

EVALUATE, ENABLE, ENGAGE

Principles to Support Effective
Decision Making in Mass Transit
Investment Programs





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EXECUTIVE SUMMARY

ENCOURAGING EFFECTIVE, SUSTAINABLE MASS TRANSIT INVESTMENTS

Continued urbanization, particularly in developing countries, creates a pressing need for sustained investment in effective mass transit projects.

Between 2000 and 2030, developing countries are expected to build more urban area than has been built throughout human history (World Bank 2010). Urban populations in China and India will grow by at least 600 million residents by 2030, roughly twice the current population of the entire United States (Dobbs 2010). Without major mobility investments, many rapidly growing cities will face traffic and economic gridlock. In India, for instance, sharp and sustained increases in private vehicle ownership and demand for mobility over the last few decades already threaten economic productivity in urban

areas, which account for approximately 65 percent of gross domestic product (Agarwal and Zimmerman 2008, Ministry of Urban Development [MoUD] 2005a).

Against a backdrop of increasing urban mobility demands and growing concerns about the impacts of climate change, more national governments are investing in the development of urban and metropolitan mass transit systems. Within the last 10 years, national governments in several populous countries with quickly growing economies, including India, Mexico, and Brazil, have

introduced programs to fund at least a portion of the construction costs of new mass transit systems. They join countries with more mature transport infrastructure, including France, the United Kingdom and the United States, that have continued and, in some cases, increased their investments in mass transit.

Given high demand and limited resources, the structure of the national programs that fund mass transit investments is important. Programs must prioritize effective, deliverable projects that support accessibility and urban development goals and that perform strongly against alternative strategies to meet these goals. Programs also need to foster buy-in from the local governments that will operate the projects. Ultimately, decisions about which projects to support are political, not technical; so the role of programs should be to equip decision makers with clear, complete information about the projects' merits.

This report examines 13 existing national mass transit investment programs from the perspective of informed decision making. Although the political, financial, and institutional contexts differ across the programs, the concepts involved in measuring the rationale and deliverability of proposed projects are broadly similar. Therefore, this report highlights how the reviewed programs address the concepts, with a particular focus on practices that are likely to yield information critical to effective decision making. The insights will be of use to administrators of national mass transit investment programs that are identifying areas for improvement, national governments that are introducing new programs, and representatives of multilateral institutions that are helping to structure such programs.



Mass Transit Defined

Mass transit is a form of public transport or public transit that can transport a greater volume of passengers and provide a higher quality of service than conventional services through a systematic combination of infrastructure, equipment, and information technologies. Most national investment programs fund a variety of modes of mass transit. The most common modes are defined below. These are general definitions and specific interpretations may vary by country.

Bus rapid transit (BRT): a high-quality, high capacity bus service commonly operating at higher speeds than conventional buses, in separated lanes, with distinct stations, level boarding, special branding, and frequent all-day service

Ferry: waterborne service provided by large boats that carry passengers (and sometimes vehicles) short distances, usually serving terminals designed for fast passenger access and egress

Light rail transit (LRT): a form of rail transit that may operate in mixed traffic or separated ways, typically using moderate- to high-capacity vehicles that may operate in up to three-car trains

Metro (alternatively heavy rail, subway, or rail rapid transit): a high quality, high capacity form of rail transit that operates on fully separated travel ways, with frequent service and large cars that may operate in up to 10-car trains

Regional rail (also commuter or suburban rail): a service oriented toward longer trips, with the highest-capacity cars but fewer stations and higher speeds; lines are typically shared with other intercity or freight rail traffic

Streetcar or tramway: similar to LRT, but using smaller vehicles and more likely to operate in mixed traffic

Source: Adapted from Vuchic 2007, Hidalgo and Carrigan 2010.

HOW TO USE THIS REPORT

This report provides principles to foster effective decision making in national mass transit investment programs. Examples of practices from the 13 existing programs that are likely to generate more complete information about the projects' benefits, costs, and risks illustrate each principle, with an emphasis on practices that can be widely applied. The following six sections of the report provide—

- An overview of the study that describes the contexts and structures of the 13 programs.
- A framework to support effective decision making consisting of three interdependent “pillars”: rationale, deliverability, and local buy-in. Each of the pillars, in turn, comprises a set of critical principles.

- A description of the three pillars and their corresponding principles, illustrated by examples from the 13 programs.
- Conclusions and detailed recommendations for applying the principles in developing and refining mass transit investment programs, along with topics for further research.

The review of the 13 programs focuses on their design, not their past or projected performance. Primary research material consisted of publicly available program documentation from national government agencies. To obtain comparable levels of information across the programs, literature reviews and interviews (with program officials or local transport experts) were also conducted for most programs.

FINDINGS

The 13 programs reviewed for this study reflect unique development and institutional contexts. Although some programs have funded dozens of projects, others have supported only a few so far. Implicitly, all programs share the aim of supporting effective, deliverable projects, and all follow the principles described in this report at least to a moderate degree. Materials from the programs outline processes at varying levels of elaboration to support informed decision making through assessments of project rationales, evaluations of project deliverability, and procedures to garner local buy-in.

Given the variety of contexts, no universally ideal structure for a good mass transit program exists. The principles articulated in subsequent sections of this report allow for flexibility in how they are adopted. The following recommendations provide steps that newer programs in particular can take to improve the quality of information available for decision makers' consideration.

RECOMMENDATIONS

Overall

- Provide clear, complete, and consistent guidance on how the program functions, how projects are evaluated, and how decisions are made. Guidance should also direct sponsors in preparing the information needed for a decision.

Rationale

- Ensure that project sponsors identify and analyze a wide range of alternatives to solve the transport problem at hand.
- Use evaluation criteria appropriate to project sponsors' capabilities.
- Assess costs and benefits, both those that can be translated into monetary terms and those that cannot, that are likely to be considered in political decisions.
- Require clear, succinct summaries of evaluation results for decision makers.

Deliverability

- Provide feedback to sponsors on their project management plans and risk assessments, including corrective measures.
- Incorporate risks into cost estimates, where possible, to reduce delays or reductions in scope once funding is approved.
- Track projected costs and benefits of projects as they are developed through multiple evaluation points, including prior to approval of construction funds.
- Conduct ex-post assessments of projects.
- Assist sponsors in developing their technical and institutional capacities.
- Ensure that funding will be available to meet financial commitments to projects that have been approved for construction.

Local political buy-in

- Assign project planning and development responsibilities to local governments.
- Require that project sponsors share implementation costs with the national government.
- Assess consistency between proposed projects and local transport and land use plans.
- Ensure that the public is engaged in local planning processes.



Ultimately, decisions about which projects to support are political, not technical; so the role of programs should be to equip decision makers with clear, complete information about the projects' merits.



OVERVIEW

NATIONAL MASS TRANSIT INVESTMENT PROGRAMS

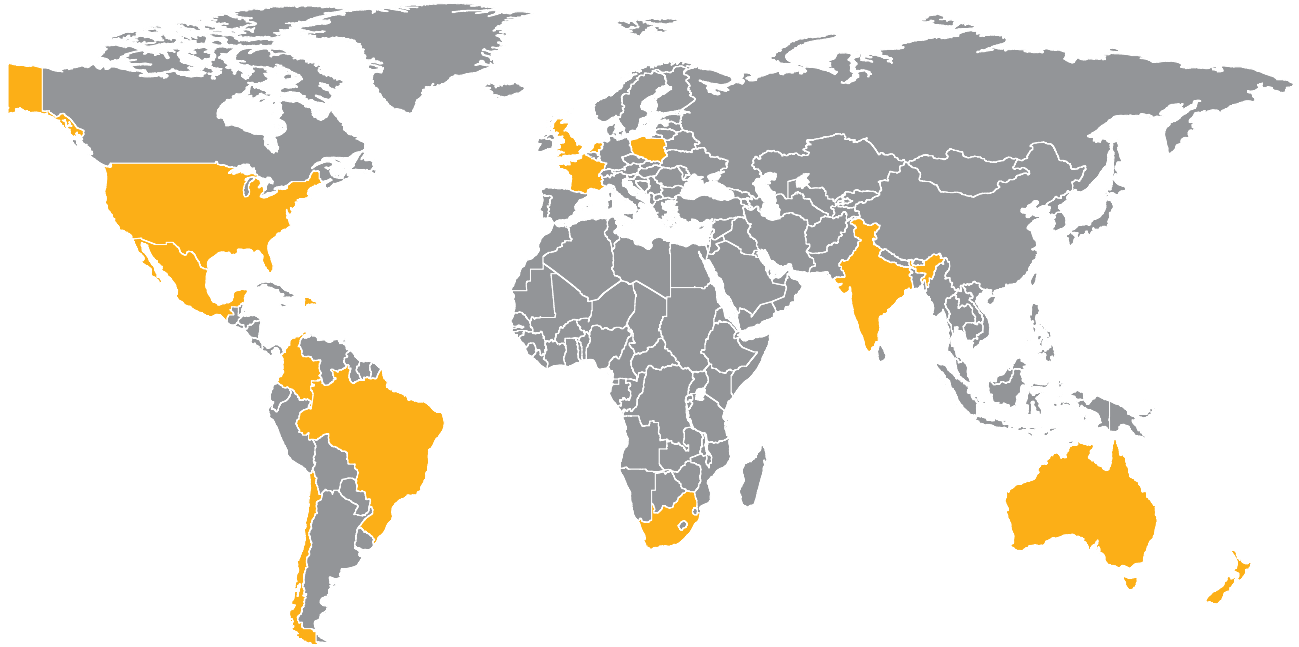
During the last several years, more national governments in populous countries with rapidly expanding economies, including Brazil, India, and Mexico, implemented investment programs for urban and metropolitan mass transit.

As urban population growth continues and the negative externalities of high levels of automobility become clearer, yet more developing countries may adopt mass transit investment programs; others may receive funding for individual mass transit projects from multilateral development banks. National governments and development institutions could therefore benefit from a primer on how to structure investment programs to encourage project proposals that respond to transport needs, are well-justified, are deliverable, and are supported by local governments. Because no such primer

has been produced to date, this report strives to fill the gap.

This report articulates a framework for effective decision making based on principles that address key components of project funding decisions: rationale, deliverability, and local support. As illustration, examples are drawn from guidance and procedural documentation produced by the national government agencies that administer 13 mass transit investment programs from around the world:

Figure 1 National Programs Included in This Study



- **Australia** (Reform and Investment Framework)
- **Brazil** (Growth Acceleration Program Phase 2 – Mobility in Large Cities)
- **Chile** (National System of Investment [SNI] – Urban Transport)
- **Colombia** (National Urban and Mass Transit Policy)
- **England** (Local Major Transport Schemes)
- **France** (Public Transport in Dedicated Rights-of-Way [TCSP])
- **India** (Jawaharlal Nehru National Urban Renewal Mission [JnNURM] and National Urban Transport Policy [NUTP])
- **Mexico** (Federal Support Program for Mass Transit [PROTRAM])
- **Netherlands** (Multiple-Year Program for Infrastructure, Spatial Planning, and Transport [MIRT])
- **New Zealand** (National Land Transport Programme)
- **Poland** (Urban Transport in Metropolitan Areas)
- **South Africa** (Public Transport Infrastructure and Systems Grant [PTIS])
- **United States** (Capital Investment Program [New Starts and Small Starts])

Table 1 Key Statistics of Countries Studied

Country	Urban population (million), 2010 ^b	Urban population density (persons/km ²), 2010 ^c	Share of population residing in urban areas, 2010 ^d	Gross domestic product per capita (US\$), 2009 ^e	Vehicle ownership per 1,000 residents	Mass transit route-km per million urban residents ^h
Australia	19.9	1,515	89%	42,131	653 ^f	Medium ⁱ
Brazil	168.6	5,662	87%	8,251	198 ^f	Low ^j
Chile	15.2	6,328	89%	9,487	109 ^g	Low ^j
Colombia	34.8	16,855	75%	5,166	66 ^f	Low ^j
England^a	56.1	4,436	90%	35,163	462 ^g	High ^k
France	50.5	1,896	78%	40,663	495 ^g	High ^l
India	352.5	13,110	30%	1,195	15 ^f	Medium ^m
Mexico	88.2	6,440	78%	7,880	244 ^f	Low ^j
Netherlands	13.8	2,512	83%	48,068	449 ^g	High ⁿ
New Zealand	3.8	2,362	87%	29,352	729 ^f	Low ^o
Poland	23.4	3,621	61%	11,288	422 ^g	High ^p
South Africa	30.8	3,069	62%	5,733	159 ^f	Low ^q
United States	254.3	1,327	82%	45,745	820 ^f	Medium ^r

Sources:^a Data pertains to the United Kingdom.^b World Bank 2011a. Urban areas are as defined by national statistical offices.^c Demographia 2011. Includes urban areas with populations above 500,000. For England, figure refers to the entire United Kingdom.^d World Bank 2011b. Urban areas are as defined by national statistical offices.^e World Bank 2011c. In current US\$.^f SUTP 2011^g World Bank 2011d. Refers to road motor vehicles, other than two-wheelers, intended for the carriage of passengers and designed to seat no more than nine people (including the driver).^h Includes systems identified as national passenger rail (encompassing regional networks), suburban rail, commuter rail, metro, heavy rail, light rail, urban rail, and exclusive right-of-way bus rapid transit. Where only track length of a network was provided, route length was assumed to be half of track length (i.e., double track).
Low = less than 100 route-km per million urban inhabitants; Medium = at least 100 but less than 200; High = 200 or more.ⁱ <http://www.urbanrail.net/au/oceania.htm>; http://www.railcorp.info/about_railcorp/access_to_information/publication_guide; Institute for Transportation & Development Policy 2007^j Hidalgo 2011^k <http://www.dft.gov.uk/statistics/releases/tsgb-2011-public-transport/>; Institute for Transportation & Development Policy 2007^l MEEDDM 2011, http://www.stif.info/IMG/pdf/STIF_Les_chiffres_2005.pdf, http://medias.sncf.com/resources/en_EN/medias/MD0006_20100210/file_pdf.pdf^m http://www.indianrailways.gov.in/railwayboard/uploads/directorate/stat_econ/Stat_0910/Annual_Statistical_Statements_2009-10_Rly_Bilingual.pdf, <http://www.urbanrail.net/as/asia.htm>, Tiwari and Jain 2010ⁿ <http://www.urbanrail.net/eu/euromet.htm>, <http://www.gvb.nl/overgvb/feiten-en-cijfers/Pages/vervoer-in-cijfers.aspx>, Institute for Transportation & Development Policy 2007, <http://www.prorail.nl/Over%20ProRail/documenten/Documents/ProRailJaarverslag2010.pdf>^o http://www.aucklandtransport.govt.nz/improving-transport/plans-proposals/IntegratedTravel/Documents/Original/AT_ARTA_Policy_RailDevelopmentPlanSeptember2006.pdf, <http://www.nzta.govt.nz/network/projects/project.html?ID=15>, <http://www.urbanrail.net/au/oceania.htm>^p <http://www.plk-sa.pl/linie-kolejowe/siec-linii-kolejowych-w-polsce/infrastruktura-kolejowa/>, <http://www.urbanrail.net/eu/euromet.htm>
^q <http://www.metrorail.co.za/index.html>; I. Seedat, personal communication, October 5, 2011^r American Public Transportation Association 2011, Institute for Transportation & Development Policy 2007, http://www.amtrak.com/servlet/ContentServer?c=AM_Content_C&pagename=am%2FLayout&c_id=1241267290796

Each of the selected programs—

- Supports the costs of constructing and/or rehabilitating at least one mode of urban or metropolitan mass transit (see box for definitions);
- Is extensively described in documentation posted on national governments' public Web sites;¹
- Conducts at least one formal evaluation of each proposed project at the national level, as opposed to programs that assign primary project evaluation and funding allocation responsibilities to local or regional governments; and
- Is most relevant to urban or metropolitan mass transit, where more than one funding program exists that meets the other three criteria above.

