

Private Finance of Public Sector Infrastructure

Martha B. Lawrence and John H. Winner¹

Harral Winner Thompson Sharp Lawrence, Inc.

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In the United States, local, state and federal governments spend about \$125 billion a year on surface transportation facilities and services.² This expenditure is funded by a complex network of taxes and user fees. Aging infrastructure is driving up maintenance and renewal costs. Taxes and fee revenue increases are failing to keep pace with demand. In this environment, funds for investment in new infrastructure are becoming ever more scarce. To expand the pool of investment funds and make beneficial investments sooner rather than later, governments are exploring ways to use public funds to leverage private capital. Some innovative financing instruments such as TE-045 assistance and Grant Anticipation Revenue Vehicle (GARVEE) bonds³ package future government revenue flows in a way that enables government to borrow money from private sector lenders.

In many countries, governments have encouraged the private sector to own and operate publicly used assets rather than simply financing them. Private participation has been encouraged using structures such as concessions, leases, and service contracts. The use of such techniques to finance infrastructure is relatively rare in the United States, but is beginning to occur in sectors such as municipal lighting, water and waste treatment. Applications in transport include concessions for a small number of private toll roads and bridges, and service contracts for commuter rail services on shared use or government owned rail infrastructure.

¹ Martha B. Lawrence (LawrenceHWTSL@aol.com) is a Managing Director of Harral Winner Thompson Sharp Lawrence, Inc. She has a BA in economics and an MBA in finance and transportation management from Northwestern University. Ms. Lawrence consults to railways and transit agencies worldwide on restructuring, business planning and financial issues. John H. Winner (WinnerHWTSL@aol.com) is a Managing Director of Harral Winner Thompson Sharp Lawrence, Inc. He has a BS in civil engineering from Carnegie-Mellon University. Mr. Winner consults to the transportation industry on restructuring, strategy, financial, and operating issues.

² Goldman, Todd and Martin Wachs, "A Quiet Revolution in Transportation Finance: The Rise of Local Option Transportation Taxes," *Transportation Quarterly* 57(1) (2003), pp. 19-32.

³ Drike, Kristine and Kumaries C. Sinha, "An Evaluation of Innovative Highway Financing Techniques for Indiana." *Transportation Quarterly* 57(1) (2003), pp. 59-76.

In conventional wisdom, the private sector provides public services more cheaply than the public sector, but the public sector can obtain capital more cheaply than the private sector. After all, the government pays zero interest for tax funds and interest rates on government borrowing are usually very low and tax advantaged. Thus, private sector involvement in public services is thought to be cost effective when operating expenses are a large share of a project's costs, but not when asset financing is a large share of costs. As the need for infrastructure financing grows, we believe the conventional wisdom should be challenged. In particular, we believe that assumptions about the government's cost of capital should be reexamined. In the following pages we examine these assumptions, using as an example an investment in new passenger rail infrastructure.

Passenger Rail Infrastructure Investment

Public use passenger rail infrastructure has many characteristics that pose barriers to private ownership. The service provided with passenger rail infrastructure is typically loss-making. Unlike toll roads, the costs of investment and operations cannot be recovered directly from users. To be financially viable, government must subsidize passenger rail infrastructure and services. This means that before private sector participation can occur, the government must decide that (1) the service should be provided, (2) government will support it financially and (3) the private sector should provide the service. This last condition will only occur if the government determines that private participation is beneficial (i.e., cheaper) than providing the service itself.

Governments have made these decisions in many places. For example, in Stockholm, Storstockholms Lokaltrafik (SL) hires private sector service providers to operate all bus, light rail, commuter rail and metro services. SL has benefited from the private sector's ability to operate more efficiently and has seen its cost per seat-km decline by 19% since it started contracting out operations.⁴ In Stockholm however, SL retains ownership of the rail infrastructure assets, so operating costs, where a private operator would be expected to have an advantage, are separated from ownership costs, where the public agency is normally expected to have an advantage.

In the United States, transit authorities sometimes hire private firms to operate commuter services. For example, authorities in major cities such as Boston, Dallas, San Diego, Chicago, and Seattle use private sector operators. In some cases, the infrastructure over which transit services operate was built

⁴ AB Storstockholms Lokaltrafik, *2001 Annual Report*, p. 45.

for dual freight and passenger use and a freight company owns and operates the infrastructure.⁵ Transit authorities sometimes buy dual-use infrastructure and convert it to passenger only use.

