

Investing in transportation

Doing more with less

January 2012

At a glance

PwC surveyed five countries—the UK, Australia, Japan, Sweden, and Canada—to analyze their transportation investment decisions.

The research illustrates that transportation investment frameworks align policy objectives with investment resources using transparent, accountable processes.

Performance-based metrics rank projects based on their ability to deliver the greatest value.

Allocating scarce public monies to the projects that yield the best return for taxpayer investment is especially critical today. A PwC survey of five countries illustrates how transportation investment frameworks can help prioritize projects and measure performance.

Shrinking public resources

Historically endowed with the resources necessary to create and maintain world-class transportation infrastructure, the US in recent years has experienced a decline in transportation infrastructure spending. State and federal budgets are squeezed tighter than ever before as various constituencies compete for a limited—often shrinking—pool of funding.

As a result, the US has become less and less able to do either: create new infrastructure or maintain what already exists. Today, the US ranks 24th in the world for the quality of its overall infrastructure—between Malaysia in 23rd place and Taiwan in 25th—according to the World Economic Forum's Global Competitiveness Report evaluating 142 countries.¹

The need for more efficient infrastructure investment

On the one hand, government budgets are tighter than they've ever been: Infrastructure maintenance and improvement funding gaps as high as 70 percent are not uncommon, according to the American Association of State Highway and Transportation Officials. As Figure 1 illustrates, estimates from the US Department of Transportation, the National Surface Transportation Infrastructure Financing Commission, and the National Surface Transportation Policy and Revenue Study Commission all concur that significant gaps in funding exist.² And 29 states have projected budget shortfalls totaling \$44 billion for FY 2013, which begins July 1, 2012.³

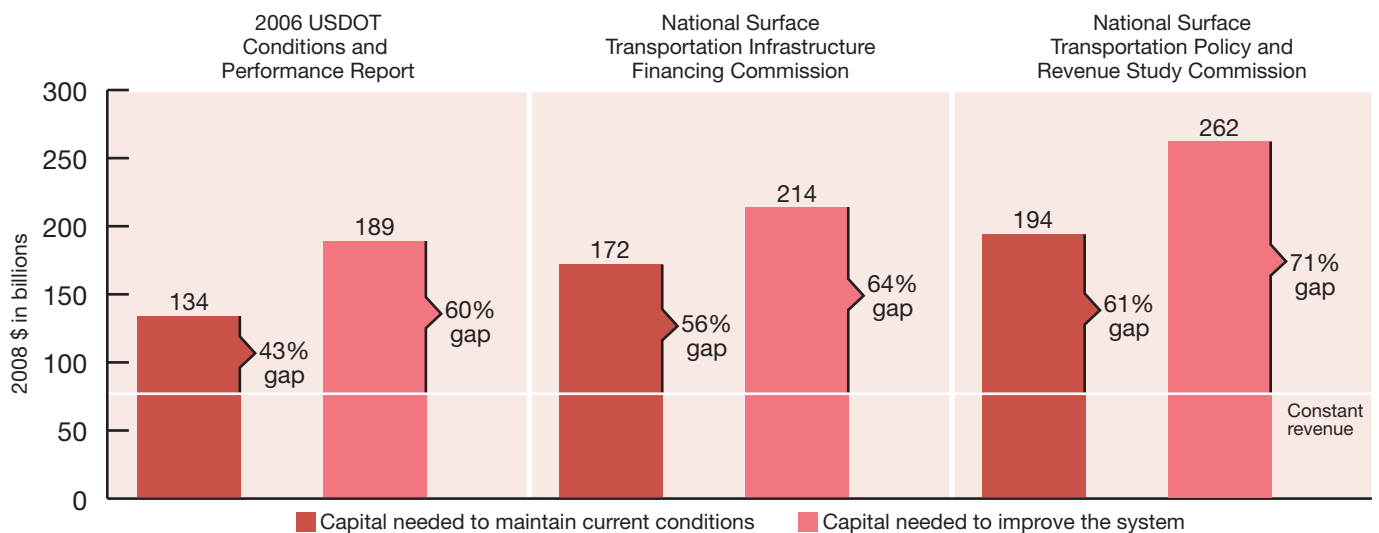
71%

The National Surface Transportation Policy and Revenue Study Commission estimates a 71% gap between the amount of capital available and the amount of capital needed to improve transportation infrastructure between 2008 and 2035.