Ultimately, programs from more than 13 countries met these criteria. The programs selected for review represent a diverse assortment of contexts, degrees of establishment, and structures, as discussed in the following subsections.²

CONTEXTS FOR MASS TRANSIT INVESTMENT PROGRAMS

As shown in Table 1, the demographic, socioeconomic, and development contexts for investment programs vary among the 13 countries. Urban populations, for instance, range from approximately 4 million in New Zealand to more than 350 million in India. In terms of development patterns and socioeconomics, the countries fall into three broad groups:

- **High population density, low income and personal vehicle ownership, and limited mass transit infrastructure.** This group

includes India and most Latin American countries. The development patterns and demographic characteristics of cities in these countries are well-suited to mass transit expansion.

- **Low population density, high income and personal vehicle ownership, and moderate levels of mass transit infrastructure.** This group comprises Australia, New Zealand, and the United States. Overall levels of motorization are high while mass transit is reasonably well-developed in the larger urban agglomerations; commuter rail services account for much of the mass transit network length, particularly in Australia and New Zealand.
- **Low to moderate population density, high income, moderate personal vehicle ownership, and extensive mass transit infrastructure.** Most European countries fall into this group. Mass transit encompasses a range of modes and is well complemented with conventional bus services; as a result, personal vehicle ownership is less critical for mobility.

REASONS FOR INVESTING IN MASS TRANSIT

Just as national contexts for mass transit investment vary, so do reasons for investing in mass transit. A few examples follow:

- **In Brazil and South Africa,** mass transit investment programs were implemented in part to meet urban mobility needs associated with major international events (the World Cup in each case) (Department of Transport [DoT] 2007, Governo Federal Brasileiro [GFB] 2011).³
- **In France,** expansion of mass transit is part of the national government's strategy to reduce

¹ Program officials, local public transport experts, or relevant academic literature were consulted where most but not all information about the decision-making process was available.

² A diverse group of programs was selected because the initial intent of the study was to survey project evaluation criteria and procedures in mass transit programs, not specifically to recommend principles for effective decision making. Some programs appear frequently in the discussions of practices likely to support informed decision making, while others appear infrequently or not at all. The comparison of procedures between more- and less-mature programs allowed for identification of areas where descriptions of "good" practices for decision making would be most helpful to less mature and new programs.

³ Google Translate (<http://translate.google.com>) was used in the translation of most non-English sources for this report.

greenhouse gas emissions (Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer [MEEDDM] 2011). Projects are expected to reduce carbon dioxide emissions and energy consumption, in part through mode shifts from automobile travel (MEEDDM 2010). By 2020, an additional 1,500 km of public transport lines with dedicated rights-of-way will be built.

- **India's** investment program supports a range of infrastructure projects in urban areas, with the goal of accommodating projected urban population growth and supporting increased economic productivity (MoUD 2005a). The overall program funds several categories of projects in addition to urban transport, including water supply and sewerage facilities and urban renewal projects.
- **In Australia**, public transport investments are viewed as critical to a "triple bottom line" of improved social, environmental, and economic conditions (Infrastructure Australia [IA] 2008, p. 8).

AGES OF MASS TRANSIT PROGRAMS

As shown in Table 2, some of the programs reviewed for this study are well-established, while others are new. Programs in developing countries are less than a decade old in most cases.

More established programs tend to have more developed procedures for assessing projects, evaluating project sponsors' management capabilities, and providing technical support than newer programs. This is not surprising: Newer programs in India, Mexico, and South Africa, for instance, began with limited levels of mass transit investment experience (Pai and Hidalgo 2009; Agarwal and Zimmerman 2008; D. Uniman, personal communication, November 29, 2011; I. Seedat, personal communication, August 22, 2011). Where the more detailed procedures appear likely to improve the quality of information available to decision makers, recommendations in this report describe how they could be applied in countries with less mass transit investment history.



Table 2 Program Characteristics

Country	Name of program	Administering entity	Year of program initiation ¹
Australia ^{a,2}	Reform and Investment Framework	Infrastructure Australia	2008
Brazil ^{b,2}	Growth Acceleration Program - Mobility in Large Cities	Ministry of Cities	2007
Chile ^{c,2}	National System of Investment (SNI) - Urban Transport	Ministry of Social Development	1950s
Colombia ^d	National Urban and Mass Transit Policy	National Department of Planning	1996
England ^e	Local Major Transport Schemes	Department for Transport	1968
France ^f	Public Transport in Dedicated Rights-of-Way (TCSP)	Ministry of Ecology, Sustainable Development, Transport and Housing	1994
India ^g	Jawaharlal Nehru National Urban Renewal Mission (JnNURM)	Ministry of Urban Development	2005
Mexico ^h	Federal Support Program for Mass Transit (PROTRAM)	National Bank of Public Works and Services (BANOBRAS)	2008
Netherlands ⁱ	Multiple-Year Program for Infrastructure, Spatial Planning and Transport (MIRT)	Ministry of Infrastructure and Environment	1960s
New Zealand ^{j,3}	National Land Transport Programme	NZ Transport Agency	1997
Poland ^k	Urban Transport in Metropolitan Areas	Ministry of Infrastructure	2004
South Africa ^l	Public Transport Infrastructure and Systems Grant (PTIS)	Department of Transport	2005
United States ^m	Capital Investment Program (New Starts and Small Starts)	Federal Transit Administration	1976

*Notes:*¹ Or year in which mass transit expansions became eligible for national funding² Guidance did not indicate any restriction on eligible modes of mass transit.³ Rail transit infrastructure in capital region not eligible for support.

Table 2 (continued)

Country	Scope			Eligible modes				Eligibility				Authorization			Award types		
	Mass transit only	Surface transport	Other types of infrastructure	BRT	LRT	Metro	Suburban rail	Any size of city	Larger cities only	Capital city / region / excepted	Minimum project cost threshold	Ongoing	Multiple-year	Individual calls for projects	Grant	Loan	Combination
Australia ^{a,2}			X	X	X	X	X	X			X		X		X	X	
Brazil ^{b,2}	X			X	X	X	X		X					X		X	X
Chile ^{c,2}		X		X	X	X	X		X			X			X		
Colombia ^d	X			X					X				X		X		
England ^e		X		X	X		X	X		X	X		X		X		
France ^f	X			X	X	X		X		X			X		X	X	
India ^g			X	X					X				X		X	X	X
Mexico ^h	X			X	X	X	X		X				X		X	X	
Netherlands ⁱ			X	X	X	X	X	X			X		X		X		
New Zealand ^{j,3}		X		X	X	X	X	X					X		X		
Poland ^k	X				X	X	X		X				X		X		
South Africa ^l	X			X					X				X		X		
United States ^m	X			X	X	X	X	X					X		X		

Sources:

^a IA 2008, IA 2010, IA 2011b, <http://www.finance.gov.au/investment-funds/nbf/baf.html>

^b MdC 2007, MdC 2011a, MdC 2011b

^c MDS 2012b, MDS 2012c, Secretaría de Planificación de Transporte 2012

^d Secretaría del Senado 1996, DNP 2002, DNP 2003a, DNP 2011

^e DfT 2007, DfT 2009c, Headicar 2009, DfT 2011i

^f MEEDDM 2010; CERTU 1999; Loi n° 2009-967 2009

^g Agarwal and Zimmerman 2008; MoUD 2005a; M. Pai, personal communication, November 14, 2011

^h FONDO 2009a; D. Uniman, personal communication, November 29, 2011

ⁱ VenW 2009, VenW 2010b, RWS 2010b, Bakker and Zwaneveld 2009

^j NZTA 2009, Lee and Rivasplata 2001

^k Ministerstwo Infrastruktury [MI] 2011, <http://www.spot.gov.pl/1,1,14.html>

^l I. Seedat, personal communication, October 5, 2011; DoT 2007

^m FTA 2011a, Weiner 2008

SCOPES OF INVESTMENT PROGRAMS

Although some of the 13 programs fund only mass transit investments, others fund additional types of transport or infrastructure investments from the same account. Program scopes fall into three main categories (see Table 2 for the classification of each of the 13 programs), based on the extent of competition for funds and the degree to which guidelines are particular to mass transit projects:

- **Mass transit-only (seven programs).** Mass transit investments have their own budget and/or detailed policy guidelines.
- **Surface transport (three programs).** Other surface transport projects—such as road and intercity or freight rail—are supported by the same program, and evaluation procedures are consistent across modes.
- **Broader infrastructure (three programs).** Projects belonging to other categories of infrastructure are also funded by the program, including energy, telecommunications, and water management; and guidelines are not specific to mass transit projects.

Examples of the reasons for pursuing each type of structure are as follows:

- Colombia is among the programs with policy considerations particular to *mass transit investments*. The policy considerations reflect the national government's interest in coupling mass transit investments with reductions in the oversupply of loosely regulated, privately operated local transport services (Departamento Nacional de Planeación [DNP] 2002, DNP 2003a). Also, construction cost-sharing arrangements between national and local governments in Colombia are fairly unique to mass transit investments, as most other types of local infrastructure are funded either from local or national funds.

- England's program funds *multiple modes of surface transport*, namely local mass transit, roadway, walking, and cycling infrastructure. Projects in all modes are assessed relative to national goals for the transport system using a consistent set of evaluation criteria (Department for Transport [DfT] 2007). The criteria encompass interactions among modes, such as the impacts of a roadway project on public transport travel times to significant local destinations, as well as on pedestrian travel routes (DfT 2011a, DfT 2011b).
- In the Netherlands, transport investments are considered alongside *other types of infrastructure*, namely water management and land development projects. This integration occurred over the last decade in recognition of the interrelatedness of these types of projects (Ministrie van Verkeer en Waterstaat [VenW] 2007, VenW 2010a).

AUTHORIZATION AND FUNDING

Programs also vary in their durations and the amounts of funding that they provide for mass transit. As shown in Table 2, most programs operate on multiple-year or continuous authorizations; but others, such as Brazil's, have conducted periodic calls for projects (Ministério das Cidades [MdC] 2011a, GFB 2011).

Funding levels between programs are not readily comparable, in part due to differences in authorization periods. Additionally, while some programs provide indicative annual or multiple-year budgets for mass transit investments (particularly mass transit-only programs), in others, the amounts may fluctuate with the number and cost of eligible projects. Finally, costs of project development, materials, labor, and construction differ among the countries.

In most cases, national programs award construction funds as grants (see Table 2). In a few programs, funds may instead be awarded as loans or as a combination of grants and loans.

Regardless of context or structure, mass transit investment programs can adopt principles and practices to support informed decision making about which projects are worthy of and ready to receive funding.





▶ A FRAMEWORK FOR NATIONAL PROGRAMS

FOSTERING EFFECTIVE DECISION MAKING

Regardless of context or structure, mass transit investment programs can adopt principles and practices to support informed decision making about which projects are worthy of and ready to receive funding.

Because decision-making requires political considerations of trade-offs, the worth of a technical evaluation process can be measured by its ability to inform the decision-making process (Small 1999) – for instance, by identifying significant benefits, costs and risks of each project. This perspective frames the principles described below, as well as the identification of examples of good practice. The most critical principles for effective decision making fall under the following three primary pillars:

- **Rationale.** A proposed project should result from a clear definition of need and comparison of alternative strategies. It should also be appropriately scaled to solve the problem at hand, with costs and benefits compared. The technical evaluation process should be transparent and free of political influence.
- **Deliverability.** A proposed project should not have significant outstanding risks that could threaten its successful implementation. Also, the project sponsor should have adequate capacity to implement the project. That capacity depends on access to technical support from the national government and other institutions with mass transit expertise.
- **Local buy-in.** A proposed project should be a priority for the local agencies that will implement and operate it. Local governments should therefore lead project planning and development and help to fund project implementation. Projects should also be consistent with, and ideally derive from, existing local transport and development plans.

The three pillars are interdependent, so a well-designed national transit investment program should incorporate all three:

- The *rationale* for a project depends on *deliverability* considerations: Risks can affect the costs and benefits of a project, potentially making it unjustifiable. In order to assess the rationale for a project, sponsors must be capable of conducting (sometimes rigorous) technical analyses. Rationale also depends on *local buy-in*: A project's anticipated costs and benefits are often sensitive to how the project is integrated with local transport and development plans.
- *Deliverability* depends on the analysis of project *rationale*, as desirable project alternatives may carry unique implications in terms of project

management and risk. Deliverability also relies on *local buy-in* in terms of adequate resources, financial and otherwise, to implement the project, as well as sufficient political and public support for implementation.

- *Local buy-in* requires practices to ensure project *deliverability*: Local governments may need capacity-building assistance to propose and develop quality projects. Local buy-in also requires a process for the national government to assess a project's *rationale* that is achievable and transparent, as local governments may otherwise be dissuaded from proposing projects.



