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Revenue Risk Sharing for Highway Public-Private Partnership Concessions

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16. Abstract

This discussion paper was developed for transportation professionals who may be involved in a Public-Private Partnership (P3) concession project. P3 concessions are an integrated service delivery approach where a public transportation agency enters a contractual agreement with a private sector entity to deliver a service and/or facility for a specific period. Under the P3 approach, the private sector entity is singly responsible for the design, construction, finance, operations and maintenance of facilities for a specified concession period. During the last decade, several U.S. P3s experienced significant financial stress requiring restructuring. Lately, some private concessionaires have avoided revenue risk P3s, preferring those in which public agencies assume all the revenue risk, typically through availability payments. To ensure robust private participation in U.S. P3s – and explore whether there is a "middle ground" between availability payment and revenue risk toll P3s –this paper seeks to foster a discussion about revenue risk sharing. The discussion paper evaluates revenue risk sharing mechanisms from both the public and private sector perspectives, applying four criteria -- value for money, fiscal impacts, financeability and ease of implementation. The discussion paper was developed based on existing literature, interviews with over 25 P3 market participants, and analysis of cases in the U.S. and internationally.

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Preface

On July 17, 2014, the Build America Investment Initiative was implemented as a government-wide effort to increase infrastructure investment and economic growth. As part of that effort, the U.S. Department of Transportation (USDOT) established the Build America Transportation Investment Center (BATIC). The BATIC helped public and private project sponsors better understand and utilize public-private partnerships (P3s) and provided assistance to sponsors seeking to navigate the regulatory and credit processes and programs within the Department. In December 2015, the Fixing America's Surface Transportation Act (FAST Act) was enacted, which directed USDOT to establish a National Surface Transportation Infrastructure Finance Bureau, which was renamed the Build America Bureau (the Bureau).

Building upon the work of the BATIC, the Bureau was established in July 2016 as USDOT's go-to organization to help project sponsors who are seeking to use Federal financing tools to develop, finance and deliver transportation infrastructure projects. The Bureau serves as the single point of contact to help navigate the often complex process of project development, identify and secure financing, and obtain technical assistance for project sponsors, including assistance in P3s. The Bureau replaces the BATIC and is now home to DOT's credit programs, including Transportation Infrastructure Finance and Innovation Act (TIFIA), the Railroad Rehabilitation and Improvement Financing (RRIF) and Private Activity Bonds (PAB). The Bureau also houses the newly-established FASTLANE grant program and offers technical expertise in areas such as P3s, transit oriented development and environmental review and permitting. The Bureau is also tasked with streamlining the credit and grant funding processes and providing enhanced technical assistance and encouraging innovative best practices in project planning, financing, P3s, project delivery, and monitoring.

Working through the Bureau, USDOT has made significant progress in its work to assist project sponsors in evaluating the feasibility of P3s, and helping simplify their implementation. In response to requirements under the Moving Ahead for Progress in the 21st Century Act (MAP-21) and the FAST Act to develop best practices and tools for P3s, the Bureau, jointly with FHWA, is publishing this report on U.S. highway P3 concessions.

Executive Summary

I. Introduction

During the past decade, many U.S. highway public-private partnerships (P3s) have experienced financial distress due to lower-than-expected traffic and revenue. The main source of cash flow for tolled highway P3 projects is user fees. Toll revenue is usually the key determinant of whether a P3 project has sufficient liquidity to allow the private concessionaire (Developer) to earn its required return and the debt providers (Lenders) to be repaid. P3 projects that experienced this difficulty and were restructured include the Dulles Greenway (VA), South Bay Expressway (CA), I-495 Capital Beltway (VA), Pocahontas Parkway (VA), and Indiana Toll Road (IN). Most recently, the SH-130 in Texas was reported to be in financial distress and is expected to be restructured.

Due to the uncertainty of traffic and revenue forecasts, the allocation of revenue risk is one of the key decisions in the structuring of a P3 contract. Studies have shown that traffic and revenue forecasts tend to suffer from "optimism bias." Traffic levels are often overestimated due to difficulties associated with predicting economic conditions, demographic trends, or changes in technology. In addition, Developers may have incentives to inflate traffic and revenue forecasts to win a contract award. One of the key decisions in structuring a P3 is which party should bear the traffic and revenue risk—the public agency (Agency) or the Developer.

Although some Developers may be willing to assume traffic and revenue risk, their inability to manage the underlying risk drivers may come at a high cost to Agencies. As confirmed at a roundtable organized by FHWA on the topic of revenue risk sharing, some Developers have become reluctant to bid for P3 projects in which they are expected to assume the traffic and revenue risk. Other Developers, however, continue to bid for such projects, as illustrated by the ongoing development of revenue risk highway P3s across the U.S. Allowing the Developers to bear the traffic and revenue risk, however, may not always deliver the most value for the Agency and society. As part of its bid, a Developer must price the project's risks. As Developers cannot manage many of the underlying drivers of traffic and the revenue stream they generate (such as demographic trends, economic conditions, etc.) they will likely charge a premium for assuming the risk (known as inefficient risk pricing). This, in turn, can result in a higher price or a lower concession fee for the Agency and potentially reduce value for society.

Although some Developers may be willing to assume traffic and revenue risk, often the Agencies absorb this risk with the attendant budgetary liabilities. In availability payment (AP) P3s, Developers receive fixed payments from the Agency as long as the highway meets the contractual conditions. In these P3 contracts, the Agency bears all of the traffic and revenue risk for the project. Many Agencies are unwilling to take on such budgetary liabilities. As a result, many have sought a middle ground between APs and complete revenue risk toll P3s through revenue risk sharing mechanisms.

II. Analytical Framework

The purpose of this Discussion Paper to discuss and evaluate revenue risk sharing mechanisms in P3s. The Federal Highway Administration's (FWHA) Office of Innovative Program Delivery (OIPD) commissioned this Discussion paper (the Discussion Paper) to foster a discussion about revenue risk sharing mechanisms. The Discussion Paper categorizes and evaluates revenue risk sharing mechanisms used

internationally and in the U.S. and provides guidance to Agencies in the selection of mechanisms. The Discussion Paper identifies a number of revenue risk sharing mechanisms that could be applied in the U.S. infrastructure market.

The Discussion Paper uses four criteria to evaluate revenue risk sharing mechanisms: 1) value for money (VfM), 2) fiscal impact, 3) financeability, and 4) ease of implementation. VfM assesses the extent to which a revenue risk sharing mechanism allows the Agency to receive (or pay) a fair price for the P3 contract. Ensuring a fair price implies avoiding any risk allocation that requires the Developer to inefficiently (and excessively) price the risk. Fiscal impact refers to the direct and indirect budgetary impacts of a mechanism for the Agency. Financeability evaluates the extent to which a revenue risk sharing mechanism may make it easier to obtain financing for the project. Finally, ease of implementation evaluates the practical challenges associated with implementing a revenue risk sharing mechanism.

The methodology for the Discussion Paper combines a literature review, interviews with P3 practitioners, case studies, and financial analysis. Evaluations of the revenue risk sharing mechanisms are based on an extensive literature review, interviews with over 25 P3 market participants, and an analysis of revenue risk sharing applications in the U.S. and internationally. In addition, a simplified financial model was developed to demonstrate differences between revenue risk sharing mechanisms.

III. Revenue Risk Sharing Mechanisms

The Discussion Paper considers seven different revenue risk sharing mechanisms, each of which have varying impacts in terms of value for money, fiscal impact, financeability, and ease of implementation. These revenue risk sharing mechanisms are summarized in Table 1 and described on the following pages.

Table 1: Summary of Key Benefits of Revenue Risk Sharing Mechanisms for Agency*

Criterion	Present Value of Revenues	Minimum Revenue Guarantee	Contingent Finance Support	Availability Payment & Revenue Sharing	Shadow Tolls	Regulated Returns	Innovative Finance Programs
Value for Money	●●●	●●●	●●	●●●	●	●	●●
Fiscal Impact	●●●	●●	●●	●	●	●	●●
Financeability	●●	●●●	●●●●	●●	●●	●●●	●●●
Ease of Implementation	●●●	●●●●	●●●	●●	●●●	●	●●●

Key: Most value or benefits = ●●●● Least value or benefits = ●

* Benefits are in terms of maximizing value for money, reducing fiscal impact, enhancing financeability, and increasing ease of implementation. Enhancing financeability benefits the Developer, who usually is responsible for the financing, yet it also benefits the Agency, whose interest is also in a successful financing.

a. Present Value of Revenues

The Present Value of Revenues (PVR) mechanism—in which the contract term can be extended to compensate for lower-than-expected revenues—transfers limited revenue risk to the Developer. Under a PVR mechanism, Developers bid a minimum gross revenue discounted at a common discount rate. The P3 contract ends when the net present value (NPV) of the gross revenue is reached. Because the contract term can be extended if revenues fall below expected levels, risk transfer to the Developer is limited—although not zero, as there is typically a maximum contract duration. By allowing the contract term to be extended, and therefore delaying receipt of toll revenues, the Agency retains most of the revenue risk.

The PVR mechanism may be an attractive mechanism for Agencies, as it is relatively easy to implement, has few immediate fiscal impacts, and is likely to deliver VfM. Although the PVR mechanism transfers most of the revenue risk to the Agency, fiscal impacts are limited to the years of contract extension. Because the PVR mechanism provides downside revenue risk protection for Developers—and therefore minimizes excessive risk pricing by the Developer—this mechanism is also likely to provide more VfM than full revenue risk transfer to the Developer. The PVR mechanism is relatively easy to implement, although the uncertain contract term may present challenges for debt financing terms.

b. *Minimum Revenue Guarantee*

Under a Minimum Revenue Guarantee (MRG), the Agency guarantees revenues below a certain threshold, partially retaining revenue risk. Under a MRG, the Agency sets a base case revenue line and guarantees revenues below this line. Internationally, Agencies have guaranteed 60% to 85% of projected revenues, covering debt service either partially or fully. The extent to which revenue risk is transferred to the Developer depends on the level of revenue guaranteed by the Agency.

Although a MRG is relatively easy to implement and enhances financeability and VfM, it creates uncertain contingent liabilities for the Agency. A MRG is a transparent mechanism that is relatively easy to implement. Because a MRG reduces revenue risk for the Developer, it may enhance financeability and VfM. However, a MRG creates contingent liabilities for the Agency which are difficult to estimate.

c. *Contingent Finance Support*

Under a Contingent Finance Support (CFS) mechanism, the Agency provides a guarantee on the repayment of financing, rather than on revenue. By guaranteeing that the project will be able to repay debt, even under extreme downside cases, the CFS mechanism is similar to a MRG. Under a CFS mechanism, the Agency retains significant risk, protecting Developers from lower-than-expected revenues or higher-than-expected operational costs which could erode the project's ability to meet its obligations.

Although a CFS mechanism improves financeability, it is sub-optimal from a VfM perspective and creates contingent liabilities for the Agency. A CFS not only protects against revenue shortfalls, but also against operating cost overruns. As a result, it is likely to improve financeability by providing significant protection to Lenders. However, a CFS mechanism is sub-optimal from a VfM perspective, as the Developer is no longer incentivized to minimize lifecycle costs. Like a MRG, a CFS mechanism creates uncertain contingent liabilities for the Agency.

d. *Availability Payment and Revenue Sharing*

Combining Availability Payments and Revenue Sharing protects the Developer from downside revenue risk while allowing the Agency to earn a share of the revenues. By combining Availability Payments and Revenue Sharing, some of the Developer's toll revenues are exchanged for an AP received from the Agency. By providing an AP regardless of traffic and revenue conditions, the Agency retains a share of the revenue risk. However, by engaging in revenue sharing above a certain threshold, the Agency will also earn a share of toll revenues.