Increasingly, authorities build infrastructure specifically for passenger services, including subway, light rail, and commuter rail systems. Typically, special purpose infrastructure is built by private sector firms under contract to a government authority. Transit authorities sometimes use private sector concessionaires or contractors to provide passenger services and to conduct infrastructure maintenance and capital improvements. Occasionally, a new system will be built with private finance using a design-build-operate-maintain and transfer contract. In the United States, New Jersey Transit's Hudson Bergen Light Rail Transit line was originally bid in this way—using private finance.⁶ For the most part, however, US rail passenger infrastructure is provided through public financing.

Our example focuses on publicly owned special purpose rail passenger infrastructure. In this case, the cost of the infrastructure and its financing is quite high while the cost of using the infrastructure to provide infrastructure services⁷ to an on-rail operator is quite low. Even if a private entity can operate the infrastructure much more efficiently than a public entity, the relative cost of capital between the entities is thought to determine whether private capital can be used to finance the infrastructure. This is the central dilemma facing private investors seeking commercial returns providing public infrastructure. We will show that careful analysis can solve this dilemma and permit common use of private ownership of rail passenger infrastructure.

Private versus Public Costs

To analyze when a government agency would decide to have the private sector provide both infrastructure and infrastructure services, we compared the costs a transit agency would incur to provide passenger rail infrastructure and infrastructure service to the costs a private sector firm would incur to provide the same assets and services.

We posit that the private sector provider would charge its costs (including a fair return on capital) and the transit agency would be willing to pay up to—but not beyond—its own expected costs. We assumed that the initial

⁵ The transit authority most often contracts with the freight carrier for the operation of passenger services. Payments include fees for the use of the infrastructure.

⁶ In the end, HBLRT was built using NJT provided funding, much of it from FTA funds.

⁷ Infrastructure services include inspection, basic maintenance, repair of infrastructure components, provision of electrical, communications, signaling and dispatching services.

investment in the infrastructure asset was \$1 billion and the asset was purchased new. The cost of providing passenger rail infrastructure includes the following four main elements.

1. Opportunity cost of capital invested.
2. Operating costs.
3. Renewal costs.
4. Cost of the risks associated with providing this service, such as risk of infrastructure failures, renewal cost overruns and price changes.

Of these costs, the opportunity cost of investing capital in the infrastructure asset is by far the largest element, accounting for 90% of costs in the first year of analysis. Over time, as assets must be renewed and inflation increases the cost of both operating and capital expenses, the share of costs represented by the original investment reduces. Nonetheless, opportunity cost is still more than two-thirds of all costs by year 20 and more than half through year 46.

Opportunity Cost of Investment Capital

The opportunity cost of investing \$1 billion in a passenger rail infrastructure asset is the value of having \$1 billion available for other purposes. In the private sector, the opportunity cost of capital is relatively easy to quantify—it is the return foregone by investing in the current project rather than investing in other projects of comparable risk.⁸ If the risk of the project is similar to the overall risk of the firm, the firm's weighted average cost of capital (WACC) is often used as a proxy for the opportunity cost of capital.⁹ Since an individual firm is small relative to the pool of private capital available, the amount of capital the firm needs to raise does not affect the firm's cost of capital unless it changes the firm's risk profile.

To estimate the private operator's opportunity cost, we looked at the WACC for operators of rail infrastructure in the US and UK, shown in Table 1. British infrastructure provider Railtrack¹⁰ is similar to our private operator in that it was a private rail infrastructure provider whose customers were mostly private passenger train operators. The UK Rail Regulator found that Railtrack's required return was 7% to 7.5% for debt and 9.4% to 10.7% for equity. The Regulator allowed Railtrack the higher end of this range, because of the need for substantial capital investment in the near term.

⁸ Brealey, Richard and Stewart Myers, *Principles of Corporate Finance* (1981), p. 12.

⁹ *Id.*, p. 361.