Key terms defined

Alternatives analysis (also options analysis):

a comparison of the costs and benefits of a project and alternative strategies for it, often relative to a baseline scenario

Baseline alternative: an alternative that typically includes limited investments to maintain current transport levels of service and thereby serves as a reference for measuring the costs and benefits of project alternatives (especially in cost-benefit or cost-effectiveness analysis)

Cost-benefit analysis: a comparison of monetized, discounted (socio)economic costs and benefits associated with a change relative to maintenance of the status quo. There are several terms associated with cost-benefit analysis:

- *Discount rate:* the rate at which the value of future benefits and costs decreases for each additional year of analysis, usually related to social time preferences and opportunity costs of capital
- *Benefit-cost ratio:* the ratio of the sum of discounted benefits across the period of analysis to the sum of discounted costs across the period of analysis
- *Internal rate of return:* the discount rate at which the net present value of a project is zero, also referred to as the rate of social profitability of a project
- *Net present value:* a measure of the total change in welfare over a project's life, derived by discounting future benefits and costs and summing the net discounted benefits across all years
- *Residual value:* the value of a project's components at the end of an economic appraisal period

Cost effectiveness analysis: assessment of the cost of a project or activity associated with one unit of benefit, or vice versa (e.g. annual operating cost per yearly passenger, capital cost per passenger-kilometer of travel)

Distributional impacts: the pattern in which costs and benefits of a project are distributed among social groups (e.g. by income level) and/or geographic areas

Ex-post analysis: an assessment of a project's actual performance once in operation, compared to the expectations (ex-ante projections) or the baseline (without the project)

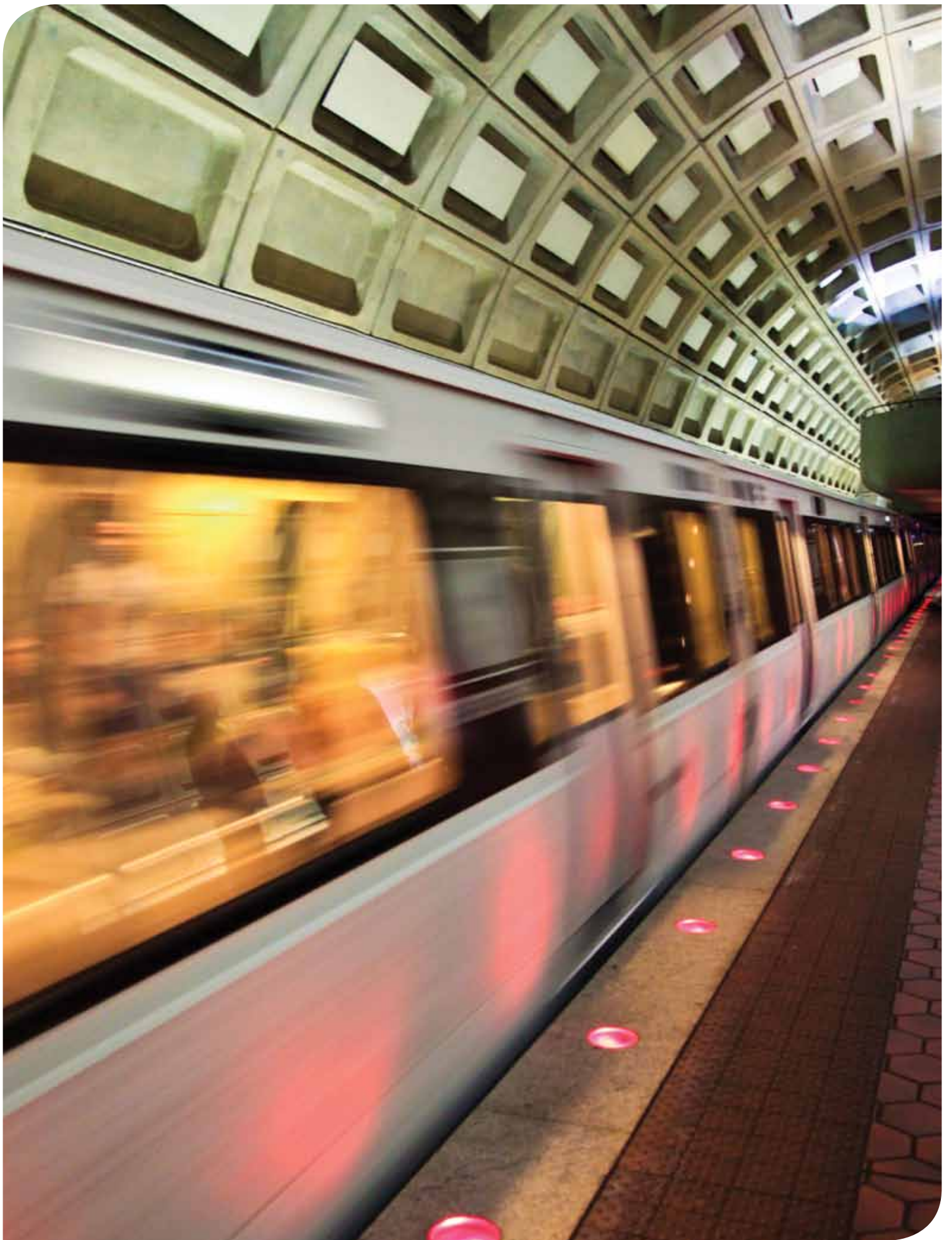
Funding share: the proportion of project costs met by a particular party

Project development: the process of advancing a project from conceptual plans to implementation, usually entailing alternatives analyses, technical studies, engineering, design and construction

Project sponsor: an entity (usually a local or state agency) that proposes a mass transit project for implementation and leads project planning and development; also commonly responsible for a portion of the cost of implementing the project

Socioeconomic impacts: a project's costs and benefits to a society as a whole, as opposed to financial impacts that pertain to a particular party or point of view

Technical capacity: the ability of a project sponsor to manage the project development process and ultimately implement a project successfully



THE RATIONALE PILLAR

DEFINING NEED AND EVALUATING ALTERNATIVES

A key element of a strong mass transit investment program is a well-defined, transparent process to evaluate the rationale for a project.

The following principles should guide assessments of rationale:

- Identify project need and analyze alternatives.** Proposed projects should result from a thorough examination of the transport problem at hand and an assessment of alternative investments and policies, including lower-cost options that address the same problem. The process should encourage consideration of policy and regulatory changes to ensure the sustainability of the project and lessen the need for future investments or large operational subsidies.
- Compare project costs and benefits** to assess whether proposed projects represent a good use of limited resources and are reasonably scaled to solve the

problem at hand. For transparency's sake, the comparison should include nonmonetizable reasons for pursuing a project in addition to monetizable socioeconomic factors. Guidance to project sponsors should clearly indicate how the programs measure and present evaluation criteria for decision makers' consideration, including the procedures for analyses of costs and benefits that sponsors must conduct.

- Keep politics out of technical evaluations** to facilitate transparency in the development of the case for a project. Separation of technical analysts from funding decision makers needs to be clear (i.e., by organization or branch of government), such that the latter cannot intervene in analyses.

Each of the 13 programs satisfies each principle to some degree. The programs offer inconsistent levels of guidance, ranging from simple statements that alternatives analyses or cost-benefit analyses are required to detailed descriptions of how they should be conducted. On the third principle, relationships between the individuals conducting technical analyses and making funding decisions do not always appear to preclude the latter from becoming involved in analyses.

IDENTIFY PROJECT NEED AND EVALUATE ALTERNATIVES

An important starting point in formulating any project is identifying the problem and the range of solutions that could alleviate it. To be effective in reducing automobility, solutions might include policies beyond mass transit, like user charges, changes to land use regulations, and construction of new infrastructure. Alternatives (or options) analyses encourage project sponsors to assess mobility problems in depth and contemplate more than one desired solution.

Key questions for alternatives analyses include—

- What is the transport problem? How significant is it, and what are its causes? Does it require a large investment to solve?
- Could the implementation of policy or regulatory changes in conjunction with an infrastructure investment improve the solution's effectiveness and sustainability? Could such changes reduce the need for future investments and subsidies? Could such changes solve the problem more effectively than additional infrastructure?
- Do investment alternatives match capacity with demand? Are there less-expensive options that offer similar benefits?
- Were alternatives omitted from the analysis that might have been reasonable? If so, why?
- Are there minor changes to the proposed project that could improve its effectiveness?

Alternatives analysis should not be considered an opportunity for a national government to impose a particular solution upon a project sponsor. Doing so could undermine local buy-in for projects, which is necessary for a program's success. Rather, the process should eliminate unfeasible alternatives from consideration, examine changes to a preferred approach that might improve its benefits and lessen its costs, and result in a justification for why a preferred approach was selected. To improve objectivity, the process should be conducted and results reviewed as early in project development as possible, when sponsors may informally identify a preferred alternative on their own. If the analysis is reviewed after a desired strategy has already been selected and developed, the analysis has little value.

Alternatives analysis commonly involves the following steps:

- Diagnosis of the transport problem, including its significance and causes
- Identification of key performance indicators to compare alternatives, such as travel time, travel cost, traffic casualties, emissions levels and implementation risks
- Engagement with the public in project planning, including assessments of public transport users' expectations and needs (described in more detail in this report under the local buy-in pillar)
- Identification of alternatives to solve the problem
- Rough assessment of how the alternatives address the key performance indicators, with subsequent elimination of less-promising alternatives
- Detailed evaluation of the promising possibilities against the key performance indicators
- Advancement of the most promising alternative for further study and development and, ultimately, funding consideration

Guidance to project sponsors from programs in Australia, the Netherlands, Colombia, and the United States describe versions of the process in more detail (see IA 2011a, Rijkswaterstaat [RWS] 2010a, DNP 2006, Federal Transit Administration [FTA] 2003). Australia's program offers a good example of an approach that encourages sponsors to derive alternatives from an analysis of issues and goals beyond the scope of an individual project, for instance, across levels of government (IA 2011a).

Some programs specify the types of alternatives that should be considered. The alternatives may reflect the following factors:

- Regulatory and policy changes, including approaches to land use planning and pricing for use of transport infrastructure
- Better-use measures, such as travel demand management, information campaigns, and deployment of intelligent transportation system technologies

- A range of investments, including different modes (public transport or otherwise), routings, implementation time frames and phasing, investment amounts, and commercial options (DfT 2003a, MEEDDM 2010, MoUD 2005b, NZ Transport Agency [NZTA] 2009, IA 2011a, Joint Assistance to Support Projects in European Regions [JASPERS] 2008).

A preferred alternative should be well-defined, but given that alternatives are evaluated at an early stage of project development, details may be refined later in the project development process (VenW 2009, FTA 2003).

A baseline (sometimes referred to as reference) alternative must be selected, along with the preferred alternative. Because the baseline represents the scenario against which costs and benefits of the project will be compared, it needs to be realistic. The baseline alternative is rarely a no-investment (do-nothing) scenario that would lead to deteriorating conditions (Mackie and Nellthorp 2001).



Table 3 Cost-Benefit Analysis Factors by Country

Country	Users			Producers		Society					Construction-phase impacts	Other factors
	Travel time	Travel cost	Travel quality	Implementation costs	Operating costs	Collisions	Noise	Air quality	CO2 emissions	Government costs		
Australia^a	+	+	+	+	+	+	+	+	+	+	+	(1)
Chile^b	++	++	o	o	o	o	o	o	o	+	+	(2)
Colombia^c	+	o	o	+	+	+	o	+	o	+	o	
England^d	+++	+++	o	++	++	+++	+++	o	+++	++	+++	
France^e	++	+	o	+	+	++	++	++	o	+	o	(3)
India^f	+	+	+	o	+	+	o	+	+	+	+	(4)
Mexico^g	+	+	o	+	+	+	o	+	+	+	+	(5)
Netherlands^h	+++	o	+++	++	++	+++	+++	+++	+++	++	+	(6)
New Zealandⁱ	+++	+++	+++	++	++	+++	+++	+++	+++	++	+++	(7)
Poland^j	+++	+++	o	++	++	+++	o	+++	+++	++	+	(8)

Legend:

o = not mentioned or specifically excluded

+ = listed as a possible or common item

++ = measurement or valuation guidance provided

+++ = measurement and valuation guidance provided

Notes:

¹ Crowding on vehicles and at stations, amenities on-board and at stations, health and physical fitness, road network congestion reduction, costs of decommissioning or rehabilitation.

² Analysis factors are from guidance for urban road and bus lane projects. Social and environmental factors are considered in a complementary analysis (see Table 5). Other costs include opportunity costs associated with future investments necessitated by the project and legal costs associated with expropriation.

³ Changes in earnings among operators, competitors and up- and downstream firms; opportunity cost factor applied to portion of project cost that would be funded by government.

⁴ Access, employment, coverage, supply continuity or disruptions, quality of life, haphazard development, other environmental impacts.

⁵ Improved energy efficiency, reduced road maintenance costs, real estate income, value of use of the right-of-way.

⁶ Changes in government revenues due to less motoring, costs of investments avoided due to project.

⁷ Road traffic reduction, agglomeration (if applicable), access security (if applicable), option values (if applicable), cost offsets for future road construction avoided.

⁸ Changes in comfort and travel safety, if directly related to project objectives and monetizable.

Sources:

^a IA 2010

^b CTU 1988, MIDEPLAN 2011b, MIDEPLAN 2011c

^c Based on typical factors in appraisals of approved projects. DNP 2003b, DNP 2003c, DNP 2004a, DNP 2004b

^d DfT 2011

^e MEEDDM 2010

^f MoUD 2006

^g FONDO 2009b

^h RWS 2010b, Bakker and Zwaneveld 2009, RWS 2011

ⁱ NZTA 2010a, NZTA 2010b

^j JASPERS 2008

Some programs define the baseline alternative as an optimal version of the current situation that would occur without the project (MEEDDM 2010, Secretaría de Hacienda y Crédito Público [SHCP] 2008). This is the case in France, where guidance notes the unavoidability of limited investments and suggests selection of the most probable scenario in light of transport policies and potential changes in pricing, intermodal competition, and the economic environment (MEEDDM 2010). In certain other programs, the baseline consists of investments needed to sustain current conditions along with other projects that have funds committed (VenW 2008, JASPERS 2008, IA 2010). Chile's program suggests a cost threshold for the baseline alternative: Sponsors should consider reformulating the baseline alternative if its cost exceeds 20 percent of the average cost of the project alternatives under consideration (Comision de Transporte Urbano [CTU] 1988).

At a minimum, national government agencies should review both project need and the proposed alternatives with project sponsors. A few programs elaborate on the extent of their review of the process:

- In the Netherlands, the national government's decision to accept a preferred alternative depends on the sponsor's providing a clear description of underlying problems and challenges, alignment of the project with policies and goals, insights into the impacts of top alternatives, further justification for a preferred alternative, and evidence of alignment with other parties affected by the project (VenW 2009).
- In the United States, the national agency must approve the baseline and project (build) alternatives (FTA 2003). The build alternative must perform acceptably according to the program's evaluation and rating process (FTA 2003).
- In England, the national government may decline to fund a project if the quality of the alternatives analysis is poor or an alternative that appears preferable was excluded (DfT 2007).

COMPARE PROJECT COSTS AND BENEFITS

Comparisons of costs and benefits are essential to determining whether a project offers a worthwhile return on its costs (Mackie and Nellthorp 2001). The range of costs and benefits can be broad. Socioeconomic factors that can be monetized can be compared through cost-benefit analysis, a well-accepted technique that requires clear guidance and consistent assumptions to allow for meaningful comparisons among projects. Projects should also be evaluated on quantitative and qualitative factors that cannot be monetized but are still important for decision makers to consider, including distributional impacts across societal groups.

In most of the reviewed programs, the project rationale largely depends on socioeconomic viability (see Table 4). Three programs provide clear mechanisms for incorporating quantitative and qualitative factors:

- In England, cost-benefit analysis results are rated, and this rating may then be adjusted based on the presence of significant quantitative or qualitative costs and benefits (DfT 2011c).
- In New Zealand, cost-benefit analysis results account for approximately one-third of a project's rating (NZTA 2009). Two qualitative criteria that encompass strategic and policy factors account for the remainder of the rating.
- In the United States, cost effectiveness is assessed alongside several other criteria related to project justification, accounting for 20 percent or one-third of the justification rating (FTA 2011a, FTA 2009). In turn, the project justification rating is averaged with a local financial commitment rating to arrive at an overall project rating (FTA 2011a).

Comparison of monetizable costs and benefits through cost-benefit analysis

Cost-benefit analysis is the most common technique to appraise the socioeconomic impacts of mass transit investments. This type of analysis helps identify investments that represent good value to society over the long run, not just at a particular point in time. It also helps to prioritize use of limited resources, either

in terms of alternatives to solve a particular problem or in determining which problem to solve. Eleven of the 13 programs in this study use cost-benefit analysis. Guidance for project sponsors on how to complete the analysis is inconsistent across countries, however; and choices as to which benefits and costs to include as well as analysis parameters can affect determinations about a project's viability. Table 3 shows the range of costs and benefits typically encompassed in cost-benefit analysis (Mackie and Nellthorp 2001) and their treatment among the 10 countries that provide guidance to sponsors on how to conduct it, while Table 4 depicts the range of cost-benefit parameters that can affect viability determinations.

Cost-benefit analysis is not perfect, however. Summary figures do not describe the particular benefits and costs of a project, or indicate how the benefits and costs are distributed geographically or socially. For instance, most travel time benefits could accrue to one community, while most externalities could be borne by another. Other benefits and costs are challenging to monetize, such as a project's impacts on the natural environment or its ability to improve quality of life. Finally, cost-benefit analysis relies on many assumptions about future development, behavior, and values; and if these are inconsistent among projects, the results cannot be fairly compared.