Combining Availability Payments and Revenue Sharing may be attractive from a financeability and VfM perspective, although it may be relatively difficult to implement. Combining an AP with revenue sharing is likely to enhance financeability compared to a full revenue risk transfer, as the Developer is partially protected from downside revenue risk. A mixed AP toll revenue structure could be confusing for Lenders (banks, bondholders, and credit rating agencies), however, since the Developer is compensated through two different payment approaches (AP and toll revenues). This could lead

to sub-optimal debt pricing. Although this mechanism is likely to generate VfM, it creates fiscal liabilities for the Agency. In addition, it is relatively challenging to implement.

e. *Shadow Toll*

In a Shadow Toll mechanism, traffic risk is transferred to the Developer, while toll collection risk is retained by the Agency. In a Shadow Toll approach, the Agency collects the actual toll revenues (if any) and pays a Developer on a per vehicle basis. Because the payments to the Developer depend on traffic levels, the Developer continues to assume traffic risk as under full revenue risk transfer.

A Shadow Toll mechanism is likely to decrease financeability and VfM but could create positive economic externalities. Transferring the full traffic risk to the Developer may result in higher financing costs and lower VfM compared to other mechanisms. However, depending on the exact nature of the road and concession agreement, Shadow Toll mechanisms can be enhanced to increase public welfare by incentivizing the Developer to optimize the number of vehicles on managed toll lanes. Such considerations could provide an economic rationale for using this mechanism. Although a Shadow Toll mechanism requires reliable traffic counting and electronic tolling technology, implementation difficulties are expected to be relatively limited in the U.S. context.

f. *Regulated Return*

Under a Regulated Return Mechanism (RRM), the Agency guarantees that the Developer will meet its target internal rate of return (IRR), thereby reducing the Developer's exposure to revenue risk. Several adjustment mechanisms can be used to meet the target IRR, including extending the length of the contract, raising toll rates, or providing government subsidies. As a result, the risk retained by the Developer under this mechanism will depend on the rebalancing mechanism that is chosen.

A RRM may be relatively challenging to implement and the VfM and fiscal impacts will depend on the adjustment mechanism used to achieve the target IRR. If a contract extension is used to achieve the required IRR, the RRM will have the same impacts as the PVR mechanism. If a government subsidy is used to achieve the required IRR, the RRM will have direct fiscal impacts. The disadvantage of a RRM is that it may be complex to implement, particularly if the adjustment mechanism is based on net revenues, which will require re-optimizing the Developer's financial model to maintain the target equity IRR. If the Developer is compensated for higher-than-expected O&M costs, a RRM may have high monitoring costs, low VfM, and poor public perception.

g. *Innovative Financing*

Although Innovative Financing mechanisms may not directly address revenue risk, they may help improve financeability. Innovative Financing mechanisms such as the USDOT's Transportation Infrastructure Finance and Innovation Act (TIFIA) program or state infrastructure banks help ease short-term liquidity by providing low interest rates, long tenors, flexible backloaded repayment terms, and interest capitalization, thereby improving financeability. Although innovative financing mechanisms do not typically pose implementation challenges, they may contradict the P3 philosophy of efficient risk transfer and VfM if they provide protection for overall project risks as opposed to revenue risk specifically.

IV. Conclusions

The PVR and MRG appear to be the most promising revenue risk sharing mechanisms for the U.S. context, due to their relatively positive impacts on VfM, fiscal impact, financeability, and ease of implementation. The MRG, however, is less attractive from a fiscal impact perspective than the

PVR, as it creates significant contingent liabilities. For Agencies that are not able to accept such contingent liabilities, a combination of a PVR and a lower MRG could represent a viable alternative. The variables in both of these mechanisms—including the sizing of the MRG and minimum and maximum contract term—allow for considerable tailoring to Agency requirements and the needs of individual projects.

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1 Introduction and Background

1.1 Current Practice in Revenue Risk Sharing

Since the early 1990s, state departments of transportation (DOTs) and other transportation agencies (collectively Agencies) have fostered the development of highway projects with private concessionaires and developers (Developers) through public-private partnerships (P3s). These P3s have taken advantage of new approaches to deliver infrastructure, recognizing that, through P3s, risks may be more optimally allocated, projects may be realized more quickly and with lower life-cycle costs, and Agencies' budgets are less burdened.

In the last decade a number of P3s have experienced significant liquidity issues and financial stress requiring additional equity investments, restructuring, and/or bankruptcy processes resulting in losses to banks and bondholders (Lenders) and Developers as shown in Table 2. There are a number of explanations for these challenges, but two frequent ones include the global financial crisis impact and traffic and revenue forecasts that proved to be inaccurate.

Table 2: U.S. P3s and Public Non-Recourse Toll Roads Undergoing Financial Distress

Project	Status
P3 and Private Toll Roads	
Dulles Greenway, VA	Privately-owned toll road underwent a technical bankruptcy in the 1990s, resulting in the original Developer selling its ownership to Macquarie.
South Bay Expressway (SBX), CA	Restructured and sold by the original Developers. The second Developer, Macquarie, experienced financial difficulties once the road opened and Lenders took over the project and then sold it to a public authority, San Diego Association of Governments in 2011.
I-495 Capital Beltway (Capital Beltway), VA	Restructured in 2014, with the Developer, Transurban, swapping senior debt for additional equity.
Pocahontas Parkway, Richmond, VA	The most recent Developer, Transurban, transferred its interest to Lenders resulting in a total loss of its investments in 2014.
The Indiana Toll Road, IN	Sold in 2015 in an auction for $5.725B, wiping out the equity of the original Developer, Cintra/Macquarie. The bid was high enough to cover most of the $6B of outstanding debt.
SH-130, TX	Developed by Cintra, reported to be in a restructuring process.
Northwest Parkway, CO	A private toll road concession in the Denver area of Colorado, reported to be undergoing financial stress due to low traffic.
Public Non-Recourse Toll Roads	
San Joaquin Hills Transportation Corridor Agency 73 toll road, CA	The $1B project, financed in the early 1990s on a non-recourse basis by a public authority, has had much lower than expected revenues for most of its project life. The authority was able to refinance the project in 2014, taking advantage of lower interest rates.
LA 1 Expressway, LA	A public authority toll road connecting to the Port of Fourchon, this road had much lower traffic than forecasted and was taken over by the State of Louisiana in 2013.

Due to the uncertainty surrounding traffic and revenue forecasts, one of the key decisions in structuring a P3 is which party should bear the traffic and revenue risk—the Agency or the Developer.

In part because of the history of underperforming highway P3s, some Developers operating in the U.S. are shying away from revenue risk P3s. In interviews with observers and participants (Respondents) in the U.S. P3 market conducted for this Discussion Paper (see a list of these in 0), several Developer Respondents discussed how they had suffered financially from managed lanes projects that were once considered less risky than greenfield toll roads, and would not consider managed lanes without a revenue risk sharing mechanism. Furthermore, some Developers have indicated that they believe their competitors may have acted irrationally and have been accepting excessively risky forecasts. Therefore, some Developers prefer P3 structures in which the Agencies assume all revenue risks primarily through availability payments (AP) as is common in Europe

and Canada. Under an AP P3, the Developer receives an annual AP that should cover its operations and maintenance (O&M), debt service, and equity dividends, subject to making the road available and maintaining it to established standards. If a Developer fails to carry out its duties, the Agency can impose penalties, in the form of AP deductions that can place pressure on their equity dividends and possibly the Developer's ability to make debt service payments.

Nonetheless, other Developers still actively consider revenue risk projects. In 2015, Industry Funds Management, an Australian-based infrastructure fund, purchased the Indiana Toll Road for $5.725B, paying off most of the outstanding debt, demonstrating the continued availability of equity for revenue risk deals for existing or "brownfield" facilities. In addition, the Virginia Department of Transportation (VDOT) has issued an RFQ in 2015 for the I-66 managed lanes that could be structured as a revenue risk sharing P3. VDOT received statements of qualifications from three consortia interested in bidding on the revenue risk sharing transaction and other consortia interested in non revenue risk sharing structures. Furthermore, established public toll roads tend to be financially stable and highly rated, according to credit rating agency Respondents, making bonds issued by these entities highly desirable. Finally, Developers report that at least in 2015, and likely in 2016, Financial Investors have become very aggressive in offering financing for P3s, including increased willingness to take on start-up period development and T&R risks.

While APs may create public policy benefits or "value for money" (VfM) due to a more efficient risk allocation (see Section 2.1), in many instances they require that the Agency recognize a part or the entire AP payment as a long-term liability, thereby reducing the "off balance sheet" advantages of AP P3s (Hecht, 2015). Even when the AP is funded by toll revenues collected by the state on that facility, known as "self support," the rating agencies will only recognize that revenue after three years of stable support. In interviews, some Respondents raised concerns that Agencies will "run out of money" if they only commission AP P3 transactions.

The question is therefore whether there is a more optimal "middle ground" between APs where Agencies absorb all revenue risk and current U.S. revenue risk toll P3s where Developers are responsible for revenue risk. In light of the foregoing, this Discussion paper (the Discussion Paper) to explores this question, seeking to foster further thinking about revenue risk sharing in highway P3s and maintain robust private participation in these concessions.

1.2 Discussion Paper Objective

The Discussion Paper primarily focuses on those mechanisms that redistribute revenue risk in cases where actual revenue is significantly below forecasted revenue. The U.S. P3 market has already developed a set of approaches to address the sharing of revenues in upside cases, as documented in the major concession contracts such as in Texas and Virginia. The purpose of this Discussion Paper is to:

- Evaluate existing revenue risk sharing mechanisms in the U.S. and worldwide;
- Address how new or existing mechanisms could better work in the U.S. given financing constraints, the need to create VfM, fiscal impacts, and ease of implementation; and
- Provide information to assist Agencies in the selection of revenue risk sharing mechanisms.

2 Analytical Framework and Research Approach

This chapter sets forth the Discussion Paper's analytical framework and research approach. It defines revenue risk, discusses various perspectives on such risk, and reviews the impact of revenue risk sharing on financeability. Furthermore, it discusses the trade-off between direct liabilities and contingent liabilities and the analytical framework criteria—value for money, financeability, fiscal impacts, and ease of implementation—that are used to evaluate the revenue risk sharing mechanisms. It also lays out the research approach, including literature review, case studies, interviews, and financial analysis. Finally, it provides context on how recent P3 transactions have been funded and financed.

2.1 Analytical Framework

2.1.1 Understanding Revenue Risk

The key drivers of revenue risk include: 1) traffic volume, 2) tolling regime (i.e., toll schedule) and 3) toll collection. Traffic and revenue (T&R) forecasts for many types of toll facilities — including greenfield toll roads, brownfield toll roads, and dynamically managed lanes — may have been too optimistic in early years or may have not considered the greater volatility. This "optimism bias" of Agencies, Developers, and all involved in both public and P3 toll road projects has been documented by several observers (Flyvbjerg et al, 2004 and 2005; Bain, 2009).

The uncertainty in T&R forecasts stems from a number of factors, including:

- Demographic trends, such as population growth;
- Economic conditions, such as the global financial crisis;
- Changes in work patterns;
- Technological developments;
- Competing facilities and travel modes, such as alternative roads and transit services; and
- Changes in the cost of travel, such as fuel.

In addition, in some cases, Developers may have simply accepted optimistic forecasts to assist them in winning their bids. This may not be rational in the short-run but may yield long-run benefits from building up a portfolio of assets and experience in the U.S.

Since the beginning of the global financial crisis in 2007, vehicle miles travelled have declined and only in 2015 are they expected to surpass 2007 levels (USDOT FHWA OHPI, 2015). Researchers ascribe this unprecedented dip to a number of factors, especially the loss of jobs. However, some in the transportation community hold that the "millennial generation" is actively eschewing cars in much greater numbers than previous generations, seeking more urban housing and alternative commuting modes (American Public Transportation Association, 2013). Furthermore, with the rise of ride-sharing, shared mobility apps, automated vehicles, and telecommuting, some researchers such as David Levinson believe that there may be "structural disruptions" in the demand for road capacity and traditional car services in the next decades that make any type of T&R forecasting difficult (Levinson 2015). Credit rating Respondents said that, at the least, they severely discount growth rates in toll road forecasts beyond 25 years, as they understand that current known alternatives, such as public transportation, vehicle technology, and telecommuting could materially impact traffic growth rates.