¹⁰ Figures in Table 1 are from the Office of the Rail Regulator, *The Periodic Review of Railtrack's Access Charges: Final Conclusions* (October 2000)

Class I carriers are the largest rail systems in the United States. US Class I railroads provide integrated rail freight services and provide infrastructure and operating services for passenger service. The Surface Transportation Board found that their cost of capital in 2001 was 6.9% for debt and 12.8% for equity.¹¹

Table 1: Financial Structures in Rail Industry

	UK Railtrack 2000	Class I RRs 2001	Private Operator
Capital Structure			
Debt	50%	41.8%	70%
Equity	50%	56.0%	30%
Preferred	NA	2.2%	NA
Cost of Capital			
Debt	7% - 7.25%	6.9%	7%
Equity (after tax)	9.4% - 10.7%	12.8%	13%
Preferred	NA	6.3%	

We believe that the basic business of a passenger rail infrastructure provider would be less risky than either Railtrack or the US Class I railways. A typical service agreement for rail infrastructure or operations is governed by a clearly-defined long-term contract between the transit authority and the infrastructure owner-operator, with reasonable provisions and subject to normal legal enforcement. Revenues under such a contract would be relatively predictable, likely structured to reflect costs, and payment from the transit agency would be reasonably assured.

By contrast, US Class I railways operate in a constantly changing very competitive marketplace, with traffics that can disappear with a dip in the economy or price change from a competitor. Railtrack, as evidenced by its descent into administration, also operated in a much higher risk environment. It had multiple contracts subject to extensive regulatory intervention, massive traffic growth on deteriorated infrastructure and an escalating set of safety requirements that were mandated but not funded in the regulatory process.

Based on the lower risk of our infrastructure provider's business, we believe that using a 7% interest rate on debt is reasonable and likely conservative. Given the singular nature of the service it provides and its relatively secure commercial environment, we also expect that our infrastructure provider

¹¹ Figures in Table 1 are from the Surface Transportation Board, STB Ex Parte No. 558 (Sub No. 5), *Railroad Cost of Capital – 2001* (June 14, 2002).

would be more leveraged than Railtrack or the US Class I's. We have used a debt:equity ratio of 70:30 to reflect this. Given the higher leverage but lower business risk, we expect investors will be looking for a rate of return on equity tending toward the higher end of the Railtrack/Class I range. We estimate that an after tax rate of return of about 13% would be expected. These values are summarized in Table 1. Based on an effective tax rate of 40%,¹² these assumptions translate into a pre-tax WACC of 11.4%:

$$\text{Private Operator WACC} = [0.7 * 0.07] + [0.3 * 0.13 / (1 - 0.4)] = 0.114$$

This WACC implies that the opportunity cost of capital for our hypothetical \$1-billion infrastructure project would average \$114 million per year. The private operator must pay \$49 million in interest each year on the debt portion of its investment. Over the life of the project, free cash flows must yield 13% after tax (21.7% pre tax) on the equity portion of the investment.

Using WACC as a measure of the opportunity cost of investment funds for a transit agency is much more problematic. An agency's WACC is difficult to quantify meaningfully because the agency's capital is not obtained in a normally functioning capital market. Price doesn't reflect risk and doesn't affect the quantity of capital demanded or supplied. Instead, much of a transit agency's capital is often free (provided through grants) but the quantity of capital available is rationed through non-price means.

For example, in the US, a transit agency's funds for an investment project are likely to come from the Federal Transit Administration (FTA) and from state and local governments. Funding sources for the Hiawatha Light Rail Line, a typical new start in Minneapolis are shown in Table 2.¹³ As the table indicates, capital funds for this project are grant-based. That is, the transit agency is not expected to pay interest or dividends on the funds invested.

At times, transit agencies choose to invest earlier than their grant/tax funding sources provide resources. The most common method for bridging this funding gap is to sell debt that pledges the taxpayer-funded resources assembled to pay for the investment. Examples include:

- Tax Anticipation Notes (TANs) or revenue bonds in which the transit agency borrows against a dedicated funding tax funding source (usually a sales tax).

¹² Accelerated depreciation could reduce tax liabilities in early years. When analyzing a specific investment, HWTSL would prepare a project-specific forecast of income taxes.

¹³ "Transit and Politics in the Twin Cities," *Mass Transit* (February/March 2003), p. 16.