On the other hand, the ability to transport people, raw materials, and finished goods is even more essential in today's interconnected global economy: The quality of a region's infrastructure indicates not only its energy in the present but also its

momentum for the future.⁴ In fact, underinvestment in infrastructure is a top 10 economic risk for the entire global landscape according to a World Economic Forum risk report because infrastructure is the foundation of a region's prosperity and resilience.⁵

Figure 1. Average annual capital needs and gap estimates, all levels of government, 2008–2035



Source: National Surface Transportation Infrastructure Financing Commission

Analyzing international approaches

As governments around the world juggle competing priorities within the context of limited budgets, they have sought more effective ways to maintain and expand their transportation systems. Several have developed investment frameworks to guide decisions and evaluate performance. Transportation investment frameworks establish a long-term policy approach to investment decision-making that achieves agreed policy objectives.

To evaluate how other countries use transportation investment frameworks to allocate scarce public funds to the highest priority transportation investments, PwC analyzed approaches in the UK, Australia, and Japan.⁶ These countries were selected for the currency and relevance of their transportation investment frameworks as well as for their use of quantitative and qualitative appraisal models. In

addition, PwC studied frameworks in Sweden and Canada to evaluate less quantifiable benefits such as livability, sustainability, and environmental impacts. The two-part analysis also uncovered which elements of these investment frameworks provide important lessons learned for the US. This report is a high-level summary of Part 1 of the analysis.

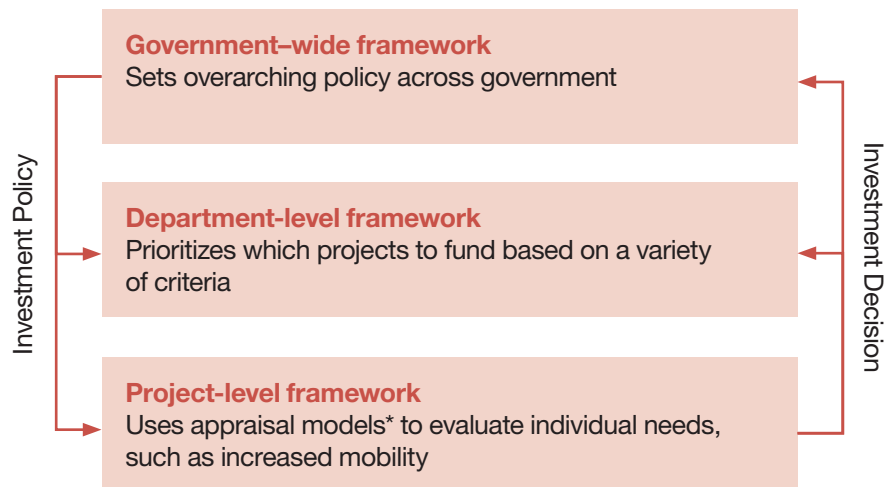
In the second part of the five-country study, PwC assessed how value for money (VfM) analysis guides transportation investment decision-making. VfM analysis supports decision makers as they assess the roles of the public and private sectors in delivering a specific infrastructure project.

Research questions explored

- What are the objectives of the transportation infrastructure investment model in the various countries studied: UK, Australia, Japan, Canada, Sweden?
- How best do officials ensure that taxpayers receive optimal return on investment in the transportation system?
- What are the best ways to ensure that transportation systems are contributing to economic growth?
- How does the jurisdiction ensure that its transportation investment model is achieving valuable results?

PwC conducted the research for this report with the US Department of Transportation. However, this report does not represent the policy or views of the US Department of Transportation.

Figure 2. Transportation investment frameworks align investment policy and resources



**For more on appraisal models, see pages 8-9.*

Source: PwC analysis, based on interviews in the UK, Australia, Japan, Canada, and Sweden

What is an investment framework?