Regardless of how these trends are impacting toll revenues in the short- and long-run it appears that Agencies, Developers, Equity Investors and Lenders will continue to view T&R forecasts as containing significant risk.

The Discussion Paper represents two major revenue risk viewpoints: 1) the Developer perspective, which includes Lenders and Equity Investors and 2) the public perspective of contracting Agencies and their constituencies, both which are discussed below.

2.1.2 Developer Perspectives on Revenue Risk

The Developer perspectives on revenue risk can be seen from two separate viewpoints: 1) Developer/Equity Investors and 2) Lenders (including banks and bondholders). Developers/Equity Investors provide equity and are generally expecting to receive dividends in return. In a revenue risk toll concession, dividends can be highly volatile and may only be paid out after many years (if ever). Developers/Equity Investors bear the full upside/downside revenue risk and therefore expect a return that is commensurate with this risk.

Lenders on the other hand have no upside as they receive only interest on their loans. As a result, Lenders tend to be more conservative than Developers and impose stringent requirements to ensure they will receive interest and principal payments on time even in downside cases. Although Developers ultimately care most about equity returns, they know that without Lenders, the project cannot be cost-effectively financed. So their interests can be summarized as follows:

- Winning the bid and successfully operating the concession;
- Obtaining debt financing; and
- Earning cash flows to attain or exceed the expected equity return.

Since most P3s are financed primarily with debt, obtaining Lenders' approval is critical to successful P3s. A project's ability to attract non-recourse debt and equity financing is a key consideration when evaluating revenue risk sharing mechanisms.

While the Discussion Paper focuses on revenue risk sharing for P3s, the issues are similar in the transfer of revenue risk in tax-exempt toll road revenue bonds issued by Agencies, which can only pledge the toll revenues and reserve funds collateral. Bondholders of these non-recourse bonds, which are primarily U.S. individuals and some financial institutions, take on the risk that the Agency is able to repay on a timely basis or at all. While public toll road agency bankruptcies have been rare, changes in bonds' credit ratings have been more common, with such ratings affecting the price of those bonds on the secondary bond market (Tollroads, 2014).

Public toll road agencies may take similar measures as Developers to reduce the risk of revenue bonds in order to make them attractive to bondholders. These include increasing debt service coverage ratios by including more grants in the financing structure, increasing reserves, and/or adding subordinate debt (such as from the Transportation Infrastructure Finance and Innovation Act (TIFIA) program) to the financial structure. In particular, adding grants or increasing public funding (but not TIFIA loans) can be viewed as a form of public agency equity.

2.1.3 Public Agencies' Perspectives on Revenue Risk

P3s are principally about efficiently managing risks, drawing on private sector expertise, and attracting private capital. From a VfM perspective, one of the key value drivers in P3s is optimal risk allocation between Agency and Developer. Optimal risk allocation means that a risk should be transferred to the party that is best able to manage that risk. However, the dilemma with revenue risk is that it is difficult to manage for both Agencies and Developers (Quiggin, 2005).

Although the Developer may be better positioned to provide customer service, manage certain revenue risks (such as toll collection technology and accident removal risks), and maintain the facility, other risks (such as population growth or traffic pattern changes) are largely beyond its control. Therefore, transferring all revenue risk to the Developer may be inefficient as Developers may struggle to price the risk efficiently (see Section 2.1.4).

Similarly, Agencies struggle to effectively manage revenue risk as they have limited influence over traffic. Most of the financial difficulties of recent U.S. and international P3 toll roads were due to ambitious projections of jobs and housing growth and the inability to weather economic cycles, including the global financial crisis, all of which are out of most Agencies' control. Managing national economic risks are primarily the responsibility of national governments', and is an enormous challenge.

However, Agencies may have control over a project's transport links, such as connecting interchanges and land use. They also have the ability to delay or accelerate the development of competing transportation, such as transit and parallel roads, and pursue economic development policies impacting toll revenues. These powers are rarely vested in one Agency, however, and differences among Agencies at various levels of government make unified policy decisions difficult. Nevertheless, it could be argued that Agencies are in a better, albeit far from perfect, position to manage revenue risk.

Based on the above, the VfM perspective is that it is more efficient for Agencies to retain most revenue risk. If an Agency is of the opinion that the Developer will perform better if exposed to revenue risk, Agencies could decide to transfer a small portion of the revenue risk to ensure that the Developer is sufficiently incentivized while still maintaining a high VfM.

However, VfM is only one perspective and ignores other considerations such as the fiscal impacts. From that perspective, revenue risk P3s are essential to finance infrastructure projects that would otherwise not be realized in the same time frame through public financing. This is because: 1) equity in a transaction increases the amount of financing capacity, as it is "patient" in early years, compared to traditional tax-exempt financings, 2) it may be easier for Developers to increase toll rates — subject to the concession agreement — than Agencies can. Furthermore, in the case of an AP concession, regardless of whether future toll revenues would cover AP payments and maintain an Agency's high credit rating, Agencies can reach a politically-determined debt limit. Given strong anti-debt movements throughout the U.S. and transportation's competition with other public priorities such as education and health care, it may be unrealistic for Agencies to develop all projects as AP concessions.

2.1.4 Inefficient Risk Pricing and Revenue Risk Sharing

If the Agency transfers revenue risk to the Developer, the Developer faces the challenge of pricing this risk. From a VfM perspective, if the Developer cannot effectively manage this risk, it may either 1) conservatively price the revenue risk, potentially leading to inefficient pricing, or 2) decide not to bid, reducing the number of bidders, and possibly resulting in market failure.

To reduce the chance of market inefficiencies, revenue risk sharing mechanisms could be considered. In this case, the Agency still achieves some off-balance sheet financing while avoiding excessive pricing of risk or increasing the number of credible Developers willing to bid.

Based on the above concepts and a review of revenue risk sharing experience, the Discussion Paper suggests how Agencies may implement mechanisms on the continuum between AP at one extreme and a full revenue risk transfer to the Developer at the other.

2.1.5 Revenue Risk vs. Financial Viability

When evaluating revenue risk sharing mechanisms, it is important to distinguish revenue risk from financial viability. Revenue risk refers to the uncertainty in the revenue stream. Typically, this uncertainty is reflected in the private cost of capital (debt and equity combined) associated with the project. If the net present value (NPV) of expected future cash flows discounted at the weighted average cost of capital (WACC) of the project is negative, a project is not financially viable.

One way to make such a project financially viable is to provide an upfront Developer subsidy, as has been common in many U.S. P3s. Providing such a subsidy to the Developer does not change the risk profile of future cash flows. However, with the upfront subsidy, the Developer is more willing to accept the revenue risks as the expected return on the Developer's capital is now equal to or exceeds the Developer's cost of capital. In other words, with an upfront subsidy, the Developer does not need to seek as much senior debt, can obtain cheaper senior debt, and/or can reduce the amount of the equity investment. Many of these benefits result in the Developer facing smaller potential losses from volatile cash flows. When these lower potential losses are combined with potential profits from other aspects of the project, such as the construction contract, the overall attractiveness of the project to the Developer increases.

Revenue risk sharing mechanisms do not necessarily replace or eliminate subsidies to financially unviable projects. However, they can reduce the required subsidy by changing the risk profile of future revenues. If the future revenues to the Developer become less uncertain—for example, due to a minimum revenue guarantee (MRG)—the required return on capital can be lower. As a result, a smaller upfront subsidy will be required to ensure that the expected future cash flows discounted at the lower project WACC is equal to or exceeds zero.

2.1.6 Direct vs. Contingent Liabilities

Another important distinction for Agencies when evaluating revenue risk sharing mechanisms is the difference between direct and contingent liabilities. An upfront subsidy or an AP is a direct liability; the Agency knows that it will incur this cost. A revenue guarantee, however, is a contingent liability. Depending on traffic and revenues, the Agency may or may not have to make a payment.

This uncertainty regarding the payment by the Agency to the Developer is an important feature of any guarantee. Unfortunately, this can also cause big surprises, as was the case in Portugal. With one of the world's largest P3 programs, it assumed significant contingent liabilities, resulting in a considerable fiscal burden in the aftermath of the financial crisis (Diu, 2014).

Furthermore, the uncertainty of contingent liabilities makes a fair comparison with direct liabilities difficult. For example, how does one compare a $100M upfront subsidy to a 20-year minimum revenue guarantee of $15M per year? If traffic is lower than expected, the guarantee could cost the Agency up to $300M in nominal value ($186M in NPV terms at a discount rate of 5%). However, if traffic were in line with expectations, it would mean that the Agency would not pay anything while still lowering the cost of capital of the Developer, due to reduced uncertainty of the revenue stream, and resulting in a lower bid. However, if the economy were to slow down, as in Portugal, the Agency's costs could be considerable.

As described below, contingent liabilities such as MRGs can help share revenue risk between Developers and Agencies. A number of academics have explored approaches to value contingent liabilities (Cheah and Liu, 2006; Chiara and Garvin, 2007; Irwin, 2007; Shan, Garvin, and Kumar, 2010). However, there is no single simple approach to undertake these valuations, making the exact cost to the Agency is difficult to determine.

2.1.7 Evaluation Framework for Revenue Risk Sharing Mechanisms

Using the different perspectives, this Discussion Paper assesses the various revenue risk sharing mechanisms used around the world and in the U.S. More specifically, each revenue risk sharing mechanism will be evaluated using the following criteria:

- *Value for Money*[1]: How does the proposed revenue risk sharing mechanism affect VfM? Does it provide for an optimal risk allocation?
- *Fiscal Impacts*: What are the fiscal impacts of the revenue risk sharing mechanism? Does it allow for off-balance sheet financing and, if so, how is it accounted for? Does the proposed revenue risk sharing mechanism use direct or contingent liabilities?
- *Financeability*: How does the proposed mechanism affect the Developer's ability to finance the project? Does it help attract private capital and/or reduce costs of private capital?
- *Ease of Implementation*: How easy is it to monitor the proposed revenue risk sharing mechanism? Is there potential for unintended bidding behavior, such as artificially inflating O&M costs in a net revenue transaction to create additional profits? Does the mechanism allow for a simple comparison of bids in the procurement stage?

2.1.8 Economic Perspective

Revenue risk sharing mechanisms are primarily about the allocation of a defined set of risks for a defined project. The mechanisms do not fundamentally change the project or its risks. This is why these mechanisms are not expected to have significant societal or welfare impacts, beyond the impacts already covered under the other considerations (including VfM and financeability). The mechanisms can, however, have an impact on the incentives of the Developer to maximize traffic or revenues, which could have welfare impacts. Even though the Discussion Paper does not primarily examine this broader economic perspective, it will point out the impacts of incentive mechanisms on welfare where appropriate.

2.1.9 Other Project Risks

Besides revenue risks, U.S. P3s are subject to numerous other risks, including:

- Environmental;
- Design and construction;
- Operations & maintenance (O&M); and
- Regulatory and political risk.

The Discussion Paper does not address these issues. They are extensively reviewed in the project development literature. Nevertheless, these other risks can materially influence a project's risk profile and may affect their evaluation of overall risks. For example, a Developer may not bid on a toll road P3 with low revenue volatility if environmental issues and possible litigation have not been adequately addressed.

[1] In the context of this White Paper, VfM assesses the extent to which a revenue risk sharing mechanism allows the Agency to receive (or pay) a fair price for the P3 contract. Ensuring a fair price implies avoiding any risk allocation that requires the Developer to inefficiently (and excessively) price the risk.