- Grant Anticipation Notes (GANs) in which the transit agency borrows relatively short term against pledged grant funds.
- Certificates of Participation (COPs), bonds whose payments are secured by a transit agency lease. Lease payments are typically secured by pledged grant funds.¹⁴

The interest paid to lenders for such borrowing is typically tax free and interest rates reflect this tax-free status. The size of borrowing is limited by the tax-payer resources backing the borrowing. Many transit agencies also engage in lease financing.

Table 2: Funding Sources for Light Rail Line

Funding Sources for Hiawatha Light Rail Line	Amount (\$millions)
Federal Grant (FTA)	334
Federal Grant (CMAQ)	50
State of Minnesota	100
Airport	87
Hennepin County Regional Rail Authority	84
Minnesota DOT	20
Total	675

A review we conducted of long term capital sources for a sample of large and medium size transit agencies found that approximately a third came from these various financing sources, with pledges of sales taxes and pledges of federal grants being the most common.¹⁵ The remaining two-thirds of capital was equity, that is, provided without interest.

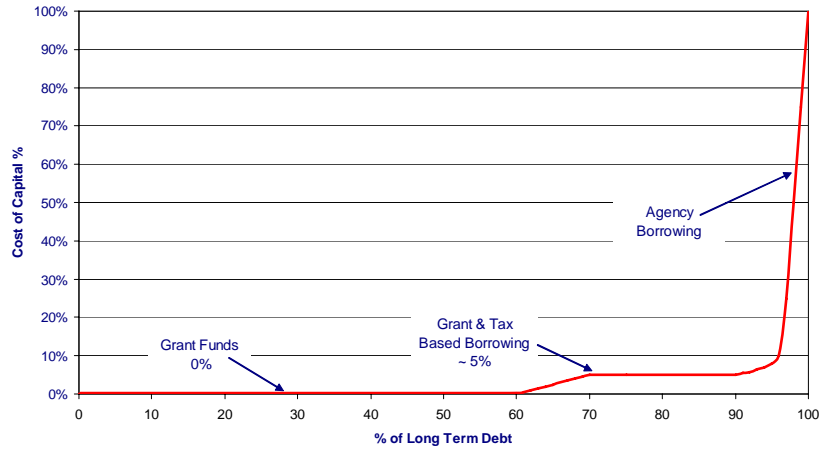
Figure 1 illustrates the cost of capital dilemma. Some portion of a transit agency investment funds is interest free grant funds. The amount of such funds is severely rationed, but grant funding usually represents a significant portion a transit agency investment for a major infrastructure project. The transit agency may borrow in capital markets against the promised grant funding or tax revenues. Such borrowing usually has a low interest rate because guaranteed government funds are pledged for repayment and interest earned on some funding sources is exempt from taxes.

¹⁴ For example, New Jersey Transit COPs are “special limited obligations of the Corporation payable solely from Federal Capital Grant proceeds and investment earnings on undisbursed proceeds held by the trustee.” New Jersey Transit, *2000 Annual Report*, p. 37.

¹⁵ Interest rates averaged approximately 5%.

A typical transit agency could not borrow any substantial amount outside these pledged sources. Most transit agencies are loss making and have neither

Figure 1: Illustrative Cost of Capital for Transit Agency



the authority to tax nor a guaranteed source of income. Because of this, the market would not supply long term, large scale financing, so the interest rate on such borrowing is effectively infinity. Thus, rather than bearing any relationship to returns in the market and risk of the project, the rate an agency pays for capital could be zero, 5%, or infinity, depending on the source of funds. This profile is not informative for understanding the transit agency’s opportunity cost of capital.

Measuring the opportunity cost of capital using the rate of return on a transit agency’s project alternatives is also problematic. Most transit agency projects have a positive economic rate of return, but not a positive financial return.¹⁶ The transit agency’s alternative is to invest the funds in other socially beneficial projects that also do not generate positive financial returns.¹⁷ These projects may have a very high benefit to society, but knowing the social benefits does not help us quantify a financial measure of the opportunity cost of capital.

¹⁶ New transit systems have a significant impact on property values and economic development in areas surrounding stations. For the community at large, increases in property values, employment opportunities, and economic growth may be significant, but transit services themselves are rarely self-financing.