At its core, an investment framework consists of analytical tools and processes to identify investment needs, evaluate projects that could meet those needs, and then assess how best to fund and deliver those projects. Many states and localities in the US employ some version of an investment framework to prioritize their transportation needs. The federal government meanwhile, uses a range of analytical tools to evaluate and allocate funding to priority transportation investments.

The transportation investment frameworks reviewed in this multi-country study are marked by their overarching scope. These high-level frameworks typically cover

multiple infrastructure sectors. More importantly, they are designed to prioritize investment decision-making while infusing the process with transparency and accountability. These frameworks also measure and report investment results based on agreed performance criteria. More so than other common approaches, they are characterized by the transparency and accountability they bring to investment decision-making.

Figure 2 above shows how these frameworks typically cascade, starting with a government-wide framework, moving to the departmental level, and then finally, providing project-level assessment and reporting capability. Each level of the framework aligns investment policy objectives and resources with project delivery and reporting. While most transportation

investment frameworks rely heavily on quantitative tools to measure expected and realized project benefits, several of those studied also included methodologies to evaluate less quantifiable benefits such as livability, sustainability, and environmental impacts.

The underlying premise of the frameworks however, is the concept of value for money. In this context, value for money secures the best mix of quality and effectiveness for the least outlay during the entire lifetime of a project, from procurement to long-term operations and maintenance. The investment frameworks guide the procuring authorities in identifying, prioritizing, and selecting projects that meet agreed policy objectives and provide value for money.

How transportation investment frameworks work at various levels

At the **government-wide level**, the framework sets overarching policy for the various government agencies competing for funding (see Figure 3 below). In some of the countries studied, an infrastructure advisory body advises the government on priorities.

At this level, officials make big-picture policy decisions, allocating

for example, various funding levels for transportation or health care. If the government-wide framework is established at the federal level, state and regional guidelines often align with these federal objectives. Examples of a government-wide investment framework include the Treasury Green Book in the UK (see Figure 4 on the following page), the Gateway Review Process in Australia and the UK, and many aspects of the American Recovery and Reinvestment Act in the US.

Figure 3. Economic infrastructure funding and finance models in the UK*

	Public capital		Private finance		
	Public industry	Conventional procurement	Public-private partnership (PPP)/ Private finance initiative (PFI)	Regulated private industry	Other private industry
Energy				national electric power transmission network	electricity generation
Telecommunications				national telecommunications infrastructure	cable networks
Transportation		most roads	M25 motorway widening	some airports	ports
Waste	commercial operations by local authorities	municipal facilities	municipal operations		commercial disposal
Water	Scotland	flood and coastal defenses	Northern Ireland PFIs	England & Wales	

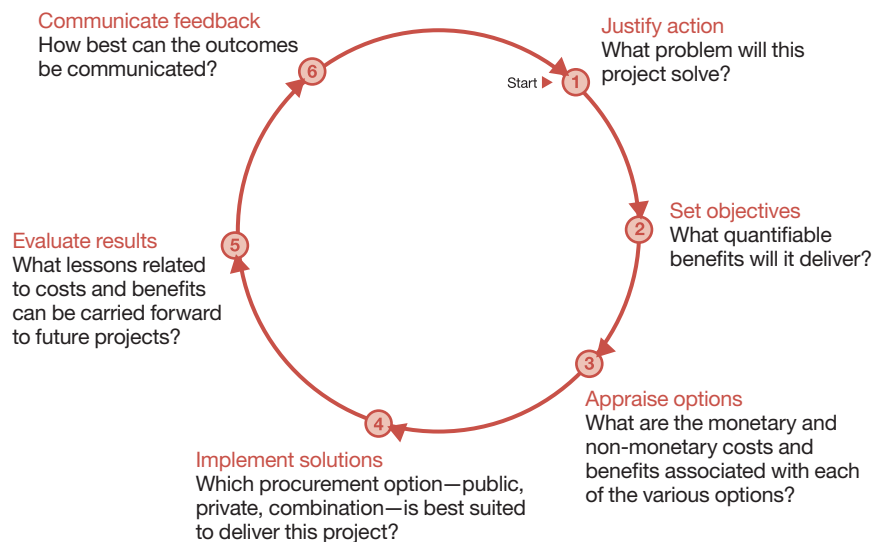
*The government-wide level framework sets overarching policy for all the various government agencies competing for funding.