2.2 Methodological Approach

This section briefly describes the methodological approach used to review and evaluate different revenue risk sharing mechanisms.

2.2.1 Literature Review

The review of the literature on revenue risk sharing included:

- Articles in peer-reviewed and trade press publications;
- Materials developed by the USDOT, state DOTs, and international governments;
- Presentations made at major trade association events, DOTs, and at international finance institutions (IFI), such as the World Bank.

Appendix V provides a listing of this literature.

2.2.2 Case Studies

The Discussion Paper's Appendix I describes several revenue risk sharing mechanism case studies that help to illustrate the mechanism and describe the context and evolution of these mechanisms. Based on these cases, mechanisms that are most appropriate for the U.S. market were selected for further analysis in Section 4.

2.2.3 Interviews

More than 25 specialists involved in P3s were interviewed, including those employed at universities, research institutes, Agencies, Developers, Lenders, Equity Investors, law firms, and international finance institutions (i.e., the Respondents). They are listed in Appendix IV. To ensure that Respondents felt comfortable freely sharing their views, the Discussion Paper does not quote the Respondents directly, nor does it attribute any comments to any one entity. The exception is reference to the authors of published materials that are publicly available or Respondents who helped provide information on specific case studies.

2.2.4 Financial Analysis

For those mechanisms meriting U.S. consideration, a simplified financial model was developed to illustrate how each mechanism might apply and is used in Section 3. Some of the model parameters are derived from recent U.S. P3s, but have been simplified in order to convey how the mechanism would work. P3 transactions have many elements in common but differ enough that making generalized conclusions on the ideal mechanism can be difficult.

2.3 Typical Financing Structure and Toll Forecasting Issues

2.3.1 P3 Financing Structure

The Discussion Paper draws upon the U.S. P3 experience in the last two decades. Table 3 shows the financing structure typical of these transactions based on nine representative financings in which TIFIA has been involved (USDOT TIFIA, 2015).

Table 3: Typical Structure of U.S. P3 Financings at Financial Close

Financing Source	Revenue Risk P3	Availability Payment P3
Senior Debt	20%-49%	4%-40%
TIFIA Loan*	Up to 33%	Up to 33%
Equity/Deeply Subordinated Debt	18%-47%	6%-12%
Upfront Public Capital Contribution	0%-33%	20%-57%

*A TIFIA Loan can cover up to 49% of eligible costs as defined by the TIFIA program, although no more than 33% has generally been provided; the actual TIFIA percentage may not necessarily reflect a percentage of the total financing structure, due to TIFIA's definitions of "eligible" costs.

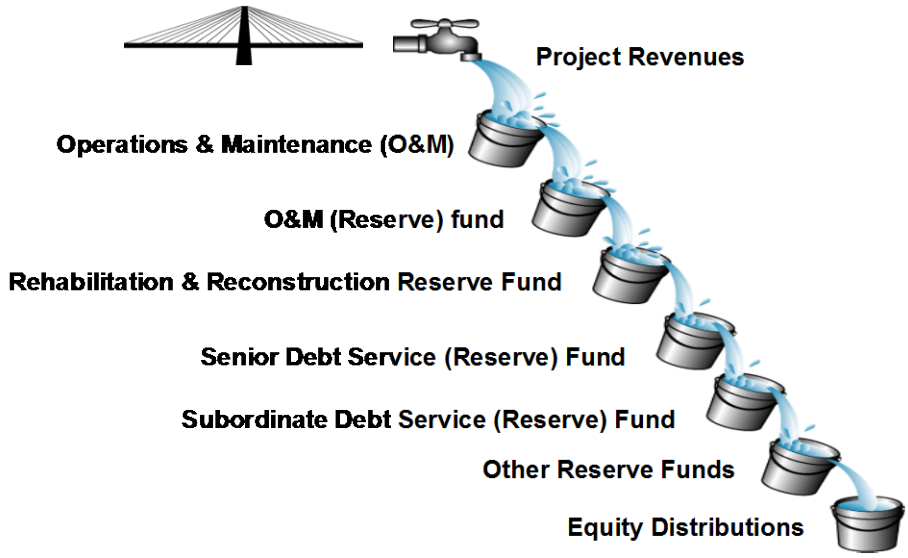
Financing structures of many of these transactions are summarized on the USDOT TIFIA website (http://www.transportation.gov/tifia/projects-financed). These transactions frequently have four primary financing sources: senior debt, TIFIA loans, equity/deeply subordinated debt, and upfront public capital contributions, with the following characteristics:

- The senior debt often comes in the form of bank loans or private activity bonds (PABs), the latter issued with approval of the USDOT program.
- The USDOT TIFIA program has played a major role in many transactions and is one mechanism that reduces financing risk (including revenue risk and other risks).
- Equity and deeply subordinated debt is the third financing source. Deeply subordinated debt in this case has characteristics common to equity, although structured as a fixed-income instrument. It has not been used frequently.
- An Agency-provided upfront capital contribution is a commonly used form of support to ensure the financial viability of a toll road project.

Typically, transactions are structured to manage financing risk with mechanisms that address downside revenue scenarios. Structuring includes ensuring adequate debt service coverage ratios (i.e., a sufficient buffer to ensure debt service can be paid even in severe downside cases), debt service reserve funds, and/or ramp up reserves and other short-term liquidity facilities. Revenue risk P3s tend to have more equity than AP P3s, reflecting higher revenue volatility.

The "flow of funds" establishes the priority of payments as shown in Figure 1. Typically, toll revenues are used to first pay O&M costs, then senior debt, followed by the TIFIA loan, and finally equity. Actual flow of funds provisions are more complicated, including reserving monies to pay for hedging costs, reserve funds, and major maintenance. Financing sources higher in the waterfall are subject to less revenue and cash flow risk.

Figure 1: Example of Typical Flow of Funds or Cash Waterfall

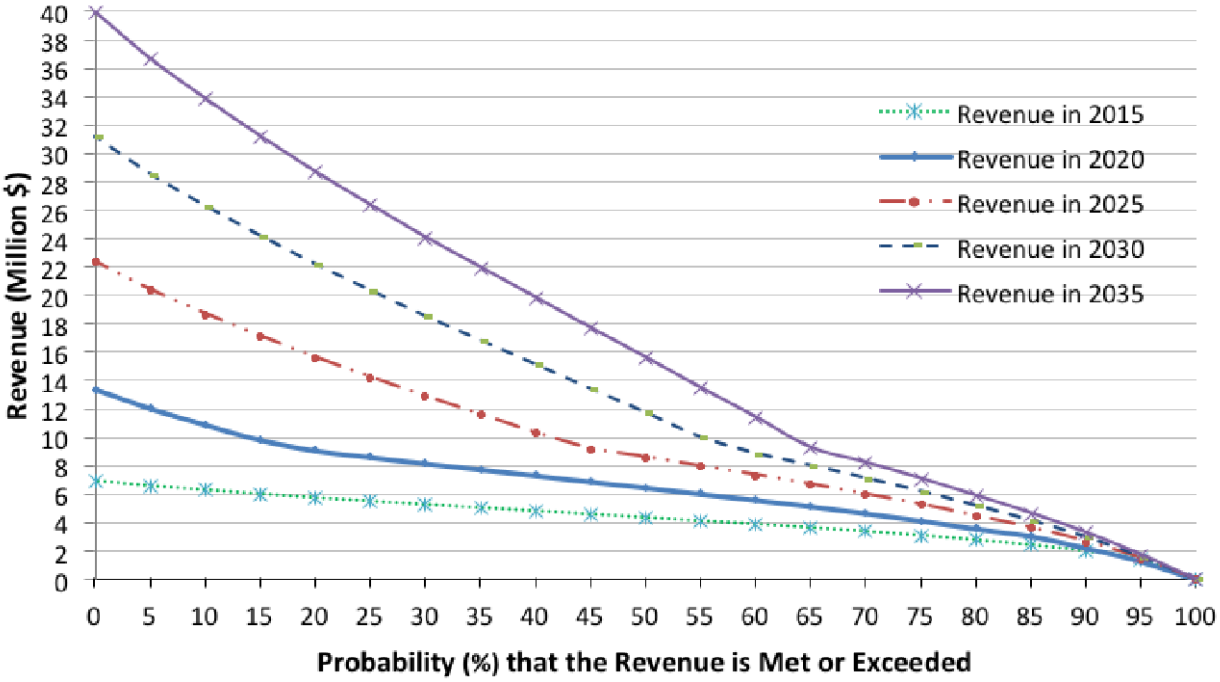


Revenue risk is the risk that income at the "top of the cash waterfall" is not adequate to fund all "buckets" in the waterfall. The risk associated with financing is that the revenue available to pay senior and TIFIA debt is not adequate to meet those specific requirements. Financing risk incorporates both revenue risk and the risk that higher priority costs are greater than expected, e.g., higher O&M or higher major maintenance costs may absorb more cash than expected, leaving less for lower priority buckets. For most U.S. toll road P3s, revenue volatility is usually the most significant project risk.

2.3.2 *Toll Revenue Forecasting Issues*

Given the performance of past toll road transactions, Lenders have required new approaches to improve T&R forecasting. In particular, probabilistic analysis techniques that have been used in other infrastructure markets such as wind and hydropower are now being applied (see Figure 2). This method may better take into account the volatility of demand drivers, such as regional population and employment. Under a probabilistic approach, a Developer derives a 50% probability forecast (P50) as a base case. Under P50, actual revenues are expected to exceed the forecast 50% of the time. Based on Lenders requirements, the Developer and/or Lender typically also develop a downside forecast (P80 or P90), which has an 80% or 90% probability of being achieved, or a 10% or 20% probability of not being met.

Figure 2: Example of Probabilistic Approach to T&R Forecasts



3 Potential Revenue Risk Sharing Mechanisms for the U.S.

This section discusses revenue risk sharing mechanisms that could potentially be applied in the U.S. As summarized in Table 4, these mechanisms can create a range of impacts. For example, the extent to which a project is made financeable by a Minimum Revenue Guarantee depends on the level of protection provided by the guarantee.

Table 4: Summary of Key Benefits of Revenue Risk Sharing Mechanisms for Agency*

Criterion	Present Value of Revenues	Minimum Revenue Guarantee	Contingent Finance Support	Availability Payment & Revenue Sharing	Shadow Tolls	Regulated Returns	Innovative Finance Programs
Value for Money	●●●	●●●	●●	●●●	●	●	●●
Fiscal Impact	●●●	●●	●●	●	●	●	●●
Financeability	●●	●●●	●●●●	●●	●●	●●●	●●●
Ease of Implementation	●●●	●●●●	●●●	●●	●●●	●	●●●

Key: Most value or benefits = ●●●● Least value or benefits = ●

* Benefits are in terms of maximizing value for money, reducing fiscal impact, enhancing financeability, and increasing ease of implementation. Enhancing financeability benefits the Developer, who usually is responsible for the financing, yet it also benefits the Agency, whose interest is also in a successful financing.