¹⁷ In theory, the transit agency could invest the funds in non-transit projects with comparable risk and positive financial returns. But this concept breaks down in trying to define the “comparable risk” to a project with a negative financial return.

The nature of transit agency investments makes defining the value of alternative government investments problematic. Since most transit infrastructure is ultimately built with taxpayer funds, we are left with the most basic alternative use of the money—leaving it in tax payers’ pockets. That is, we can measure the opportunity cost of tax-funded investments by looking at the cost of displacing private use of funds. If the tax displaces investment, the opportunity cost is the pre-tax opportunity cost of the investments displaced.¹⁸ If the tax displaces consumption, the cost is the after-tax rate that reflects society’s time preference for consumption now vs. consumption later.¹⁹ Since taxes displace a mix of consumption and investment, an average can be used that weights how much money comes from displace investment and how much comes from displaced consumption.

This is the approach used by the US government. The Office of Management and Budget has researched the opportunity cost of tax money for the US Federal Government. It finds that the cost of capital for federal tax-funded investments should be 7% (real), although a higher rate may be used if the funds are expected to come primarily from private investment.²⁰ The US Federal Transit Administration sponsored a guidebook on financial analysis of transit projects published by the Transportation Research Board. It indicates that discount rates of 12 to 14 percent²¹ (nominal) are typical for transit investments.

In our analysis, we use the lower OMB rate of 7% real for the transit agency to be conservative. We assumed long term inflation of 2.5% inflation throughout the forecast period, so in nominal terms we used a 9.5% rate. On

¹⁸ “Funds withdrawn from private investment should be valued at the opportunity cost of those investments. This should be measured by the pre-tax rate of return.” *Rosen, Harvey S. Public Finance: Sixth Edition (2002)* p. 228. The pretax rate of return is used because the funds invested would be pretax funds.

¹⁹ “Funds withdrawn from private consumption should be valued at the rate at which society values consumption now over consumption in the future. This should be measured by the after tax rate of time preference.” *Rosen, Harvey S. Public Finance: Sixth Edition (2002)* p. 228. The after-tax rate is used because consumption is paid for with after-tax funds.

²⁰ “Constant-dollar benefit-cost analyses of proposed investments and regulations should report net present value and other outcomes determined using a real discount rate of 7 percent. This rate approximates the marginal pretax rate of return on an average investment in the private sector in recent years....in analyzing a regulatory proposal whose main cost is to reduce business investment, net present value should also be calculated using a higher discount rate than 7 percent.” Office of Management and Budget, *Circular No. A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs* (October 29, 1992) p. 6-7.

²¹ “[For] transit projects in developed countries such as the United States, [discount rate] values normally range between 12 and 14 percent.” Transportation Research Board, *Economic Impact Analysis of Transit Investments: Guidebook for Practitioners*, TCRP Report 35 (1998) pp 4-14.

a \$1 billion investment, this translates into an investment cost of \$95 million per year.

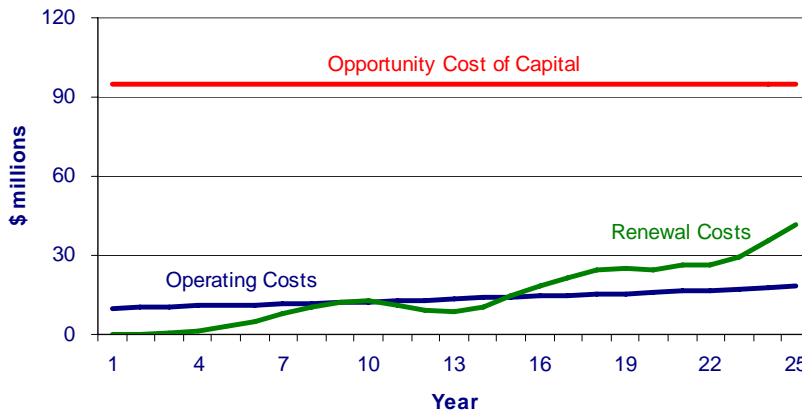
Operating Costs

When analyzing a specific rail investment, we usually prepare a detailed forecast of operating costs by activity and natural expense, based on historical costs and other operating benchmarks. For purposes of this example, however, we have assumed that operating costs for the transit agency are \$10 million per year and increase annually with inflation. On an order-of-magnitude basis, \$10 million is a reasonable operating cost for a \$1 billion infrastructure property.