Source: PwC analysis of Strategy for National Infrastructure, Infrastructure UK

Working from government-wide investment priorities, transportation officials determine which projects to fund at the **department level**, based on a variety of criteria such as policy, performance-based metrics, and the needs of various competing constituencies. The UK Department of Transport's new approach to appraisal is one example. In the US, the Department of Transportation's TIGER, TIGER II, and TIGER III discretionary grant programs use departmental level analysis in similar ways.

At the **project level**, individual projects vie for transportation funding based on specific needs such as traffic congestion. In developing a project, officials use appraisal models to evaluate and prioritize the various costs and benefits of each option for example, reduced congestion, improved reliability, lower carbon emissions, and increased mobility. Costs might include service downtime, capital investment, and strain on other services (see Figure 5).

Figure 4. Appraisal and evaluation of transportation projects in the UK



Source: PwC analysis of The Green Book: Appraisal and Evaluation in Central Government, HM Treasury, UK

Figure 5. Sample benefits and costs evaluated in an appraisal model

Benefits	Costs
<ul style="list-style-type: none"> • Reduced congestion • Improved reliability • Lower carbon emissions • Increased mobility options 	<ul style="list-style-type: none"> • Service downtime • Capital investment • Strain on other services

Source: PwC analysis, based on interviews in the UK, Australia, Japan, Canada, and Sweden

The role of appraisal models

Appraisal models are tools used in the investment decision process to assess and compare the merit of various investment options. Single or multiple appraisal models can be used throughout the investment decision-making process to identify and estimate the potential value offered by a particular option.

A formal evaluation using established appraisal models—rather than ad hoc assessments—allows transportation officials to select and prioritize investment options while quantifying actual benefits. Pure financial

evaluations aren't comprehensive enough to justify a transportation project's overall viability because they don't account for the economic costs and benefits that accrue to the wider region.

Instead, officials in the countries studied use a range of appraisal models. These models balance quantitative metrics with qualitative assessments and include various combinations of a cost-benefit analysis, multi-criteria analysis, economic impact analysis, and cost-effectiveness analysis. Figure 6 on the following page illustrates the various appraisal models.

How does transportation benefit overall economic development?

Transportation projects must be evaluated within the wider context of the region's economic development. Below are some of the benefits that accrue to an entire region in the wake of a new transportation infrastructure project:

- Improves business efficiency through time savings and increased reliability.
- Increases business investment and innovation by supporting economies of scale and new ways of working.
- Supports clusters of economic activity by serving as a catalyst for business interactions.
- Contributes to more efficient labor markets by increasing market flexibility and job accessibility.
- Fosters competition by opening access to new markets.
- Increases domestic and international trade by reducing trading costs.
- Attracts globally mobile activity to the region by providing desirable quality of life.⁷

Figure 6. Selected appraisal models used in transportation investment frameworks

Appraisal model	Most appropriate when
Cost-Benefit Analysis Quantifies benefits and costs to determine overall impact to society and the economy.	<ul style="list-style-type: none"> • Considering relevant economic costs and benefits to the entire community—rather than to a particular stakeholder • Making trade-offs between financial, economic, social, and environmental costs and benefits (to the extent that they can be quantified) • Comparing costs and benefits across modes, capital scenarios, and management strategies • Seeking economic efficiency as the primary objective
Multi-Criteria Analysis Compares various options with agreed objectives and measurable criteria.	<ul style="list-style-type: none"> • Considering a range of compelling policy objectives beyond economic and financial goals—such as safety, access, or environmental considerations • Quantifying major benefits proves challenging • Engaging with stakeholders to develop criteria collectively and generate ownership over results
Economic Impact Analysis Measures the economic impact on households and businesses within a given region using sophisticated computer modeling.	<ul style="list-style-type: none"> • Analyzing the extent, flow, and distribution of impacts across regions • Measuring impacts on key economic indicators, such as: <ul style="list-style-type: none"> – GDP – Real consumption, incomes, investment – Employment – Government revenues – Interest rates, exchange rates, terms of trade
Financial Evaluation Determines benefits and costs to a particular organization rather than to the economy or society.	<ul style="list-style-type: none"> • Considering a single organization’s perspective • Assessing profitability and cash flows from commercial opportunities • Dealing with competitive markets; most costs and benefits are reflected in market prices • Fulfilling governmental financial responsibilities • Comparing different procurement methods, for example, traditional government ownership versus outsourcing
Cost-Effectiveness Analysis Measures benefits in nonmonetary terms, for example, cost per life saved; ranks projects by a comparative “cost per unit of effectiveness.”	<ul style="list-style-type: none"> • Quantifying benefits is difficult • Assessing consistent, similar alternatives