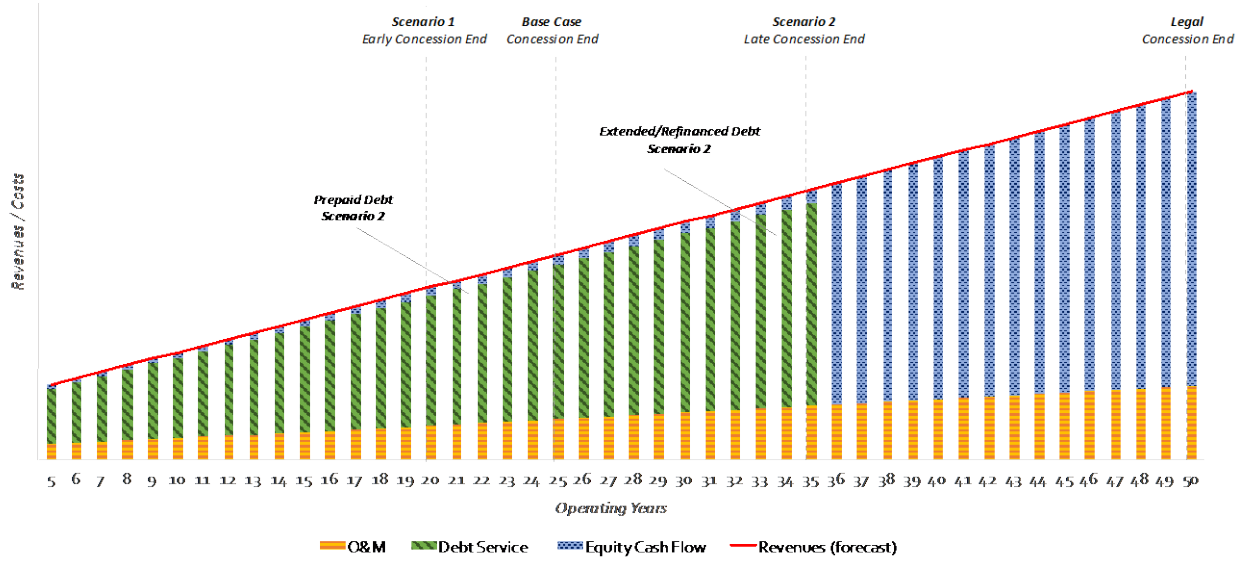
Examples of these mechanisms are provided in Appendix I. Most of the examples are international with the exception being Contingent Finance Support. Some mechanisms are not included in this section (e.g., Revenue Distribution Mechanism, Rate of Return, and Price Cap), since they are not sufficiently developed for consideration in the U.S. and/or are difficult to implement for standalone projects.

3.1 Present Value of the Revenues

Under a PVR approach, Developers bid a minimum gross revenue discounted at a pre-determined discount rate. The P3 contract ends when the NPV of gross revenue is reached. The concession term varies as a function of realized gross revenues, but the contract provides for a base case and minimum and maximum terms as discussed in Appendix 4I.1.

Figure 3 illustrates PVR's impact on debt service, with debt prepaid if PVR revenues are higher than expected (Scenario 1) and maturity of debt extended if revenues are lower than expected (Scenario 2).

Figure 3: Illustration of PVR Mechanism



3.1.1 Value for Money

Under a PVR mechanism, the revenue risk transfer to the Developer is limited as the contract can be extended if revenues fall short of expectations. However, in extreme downside cases, Developers will still be exposed to revenue risk as the maximum contract duration will typically be capped. Furthermore, for the PVR mechanism to effectively reduce revenue risk, the base concession term should not be too long (e.g., no more than 20 to 30 years) so that an extension of the concession can indeed achieve the desired gross revenue NPV bid value. If the base concession term were to be 50 years, an additional 20 years (or even 50 years) may not have a significant effect on the gross revenue NPV due to the effect of discounting.

Assuming that the selected PVR structure addresses these concerns, the Agency effectively accepts the revenue risk through the flexible contract end date (i.e., the Agency will only start receiving toll revenues after that date). Since a contract extension could result in additional O&M costs that are non-linear, negatively impacting the Developer's returns, the Developer is incentivized to maximize early revenues.

Compared to a full revenue risk transfer, inefficient risk pricing is less likely as the PVR provides downside revenue risk protection for Developers. Given the potential for excessive pricing without PVR in a less-than-robust market, the mechanism is expected to create more VfM than a full revenue transfer to the private sector.

3.1.2 Fiscal Impact

The PVR mechanism does not have any immediate direct or contingent fiscal impacts for the Agency. However, as explained, the concession term variation does impact when the Agency will start receiving toll revenues, which obviously has future fiscal impact.

3.1.3 Financeability

Subject to the limitations listed in the VfM section above, the PVR mechanism can significantly reduce the revenue risk for the Developer, thereby enhancing financeability. However, not only the revenues, but also the Developer's costs vary with the contract term. To the extent the costs are more or less linear, the

Developer will be able to account for them in determining the minimum gross revenue. To the extent the costs are non-linear, such as major maintenance costs or expansions, the variable term contract creates a risk.

Just as in other P3s, Lenders would have step-in rights in case revenues are too low to meet debt service obligations. In that case, a contract extension would improve the possibilities for a successful restructuring, compared to a situation without the possibility of such an extension.

While U.S. terms for toll concessions are now around 50 years, most Lenders will currently not lend for a period of more than 40 years, creating a refinancing risk in downside cases. Private Activity Bonds, the typical choice of senior debt in current U.S. P3s, have provisions limiting early repayment (especially in the first decade) and generally have a maturity of no longer than 30 years, making it difficult to adjust the senior debt tenor. To overcome this, Agencies could consider 1) basing the minimum and maximum contract terms stated in the P3 agreement upon what is achievable in the financing market, 2) obligating the Agency to partially or fully repay the bond if it is not repaid after 30 years (effectively shifting more of the revenue risk to the Agency), as is the case in some termination provisions of U.S. P3s, and/or 3) encourage Developers to use zero coupon instruments in their financial structure, which has been used in some non-recourse toll roads such as the San Joaquin Hills Transportation Corridor Agency 73 toll road financing in California.[1]

Some Developer respondents said they might not like the fact there is no or little "upside." That may be the case, but the flip side is that the mechanism offers significant protection. A combination of significant downside protection and significant upside potential should be attractive to Developers, but unrealistic and unreasonable from an Agency perspective.

3.1.4 Ease of Implementation

The proposed mechanism is based on gross revenues, which can be easily monitored. A mechanism based on net revenues, including O&M, has proven difficult to monitor in some P3s, since Developers included what are essentially profits in certain cost categories. Therefore, a gross PVR mechanism scores high on ease of implementation.

Some Developer Respondents stated that PVRs add complexity to an already complex market made up of fifty or more DOTs with a variety of legislative and political requirements, because the mechanism is new and requires a strong understanding of finance. However, calculating the PVR is relatively straight forward and is not much more complicated than current P3 or revenue bond financings currently in the market.

If the discount rate specified in the PVR mechanism reflects the Developer's weighted average cost of capital (WACC) based on previous P3s, Lenders are relatively indifferent to when they receive their payments. If the discount rate is different from the Developer's WACC, this may create problems. For instance, if the Developer's discount rate is lower than the Agencies' prescribed WACC, then the Developer may have an incentive to prolong the concession. Getting the discount rate right is therefore the main challenge. Obviously, information from recent transactions should get close to the "right" discount rate. To minimize negative impact for the Developer, the actual WACC at financial close could be included in the P3 agreement.

PVRs may fail to incentivize performance related to maintenance and quality of service, and the uncertain duration of the concession could present challenges relating to handback of the facility. These issues can be

[1] In a zero coupon bond or capital appreciation bond, in the municipal market, interest payments are capitalized until the final year of maturity, providing interest debt relief for the early years in which revenues are uncertain. Such instruments are not always available in the market and their amounts may be limited.

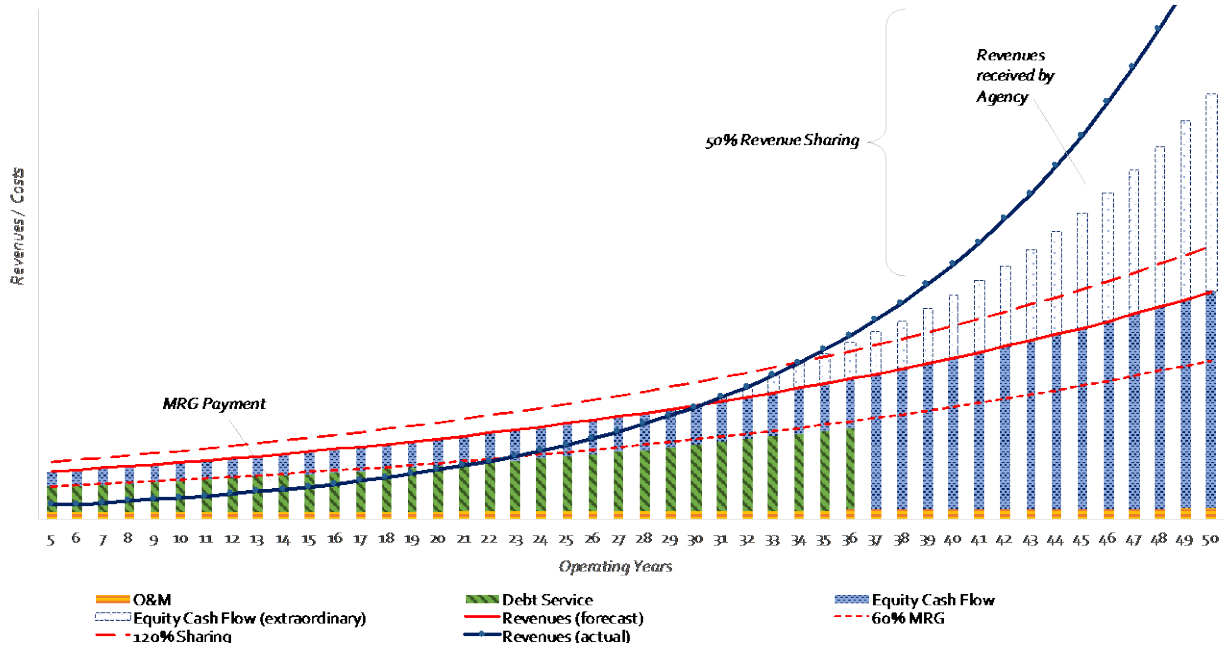
dealt with by structuring and enforcing performance standards through penalties, as would be the case in AP P3s.

3.2 Minimum Revenue Guarantees

Under a MRG, the Agency sets a base case revenue line and guarantees to cover revenues in any year in which revenues fall below this line. Appendix I discusses how Agencies have guaranteed revenue ranging from 60% of base forecast in Canada and Brazil to 80%-85% in Chile. Initially, South Korea guaranteed 80%-90% of the revenue forecast, but it has become less "generous" over time. The MRG can be sized in different ways. For example, it could cover debt service — partially or fully — possibly in combination with expected O&M expenses, or even providing some protection to equity. Its duration can extend to the entire concession period or can be limited, for example, to only the debt tenor. The MRG level can also change over time.

MRGs often have a corresponding upside revenue sharing mechanism, in which the Agency shares in upside revenues above a certain level, for example 120% of forecasted revenues. Such provisions are common in U.S. revenue risk toll roads, such as in Texas and Virginia, but they have rarely been tested due to lower than expected realized revenues. Figure 4 illustrates an example of a MRG mechanism where the Agency partially covers the gap between actual and forecasted revenues in combination with an upside revenue sharing mechanism.

Figure 4: Illustration of Minimum Revenue Guarantee Mechanism



From a flow of funds perspective, MRG payments are defined as project revenue, entering into the priority payment structure at the top of the cash waterfall.

A MRG mechanism could also include a claw back clause, where the Agency is repaid its earlier contributions if the project's revenues exceed forecasted revenues at a later date.

3.2.1 Value for Money

MRG mechanisms help protect Developers' downside risk as the Agency guarantees revenues up to a certain level. A MRG provides better revenue risk protection to Developers in extreme downside revenue cases than a PVR due to PVR's contract duration limits. However, the overall revenue risk protection will ultimately depend on the revenue level that the Agency guarantees.

Compared to a traditional toll concession with full revenue risk transfer, MRGs should generate more efficient risk pricing and likely additional private sector interest leading to more competition as it can provide significant downside protection. As a result, MRGs are expected to create more VfM than a full revenue risk transfer.