Over time operating costs grow with inflation, but they start so much lower than investment costs that they do not equal capital costs until year 93 of the analysis. Figure 2 illustrates the dominance of capital costs for the first 25 years.

It is our experience that private operators have lower costs than most transit agencies:

Figure 2: Transit Agency Capital, Operating & Renewal Costs for Rail Infrastructure



- Private operators use less staff, and buy in more services from specialized contractors, especially for stations & signals and communications.
- Private operators use non-Railway Labor Act employees, reducing wage rates, reducing benefits rate to 50% of salaries (from 80%) and increasing productivity.
- Private operators have lower overhead.

For purposes of this simplified analysis, we have assumed that the private operator operating costs are 40% less than the transit agency’s costs. This is

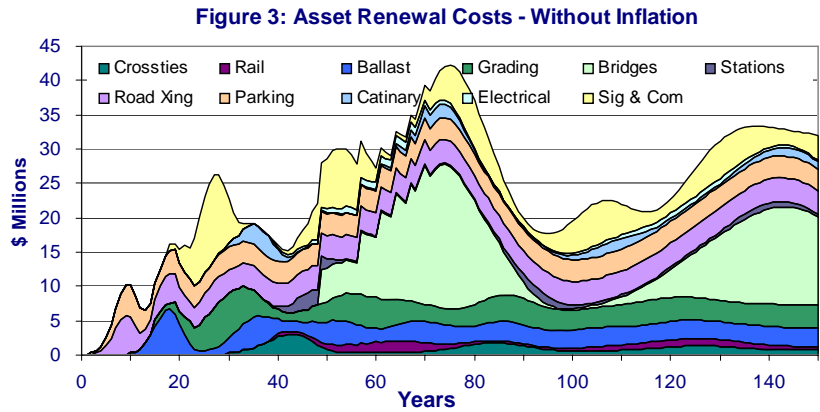
consistent with our experience in analyzing publicly and privately operated passenger services. Private operator costs start at \$6 million per year and increase annually with inflation.

Cost of Renewing the Infrastructure

Once constructed, railway infrastructure lasts a long time. Some components, like cross-ties or rail may last 20 to 30 years. Other components, such as bridges and overhead structures, may have an engineering life of 75-years or more. Over the life of the infrastructure it must be maintained and, as components wear out, they must be renewed or replaced, usually a capital expense.

At any point in time after construction is complete, some infrastructure components are partially worn, others are approaching the time when they must be replaced or renewed, while other components have just been replaced and are again in a “new” state. Over time, the typical replacement cycle of infrastructure components requires the cash flows shown in Figure 3, by type of asset, in constant cost terms.

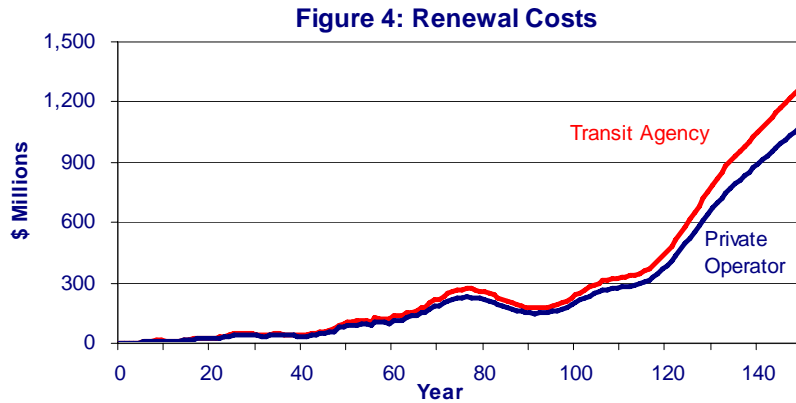
As Figure 3 demonstrates, cash flows to renew rail infrastructure are lumpy and large expenditures occur in later years. In constant dollar terms, the



remaining value of infrastructure components is always less than the original cost, because some components will always be less than new.

