Many Milwaukee area voters are still in an angry mood over a recent move by county officials to sweeten their pensions. The citizens reacted, driving the long-time county executive into retirement and ousting several members of the County Board in recall elections. It is difficult to predict how these same voters will interpret a proposal to toll the Marquette. But it is important to note that these same voters replaced the old guard with a young, fiscally conservative county executive (and former state representative) who generally opposes expanding government and raising taxes. A proposal that would get the Marquette done while reducing government and taxes could get a warm reception from the new county executive.

This is especially true since the only alternative being considered (auto sales tax transfer) threatens general fund programs that subsidize the Milwaukee City and County budgets. The City and County have a high stake in seeing the Marquette completed in a timely manner, but they will not want one of their sources of state revenue threatened.

(3) The Case for Urgency

Given its budget crisis on the one hand and the need for action on the Marquette Interchange on the other, the state faces an enormous problem. As the clock ticks away, the need for a solution becomes more urgent. While the notion of tolling may seem painful or at least unfamiliar to some citizens, they would no doubt find it more painful if funding problems and political inertia caused certain freeways to be closed or restricted.

At the same time, the state faces a clear opportunity. Governments at all levels are being asked to consolidate, innovate and become more efficient, so that taxpayers don’t have to pick up more of the costs. A public/private partnership for the Marquette Interchange project would enable Wisconsin to act in this manner, getting the Interchange done right and on time while reducing government involvement and taxes.

PART 8 — CONCLUSIONS AND RECOMMENDATIONS

Rebuilding the Marquette Interchange via tolls and a public/private partnership is financially feasible. Large-scale urban highway, bridge, and tunnel projects of equal or greater size, cost, and complexity have been financed and built during the past decade using this approach. Tolls can be collected in an automated manner, avoiding the inconvenience, traffic congestion, safety, and environmental issues associated with toll booths and traditional toll-collection systems. Strong current and projected traffic levels, and tolls comparable to those charged on other U.S. bridges, would support the \$1.5 billion project cost. Moreover, obtaining the funding in this manner would leave up to \$1.5 billion in traditional state and federal highway funding sources free to meet the state's many other urgent funding needs, including the reconstruction of the Milwaukee freeway system.

To accomplish this, several next steps should be pursued. First, the state should test the interest of the private sector in such a project by issuing a Request for Qualifications, in which companies (or consortia of companies) would submit documentation of their interest and qualifications to design, finance, build, and operate such a project. In parallel with this process, WisDOT should commission an investment-grade traffic and revenue study, to verify the preliminary traffic and revenue estimates used in this report. Third, the legislature — drawing on expert advice — needs to modify and fine-tune the state's current public/private partnership law to be sure that it is adequate for a project of this scale and scope. That would include ensuring that there is adequate legal authority for the charging of electronic tolls, for enforcement against those who would abuse the electronic toll system, and for use of the design-build procurement technique for projects developed under the PPP law. It may also require strengthening conflict of interest and other such state laws to ensure the integrity of the procurement process, from both actual and perceived perspectives.

Finally, once all political and legal processes are in place, the state would hold a competition, soliciting proposals from the pre-qualified private consortia to design, finance, build, and operate the new Marquette.

ABOUT THE AUTHORS

Robert W. Poole, Jr. is Director of Transportation Studies at the Reason Foundation in Los Angeles. He received B.S. and M.S. degrees in engineering from MIT and did additional graduate work in operations research at NYU. He worked in aerospace and for several research firms before launching Reason Foundation in 1978. His 1988 policy study, "Private Tollways: Resolving Gridlock in Southern California," directly inspired California's 1989 public/private toll roads law, which has been emulated in more than a dozen other states. He has advised the U.S., California, and Florida departments of transportation, and served 18 months as a member of California's Commission on Transportation Investment. He has also advised the last four White Houses on various transportation policy issues.