3.2.2 Fiscal Impact

MRGs are contingent liabilities as the Agency's contributions will ultimately depend on realized traffic. As mentioned, accurately forecasting traffic can be challenging, which is why valuing contingent liabilities is difficult, although academics continue to develop new techniques that hold promise (Chiara and Garvin, 2007). In any case, Agencies need to have adequate funds to cover downsides, most likely in gas or sales tax revenues. A portion or all of these liabilities would be included in the Agency's budget, based on how each jurisdiction "scores" and how credit rating agencies view the obligation, which can vary.

As one credit rating agency Respondent pointed out, if an economic downturn reduces project revenues, it is likely that Agency's funding sources, such as gas taxes, will also decrease, as experienced in the global financial crisis. Therefore, the Agency may struggle to meet its obligations on a timely basis. This is true for any Agency contribution, but particularly contingent liabilities.

Compared to an upfront subsidy or AP mechanism, MRGs can help reduce Agencies' direct liabilities. Depending on how contingent liabilities are accounted for, MRGs may allow Agencies to support a larger number of projects than direct subsidies or AP mechanisms. This assumes, of course, that the Agency has accurately calculated its contingent liabilities and made requisite budgetary provisions.

3.2.3 Financeability

MRG mechanisms help reduce revenue volatility and eliminate extreme downside revenue risk for Developers and Lenders. Through this improved risk profile, Lenders be may be more able and willing to finance a MRG-supported project.

Depending on how the MRG is structured, it may cover the majority of debt service costs, thus addressing a key concern of Lenders in current revenue risk sharing P3s. As the price of debt reflects the nature of the risks to which it is exposed, MRG should lead to lower interest rates. For certain projects with high revenue risk, Lenders may be unwilling to lend money, even at high interest rates. In that case, MRGs—like any other revenue risk sharing mechanism that reduces risks for Developers and Lenders—can help make such projects financeable. Similarly, in order to obtain a TIFIA loan, Developers usually need to attract senior debt, often in the form of private activity bonds (PABs) which are rated "investment grade" by major credit rating agencies. An MRG can be a key credit factor in obtaining such a rating.

A revenue risk sharing mechanisms like a MRG may also affect the financial structure of a P3 transaction. Indeed, besides attracting lower cost debt, a MRG could result in higher debt-to-equity ratios, thereby lowering the overall cost of capital, as debt is cheaper than equity. Depending on the revenue guarantee level, a MRG can create different risk allocations between Lenders and Developers. They may also reduce Lenders' monitoring costs, especially if the MRG covers all or close to all debt service. However, this could have a negative impact on P3 efficiencies, as the discipline imposed by Lenders is an important value driver in P3s.

A MRG could also cover equity payments, thereby guaranteeing an equity return that could be equivalent to a U.S. Treasury or similar instrument. Most MRG mechanisms used today provide minimal or no equity protection. Many Developer and Agency Respondents felt that the MRG should not directly benefit Equity Investors. Respondents shared anecdotal evidence that some Developers, dominated by Strategic Investors, do not focus on equity returns because most profits of their combined companies are made in construction activities. Furthermore, there may also be "agency issues" as economists define them, in that Developer staff are highly incentivized to "win and close the deal" with less long-term interest in equity returns. Furthermore, providing too much revenue risk protection may reduce Developer incentives.

Several credit rating agency Respondents also focused on the need for the mechanics of MRGs and CFS (the latter discussed below) to be crystal clear: do they result in timely payment of obligations, i.e., within 30 days? These Respondents have had experience with Agencies who failed to make timely payments, even though they had strong financials. This issue can likely be addressed with clearly stated legal obligations and periodic funding of a reserve.

3.2.4 Ease of Implementation

MRGs have been used extensively throughout the world, including in Europe, Latin America, and Asia and many Developers have experience with them. As MRGs are gross revenue guarantees, they do not pose any particular practical problem in terms of monitoring.

Some U.S. states may not be able to legally provide revenue guarantees. For instance, TxDOT cannot provide revenue guarantees to toll road projects. In order to address this, TxDOT provided a subordinated loan to the North Texas Transportation Authority in the SH-161 financing, a public toll road project subject to revenue risk. In that transaction, if lower than expected revenues forced debt service coverage to dip below specified levels, then this would require TxDOT to take out senior and TIFIA debt, making this subordinated loan essentially a financing support mechanism, although it was not legally considered a revenue guarantee.

A MRG is first and foremost a revenue risk sharing mechanism. However, it can also be used as a procurement bidding parameter. In that case, bids could be evaluated based on 1) the total amount of revenue covered by the MRG in present value terms or 2) the required (upfront) subsidy for a given MRG level. Alternatively, the MRG can be treated as a form of insurance, as was the case in Chile, where the Developer paid a fee of 0.75% of the guaranteed revenue.

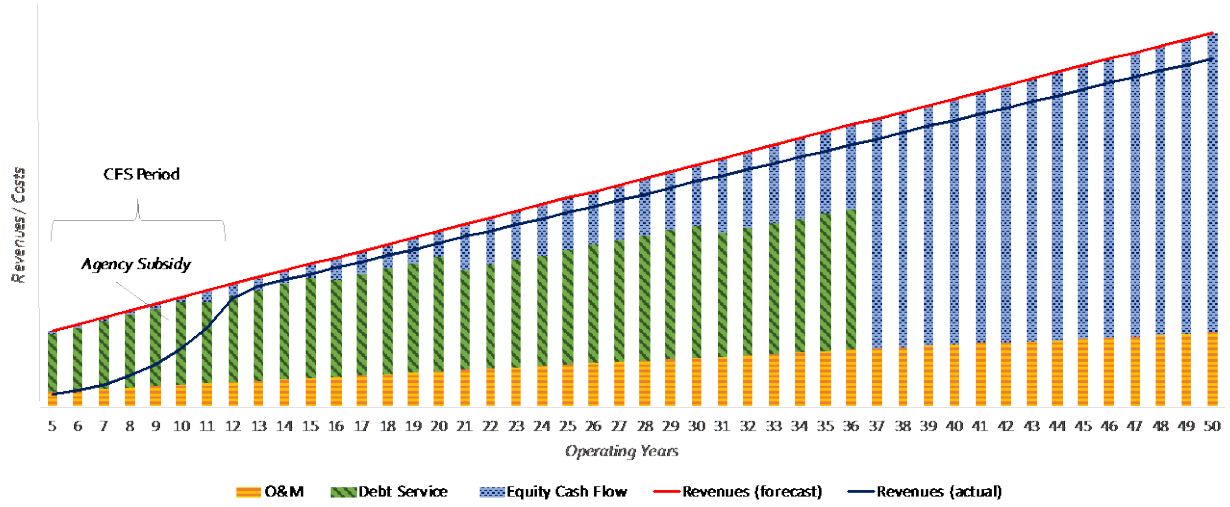
3.3 Contingent Finance Support

Contingent Finance Support (CFS) is a risk sharing mechanism that addresses financing as opposed to revenue risk. Under a CFS, the Agency guarantees that the project will be able to repay debt, even under downside scenarios. While CFS is technically not an MRG, it has many similarities and could potentially be viewed as a MRG subset. However, downside scenarios could be caused by lower than expected revenues (as under a MRG) or higher operating costs.

An example of a CFS would be the Developer Ratio Adjustment Mechanism (DRAM) used in the I-77 project in North Carolina. Under this mechanism, NCDOT guaranteed a debt service coverage ratio of 1.00x, effectively covering the Lenders but not equity investors. However, to limit its exposure, NCDOT limited the DRAM payments to a maximum of $12M per year and $75M in total. To the extent that the DRAM had not been exhausted, it would available for the entire concession period. Towards the end of that period, the DRAM would be released from NCDOT's budget and available for other projects. As the I-77 transaction closed in 2015, no DRAM has been requested or is anticipated to be requested at this time. To be prudent, however, NCDOT has programmed the expected cost of the DRAM in its long-term state transportation

improvement program based on a severe downside case. This serves as an example of how Agencies can account for CFSs and MRGs. An example of a CFS is illustrated in Figure 5.

Figure 5: Illustration of CFS Mechanism



3.3.1 Value for Money

Similar to a MRG, a CFS can provide significant revenue risk protection to Developers and Lenders. Depending on the guarantee's limits, in annual or overall value, a CFS can be particularly valuable in the project's early years when liquidity is tight.

However, as a CFS covers all risks, not just revenue risk, it means that the O&M cost risk is no longer being fully transferred to the Developer, which is less efficient, since the Developer is better placed to manage such costs. Retaining this risk would partially remove the incentive for the Developers to minimize life cycle costs, which is considered one of the key value drivers of a P3 structure. Therefore, this aspect of CFS is not conducive to VfM.

3.3.2 Fiscal Impact

Similar to a MRG, a CFS is a contingent liability. It can be difficult for Agencies to establish the value and budget implications of such liabilities. As Agencies become more familiar with MRGs and CFSs, they may develop better ways to assess the fiscal impacts of contingent liabilities.

3.3.3 Financeability

Depending on how the CFS is structured, the primary beneficiaries are most likely Lenders, for whose protection there may be a broader public understanding. Most Respondents believed that this was a public relations positive, since the general public continues to object to Agencies providing financial support that appears to "subsidize" or "guarantee" private company investments. Furthermore, several Respondents believed that Developers are readily able to obtain equity for P3s, from Strategic and/or Financial Investors, so that this mechanism correctly focuses on the problem of obtaining debt. Several Respondents referred to the sale of the Indiana Toll Road in 2015 as an example of a large supply of equity.

As was the case for MRG and other revenue risk sharing mechanisms, reducing a project's risk profile makes financing easier and cheaper. In the I-77 case, the CFS focuses on the worst case, when annual debt service coverage ratios (DSCR) fall below 1.00x, when Lenders absolutely need it. As a result, the DRAM was

essential to that transaction reaching financial close. Compared to an MRG, the CFS will further improve financeability as it considers both revenues and operating costs.

3.3.4 Ease of Implementation

Although a CFS is very similar to a MRG, its implementation and monitoring may be more difficult as it requires a detailed analysis of a project's cash waterfall and the mechanics of it may be problematic since it is not common to the U.S. municipal finance market. For example, in the case of I-77, NCDOT will need to determine both gross revenues and expenses ahead of debt service in order to determine the DSCR, which in turn triggers the DRAM payment. In that context, a MRG may be easier to implement while also more directly addressing revenue risk.

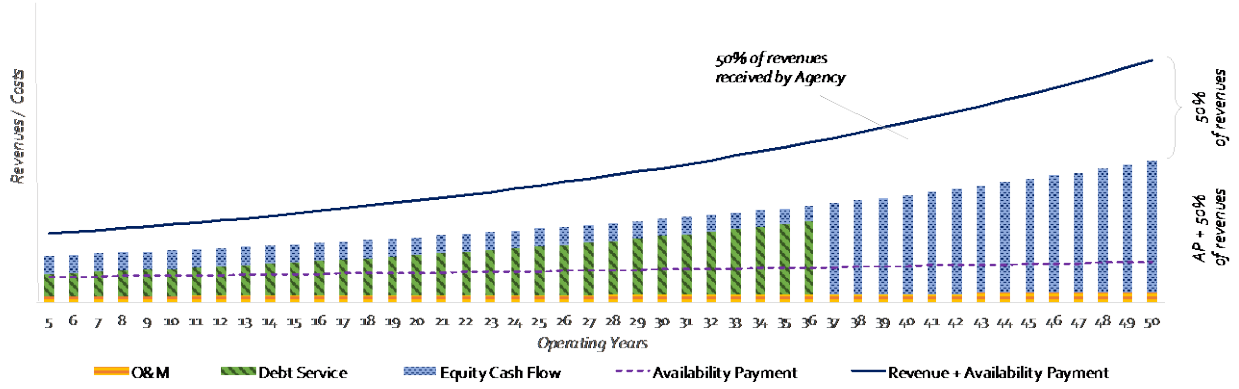
3.4 Availability Payments and Revenue Sharing

An Agency could combine an AP and revenue sharing mechanism, similar to the payment mechanism in the A25 project in Canada. In that project, the Developer compensation consisted of:

- APs, subject to penalties if availability or performance of the road is inadequate; and
- A share of the toll revenues, which could be either fixed or follow revenue bands.