We forecast the timing of physical asset renewals and estimated the cost of each renewal for a typical passenger rail infrastructure asset with a beginning value of \$1 billion. The results are shown in Figure 4.

Over the 150 years analyzed, asset renewal expenses fluctuate depending on when major asset groups need replacement. Inflation is a significant factor because of the very long term of the analysis. In year 20, asset renewal costs are just 26% of the \$95 million annual cost of capital for the initial



investment. By year 50 asset renewal costs equal interest on the initial investment; by year 75, asset renewal spending is nearly three times interest costs.

We forecast that the private operator would need to renew the infrastructure at the same rate as the transit agency, but would have lower costs than the transit agency:

- Contracting more renewal work than transit agency.
- Subcontracting work in steady, contractible increments.
- Using contractors with automated equipment not economic for acquisition by transit agency.
- Using non Railway Labor Act staff for much of the work.

For purposes of this simplified analysis, we have assumed that the private operator renewal costs are 15% less than the transit agency's costs, a conservative estimate in our experience.

Risk

When a transit agency contracts with a private operator for services, it transfers some risk to the private operator. This transfer of risk is a valuable benefit. When a public agency analyzes the cost to self-provide, it puts a value on the risk transferred. Sometimes, it is treated as a qualitative factor, but often the risk is quantified and treated as a cost of self-providing. For example, in the UK, HM Treasury requires a cost-benefit analysis of every PPP project that includes a quantification of risk. We have modeled our risk analysis on the findings in the UK, focusing on two types of risk: risk of cost overrun on capital investments and risk of cost overrun on operating expenses.²²

Studies have shown that cost overruns and construction delays are significant risks, when making capital investments in transportation infrastructure. A study of transportation infrastructure investment across multiple EU countries found that “cost overruns of 50% to 100% were common and that overruns above 100% are not uncommon.”²³ A review of 400 transportation infrastructure projects for Washington State Department of Transportation found that some 60% of projects had cost overruns averaging 27% over a project budget that included 10% to 20% contingencies.²⁴ A US Federal Transit Administration study of the probability of cost overrun for investment in light rail infrastructure found that a contingency of 28% was needed to have an 85% confidence of avoiding a cost overrun.²⁵

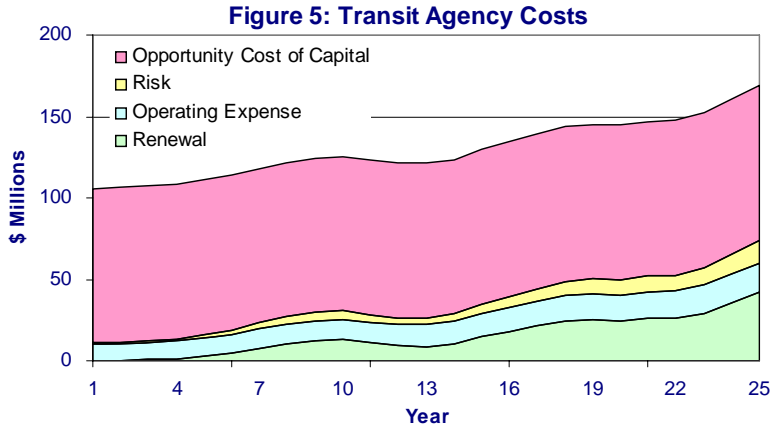
Based on these studies, we estimate that the value of cost overrun risk a transit agency would shed by hiring a private operator is 30% of capital expenditures. Using a similar approach we estimate that the value of cost overrun risk is 10% of operating expenditures. In our simplified example, the value of the risk transfer is \$1 million in year one, rising to \$9 million in year 20 and \$85 million in year 75. Total transit agency costs for providing and

²² For example, in the proposed PPP for the London Underground, the value of risk transfer was estimated as £2.3 billion out of a total cost to self provide of £14.1. Most of £2.3 risk was risk of cost overruns and cost estimating. Ernst & Young, *London Underground PPPs – Value for Money Review*. (2002)