Table 4 Cost-Benefit Analysis Parameters by Country

Country	Discount rate (percent)	Typical analysis period (years)	Residual value included?	Initial year in analysis	Threshold for viability ¹
Australia ^a	4, 7 and 10 (sensitivity test)	30	If project life is over 30 years	First year in which benefits accrue	BCR "well above" 1:1
Chile ^b	6	20	Yes	Opening year (initial investment costs subtracted from net benefits)	IRR above 6 percent
Colombia ^c	12	20	No	First year of construction	IRR above 12 percent
England ^d	3.5 (3.0 from year 31)	Up to 60	If project life is less than 60 years	Initiation of investment planning	BCR rated; typical minimum threshold is 1.5
France ^e	4 (3.5 from year 30)	Up to 50	Yes	Opening year (initial investment costs subtracted from net benefits)	IRR above 4 percent; prioritization by discounted profit per public euro
India ^f	Opportunity cost of capital	At least 20	[not indicated]	[not indicated]	IRR above discount rate (for public-private partnerships, at least 2 percent above discount rate)
Mexico ^g	12	30	Yes	First year of construction	IRR above 12 percent
Netherlands ^h	Typically 5.5 (2.5 base plus risk premium)	100	No	Year prior to project commissioning	No decision criterion
New Zealand ⁱ	8	30 for infrastructure, 15 for services	No	First year of construction	Project may be disqualified if BCR is less than 1
Poland ^j	5	25	Yes	First year of expenditures	IRR above 5 percent

Notes:

¹ BCR = benefit-cost ratio, IRR = economic internal rate of return, NPV = economic net present value

Sources:

^a IA 2010, IA 2011a

^b Based on guidance for urban roadway projects. CTU 1988, MIDEPLAN 2011b

^c Based on parameters used for approved projects. DNP 2003b, DNP 2003c, DNP 2004a, DNP 2004b

^d DfT 2011i, DfT 2011i

^e MEEDDM 2010

^f MoUD 2005c, MoUD 2006

^g D. Uniman, personal communication, November 14, 2011; SHCP 2008

^h RWS 2010b, RWS 2010a, Bakker and Zwaneveld 2009

ⁱ NZTA 2009, NZTA 2010a, NZTA 2010b

^j JASPERS 2008

Table 5 Examples of Non-Monetized Costs and Benefits by Program

Country	Economic	Environmental	Service quality
Australia ^a	<ul style="list-style-type: none"> • Indirect economic benefits • Urban consolidation benefits (in terms of infrastructure provision) 	<ul style="list-style-type: none"> • Visual and landscape impacts • Heritage and cultural impacts • Health benefits 	—
Brazil ^b	—	<ul style="list-style-type: none"> • Minimization of environmental impacts • Greenhouse gas emission reductions 	<ul style="list-style-type: none"> • User safety improvements • Punctuality and reliability improvements • Fare integration • Coordination with pedestrian access improvements
Chile ^c	—	<ul style="list-style-type: none"> • Air pollution impacts • Noise and vibration impacts • Visual intrusions 	—
Colombia ^d	<ul style="list-style-type: none"> • Contribution to development of local economy 	<ul style="list-style-type: none"> • Environmental benefits not captured in cost-benefit analysis 	<ul style="list-style-type: none"> • Fare and operational integration
England ^e	<ul style="list-style-type: none"> • Indirect economic benefits 	<ul style="list-style-type: none"> • Air quality impacts • Landscape impacts • Townscape impacts • Historic resource impacts • Biodiversity impacts • Water environment impacts • Physical fitness impacts 	<ul style="list-style-type: none"> • Travel time reliability • Accessibility - travel times to key destinations, frequency, physical access at stops • Journey and station quality • Security impacts
France ^f	—	<ul style="list-style-type: none"> • Reductions in carbon dioxide emissions and energy consumption 	<ul style="list-style-type: none"> • Service quality improvements (frequency, reliability, accessibility, comfort) • Integration with other modes
India ^g	<ul style="list-style-type: none"> • Non-monetizable cost-benefit factors (see Table 3) 	<ul style="list-style-type: none"> • Non-monetizable cost-benefit factors (see Table 3) 	<ul style="list-style-type: none"> • Non-monetizable cost-benefit factors (see Table 3)
Mexico ^h	<ul style="list-style-type: none"> • Increased property values 	<ul style="list-style-type: none"> • Urban image improvements 	<ul style="list-style-type: none"> • User perceptions of service (travel times, fares, station accessibility, on-board comfort) • Access improvements for pedestrians and cyclists

Sources:^a IA 2010^b MdC 2011a^c CTU 1988^d DNP 2003a, DNP 2006^e DfT 2004b, DfT 2009a, DfT 2011a, DfT 2011b, DfT 2011g, DfT 2011i^f MEEDDM 2010^g MoUD 2005c, MoUD 2006^h FONDO 2009a, FONDO 2009b

Strategic	Distributional	Other
<ul style="list-style-type: none"> • Consistency with investment priorities 	<ul style="list-style-type: none"> • Identification of gaining/losing groups, with scale of effects 	<ul style="list-style-type: none"> • Social capital • Impacts to social amenities (e.g., parks) • Social cohesion
<ul style="list-style-type: none"> • Use of domestically produced labor, equipment and technology 	<ul style="list-style-type: none"> • Benefits to areas with high population densities and low incomes 	<ul style="list-style-type: none"> • Coordination with other federally funded programs and projects • Implementation readiness (terms of reference, environmental licensing, land acquisition) • Status of system's operating contracts • Local funding share • Share proposed for financing (loan)
—	<ul style="list-style-type: none"> • Impacts by affected group (government, firms, motorists, public transport users, etc.) • Impacts on pedestrians and bicyclists 	<ul style="list-style-type: none"> • Collisions • Land use changes resulting from expropriation • Changes in supply of public (park) space • Parking supply impacts
<ul style="list-style-type: none"> • Commitment to public transport organizational reforms - oversupply reduction, creation of new ownership companies 	<ul style="list-style-type: none"> • Proportion of local population benefitting from project • High rates of basic needs unsatisfied among population 	<ul style="list-style-type: none"> • Adoption of tools to encourage real estate development in corridor • Community support for project
<ul style="list-style-type: none"> • Integration with other government policies 	<ul style="list-style-type: none"> • Employment changes in areas with low economic activity or employment ("regeneration areas") • Social and distributional impacts of user benefits and certain externalities across "vulnerable" (generally less mobile) groups 	<ul style="list-style-type: none"> • Severance caused by roads, particularly for pedestrians • Option value • Affordability
—	<ul style="list-style-type: none"> • Spatial distribution of gains and losses 	<ul style="list-style-type: none"> • Connection with urban development strategy and policy • Service to major destinations and development areas
<ul style="list-style-type: none"> • Inclusion of implementation plan with timeframes for governance reforms 	<ul style="list-style-type: none"> • Status of required approvals 	<ul style="list-style-type: none"> • Cost-benefit factors that cannot be monetized (see Table 3)
—	—	<ul style="list-style-type: none"> • Ability of project to meet demand • More rational use of road infrastructure • Improved traffic flow • Improved growth management

Table 5 Examples of Non-Monetized Costs and Benefits by Program (continued)

Country	Economic	Environmental	Service quality
Netherlands ⁱ	<ul style="list-style-type: none"> • Indirect economic benefits 	<ul style="list-style-type: none"> • Soil impacts • Ground and surface water impacts • Habitat impacts • Landscape and heritage impacts 	<ul style="list-style-type: none"> • Qualitative service quality and comfort improvements • Security impacts
New Zealand ^j	—	<ul style="list-style-type: none"> • Vibration impacts • Water quality impacts • Impacts on areas of special significance (cultural, ecological, etc.) • Ecological impacts • Visual impacts • Shadowing caused by structures 	—
Poland ^k	<ul style="list-style-type: none"> • Employment created by project, during construction and operation phases 	—	—
South Africa ^l	—	—	—
United States ^m	—	<ul style="list-style-type: none"> • Metropolitan area's air quality status 	<ul style="list-style-type: none"> • Mobility improvements (total trips and travel time savings per passenger mile, both for all users and for lowest regional socioeconomic stratum only)

*Sources:*ⁱ RWS 2010a^j NZTA 2009, NZTA 2010a, NZTA 2010b^k JASPERS 2008, MI 2011^l DoT 2011^m FTA 2011a

Strategic	Distributional	Other
—	<ul style="list-style-type: none"> • Description and distribution of welfare impacts (among groups, economic sectors and geographies) 	—
<ul style="list-style-type: none"> • Strategic fit of the opportunity or issue at hand with national transport investment priorities • Effectiveness of the proposed implementation approach at fulfilling strategic fit potential 	<ul style="list-style-type: none"> • Impacts to persons without private vehicles or ability to access public transport 	<ul style="list-style-type: none"> • Severance caused by roads, particularly for pedestrians and bicyclists • Isolation due to unreliable roads or remote location • Exceptional additional factors
—	<ul style="list-style-type: none"> • Access for persons with limited mobility, including hearing or vision impairments 	<ul style="list-style-type: none"> • Intermodal integration • Readiness (scope development, land acquisition, environmental decision, development of bidding documents) • Ability to complement other transport projects • Consistency with integrated public transport development plan • Public transport travel time reduction between endpoints • Daily vehicle traffic along route
—	—	<ul style="list-style-type: none"> • Change in number and percentage of households with access to rapid transit • Cost (infrastructure, system and transition) per daily passenger trip
—	<ul style="list-style-type: none"> • Share of travel time benefits accruing to lowest socioeconomic stratum in metropolitan area relative to the stratum's concentration 	<ul style="list-style-type: none"> • Existing land use characteristics • Economic development effects (supportiveness and prior performance of land use plans and policies) • Local financial commitment • Operating efficiencies • Compelling benefits not captured other under evaluation criteria



These points underscore the importance of consistent, complete guidance and separate evaluation of nonmonetizable impacts. Guidance should prescribe—

- **The monetizable benefits and costs to be included in and excluded from analyses.**

Cost-benefit analysis is typically restricted to direct costs and benefits of a project, such as travel time savings, reductions in operational costs, emissions and traffic incident reductions, and investment costs (see Table 3). Yet, certain direct impacts may be excluded because of valuation difficulties. This is particularly the case for environmental factors (Mackie and Nellthorp 2001, DfT 2011d). Indirect economic impacts (discussed further among nonmonetized costs and benefits) are often excluded due to the risk of double-counting with direct impacts (Mackie and Nellthorp 2001).

- **Necessary data and how to collect them, including on travel behavior and travel times.**

In metropolitan areas with developed travel forecasting procedures, transport modeling software may generate much of the necessary information. Otherwise, surveys of the travel patterns of existing transit riders may yield much of the data needed to assess user benefits. Guidance from Poland's program outlines the level of forecasting that may be needed for different levels of project complexity and how the forecasting can be conducted (JASPERS 2008).

- **Prices, discount rates, and periods of analysis to use in valuing benefits.**

Program materials from Chile, England, and Poland, among others, provide prices for many factors, such as the value of time (DfT 2011d, CTU 1988, JASPERS 2008). Given that valuation can be challenging, estimates may be derived from analyses conducted for similar projects or in



comparable contexts. This has been done for at least one mass transit project in Colombia, for instance (DNP 2003b).

- **Assumptions for projecting “baseline” conditions into the future.** Because the costs and benefits of a project are assessed relative to a future situation without the project, the latter must reflect how society would be expected to fare were current conditions to persist.

- **How sensitivity testing should be conducted.** Projecting costs and benefits and their values into the future requires many assumptions. Sensitivity testing may be conducted on the following factors:

- The discount rate, the factor by which future costs and benefits are discounted to reflect their diminished value relative to those occurring now (Small 1999). Australia’s program requires sponsors to assess their projects under three discount rates, for instance (IA 2010).
- Anticipated benefits and costs. Overprediction of demand and underestimation of costs are common to large infrastructure projects (Flyvbjerg, Bruzelius, and Rothengatter 2003). Guidance from programs in Poland and Chile specify ranges of variation for key variables (JASPERS 2008, CTU 1988). Population and economic growth, including development patterns around mass transit projects, constitute areas of uncertainty (DfT 2011d, IA 2010, RWS 2010b). On the cost side, England’s program requires cost estimates to incorporate risks as well as inflation factors to account for the chronic underestimation of project costs (DfT 2011e).
- Prices to use in valuation, as the ranges of potential prices may be broad. This is particularly the case for environmental factors, such as carbon dioxide emissions (Mackie and Nellthorp 2001, IA 2010, DfT 2011f).

Given the complexity of cost benefit analysis, national government agencies that administer investment programs must be capable of scrutinizing the results to ensure that the analyses were performed correctly and in line with guidance. In Australia and New Zealand, independent consultants provide a level of

scrutiny beyond that of the government agencies that administer the programs (IA 2011a, NZTA 2009).

A final consideration is that the level of analysis should be scaled to project costs. In Poland, cost-benefit analysis is only required for projects above a certain cost: €50 million (approximately US\$66 million), in accordance with European Union (EU) funding requirements (EU 2007). In India, the threshold is 1 billion rupees (approximately US\$20 million; MoUD 2006). In Mexico, a cost-benefit analysis with simplified data collection requirements applies to projects with costs of up to 150 million pesos (approximately \$12 million; SHCP 2008).

Comparison of costs and benefits through cost-effectiveness analysis

Another approach is to compare some costs and some benefits through a cost-effectiveness analysis rather than a full cost-benefit analysis. Unlike cost-benefit analysis, cost-effectiveness analysis measures the incremental cost associated with each additional unit of benefit, where benefits can be defined in terms of a single outcome (EU 2008): passenger trips, passenger-kilometers of travel or hours of travel time saved, for instance (Johnston and DeLuchi 1989). Multiple measures of cost effectiveness could be taken, however, such as project cost per new rider, project cost per accident reduced, and so forth. Benefits must therefore be quantifiable but are not monetized. The net present value of costs and benefits over a range of years could be assessed, or the analysis could focus on a single year. By focusing on a single outcome, cost-effectiveness analysis offers a simpler and more tractable approach to comparing some benefits and some costs than is the case with cost-benefit analysis, especially when benefits are difficult to measure (EU 2008). However, if only a single measure of benefit is used, many potential benefits may be left out of the calculation; economic costs are left out as well (EU 2008, Johnston and DeLuchi 1989).

The United States’ program applies cost-effectiveness analysis to measure some costs and benefits. The costs included in the analysis are financial, namely the difference in annualized capital and operating costs between the proposed project and a baseline alternative (FTA 2011a, p. 9). The baseline alternative

is defined as the “best that can be done” in the corridor to solve the identified problem, absent a major capital investment (FTA 2003). The unit of benefit is an hour of travel time saved by users of the metropolitan public transport system in the project’s horizon year (currently 2030 or 2035) relative to the baseline alternative (FTA 2011a). The current approach taken by the United States recognizes that not all benefits are captured in the assessment by scaling the project rating breakpoints to account for additional congestion relief and non-mobility benefits (FTA 2011a). However, this simplifying assumption is currently being revisited with an emphasis on improving quantification of the non-mobility benefits (FTA 2011a).

Account for nonmonetized costs and benefits

Many costs and benefits of mass transit investments are not included in cost-benefit or cost-effectiveness analysis because they cannot be monetized. Such costs and benefits—which include quantitative, qualitative, and distributional factors—may constitute an important part of the rationale for a project and should be included in evaluations. As with cost-benefit and cost-effectiveness analysis, guidance should be clear as to how the factors are measured and treated in the overall evaluation process.