Source: PwC analysis, based on interviews in the UK, Australia, Japan, Canada, and Sweden

How transportation investment frameworks guide decisions and evaluate performance

Performance-based decisions are marked by well-articulated performance targets linked to high-level policies. Translating those high-level policies into projects capable of meeting the performance targets requires collaboration between various levels of government.

Performance metrics available to all stakeholders are assessed against previously agreed targets. While a formal reward or penalty process may not be publicly established, the reporting process holds each procuring authority accountable for performance. Future budgeting decisions and executive compensation levels can hinge on performance.

In the UK, the government consistently uses five goals, adopted in 2003, to evaluate projects:

1. Tackle climate change impacts by reducing carbon emissions.
2. Support economic competitiveness with reliable, efficient transportation networks.
3. Promote equal opportunity for all citizens.
4. Ensure a healthy environment by improving quality of life for users of transportation as well as the population at large.
5. Foster long-term security by encouraging safer transportation methods.

Key performance indicators with predetermined targets measure the progress and success of these goals. Sample key performance indicators

include carbon emissions per ton of fuel, social cost per ton of carbon, change in noise levels, growth in GDP per capita, vehicle occupancy rates, percentage change in vehicle occupancy rates over time, and percentage change in the number of traffic accidents.

In Japan, the Ministry of Land, Infrastructure, Transport, and Tourism ensures that investment in transportation infrastructure promotes safe, sustainable quality of life for all residents, enhances global competitiveness, fosters civic pride, and enhances regional diversity. A multi-faceted transportation policy was approved by the ministry and endorsed by the Cabinet in 2003. With a focus on long-term priorities, this policy promotes:

- flexibility based on need, for example, the use of private-sector funds under the country's private finance initiative for the expansion of Tokyo's Haneda Airport;
- regional autonomy that promotes the effective use of local expertise and private-sector resources;
- better management of transportation demands using park-and-ride systems and alternative work schedules; and
- research and development for the next generation of transportation—such as intelligent transportation systems in which technology can improve safety, reliability, productivity, and environmental performance; dual-mode vehicles such as a minibus with retractable train wheels for use on conventional railway tracks; and magnetic levitation trains.

More efficient investments derive from transportation investment frameworks

The transportation investment frameworks analyzed by PwC in this multi-country study were selected by the US Department of Transportation for their currency and relevance as well as for the use of quantitative and qualitative appraisal models. While the frameworks in other parts of the world meet very specific needs in the jurisdictions they serve, they do offer good practices for US transportation officials.

and security for public and private partners involved in delivering the transportation infrastructure.

Using transportation investment frameworks, Canadian officials determined that low-cost public transit was a high-priority investment. Appraisal modeling led to their decision that Canada Line, a 12-mile regional rapid-transit line, could be more efficiently implemented by the private sector. Canada Line connects downtown Vancouver, the Vancouver International Airport, and central Richmond in the province of British

Transportation investment frameworks—and the tools associated with them—help policymakers determine if a project is better implemented with public resources or private capital.