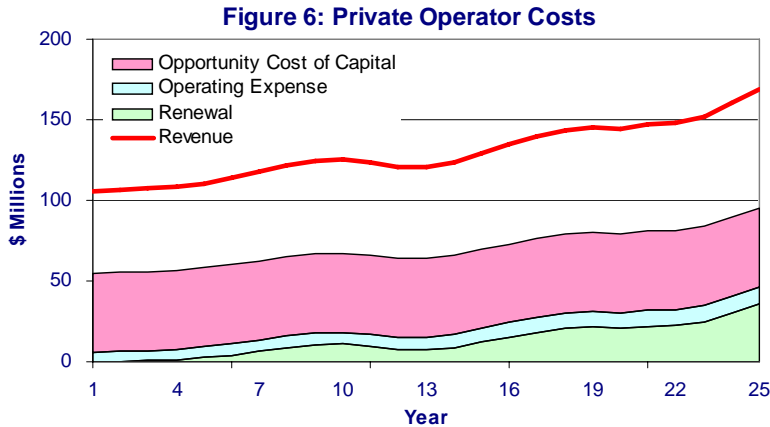
²³ Skamris, M. and B. Flyvbjerg, “Accuracy of Forecasts and Cost Estimates on Large Transportation Projects.” *Transportation Research Record* 1518 (1996) pp. 65-69.

²⁴ Hinze J. and G. Selstead, Analysis of WSDOT Construction Cost Overruns, Final Report, published by Federal Highway Administration and Washington State Department of Transportation (July 1991).

²⁵ Chaney, Victoria, Kathryn Derr, Bibi Rawoof, and Jessica Weissman, *Probabilistic Risk Analysis for Turnkey Construction: A Case Study*, FTA-MD-26-7001-96-2, published by Federal Transit Agency (June 1996).



operating infrastructure are shown in Figure 5 while the costs for a private operator are shown in Figure 6.

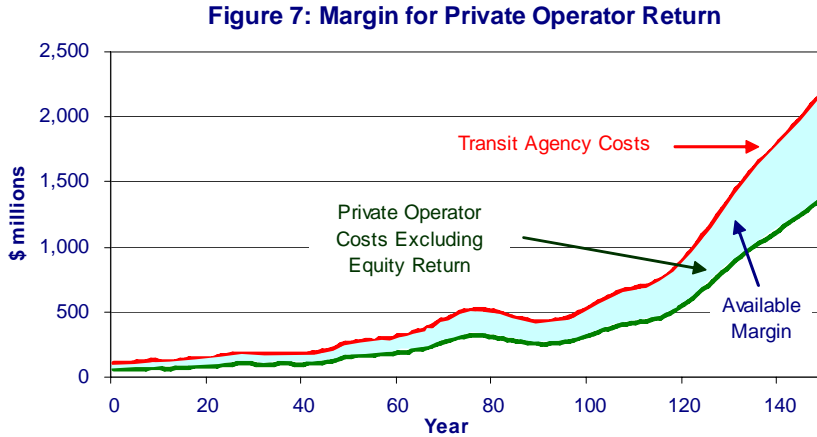


Private Infrastructure Is Financially Feasible

When we combine all the costs of the transit agency and the private operator, we find that private companies can build and operate rail transit infrastructure at a cost equivalent to or less than those incurred by public agencies. Overall financial results are shown in Figure 7.

The top line of the graph is the transit agency’s costs to provide the infrastructure service. The lower line is the private operator’s costs, excluding its return on equity. The margin between the transit agency costs and the

private operator’s costs represents the funds potentially available to pay a return on equity for the private operator. The margin is sufficient to provide the private operator a return slightly in excess of its required rate of 13% after tax.²⁶



We conclude that a transit agency could find private finance and operation of infrastructure financially beneficial, even when the service involves a large capital investment. The key to our conclusion is understanding the real cost of public funds. Even though most of a transit agency’s investment capital comes from grant sources, transit agency capital is rationed and, since it comes from taxpayers, has a much higher opportunity cost than traditionally thought.

As transit agencies compete for scarce public funding, financial structures that allow a transit agency to access private capital are likely to come into greater use. Such transactions imply a cost of capital much higher than those usually attributed to government agencies. In an environment of shortage and rationing, capital is much more costly than even we have estimated. In coming years, we expect to see private capital used to finance public transport infrastructure more frequently in the United States.



²⁶ The internal rate of return of the equity investment together with the “margin” is 21.9%.