The 13 programs consider several types of quantitative and qualitative factors, as described below and shown in Table 5:

- **Economic factors** include indirect economic benefits. Such benefits result from the correction of imperfect land, labor, or goods markets through creation of economies of scale; substantial travel time reductions; major employment shifts; or significant changes in land prices (Mackie and Nellthorp 2001, p. 168; VenW 2008). The benefits are challenging to measure; and even where they can be monetized, their value is typically small relative to direct benefits (Mackie and Nellthorp 2001). Programs in England, Australia, the Netherlands, and New Zealand require evaluation of indirect economic benefits for larger projects or in cases where imperfect markets may exist (DfT 2009a, IA 2010, VenW 2008, NZTA 2010a, NZTA 2010b).
- **Environmental factors** include impacts to the natural and built environment that are difficult to monetize or quantify, including impacts on air and water quality, heritage sites, landscapes, and habitats. Where the impacts can be quantified, they may be reported in terms of the amount of land affected or the changes in the volume of pollutants that would be generated (e.g., RWS



2010b, MEEDDM 2010). Alternatively, impacts can be described qualitatively or rated on a scale of magnitude (e.g., DfT 2003b, DfT 2004a, IA 2010).

- **Service quality factors** include impacts on travel time reliability and the overall quality of the trip. Reliability may be quantified in terms of the likelihood and potential magnitude of delays (DfT 2009b). Travel quality, on the other hand, may be described qualitatively or rated on a scale, based on changes to the atmosphere and amenities aboard vehicles and at stations (DfT 2003c, DfT 2003d).

- **Policy and strategic consistency factors** include alignment with national objectives. In Colombia, for instance, metropolitan areas that receive mass transit funding must increase their control over local public transport services, including coordination of bus routes that serve project stations (DNP 2003a). Local jurisdictions are also expected to implement tools to encourage real estate development along new mass transit corridors. In India, cities and states must commit to governance reforms (involving public participation, taxation, and accessibility of government services) as a condition of receiving funds (MoUD 2005a). Strategic consistency may also be rated, as in New Zealand: The “strategic fit” of the problem or issue at hand with national

transport investment priorities is rated on a scale, as is the effectiveness of the proposed project in delivering on the strategic fit potential (NZTA 2009, p. B4–12).

Distributional analyses identify a project's impacts on particular social groups or geographies. Because results of socioeconomic analyses do not provide these details, several programs require parallel evaluations of distributional impacts of costs and benefits. As practiced across programs (see also Table 5), analysis may extend across several groups or focus primarily on disadvantaged groups:

- In Chile, project sponsors must assess a project's impacts on users of different travel modes, transport operators, construction firms, and the government, among other groups (CTU 1988).
- In the United States, one evaluation criterion assesses the share of a project's travel time benefits accruing to “transit-dependent” populations relative to their concentration in the region (FTA 2011a, p. 19). The precise definition of “transit-dependent” varies by metropolitan area but generally encompasses households that do not own motor vehicles or that fall into the lowest income group (FTA 2011a).



- In England, project sponsors must consider how a project's benefits and externalities would be borne by low-income or "vulnerable" populations, such as the elderly, minorities, and people who do not own personal vehicles (DfT 2011g).

KEEP POLITICS OUT OF TECHNICAL ANALYSES

Given the magnitude and often uneven distribution of costs and benefits in mass transit investments, the decision making process is fundamentally political in nature (Small 1999). The rigorous alternatives analyses and comparisons of costs and benefits described in the preceding subsections help to make the consequences of these decisions clearer by providing political decision makers with complete information about the projects' merits. Although politics may help to shape a program's evaluation criteria, they should not cloud the conduct of the technical analysis. A decision-making process that separates political decisions from technical analyses ensures consistent analytical requirements across projects, which can foster local political buy-in.

In several programs, technical evaluators and funding decision makers are separated by department or government branch. Technical analysts are typically representatives of a government department or specialized technical committee. Decisions about which projects to fund are then made by advisory boards appointed by ministers, the ministers themselves (in France, even the prime minister is consulted; MEEDDM 2011), other senior government officials, or popularly elected representatives. Examples of these types of separation are as follows:

- In England, technical committees within the Department for Transport evaluate projects. While transport ministers are involved in funding decisions for all projects, the national treasury also reviews decisions for costlier projects (DfT 2007, DfT 2011h).
- In India, a nonprofit institute external to the government conducts technical reviews and submits recommendations to a government sanctioning committee (A. Bhatt, personal communication, December 9, 2011; <http://www.iutindia.org/aboutus.php>).

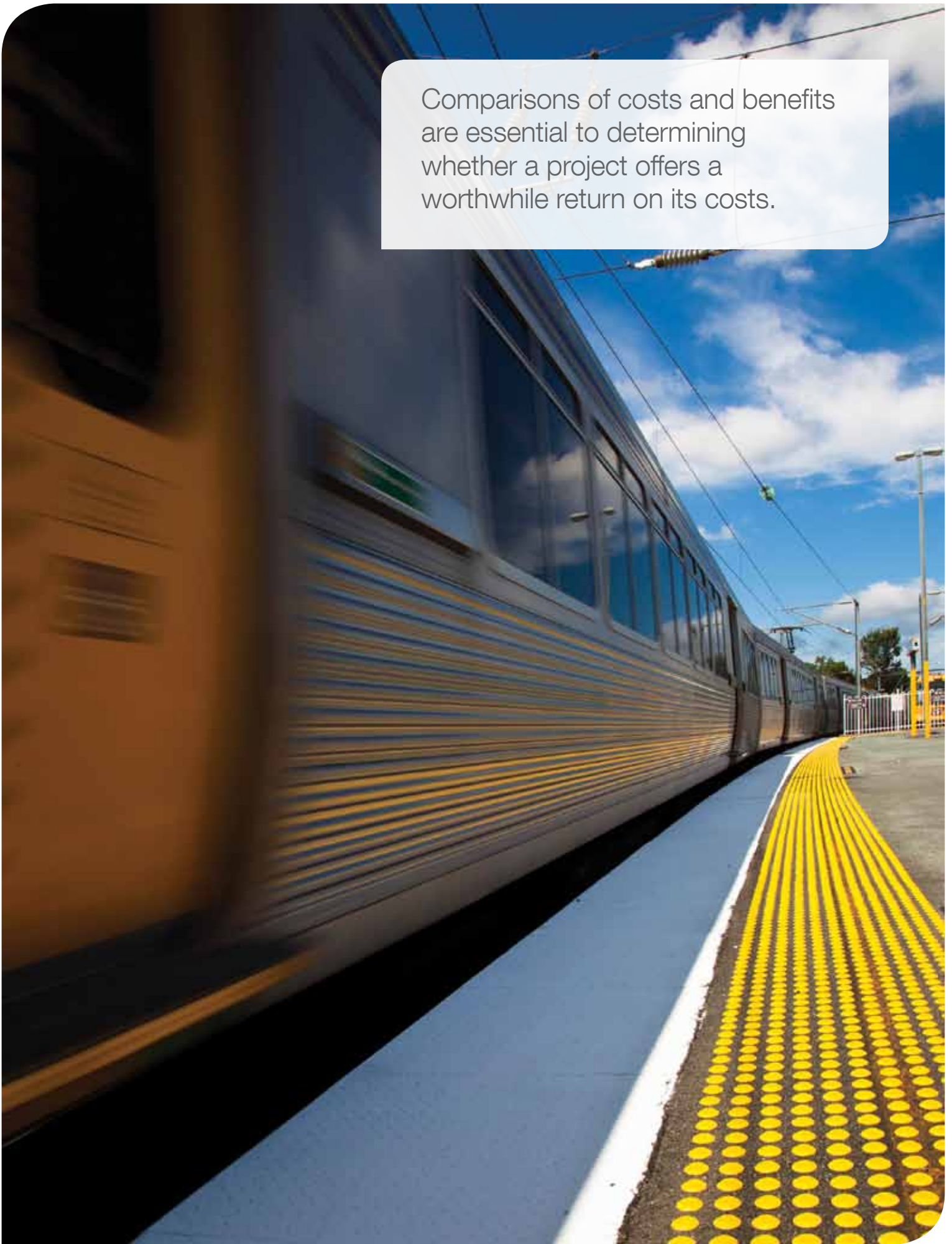
- In the United States, an executive branch agency (within the presidential administration) evaluates and rates projects and issues annual funding recommendations to the legislative branch (Congress), which is responsible for appropriating funds (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users [SAFETEA-LU] 2008, Federal Highway Administration [FHWA] and FTA 2007).

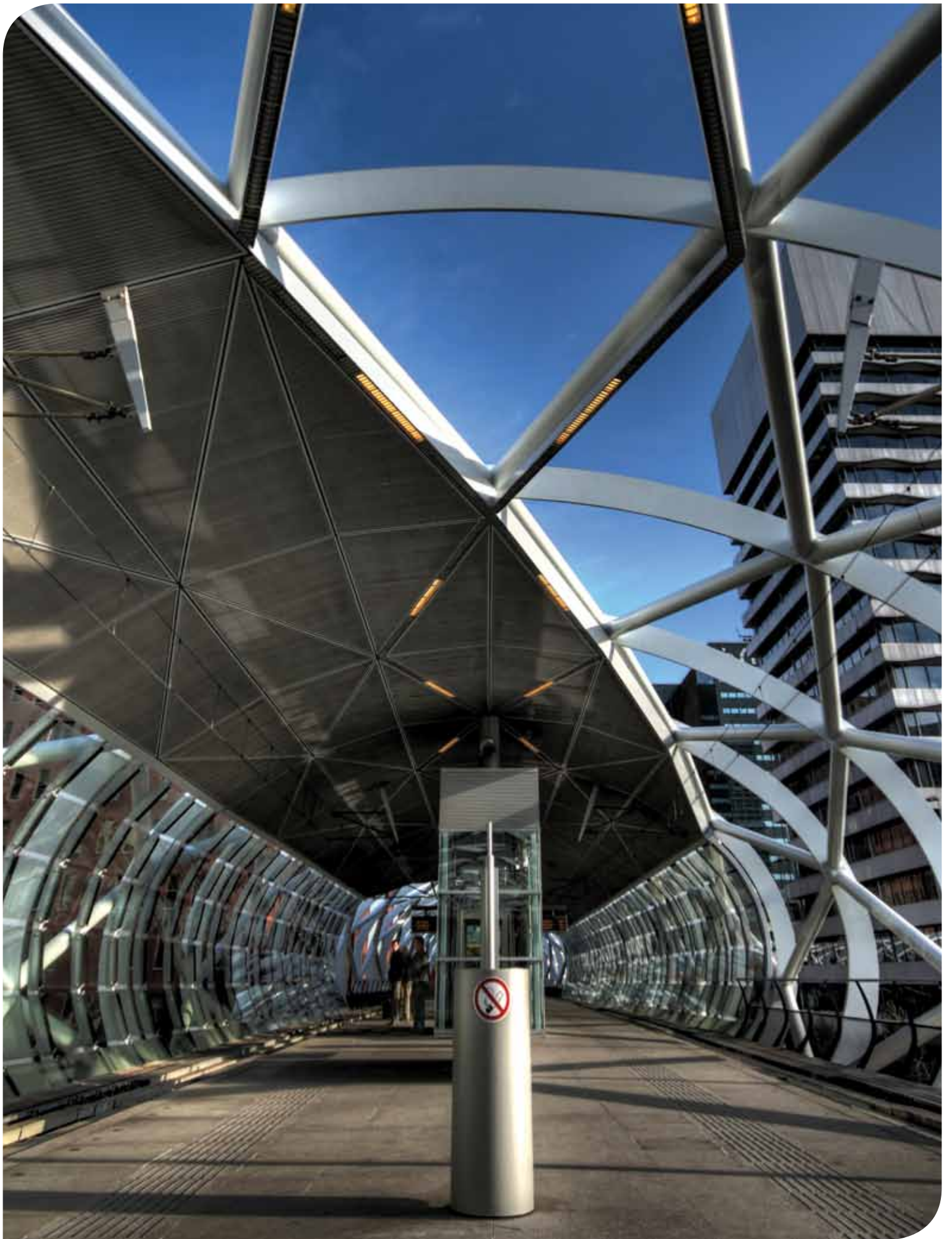
Separation is less clear when evaluators and decision makers are drawn from the same ministries but have different ranks, while no apparent separation exists in cases where a single body evaluates and makes funding decisions about projects.

The outcomes of technical evaluations should be presented clearly and succinctly for decision makers' consideration. They may be rated, as in New Zealand and the United States, or simply presented in a manner that allows decision makers to comprehend them easily. Particularly good examples of presentation include—

- England's Appraisal Summary Table (<http://www.dft.gov.uk/webtag/documents/project-manager/unit2.7.2.php>). Each project's performance under all evaluation criteria is summarized in a single table for ministers' consideration (Headicar 2009).
- Summary tables in the United States' Annual Report on Funding Recommendations (http://fta.dot.gov/12304_12438.html). Evaluation results for all projects are presented in summary tables that indicate the projects' ratings under each evaluation criterion, as well as key statistics from the evaluations.

Comparisons of costs and benefits are essential to determining whether a project offers a worthwhile return on its costs.





THE DELIVERABILITY PILLAR

MANAGING RISKS AND BUILDING CAPACITY

Another critical component to effective funding decisions is assurance that proposed projects are deliverable—that is, that they can be implemented according to their respective scopes, schedules, and budgets.

Programs should evaluate and augment proposed projects' deliverability by—

- **Assessing risks to projects' costs, scopes and schedules, and ensuring that sponsors adopt risk mitigation procedures.** Many types of risk can complicate project implementation, including shortcomings in project management procedures. Programs can take several steps to reduce risks, including assessing the reasonability of project management plans and the viability of project designs. They can also incorporate quantifiable risks into capital cost estimates. Finally, they can evaluate projects at multiple stages of project development in order to track cost and benefit estimates and sponsors' project management capacities.
- **Increasing the capacity of project sponsors to develop, implement, and operate projects.** This is especially important when project sponsors have limited experience in mass transit development, or when new institutions are created to manage projects. Institutions with mass transit expertise—including multilateral development banks, nongovernmental organizations, local universities, and private-sector firms—can augment the capacity of local governments to develop projects. They can also help to equip national government agencies with the knowledge to administer their programs effectively and provide assistance to sponsors on critical project development matters.

Table 6 Project Management Plan and Risk Assessment Requirements by Program

Country	Organizational information (structure, governance, procedures)	Roles in project development and implementation	Contracting procedures	Communication procedures	Quality assurance and control procedures	Key milestones	Risk identification and mitigation	Description of how materials are assessed
Australia^a	x	x	x			x	x	x
Brazil^b			x		x	x		x
Chile^c			x	x		x		
Colombia^d	x	x	x	x	x	x	x	
England^e	x	x	x	x	x	x	x	x
France^f						x	x	
India^g	x	x	x			x	x	
Mexico^h	x	x	x	x		x	x	x
Netherlandsⁱ	x	x	x	x		x	x	x
New Zealand^j	x		x	x	x		x	
Poland^k			x				x	
South Africa^l	x		x	x	x	x	x	
United States^m	x	x	x	x	x	x	x	x

Sources:^a IA 2010, IA 2011^b MdC 2011d^c MIDEPLAN 2011a, MIDEPLAN 2011d^d DNP 2002, DNP 2003a, DNP 2006^e DfT 2007, DfT 2011e, DfT 2011j, DfT 2011k^f MEEDDM 2010^g MoUD 2005b, MoUD 2005c, MoUD 2006^h SHCP 2008, FONDO 2009a, FONDO 2009bⁱ VenW 2009, VenW 2004a^j NZTA 2009^k JASPERS 2008, MI 2011^l I. Seedat, personal communication, October 5, 2011^m FTA 2002, FTA 2010a, FTA 2010b

With respect to risk assessment, most of the reviewed programs require project sponsors to identify risks, while all require sponsors to document at least a limited range of project management procedures. However, few specify standards or assessment procedures for the documentation. Approximately half of the programs assess projects early in the development process and again prior to approving funding for construction. With respect to technical capacity development, only a handful of programs specify procedures for the national government to assist project sponsors (outside of providing financial assistance) during the development process.