Depending on structuring, it can be similar to a MRG, although its role in a procurement may be different, as discussed below. Figure 6 illustrates an AP/Revenue Sharing combination.

Figure 6: Illustration of AP in combination with Revenue Sharing



3.4.1 Value for Money

As with other mechanisms discussed earlier, revenue risk sharing mechanisms that limit Developers' exposure to revenue risk should create VfM when competition for full revenue risk concessions is weak and/or inefficient risk pricing is likely. In this case, the extent to which the Developer is shielded from revenue risk depends directly on the level of AP in relation to the level of toll revenues to be received. If the AP is relatively high, it means that the transaction will be similar to a normal AP transaction with limited revenue risk. As a result, inefficient risk pricing is unlikely, which in turn should result in VfM. If the AP is relatively small, the Developer will still be exposed to significant revenue risk, which could lead to inefficient risk pricing if there is insufficient competition among Developers for high levels of revenue risk.

3.4.2 Fiscal Impact

As the Agency is paying an AP to the Developer, the AP is a direct liability. However, as toll revenues are used to pay the AP, the shortfall—AP minus the realized toll revenues—becomes an Agency's contingent liability. On the upside, the Agency can expect to earn a share of the revenues. Furthermore, as a portion of the project will still be financed through toll revenues, this mechanism allows for some off-balance sheet financing.

3.4.3 Financeability

To the extent that the mechanism reduces revenue risk for Developers, it should make obtaining financing easier. However, there is a risk associated with combining multiple risk sharing mechanisms. Bringing together an AP structure with revenue risk sharing could confuse Lenders on the nature of the credit. Is this primarily an AP or a revenue risk credit? In discussions with credit rating agencies, Developers and Lenders, there were differences of opinion on whether such an instrument would be rated as 1) a hybrid credit with melding of AP and revenue risks or 2) a credit based on its weakest element, revenue, even when the AP covered the majority of the debt. One Respondent commented, however, that credit analysis also depends on how well the mechanism is defined in the legal documentation.

3.4.4 Ease of Implementation

Implementing a combined AP/revenue sharing mechanism necessitates a coherent procurement strategy. As this mechanism has two distinct variables—required AP and the revenue sharing level—the Agency needs to decide on which variable it wants Developers to bid. Comparing bids that have different APs and revenue sharing levels is extremely difficult due to the challenges in determining the value of uncertain revenues.

One option would be for the Agency to set the AP and let the Developers bid on the level of revenues they are willing to share. In this case, the AP has to be set at a level well below a normal AP which would cover all investments and operational cash flows.

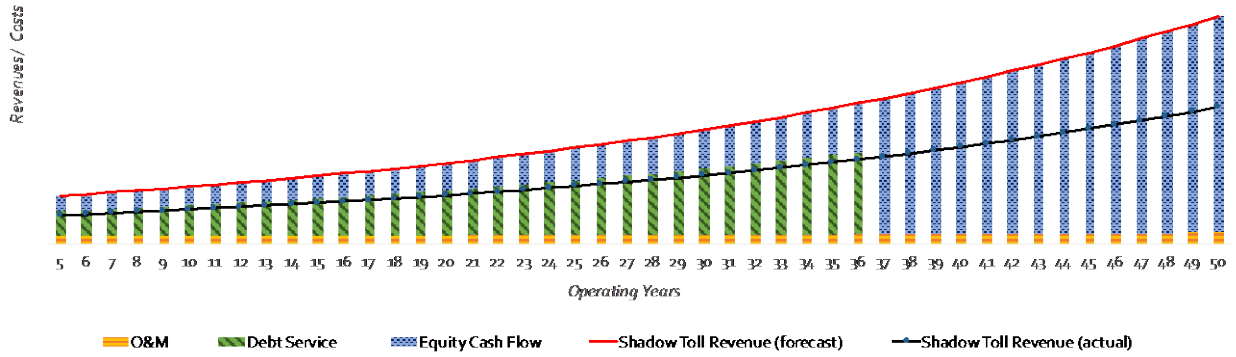
Alternatively, the Agency could specify a revenue sharing profile, using revenue bands, asking Developers to bid on the required AP. This is similar to bidding the lowest subsidy as in many U.S. P3s, yet the subsidy payments are performance-based and made over the concession period (potentially in combination with a milestone payment) as opposed to upfront payments, as in current practice.

The involved procurement process combined with potential difficulties in assessing this mechanism's credit may make it more difficult to implement.

3.5 Shadow Tolls

In a shadow toll approach, an Agency pays a Developer on a per vehicle basis, with the Agency retaining any toll revenues, if it is a toll road. As discussed in Appendix I.6 shadow tolls eliminate risks to the Developer related to perceived or real economic barriers that tolls and tolling technology create. However, under most shadow toll mechanisms implemented in the U.K. and contemplated in the U.S., Developers are still subject to all traffic risk. Furthermore, Agencies are subject to 1) payment liabilities (which depend on traffic) and 2) revenue risk (only if the facility is tolled). As Figure 7 shows, the Agency pays the Developer shadow tolls that are subject to traffic volatility, so that the Developer still faces revenue risk.

Figure 7: Illustration of Shadow Toll Mechanism



3.5.1 Value for Money

Under shadow tolls, the Developer's exposure to traffic risk means that it will face similar challenges as in a full revenue risk transfer. In particular, if there is inefficient risk pricing (e.g., due to insufficient competition among Developers) it may result in a loss of VfM compared to a more balanced approach to revenue risk sharing.

If shadow tolls are used as a partial subsidy to ensure a more efficient use of managed lanes, the economic benefits for society in the form of additional time savings could be significant since the Developer will attempt to maximize vehicle throughput on the managed lanes in order to maximize its revenue. Furthermore, the negative impact on risk pricing may be limited if the Developer believes there is sufficient demand to fill the managed lanes' capacity.

3.5.2 Fiscal Impact

Under a shadow toll, the Agency bears the traffic and tolling risks (if there is tolling), as under an AP. Unlike an AP, it also faces a payment risk, as payments to the Developer are not fixed or indexed to inflation, as in an AP, but vary according to traffic. These risks depend on the facility's nature and a large Agency may be able to absorb these risks, especially if the expected payment profile of a shadow toll—lower payments in early years and higher in later years, as traffic grows—benefits their constrained budget in the short-term and they are able to adequately manage the longer-term liabilities.

3.5.3 Financeability

In the I-595 case (see Appendix I.6), the shadow toll option was judged to have higher financing costs compared to an AP based on Developer's perceptions of the higher risk in the payment structure. During the period that the I-595 procurement was conducted, 2007-2009, Developers' perception of magnitude of traffic and revenue risk increased, and hence so did the premium required for shadow toll or full revenue risk transfer mechanisms. Some Developers and Lenders may perceive the traffic risk as high as the traffic and revenue risk of a full risk sharing toll road, which would mean that the financeability of a shadow toll concession is similar to that of a toll concession.

3.5.4 Ease of Implementation

Implementing a shadow toll scheme should be no more difficult to implement than a P3 toll concession. A key component of such agreements is reliable traffic counting and electronic tolling technology, both of which are well-tested in the U.S. Inexperience with shadow tolling may pose minor challenges to U.S. Agencies and

their advisors in drafting contracts. More importantly, as with MRG and CFS, Agencies may have challenges in accurately predicting their payment obligations and incorporating these obligations in their budgets.

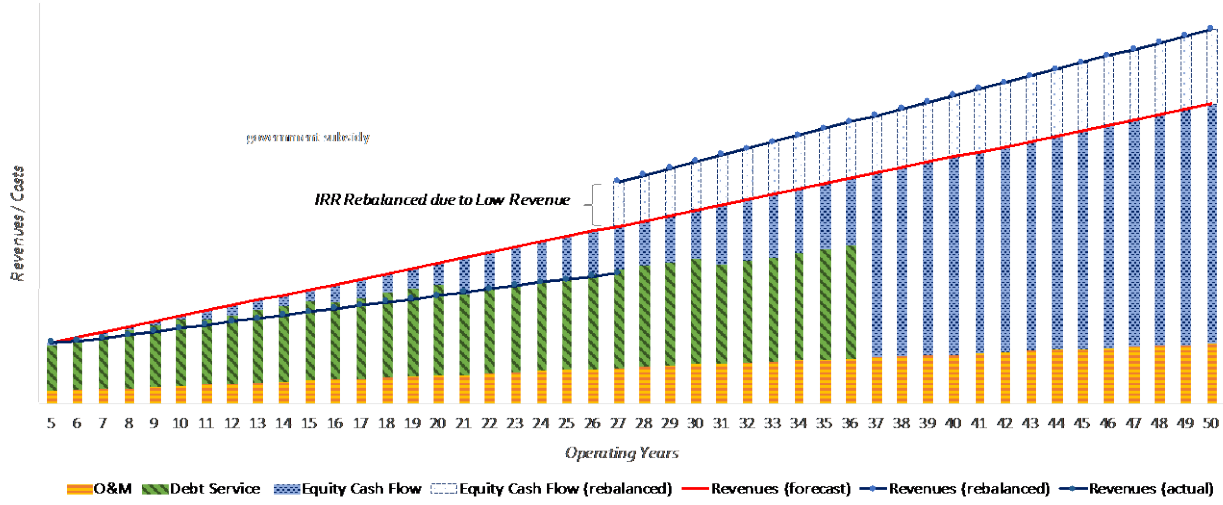
3.6 Regulated Return Mechanisms

Under a regulated return mechanism (RRM), the Developer benefits from different possible remedies to ensure that its originally proposed IRR will be realized. These include:

- Extension of the concession;
- Ability to raise toll rates; and
- Receive a government subsidy.

Figure 8 presents a case in which the Developer's IRR is rebalanced by increasing the toll tariffs above the regulated price or by receiving an ongoing government subsidy.

Figure 8: Illustration of Regulated Return Mechanism



3.6.1 Value for Money

As discussed, VfM is about efficient risk allocation. In principle, a RRM could cover any risk whenever a Developer's target returns are under pressure. For example, the Developer could be compensated if O&M costs are higher than expected or if the facility's completion is delayed. However, this would contradict the logic of efficient risk transfer and VfM, as there are many risks that are better managed by the Developer than the Agency. If, on the other hand, RRM is used specifically to transfer revenue risk to the Agency this could create VfM.

3.6.2 Fiscal Impact

The RRM fiscal impact depends on the rebalancing mechanism. In the case of a contract extension, the effects are the same as under PVR. If higher tolls are imposed on users, and assuming that the demand elasticity is sufficiently low, there is no Agency impact.

A subsidy, which can be one-off or continuous, will have a direct impact on the Agency's budget. Due to the uncertain nature of the subsidy, both in terms of timing and level, the Agency may find it difficult to value this

contingent liability. Furthermore, this liability depends not only on actual revenues, but also on the performance of the Developer.

Furthermore, if a one-off subsidy compensates a Developer, the impact would be of such magnitude that it may create payment difficulties for the Agency. In Colombia and Brazil, provisions in the concession agreement provided for such "true up" payments—payments that result in the Developer's returns equaling those that they originally bid— after five or more years. As a result, the payment would either be 1) too late to cover short-term liquidity issues or 2) could be such a large amount that the Agency would have a problem paying it from constrained budgets, both of which manifested themselves in Latin America. To avoid this, Agencies could fund a reserve fund to reflect the expected liabilities. However, this would require significant budget discipline and an accurate accounting of contingent liabilities.

3.6.3 *Financeability Considerations*

As for fiscal impacts, financeability will depend on the adjustment mechanism used to achieve the target IRR. If the concession is extended, this provides significant protection for Lenders and Developers. However, Lenders would have to be comfortable with the refinancing risk.