Kevin Soucie is a consultant on transportation policy and government affairs with Soucie & Associates, based in Milwaukee. He received his B.A. in economics and political science from McGill and his M.A. in urban planning from the University of Wisconsin, Milwaukee. He was elected to three terms in the Wisconsin Assembly from 1974 through 1980, and chaired its transportation committee during his third term. He served as Director of Intergovernmental Affairs for Milwaukee County from 1989 through 1992. His transportation consulting work has encompassed freight rail, highways, and urban transit issues. He has chaired the Milwaukee City Transportation Commission and been a member of the Milwaukee City Plan Commission.

Thomas McDaniel, Ph.D. installed the first successful electronic toll collection (ETC) system in North America on the Coronado Bridge in San Diego in 1983. Since then he has led ETC development and deployment programs on several landmark projects in the toll industry. He was Program Manager for toll systems development and deployment on the Toronto's Highway 407 ETR (the world's first fully automated toll road), managing the program from its conception to initial live operations. Dr. McDaniel has also been instrumental in the success of Advantage I-75 and HELP, Inc., the two major weigh-station pre-clearance programs now operating at state ports-of-entry throughout North America. He is currently the Chairman of the Board of Directors of The eTrans Group, Inc.

Daryl S. Fleming, Ph.D., P.E. has over 25 years experience in the planning, engineering and management of major transportation infrastructure projects, ranging from project feasibility and evaluation, to program management and the development and deployment of toll operations plans and systems. Having overseen the operational design of over 50 interchanges, eight of which are freeway to freeway junctions, Dr. Fleming is a recognized expert in freeway operations. Since 1988 he has focused on the toll industry where he is noted for his contributions to several landmark projects, including the Highway 407 ETR in Toronto, Ontario, the GA400 in Atlanta, GA, and the Transportation Corridor Agencies in Orange County, CA. Dr. Fleming has also made significant contributions to automated applications in the commercial vehicle operations (CVO) and fleet management industries. He is currently President of The eTrans Group, Inc.

NOTES

1. "Background Paper: The Federal Transportation Funding Process," Madison: Transportation Development Association, February 2002.
2. Jose A. Gomez-Ibanez and John R. Meyer, *Going Private: The International Experience with Transport Privatization*, Washington, D.C.: The Brookings Institution, 1993, Chapter 8.
3. Edward Sullivan, *Continuation Study to Evaluate the Impacts of the SR 91 Value-Priced Express Lanes, Final Report*, prepared for the California Department of Transportation, San Luis Obispo: Cal Poly State University, December 2000.
4. Gomez-Ibanez and Meyer, *op cit.*, p. 171.
5. Robert W. Poole, Jr., "Private Tollways: How States Can Leverage Federal Highway Funds," Policy Study No. 136, Los Angeles: Reason Foundation, February 1992.
6. The original central portion of Highway 407 is what is referred to in this paragraph. Under its new private-sector ownership in 2000-01, the highway was extended by 11 miles to the east and 15 miles to the west, making a total of 68 miles in operation today, all of it tolled using the system described above.
7. E-mail communication to Robert Poole from Joelle McGinnis of ISTHA, Aug. 1, 2002.
8. Associated Press, "Turnpike Extends Discounts to Out-of-State Drivers," *Boston Globe*, July 3, 2002.
9. As a conservative measure, a 5 percent "haircut" was applied to the base estimate of \$165 million developed in subsection B.
10. See subsection A of this chapter.
11. Peter Samuel, "Putting Customers in the Driver's Seat: The Case for Tolls," Policy Study No. 274, Los Angeles: Reason Foundation, November 2000, p. 34.
12. Center for Transportation Analysis, "Chapter 7: Light Vehicles and Characteristics," *Transportation Energy Data Book*, Edition 21, Oak Ridge National Laboratory. Available on-line at <www.cta.ornl.gov/cta/data/Chapter7.html>
13. *Ibid.*
14. Highway Statistics 2000, American Trucking Associations (for all trucks - 6 or more tires, single-unit plus combination trucks).



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