ASSESS DELIVERABILITY RISKS

Many types of risk, from the mundane to the catastrophic, can affect projects' capital costs, scopes, and schedules:

- Changes in national, state, and local policy and legislation, such as delays in approval of legislation needed to implement a project and unanticipated changes that affect the project's implementation or viability
- Changes in economic conditions, both at the national level and in terms of the local construction market (i.e., increases in labor and material costs)
- Construction issues, including difficulties in relocating utilities, unanticipated terrain challenges, weather conditions, and contractor deficiencies
- Design features of the project, such as the complexity of engineering and technology
- Sensitivity of the natural environment and the extent of mitigation measures
- Social impacts, such as population resettlements and changes in access to properties
- Inter-institutional coordination, particularly when different local agencies are involved (i.e., public service companies)
- Natural disasters

- Funding disbursement delays
- Willful underestimation of construction costs
- Public opposition to the project (DfT 2011e; VenW 2004a; FTA 2010a; NZTA 2010a; NZTA 2010b; C. Mojica, personal communication, December 27, 2011; Hidalgo and Carrigan 2010; Flyvbjerg et al. 2003).

Risks also include operational factors, such as variations in demand, revenue, and service levels relative to projections (DfT 2011e). Overarching all of these risks is the project sponsors' capabilities to plan, manage, and implement their projects; good project management capacities can help to mitigate risks.

Programs should identify, treat, and minimize risks in four ways:

- Assess the project sponsors' capabilities to manage their projects, including risks, and prescribe remedial actions to ensure deliverability.
- Include quantifiable risks in cost estimates.
- Evaluate projects at multiple points before construction to track changes in costs, benefits, and sponsors' management capacities.
- Identify common areas of discrepancy between projected and actual project performance through ex-post evaluations and incorporate the results into future project planning.

Assess sponsors' project and risk management capabilities

Mass transit investments are complex and require close coordination among a range of groups: project sponsors, design firms, construction contractors, vehicle suppliers, other government bodies and the public, to name a few. Investment programs should not only require project sponsors to develop plans for managing their projects, but also assess those plans to make sure that they are reasonable. The range of considerations related to project management is broad (Hidalgo and Carrigan 2010):

- Are adequate financial resources and staff available for project preparation, implementation, and operation? What is the structure of the organization(s) that will be responsible for these activities?
- Is the community engaged in the project, both in terms of input toward its development and education on how to use it? (Public involvement is discussed in more detail later in this report, under the local buy-in pillar.)
- How are other units of government and existing public transport operators involved in project development?
- Will proposed fare policies and operations contracting procedures allow the project to meet operating cost and subsidy projections?
- Will the sponsor be able to ensure that the design and construction of the project are consistent with the overall project proposal? For instance, will the design and components allow the project to serve anticipated demand? Are assumptions about future maintenance costs consistent with the lifespan of project components?
- If the project would worsen traffic congestion (at least in the short term) or create other issues that lead to public opposition, how does the sponsor propose to respond?
- Is the implementation schedule realistic (i.e., developed around the time needed to construct the project rather than election cycles)?



As shown in Table 6, all 13 programs require project sponsors to submit project management plans that describe how they propose to implement their projects. Common elements of the plans include:

- Information about the project sponsor as an organization, such as its structure, governance, resources, and internal policies
- Roles in project development and implementation, both of the project sponsor and other organizations
- Contracting procedures, such as the proposed implementation approach and how construction risks will be distributed among parties
- Communication procedures, including with the public and other external stakeholders
- Quality assurance and control procedures, including processes for reviewing and accepting project documents and designs from contractors
- Key milestones in project development and construction

Most programs, but not all, require sponsors to identify specific risks (including and beyond those related to project management) and propose mitigation measures for them. All programs should do so given the potential for significant cost fluctuations and implementation delays with unmitigated risks. With respect to risk management, several programs, including the following examples, specify the types of risk to be considered and how they should be treated:

- In Colombia, economic, social, and environmental risks should be drawn from risk management sections of land use plans (DNP 2006).
- In the Netherlands, macroeconomic risks are addressed by adding a risk premium to the discount rate (VenW 2004a). For most projects, the premium is 3 percent.
- In England, program guidance identifies several categories of risk – related to policy, delivery, operations, demand, and revenue – and recommends using evidence from prior projects to estimate their impact and likelihood (DfT 2011e).

- In New Zealand, guidance includes a detailed checklist of common risks, along with circumstances under which each risk might be classified as low or high, based on prior experience (NZTA 2010a, p. A13–6). The checklist includes risks related to demand estimates, environmental issues, ground conditions, land acquisition, and costs. For identified high risks, additional information about the nature of the risk, the risk's consequences for decisions, and possible treatment strategies must be provided.

Only a few programs describe key questions or considerations for assessing sponsors' project and risk management plans, as shown in Table 6. Similarly, a small number explicitly offer feedback to project sponsors as part of the assessments. Given the possibility of significant cost overruns and schedule delays associated with unmitigated risks, more programs should do both. Examples of programs that provide guidance to sponsors on assessment considerations or that offer feedback mechanisms include the following:

- In the Netherlands, guidance to project sponsors details critical project management steps for each phase of project development (VenW 2009).
- In Australia and England, guidance identifies key questions related to each component of the deliverability evaluation (IA 2010, DfT 2011j, DfT 2011k, DfT 2011m).
- In South Africa, project sponsors discuss proposed project management approaches with national government representatives as part of their budget request presentations (B. Stanway, personal communication, June 29, 2011).
- In New Zealand, the national government provides assistance on project and risk management practices throughout project development (NZTA 2009).
- In England and the United States, independent consultants that work for the respective national governments provide feedback on project management approaches to sponsors of higher-cost projects, including identification of technical capacity deficiencies and remedial actions

(DfT 2007, FTA 2011b). Under both programs, the reviews coincide with project development milestones.

Some programs explicitly consider outstanding project management deficiencies in determining whether a project is “ready” to receive funding. In New Zealand and the United States, for instance, project and risk management deficiencies must be resolved before funding will be awarded (NZTA 2009, FTA 2002).

Include quantifiable risks in cost estimates

Once sponsors have identified risks, programs should ensure that they are reflected in cost estimates. They should also ensure that the estimates are realistic. Underestimation of capital costs is common in large transport projects: In a study of 258 large transport projects constructed over several decades, overruns occurred in nine of every ten projects, with the average overrun ranging from 20 percent for road projects to 45 percent for rail projects (Flyvbjerg et al. 2003). Beyond not accounting for risks, sponsors may willfully understate costs to ensure that they qualify for competitive national funding support (Flyvbjerg et al. 2003).

Cost estimation should involve three primary steps:

- **Development of base cost estimates**, using figures from comparable projects, historical experience, and construction bids. As one example, project sponsors in the United States can use a database of actual costs from completed projects to develop conceptual cost estimates (http://www.fta.dot.gov/12305_11951.html).
- **Adjustment of the base cost estimates for risk**. In England, New Zealand and the United States, a probabilistic range of cost estimates for each project is then developed based on the costs and likelihood of risks (DfT 2011e, NZTA 2009, FTA 2010a). In England, the expected value (average) of these costs is taken as the risk-adjusted cost.

- **Application of further adjustments to account for likely cost increases later in project development**. In the United States, a general contingency may be added to a project’s total cost, usually as a percentage (FTA 2010a). In England, this concept is taken further, with an “optimism bias uplift” applied to cost estimates to account for estimation errors and sponsors’ intentional underestimation (DfT 2011e, p. 21). For most mass transit projects, the recommended inflation percentage is 44 to 66 percent early in project development, falling to 3 to 6 percent at the point of approval of construction funds.

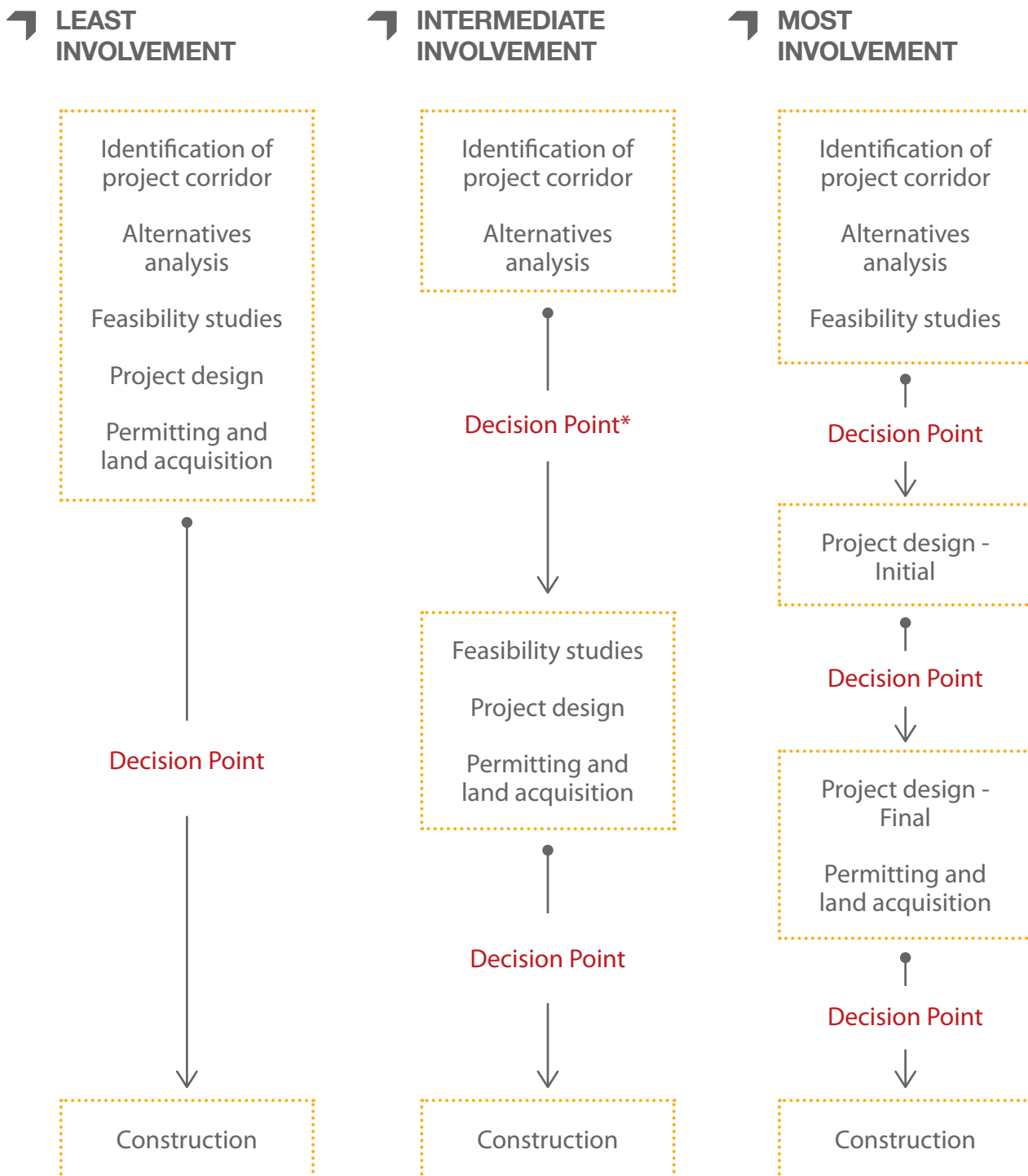
Some programs incentivize development of accurate cost estimates by limiting access to additional funds in case of cost overruns during construction. In New Zealand, the national government will only support costs of risks in proportion to its funding share in the original agreement, provided that risks have been properly distributed between project sponsors and contractors (NZTA 2009). Chile’s program ties additional funding support beyond 10 percent of the agreed amount to a detailed justification of the cost overrun and an economic reevaluation of the project (Ministerio de Planificación [MIDEPLAN] 2011a); the overruns may not be caused by changes in the nature of the project. Until recently, England’s program included a provision for funding a share of cost increases up to a specified amount (DfT 2007, DfT 2011i). The program now assigns all cost overrun risks to the project sponsor, as does the United States (DfT 2011i, FTA 2011b).⁴ A potential downside to assigning cost overrun risks to sponsors is that project scopes may be reduced if overruns occur (Flyvbjerg et al. 2003).

Evaluate projects at multiple points before construction

Multiple project evaluation points prior to construction allow national government agencies to track changes in costs, benefits, scopes, and schedules as projects are designed. These evaluation points also allow the agencies to monitor sponsors’ development of their project management capabilities and provide technical advice where needed. Additionally, clearly defined evaluation points ensure that projects are evaluated at comparable stages of development, thus facilitating relevant comparisons of rationale and deliverability.

⁴ In England, the maximum contribution is based on the optimism bias-adjusted initial estimate; in the United States, the contribution is specified in the construction grant agreement.

Figure 2 Examples of Project Development Structures and Evaluation Points



* Only if national funding support is sought for studies and design

Sources: IA 2011; MdC 2011a; MIDEPLAN 2011a; DNP 2006; DFT 2011h; MEEDDM 2010; MoUD 2005a; FONDO 2009a; VenW 2009; NZTA 2009; MI 2011; I. Seedat, personal communication, October 5, 2011; SAFETEA-LU 2008

Project sponsors must have the capacity to develop and manage complex projects. National governments must have the capacity to evaluate project proposals.

The 13 programs structure the project development process according to three approximate models, as shown in Figure 2. The simplest model (shown at left) involves a single project evaluation prior to approval of construction funding, potentially before detailed studies are complete. The programs that follow this structure do not provide funds for planning activities prior to the evaluation. One step up is the addition of optional funding support for preliminary project studies (shown at middle). Seven countries employ multiple evaluation points (shown at right), with the initial evaluation occurring around the time of the alternatives analysis process. In most of these programs, evaluations function as “a sieve, rather than a funnel” of milestones that must simply be passed (VenW 2009, p. 9, “een zeef, in plaats van een trechter” in original).

Require ex-post evaluations

Ex-post evaluations compare projects’ performance against their intended objectives and projected benefits, costs, and schedules. They are a worthwhile requirement, as the feedback can highlight areas in which projections are regularly faulty, as well as the reasons for discrepancies. Based on the feedback, national government agencies can take appropriate steps to improve program procedures and guidance.

Several programs require ex-post evaluations of projects after they enter operation. In Chile, for one, simplified ex-post evaluations that focus on project

costs and implementation schedules are performed on all projects (MIDEPLAN 2011a). Full benefits and costs of a sample of projects may be assessed after a few years of operation (Gómez-Lobo and Belmar 2011, Ministerio de Desarrollo Social [MDS] 2012a). In France, on the other hand, the full range of benefits and costs—including benefits to users, mode shifts to transit, socioeconomic returns, profitability, environmental impacts, and land use impacts—must be examined for all projects within five years of opening (MEEDDM 2010).