Long-term planning

Transportation infrastructure is part of a region's long-term plan for growth. Long-term planning that incorporates a vision for land-use well into the future includes a variety of transportation infrastructure options based on national, regional, and local needs. A visionary long-term plan that aligns these needs provides stability and security for all stakeholders including residents, whose buy-in is essential for the long-term success of the transportation infrastructure project. The plan also provides stability

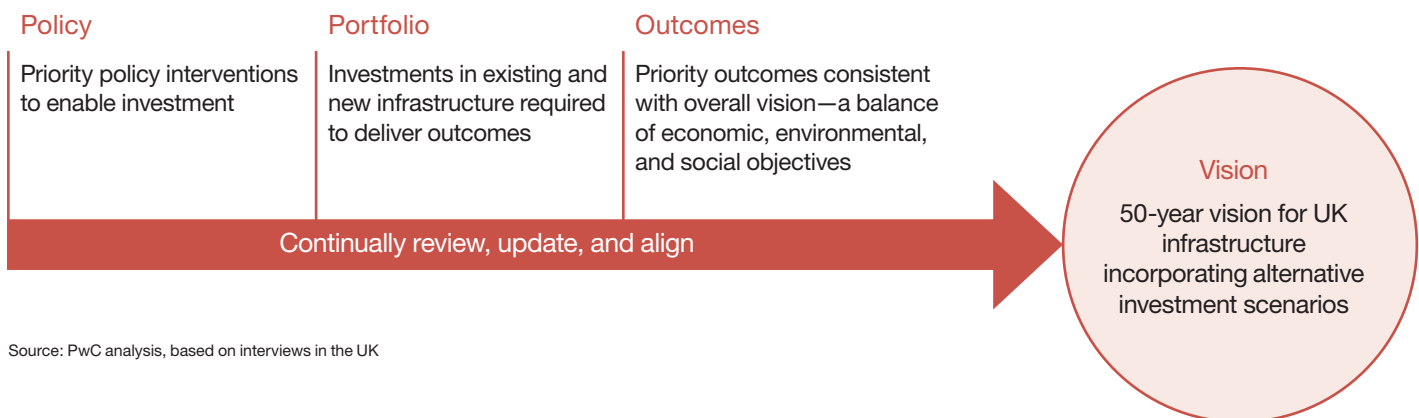
Columbia. The first transit project in North America to be developed as a public-private partnership, Canada Line had been part of the region's long-term plan since the late 1960s. Innovative tunnel design and a service plan to generate more revenue from higher midday ridership resulted in proposed construction cost savings equal to \$85 million in net present value. Ridership began tracking ahead of anticipated levels almost immediately after Canada Line opened in August 2009.^{8,9,10} Today, it transports some 110,000 people daily.¹¹

National advisory body

In several of the countries surveyed, a national body sets infrastructure investment policy and provides guidance to federal, state, and local governments. This body can incorporate various considerations such as research and development needs, private sector investment requirements, and social considerations. With guidance from this national body, the government is able to prioritize projects and funding across various competing sectors. The activities of this body are typically transparent, allowing the public—especially residents of the affected areas—to see how priorities are identified and investment decisions made.

Infrastructure UK, established in 2010, creates long-term plans in the UK to help address national infrastructure needs, coordinating future investment in research, development and innovation. The advisory body works with public- and private-sector stakeholders to develop and shape policy that encourages infrastructure investment within the UK. It also serves as a liaison between public- and private-sector stakeholders. In response to funding and financing challenges, the UK aims to collaborate with a diverse investor base (both geographically diverse and by type of investment) for large, complex projects (see Figure 7 below).

Figure 7. Sample national infrastructure framework vision



Source: PwC analysis, based on interviews in the UK

Pure financial evaluations aren't comprehensive enough to justify a transportation project's overall viability because they don't account for the economic costs and benefits that accrue to the wider region.

Quantifying the need

Transportation policies incorporate measurable targets against which to assess actual performance. Officials use appraisal models to justify the need for a project before committing funds. The appraisal models help prioritize and assess projects based on their ability to deliver on the performance targets as well as provide the greatest value for money. Lessons learned from past investments can improve future investment decisions, especially when the pool of funds is limited.

From more than 1,000 potential options in a one-year period, Infrastructure Australia identified 10 priority projects of national significance; seven of these transportation infrastructure projects were ultimately funded in equal parts by the state and federal governments. These seven environmentally sustainable projects met the specific policy goals of supporting economic growth and promoting the inclusion of all residents.