INCREASE PROJECT SPONSORS’ CAPACITIES TO DEVELOP, IMPLEMENT, AND OPERATE PROJECTS

A rigorous decision-making framework that incorporates deliverability and readiness considerations will matter little unless project sponsors have the capacity to develop and manage complex projects and national governments have the capacity to assess project proposals. The need for capacity building is particularly important in cities and countries with little mass transit investment experience, as the institutions that will plan, evaluate, operate, and manage projects may have been newly created solely for that purpose. In these instances, both national and local governments may benefit from technical assistance. Organizations outside of government—including multilateral development banks, non-governmental organizations, local universities, and private-sector entities—can help by collecting and disseminating information on good practices and procedures. The assistance to project sponsors should aim to build capacity rather than yield projects with features desired by the national government, because a focus on the latter could jeopardize local buy-in for the project.

As noted in the discussion of multiple project evaluation points, most programs engage with project sponsors early in the development process, either to provide study funding or to conduct an initial project evaluation. A few specify the types of assistance that they can provide to sponsors during project development:

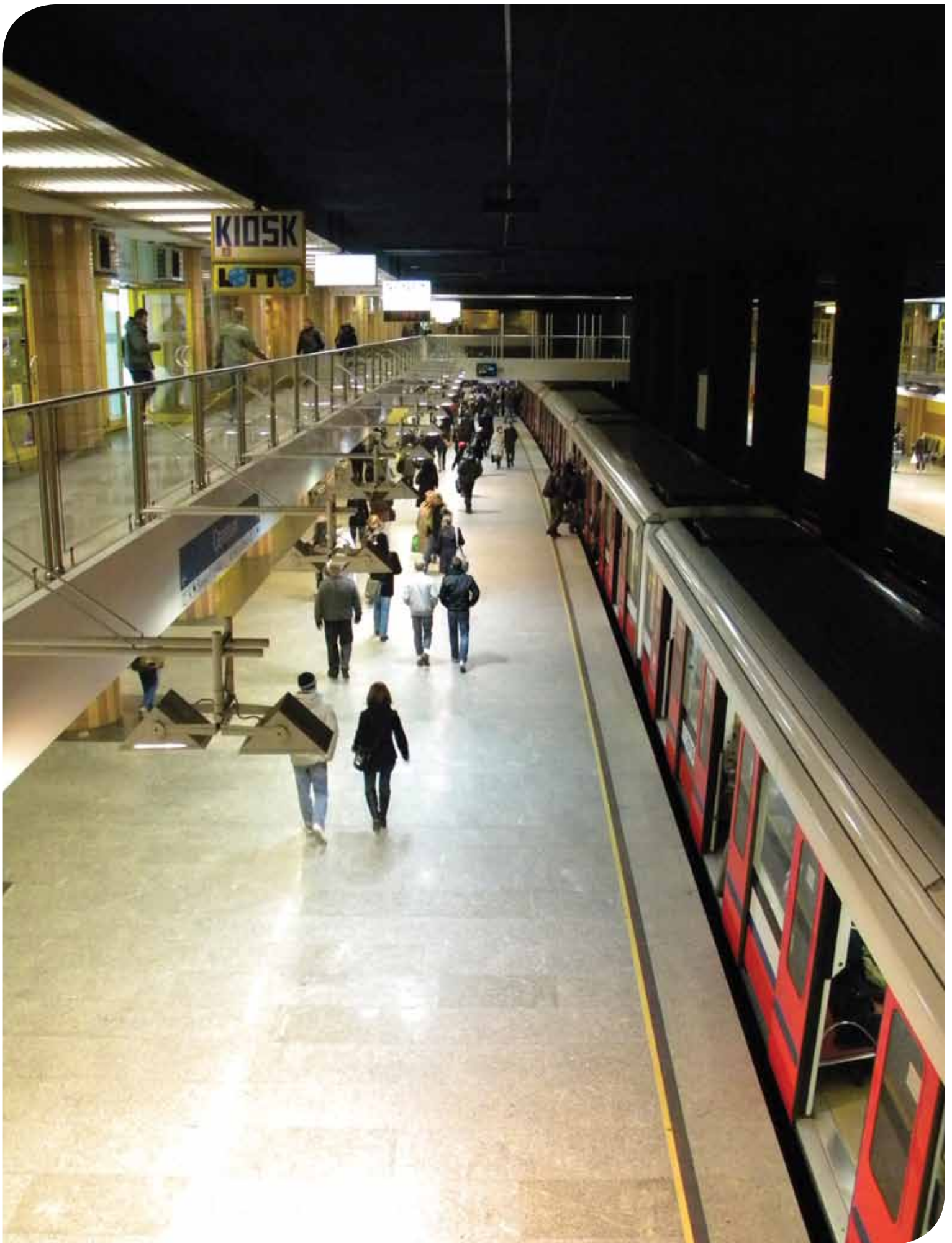
- South Africa’s Department of Transport offers to provide technical assistance to sponsors regarding transition to an industry model that

involves increased municipal coordination of services, which is one of the requirements to receive funding for mass transit projects (I. Seedat, personal communication, October 5, 2011). Assistance may take the form of workshops or site visits.

- Colombia's National Department of Planning has implemented a capacity-building program for the new companies that oversee implementation and operation of mass transit projects (DNP 2002, DNP 2003a). The program addresses key roles and processes of the agencies, as well as ways that the companies can generate ancillary income. The department also facilitates information exchanges between cities that are developing projects.

- The New Zealand Transport Agency provides guidance to project sponsors on program policies and procedures, good practices in project management, and aspects of their proposals that require improvement (NZTA 2009). Guidance articulates several areas in which the agency will be involved for each stage of project development.
- England's Department for Transport encourages contact from sponsors early in the project development process, particularly with respect to technical matters such as data collection and travel forecasting (DfT 2007). Assistance may include informal reviews of draft project submittals. As mentioned in the discussion of project management approaches, external consultants also assist sponsors of larger projects with reviews of their project management processes.





THE LOCAL BUY-IN PILLAR

ENSURING LOCAL INTEREST AND SUPPORT

The decision-making process for national mass transit investments should consider the interests of local governments in proposed projects.

The success of urban and metropolitan mass transit projects depends on strong local interest, as local governments typically operate projects and make the land use decisions that influence projects' effectiveness. Programs should ensure *local buy-in* in four ways:

- *Establish local governments as project sponsors.* Local governments are most familiar with needs and issues in their jurisdictions. They are also likely to have more interest in the projects' success if they lead project development than if the national government does so. If the impetus to develop mass transit projects originates at the national level, local governments may feel compelled, rather than encouraged, to pursue projects that they do not desire.
- Require *local financial commitment* to the project in the form of contributions toward project capital costs and commitments to operate and maintain the project. Programs should also require evidence that local funds are adequate to meet the commitment.
- Require *consistency between the project and locally driven planning processes* for transport and urban development.
- Ensure that locally driven *planning processes engage the public*, so as to have assurance that local support for projects is broad.

ESTABLISH LOCAL GOVERNMENTS AS PROJECT SPONSORS

Any mass transit investment program should ensure that the units of government that the projects will serve are committed to the success of the projects. Programs should devolve project planning and development responsibilities to local or metropolitan units of government because these bodies have the best understanding of local needs and the greatest ability to shape land development around projects. If national governments plan and construct projects but task local governments with operating them, local governments may have less interest in operating the projects at optimal levels. Even if national programs constrain the types or costs of projects that are eligible for support, local or regional governments should be better able to develop solutions more in line with their needs than national governments.

As shown in Table 7, local governments develop and implement projects under almost all programs. As with rationale and deliverability, the engagement and scrutiny of national governments in project planning and development decisions vary.

REQUIRE LOCAL FINANCIAL COMMITMENT

Another way to encourage local buy-in, as well as affordable project proposals, is to require that project sponsors contribute a portion of the cost of constructing projects from their own resources. (In some national contexts, this may require legislation authorizing municipalities to enact a new revenue mechanism.) As partners in funding arrangements, sponsors will have more vested interests in the success of their projects. Programs should verify that the sponsors' proposed contributions are available and affordable—in other words, that supporting the cost of the mass transit project will not hamper contributing agencies in undertaking their other responsibilities.

Almost all programs require a local financial contribution to project implementation costs.⁵

In most cases the national government funds at least half, but not all, of the capital cost (see Table 7). The shares vary by country, in part based on the funding resources available to local governments:

- In Chile and South Africa, no local funding match is required. In both countries, local governments have limited authority to collect revenue for infrastructure projects, instead receiving most of their financial resources from the national government (C. Zegras, personal communication, September 26, 2011; I. Seedat, personal communication, August 22, 2011). Mass transit projects in South Africa are expected to require no operating subsidy from any level of government (I. Seedat, personal communication, October 5, 2011).
- In Colombia, cities may apply revenues from a municipal gasoline tax to contribute 30 percent of the total project cost (Secretaria del Senado 1996). At least 10 percent of the project cost is expected to be provided by the private sector, including the cost of rolling stock (DNP 2003a). Similar to South Africa, private firms are expected to operate projects without subsidies (DNP 2002, DNP 2003a).
- In the United States, a 20-percent local funding match is required, but given high competition for funds, local government shares average approximately 50 percent (Duff, Gill, and Woodman 2010). Locally authorized sales and property taxes commonly support public transport operations and may be used to provide the required match (FHWA and FTA 2007). Funds from other national programs that support roadway and public transport projects may also be applied as part of the national funding share.
- In France, local shares may exceed 80 percent, depending on the project's mode and costs (MEEDDM 2010). National contributions are subject to per-kilometer or per-station limits, and land acquisition and rolling stock purchases are not eligible for support. National law authorizes public transport operators to levy a payroll tax (the "versement transport") to support operating and construction costs (Hylén and Pharoah 2002, p. 65).

As shown in Table 7, all programs require project sponsors to provide financial plans that address how local shares of capital (and, where applicable,

⁵ Only New Zealand's program provides subsidies for project operations (NZTA 2009).

operating) costs will be met. Some programs require sponsors to demonstrate that their cash flows are adequate to support proposed projects (see, for instance, FONDO 2009b, MEEDDM 2010, MoUD 2006, DfT 2011m). Only in the United States are levels of local financial commitment and the strength of proposed financial plans explicitly rated (FTA 2011a).

ENSURE CONSISTENCY WITH LOCALLY DRIVEN PLANNING PROCESSES

Another indication of local support for a project is its consistency with local transport and development plans. Transport plans should clarify the project's role in the local transport network, including its relationship to existing public transport services and other modes. Development plans should demonstrate that existing and proposed development will support the project, and vice versa. Programs should not require that existing local transport or development plans describe projects in detail; otherwise, the alternatives analysis process may be biased.

All 13 reviewed programs either require or strongly encourage consistency between proposed projects and transport planning processes. In many cases, the requirement to produce the plans is either independent of the mass transit investment program, or the plans serve a broader purpose beyond qualifying sponsors to receive mass transit funds. The legal contexts for these requirements differ by country:

- In South Africa, municipalities are required by law to develop transport plans that address all modes, specify long-term transport goals and are coordinated with land use development strategies (Integrated transport plans 2007). In the twelve larger cities that are eligible for mass transit investment funding, the transport plans must also include detailed descriptions of how mass transit networks will be developed and implemented. Consistency with the mass transit components of the transport plans is then assessed when municipalities apply for funding support for mass transit investments (I. Seedat, personal communication, October 5, 2011).





- In the United States, the law that establishes surface transport investment programs also specifies requirements for metropolitan transport planning, including the institutions that must exist and the processes they must follow to receive funds from any of the programs (SAFETEA-LU 2008). The plans are not restricted to federal funding programs: Plans must account for any “regionally significant” roadway or mass transit projects that may affect attainment of air quality goals, regardless of the funding source (FHWA and FTA 2007). For mass transit investments, the project (following alternatives analysis) must be adopted into a long-range metropolitan transport plan that is constrained to reasonably anticipated financial resources, conforms to air quality requirements, and is compliant with procedural requirements (FHWA and FTA 2007, FTA 2003).
- In England, projects are derived from and must support the objectives of local transport plans (DfT 2007). The plans, which are required by law, are expected to contribute to national transport goals that include economic growth, reduced carbon emissions, enhanced travel safety and public health, and improved quality of life (DfT 2009c).
- In France, any city with more than 100,000 inhabitants must produce an urban mobility plan (PDU), and smaller cities are encouraged to do so as well (Hylén and Pharoah 2002, Eltis 2011). PDUs must prioritize development of public transport and nonmotorized modes, specify measures to reduce use of automobiles, and provide timelines for implementing proposed strategies (Eltis 2011). Proposed projects are expected to be consistent with PDUs or, in smaller cities, with policies articulated in local or regional development plans (MEEDDM 2010).

Table 7 Funding Shares and Planning Requirements

Country	Maximum national funding share (percent)	Financial plan required	Planning requirements
Australia ^a	100	x	• Consistent with local and regional plans and planning processes
Brazil ^b	95	x	• Consistent with urban comprehensive plan • Consistent with integrated urban transport plan (or equivalent)
Chile ^c	100	x	• Contained in urban transport plan
Colombia ^d	70	x	• Consistent with local land use plans
England ^{e,1}	90	x	• Consistent with local transportation plan • Prioritized by regional assembly
France ^{f,2}	20-25	x	• Consistent with comprehensive urban strategy • Consistent with urban transport plan (or equivalent)
India ^{g,3}	35-90	x	• Prioritized in city development plan • Consistent with national urban transport policy
Mexico ^h	50	x	• Prioritized in sustainable urban transport plan
Netherlands ^{i,4}	—	x	• Derived from regional development agendas jointly developed by national and regional governments • May need to be integrated with land use plans
New Zealand ^j	60	x	• Included in regional and national surface transport programs • Consistent with regional and national transport strategies
Poland ^k	59	x	• Integrates transport subsystems
South Africa ^l	100	x	• Contained in local integrated transport plan
United States ^m	80	x	• Contained in long range metropolitan transport plan constrained to available fiscal resources

Notes:¹ 75 percent maximum share for light rail transit projects.² Maximum funding share varies by mode.³ Maximum funding share depends on urban population and state.⁴ Funding share is project-specific.**Sources:**^a IA 2010, IA 2011, <http://nationbuildingprogram.gov.au/projects/>^b MdC 2011a, MdC 2011b, MdC 2011e^c C. Zegras, personal communication, September 26, 2011; MIDEPLAN 2011a; Secretaría de Planificación de Transporte 2012^d DNP 2002, DNP 2003a, Secretaria del Senado 1996^e DfT 2007^f MEEDDM 2010^g MoUD 2005c, Agarwal and Zimmerman 2008^h FONDO 2009aⁱ VenW 2009, RWS 2010a^j NZTA 2009^k MI 2011^l I. Seedat, personal communication, October 5, 2011; I. Seedat, personal communication, August 22, 2011^m SAFETEA-LU 2008, FTA 2003, FTA 2011a

Programs should devolve project planning and development responsibilities to local or metropolitan units of government because these bodies have the best understanding of local needs and the greatest ability to shape land development around projects.

Several programs also encourage and assess consistency with development and land use plans:

- In England, a project's consistency with land use policies and plans at the local, regional, and national levels is assessed, in particular whether the project would further or hinder plans and policies (DfT 2003e).
- In France, projects are assessed for consistency with local development plans, as well as their spatial relationships with major destinations and areas of planned development (MEEDDM 2010). The assessment also considers whether municipalities are implementing zoning changes to support their projects.
- In New Zealand, one evaluation criterion considers the integration of proposed projects with land use and other infrastructure (NZTA 2009). The national government's policy for transport planning encourages coordination with land use planning, including with respect to locating new development near public transport and increasing urban development densities (NZTA 2009).

- In the United States, a project's consistency with existing and planned land use is assessed through two criteria: One focuses on existing conditions, with quantitative elements (such as population densities and employment levels near stations) most influential in determining a project's ratings (FTA 2011a, FTA 2004). The other centers on the degree to which land use plans and policies support transit-oriented development and are consistent with a mass transit project, as well as the effectiveness of the plans and policies in encouraging transit-oriented development to date (FTA 2011a). Guidance indicates the conditions that warrant certain ratings and how these conditions should be measured (FTA 2011a, FTA 2004).

REQUIRE PUBLIC ENGAGEMENT IN THE PLANNING PROCESS

In addition to assessing consistency with local transport and land use plans, programs should verify that plans and project proposals are developed with significant public input and thus reflect the needs of local residents. Engaging the public at the point of developing transport and land use plans can reduce the likelihood of contention when project proposals are developed, as the public will be aware of (and ideally largely support) the project. At the project level, the level of public support for a project can corroborate or refute anticipated project benefits. Strong support can improve a proposed project's chances of withstanding a change in political administration.

Procedures in several programs address expectations for public involvement in the planning process, including the following:

- In India, local governments are expected to expand public engagement as one of the required reforms associated with funding support (MoUD 2005a, MoUD 2005b). Citizens are expected to be engaged in identifying urban infrastructural needs and prioritizing investments, including for urban transport.
- In England, local governments are required by law to involve the public in decision making, and public transport users are among the specific

groups that must be consulted in developing transport plans (DfT 2009c). Guidance encourages local governments to involve the public throughout the planning process and to use multiple outreach approaches. Sponsors are also expected to conduct project-specific outreach during the alternatives analysis process (DfT 2007).

- Guidance from France's program advises sponsors on the timing and content of initial public consultations on proposed projects (MEEDDM 2010). The consultations are expected to measure public opinion on primary features and objectives of proposed projects, and thus are recommended to occur before finalization of an alternative.

- In the United States, agencies responsible for metropolitan transport planning must ensure that stakeholders' issues are addressed in the development of plans and projects, and that the public has opportunities to influence decision making (FHWA and FTA 2007). The agencies must make particular efforts to engage low-income and minority populations. At the project level, sponsors must begin to engage the public during alternatives analysis, and are encouraged to begin doing so at the point of identifying the purpose and need for the project (FTA 2003).





CONCLUSIONS AND RECOMMENDATIONS

IMPLEMENTING THE FRAMEWORK

The 13 programs reviewed for this study reflect unique development and institutional contexts, and although some have funded dozens of projects, others have supported only a few so far.

Implicitly, all share the aim of supporting effective, deliverable projects, and all follow the principles described in this report at least to a moderate degree. Materials from each program outline processes, to varying degrees, to assess project rationales, ensure deliverability, and garner local buy-in.

Given the variety of contexts, no universally ideal structure for a good mass transit program exists. The principles articulated in this report allow for flexibility in how they are adopted. Although many of the examples of good practice come from more established

programs, administrators of newer programs should consider their needs and capacities (as well as those of their sponsors) before settling on a precise approach. If a program's goal is to develop needed infrastructure quickly, a less intricate approach may be preferable. The following recommendations provide steps that any program can take to improve its consistency with each of the principles. Additionally, Table 8 summarizes the 13 programs in terms of practices from each that are likely to generate more complete information about projects' costs, benefits, and risks.

Table 8 Summary of Practices to Support Informed Decision-Making

Country	Rationale	Deliverability	Local Buy-in
Australia^a	Alternatives analysis process encourages consideration of policy and regulatory changes that could improve project effectiveness	Third parties assess cost estimates and engineering reports for reasonability	Project sponsorship open to any entity
Brazil^b	Evaluation factors address user experience (i.e., service quality, pedestrian access)	Guidance details review process for contracting and other technical documents	Consistency with transport and land use plans required
Chile^c	Cost-benefit analysis guidance articulates measurement, valuation, and sensitivity testing approaches	Reevaluation requirement in case of significant cost overruns incentivizes accurate cost estimation	—
Colombia^d	Funding awards linked to increased local coordination of public transport services	Capacity-building program supports development of companies created to manage projects	National legislation authorized a funding source that localities can apply toward a local match
England^e	Evaluation criteria encompass many reasons for pursuing a project	Cost estimate adjustments to account for chronic underestimation	Projects derive from local transport plans and are assessed for land use consistency
France^f	Evaluation process highlights projects' abilities to reduce greenhouse gas emissions	Comprehensive ex-post evaluation required	Projects expected to align with local urban development strategies and policies
India^g	Funding awards linked to governance reforms that encourage project sustainability	—	Local governments propose projects
Mexico^h	Simplified cost-benefit analysis requirements for lower-cost projects	Guidance indicates key considerations for institutional capacity review	Local governments propose projects
Netherlandsⁱ	Alternatives analysis requires evaluation of need and urgency, detailed investigation of three top alternatives	Clear description of project and risk management required for each phase of project development	Consistency with land use plans required for most projects
New Zealand^j	Qualitative evaluation criteria (e.g., strategic and policy factors) have clear measures	Guidance describes circumstances under which certain types of risk are likely to exist	Projects derive from regional transport planning process
Poland^k	Guidance clearly summarizes requirements for and conduct of cost-benefit analysis	—	Evaluation process encourages consistency between projects and local transport plans
South Africa^l	—	Guidance details areas in which national government can provide technical support	Projects must be consistent with local transport plans
United States^m	Funding recommendations and funding approvals separated by branch of government	Project management reviews build sponsors' capacities, provide readiness assurance to national government	Consistency of development policies and plans with a mass transit investment assessed in evaluation process

Sources:^a IA 2010, IA 2011a^b MdC 2011a, MdC 2011d^c CTU 1988, MIDEPLAN 2011a, MIDEPLAN 2011b^d Secretaría del Senado 1996, DNP 2002, DNP 2003a, DNP 2006^e DfT 2004b, DfT 2011e, DfT 2007, DfT 2003e^f MEEEDM 2010^g MoUD 2005a^h SHCP 2008, FONDO 2009a, FONDO 2009bⁱ VenW 2009, VenW 2004a, RWS 2010a^j NZTA 2010b, NZTA 2009^k JASPERS 2008, MI 2011^l I. Seedat, personal communication, October 5, 2011^m FTA 2011a, FTA 2011b, FTA 2002

OVERALL

- **Provide clear, complete, and consistent guidance.** This is particularly important in newer programs as project sponsors may not be familiar with program procedures. Guidance should explain all procedures clearly, including how projects are evaluated and how decisions are made. The guidance should also aid sponsors in preparing the information needed for rationale and deliverability evaluations. If guidance is spread among multiple documents, they should not contradict each other. The NZ Transport Agency's Planning, Programming, and Funding Manual (2009) and Economic Evaluation Manual (2010a, 2010b) offer especially strong examples of clear, complete, and consistent guidance, with the added benefit of all pertinent information being consolidated into a small number of documents.

RATIONALE

- **Ensure that project sponsors identify and analyze a wide range of alternatives to solve the transport problem at hand.** The alternatives should include regulatory and policy changes, including changes in land use planning approaches and pricing for use of transport infrastructure, that would help ensure the sustainability of any infrastructure investment. (England's program provides an extensive list of policy instruments that can be considered in alternatives analysis; see DfT 2003a.) If a sponsor cannot justify a preferred alternative, it should be directed to consider other alternatives.
- **Use evaluation criteria appropriate to project sponsors' capabilities.** This is especially the case with socioeconomic cost-benefit analysis where data collection and analytical requirements can be high. If cost-benefit analysis is used, some simplifying assumptions and use of values from prior studies or similar projects may be appropriate. Poland's blue book for the public transport sector (*Niebieska księga: Sektor transportu publicznego*; JASPERS 2008) provides a comprehensive but succinct overview of the necessary steps in cost-benefit analysis. Alternatively, cost effectiveness analysis is simpler

than cost-benefit analysis but not as suitable for incorporating a wide range of measured factors.

- **Assess both monetizable and non-monetizable costs and benefits, particularly those likely to be considered in political decisions.** Such an assessment will help to improve transparency in the evaluation process. Scoring systems can be developed to balance socioeconomic and other evaluation factors; examples exist in England, New Zealand, and the United States (DfT 2011c, NZTA 2009, FTA 2011a).
- **Require clear, succinct summaries of evaluation results for decision makers.** England's Appraisal Summary Table (DfT 2004b), the Netherlands' overview table (RWS 2010b), and the rating tables in the United States' Annual Report on Funding Recommendations (FTA 2011b) provide particularly good examples.

DELIVERABILITY

- **Provide feedback to sponsors on their project management plans and risk assessments, including corrective measures.** This may be done through in-person presentations or meetings (as in South Africa) or through the use of outside specialists (as in England and the United States). Guidance from England's program identifies key questions for assessing sponsors' project and risk-management approaches (DfT 2011j, DfT 2011k).
- **Incorporate risks into cost estimates.** This will help to reduce cost overruns once funding is approved. At a minimum, base cost estimates could be scaled upward to reflect experiences with similar projects, or major risks could be described qualitatively (JASPERS 2008). Historical cost data from similar projects may also be used.
- **Track projected costs and benefits of projects as they are developed through multiple evaluation points prior to award of construction funds.** Initial evaluations may occur during the alternatives analysis process before significant data collection begins (i.e., DNP 2006, MIDEPLAN 2011a). The final pre-award

assessment should occur when the project is ready to receive funds—that is, when the rationale and deliverability arrangements are firm and final.

- **Conduct ex-post assessments of projects.**

The analyses can be straightforward, perhaps focusing only on comparisons of projected and actual costs and implementation time frames. The information can help to improve the accuracy of cost and schedule projections in future projects.

- **Assist sponsors in developing their technical and institutional capacities.** This is especially important when sponsors have little experience developing and implementing mass transit investments.

LOCAL BUY-IN

- **Assign project planning and development responsibilities to local governments.**

Local governments are likely to have more interest in a project's success if they plan and develop it based on their own identification of need. National governments may establish rigorous procedures for evaluating projects but should not dictate project designs.

- **Require that project sponsors provide at least a small share of implementation costs.**

This will help to ensure that sponsors have vested interests in completing their projects. Sponsors' financial resources need to be considered in determining an appropriate share; a new funding source may need to be authorized.

- **Assess consistency between proposed projects and local transport and land use plans.**

The plans should show a role for the project in the transport network and in the context of local development. The more binding the plans, the better. As an example, France's legal requirements for local transport planning are separate from national funding sources and require city governments to prioritize public transport improvements (Eltis 2011). The plans must also account for expected urban development.

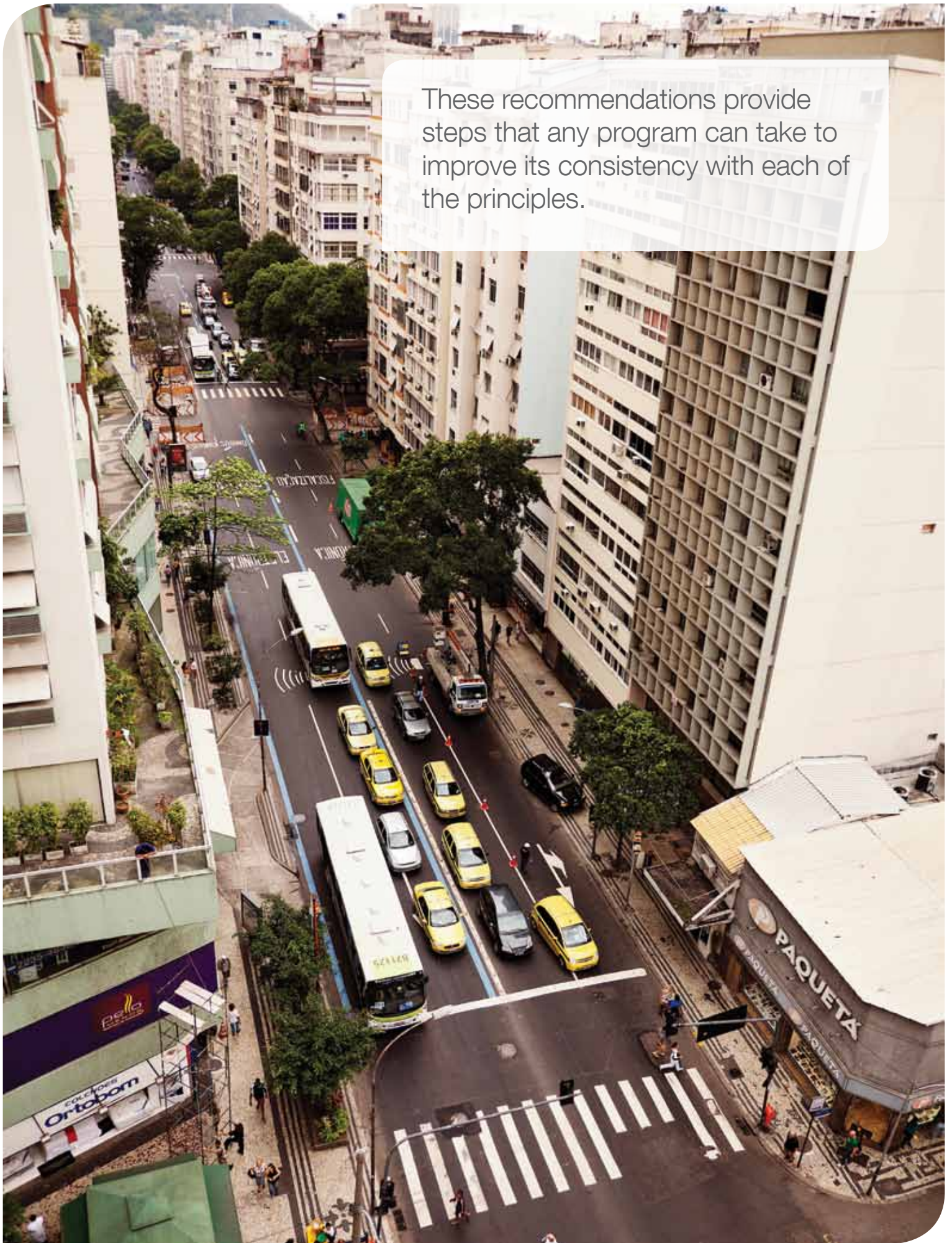
Areas for additional research

Several areas with respect to mass transit investment programs warrant additional research. These include the following:

- The effectiveness of the programs, in terms of the costs, benefits and deliverability of the projects that they support. Such research could provide empirical support for the principles contained in this report.
- Particular components of the programs that are important to deliverability or decision making, such as effective strategies to allocate risks.
- Structural trade-offs in program development, such as advantages and disadvantages of mass-transit only versus broader infrastructure programs, or of continuous versus multiple-year authorizations.
- How national governments assess mass transit projects relative to other surface transport projects -- particularly major urban roadway projects -- where different modes are funded through different programs.

- **Ensure that the public is engaged in local planning processes.** This will help to ensure that the public, not just their local officials, has a genuine interest in proposed projects. Ideally, public engagement should begin during the development of transport and land use plans, such that planning for individual projects begins with a measure of public support.

These recommendations provide steps that any program can take to improve its consistency with each of the principles.



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