Projections ensured they would deliver specific cost-benefit measures related to trip costs, vehicle operating costs, time savings, fare-box revenues,

congestion, safety, reliability, noise impacts, air pollution, carbon emissions, and health benefits. They were also required to adhere to governance and delivery metrics.

Distribution of funds

In the countries surveyed, officials aim for an equitable distribution of funds across local and regional jurisdictions to better allow both large and small jurisdictions to meet their specialized transportation infrastructure needs. A cap in federal funding for a single project encourages investments from other levels of government as well as private entities, thus requiring a collaborative effort with multiple sources of support.

The Building Canada Fund consists of two components that aim to balance the needs of urban and rural communities. The major infrastructure component targets large strategic projects of national and regional significance while the communities component focuses on communities with populations less than 100,000. The federal government works in partnership with each province and territory to address infrastructure issues specific to each region.

Building sustainable communities

Transportation investment policy decisions in Sweden take into account long-term economic, social, and environmental implications. Long-term implications can be a challenge in the short term, however, as is the case with the congestion tax, which 75 percent of residents initially opposed. Thanks to ongoing public awareness campaigns that communicate the benefits of a sustainable lifestyle, 65 percent of

encourage clean vehicles and promote renewable fuels in an effort to build sustainable communities, nurture good health, meet demographic challenges, and foster environmentally sound growth. In 2010, Stockholm netted more than \$75 million from the congestion tax while reducing downtown traffic by 20 percent. Vehicles using alternative fuels are exempt from the tax. The government leads by example, setting a target for 100 percent of all city buses to run on renewable fuel by 2025.

of global financial uncertainty adds another layer of complexity to an already multi-layered process.

Lessons learned from international transportation investment frameworks

Scarce public resources juxtaposed against increasing infrastructure needs present ongoing challenges for transportation officials. The multi-country survey conducted by PwC illustrates that investment frameworks support governments in delivering successful transportation infrastructure projects by:

- creating a framework for prioritizing transportation projects;
- aligning transportation funding with those priority projects;
- measuring and reporting the expected benefits from those investments;
- engaging stakeholders throughout the process; and
- providing transparency and accountability for project delivery and performance.

A transportation investment framework consists of analytical tools and processes to identify investment needs, evaluate projects that could meet those needs, and then assess how best to fund those projects.

residents now support the tax. Sweden laid the groundwork by building a collaborative network of public and private stakeholders to administer various aspects of its transportation investment framework.

The congestion tax pays for sustainable transportation projects; it is part of a larger initiative begun in 1994 to

All the stakeholders—public officials, private partners if any, regional and local businesses and residents—must commit to a transportation project throughout its entire life cycle for that project to succeed. Fluctuations in public opinion or changes in the political landscape can easily derail a transportation project during its life cycle. And the current environment

Endnotes

1. World Economic Forum, *The Global Competitiveness Report*, 2011-2012, 2011.
2. AASHTO Center for Excellence in Project Finance, *The Forum on Funding and Financing Solutions for Surface Transportation in the Coming Decade: Conference Report*, January 2011.
3. Elizabeth McNichol, Phil Oliff, and Nicholas Johnson, “States Continue to Feel Recession’s Impact,” *Center on Budget and Policy Priorities*, Updated January 9, 2012.
4. PricewaterhouseCoopers, *Cities of Opportunity*, 2010.
5. World Economic Forum, *Global Risks 2020: A Global Risk Network Report*, January 2010.
6. PwC, *Survey and Analysis of Transportation Investment Models in Other Countries*, June-September 2010.
7. *The Eddington Transport Study: The Case for Action*, December 2006.
8. Simon Kent, “Passing the Torch,” *PM Network*, December 2008.
9. PwC, *Public-Private Partnerships: The US Perspective*, June 2010.
10. PwC, *Game On: Mega-Event Infrastructure Opportunities*, April 2011.
11. Jeff Nagel, “Rise in Transit Use Called Olympic Legacy,” *SurreyLeader.com*, February 10, 2011.

***For a deeper discussion about
transportation investment
frameworks, please contact:***



Daryl Walcroft
Tel+ 415 498 6512
daryl.walcroft@pwc.com



Kylee Anastasi
Tel+ 1 703 918 3273
kylee.j.anastasi@pwc.com



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