If toll rates can be raised or the project benefits from a government subsidy, this again provides protection for Lenders and Developers. However, if this compensation happens only after a number of years, the project may already be facing short-term liquidity issues, as happened in Latin America. As long as Developers and Lenders are comfortable with restructuring the debt when required, RRM should provide sufficient protection against revenue risk.

3.6.4 *Ease of Implementation*

RRMs can be difficult to implement due to monitoring issues, as acknowledged by academic, Agency, and Lender Respondents. In order to regulate a Developer's return, Agencies must monitor capital costs and timing of expenses. However, if no adjustments for costs, financing, and timing (including delayed completion) are allowed, these challenges are reduced. Nevertheless, RRMs still require regular updating of the project's financial model to calculate Developer's returns in order to determine compensation. Furthermore, depending on the compensation mechanism, elasticity of demand may limit the potential for additional revenues.

The Latin American experience with RRMs has been problematic because of Agency-Developer disputes over IRR calculations, such as the Mexico Fumisa Airport P3 (Moody's Investor Services, 2012). In some examples, when the realized IRR is very low, the Agency may need to extend the contract for many more years than policymakers are comfortable with, creating a "never ending concession" risk if no cap on the concession term is defined.

3.7 Innovative Finance Programs

The mechanisms discussed so far have mainly focused on revenues. However, there are also other ways to share risks. For example, if Lenders were willing to offer flexible financing terms, this could help alleviate some of the financial impacts of revenue uncertainty. Outside the U.S., publicly-owned lending institutions or development banks often provide this type of debt. In the U.S., the USDOT's TIFIA program plays such a role as do state infrastructure banks on a smaller scale. These lending instruments can work in conjunction with the other risk sharing mechanisms. The following TIFIA provisions help reduce cash flow pressures in early years:

- Long tenors;

- Back loaded repayment arrangements;
- Ability to capitalize interest during construction and the first years of operations;
- Mandatory and scheduled debt service payments, with scheduled payments only due if sufficient cash flows are available; and
- Very low interest rates, tied to U.S. treasury rates.

The TIFIA statute requires that the senior debt in the transaction be rated investment grade, and some rating agencies treat TIFIA debt as if it were investment grade. Therefore, Developers perceive TIFIA as closer to senior debt than deeply subordinated debt that takes equity-like risks. This means that there are limits to TIFIA's ability to absorb revenue risk.

The USDOT's TIFIA program only receives debt service payments and does not participate in any "upside" of the project other than benefitting from early repayments in the event that revenues are higher than expected. However, TIFIA's scheduled/mandatory debt service approach, which allows for interest capitalization in the first years of the project after substantial completion and flexible repayment minimizes cash flow requirements in the early years.

In general, post MAP-21 requirements have become stricter reflecting: 1) the overall credit market's stricter lending following the global financial crisis, and 2) specifically TIFIA's experience with the financial difficulties of P3 projects to which it has lent, such as the South Bay Expressway and the Pocahontas Parkway.

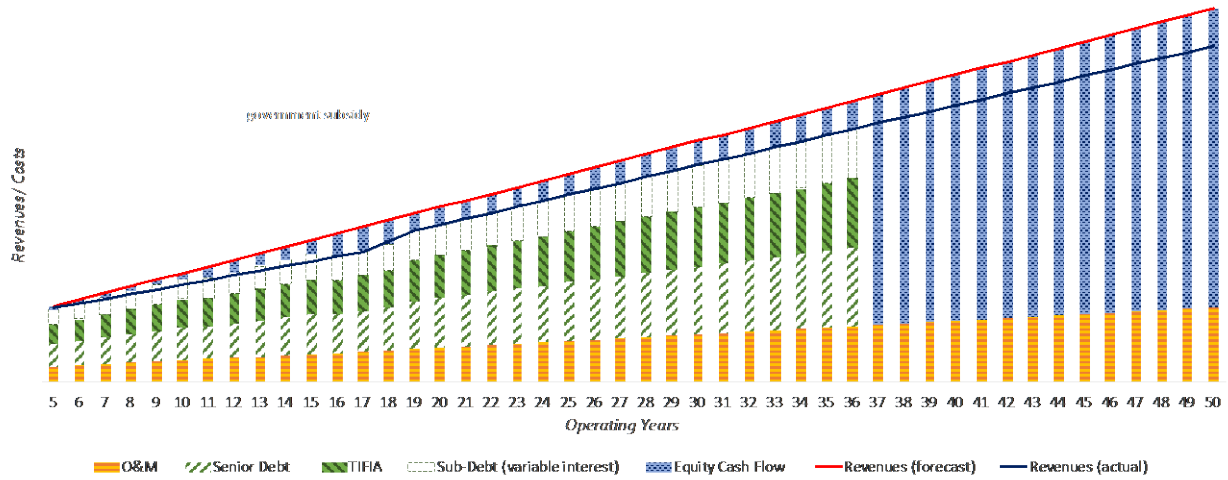
Developer Respondents also suggested that TIFIA or Agencies offer revenue risk insurance that would cover some or all of expected toll risks. Developers would pay a fee based on the amount of the coverage, similar to bond insurance or bank letters of credit. Generally, these products are not available today or are available for a much smaller set of projects than before the global financial crisis. It would appear that the MRG as practiced in Chile comes close to this product. The TIFIA program does offer a similar product in the form of a credit guarantee. However, Agencies and Developers have overwhelmingly preferred TIFIA's direct loans, since they are simpler to administer and less expensive than a credit guarantee, the latter necessitating an outside lending bank with additional fees.

Furthermore, before the global financial crisis some commercial banks operating in the U.S. provided early period relief in an "A Loan/B Loan structure," which may make some debt service payments flexible and subject to "cash sweeps." Since then, commercial banks have adopted more conservative lending practices. As they do not offer long tenors like PABs or TIFIA, they are not competitive in financing most revenue risk projects in the current market.

Internationally, there are more examples of innovative finance being used to directly address revenue risk. For example, in Australia, the Agency providing a subordinated loan to a P3 project has the right to receive "promissory notes" once certain ROR targets are met, resulting in future cash repayments on those notes (PricewaterhouseCoopers, 2011, p.13). In other words, subordinate debt providers share in the project's upside. These notes appear to be somewhat similar in purpose to revenue sharing mechanisms of current U.S. toll roads, in which Developers and Agencies share revenues at pre-established payment bands.

Spain has a subordinated program in which interest rates may change based on revenue levels, with higher-than-anticipated revenues resulting in higher interest costs (Sanchez-Solino, A. and J. M. Vasallo, 2006). This has a similar intent, but differs from the approach in the Australian promissory note program. Furthermore, the Spanish approach effectively addresses downside risk as interest rates are reduced when traffic is low, hence offsetting some of the revenue reductions. Figure 9 shows the Spanish example and the program's impact on debt service.

Figure 9: Illustration of Alternative Subordinate Debt Mechanism



Given the wide variety of innovative financing solutions, the evaluation below will focus on mechanisms that absorb revenue uncertainty similar to TIFIA's mandatory/scheduled debt service and Spain's variable interest approach.

3.7.1 Value for Money

As in the case of the other mechanisms, a transfer of revenue risk from Developer to Agency or public debt provider should create VfM if the Developer is less well-positioned to manage revenue risk than the public Agency. However, as financing solutions can only absorb a small portion of the revenue uncertainty, it is likely that innovative finance by itself will not result in a very significant revenue risk transfer. Those innovative financing mechanisms that do not focus on revenue risk, yet provide protection for all project risks, contradict the P3 philosophy of efficient risk transfer and VfM.

3.7.2 Fiscal Impact

In the case of TIFIA's mandatory/scheduled debt service approach, there is no direct cost to TIFIA for accepting later repayment as the Developer will be expected to pay interest on the outstanding balance. However, with more debt still outstanding, TIFIA's exposure will be higher for a longer time period. Furthermore, TIFIA's interest rates are significantly below market interest rates, which means that TIFIA is subsidizing the project. The value of this annual subsidy can be estimated by taking the difference between the market interest rate and the TIFIA interest rate and multiplying it by the outstanding balance. As this amount can be estimated at financial close, this subsidy can be seen as a direct liability to TIFIA.

In the case of Spain's variable interest rate approach, the lending agency effectively accepts waiving a part of the interest payments if revenues are lower than expected, which in itself is a subsidy. As the interest rate is now tied to traffic, this means that the lending agencies face a contingent liability, making it difficult to value.

3.7.3 Financeability

TIFIA loans play a key role in U.S. P3 projects. Without this source of subsidized financing, projects would be more expensive or may simply not be feasible. The flexible TIFIA repayment conditions also help absorb revenue uncertainty. In the I-77 managed lanes project, scheduled interest payments can be delayed if traffic

conditions are lower than expected. Given the uncertain nature of managed lanes revenues, this project would probably have struggled to obtain financing without TIFIA's participation.

Variable interest rates could also help absorb revenue risk. In the most extreme case, interest rates on the tranche provided by the Agency could fall to zero if revenues are much lower than expected. If such conditions were to be acceptable, it would provide significant protection to other Lenders as more cash flows would be available to service their debt, hence improving the overall financeability. The Agency could of course include a claw back clause to ensure that the Developer doesn't unfairly benefit from its lenient lending conditions.

3.7.4 Ease of Implementation

Although P3 financing is highly complex and requires significantly more legal work than a conventionally procured project, the above innovative finance solutions do not pose any particular difficulty for implementation. As P3 transaction documents are drafted and negotiated on a case-by-case basis, some Agencies may include these or other financial innovations, which may involve minimal additional costs and complexity. However, some innovations may require legislative changes.

4 Conclusions and Recommendations

The U.S. has a strong tradition of revenue risk transfer in toll P3s. Recently full revenue risk transfer has encountered financeability challenges.

There are a variety of potential mechanisms that have been applied in other countries that U.S. Agencies can consider to mitigate revenue risk in toll revenue P3s. These mechanisms, many of them including forms of minimum revenue guarantees, have evolved over time as Agencies have witnessed how some revenue risk P3s experienced severe financial difficulties. As summarized in Table 5, these mechanisms can create a range of benefits. All revenue risk sharing mechanisms discussed in this Discussion Paper will reduce the revenue risk for the Developer, which should generally lead to improved financeability.

Table 5: Summary of Key Benefits of Revenue Risk Sharing Mechanisms for Agency

Criterion	Present Value of Revenues	Minimum Revenue Guarantee	Contingent Finance Support	Availability Payment & Revenue Sharing	Shadow Tolls	Regulated Returns	Innovative Finance Programs
Value for Money	●●●	●●●	●●	●●●	●	●	●●
Fiscal Impact	●●●	●●	●●	●	●	●	●●
Financeability	●●	●●●	●●●●	●●	●●	●●●	●●●
Ease of Implementation	●●●	●●●●	●●●	●●	●●●	●	●●●

Key: Most value or benefits = ●●●● Least value or benefits = ●

The Present Value of Revenues mechanism may be an attractive mechanism for Agencies, as it is relatively easy to implement, has few immediate fiscal impacts, and is likely to deliver VfM. Although the PVR mechanism transfers most of the revenue risk to the Agency, fiscal impacts are limited to the years of contract extension. Because the PVR mechanism provides downside revenue risk protection for Developers—and therefore minimizes excessive risk pricing by the Developer—this mechanism is also likely to provide more VfM than full revenue risk transfer to the Developer. The PVR mechanism is relatively easy to implement, although the uncertain contract term may present challenges for debt financing terms.

Although a Minimum Revenue Guarantee is relatively easy to implement and enhances financeability and VfM, it creates uncertain contingent liabilities for the Agency. A MRG is a transparent mechanism that is relatively easy to implement. Because a MRG reduces revenue risk for the Developer, it may enhance financeability and VfM. However, a MRG creates contingent liabilities for the Agency which are difficult to estimate. For Agencies that are not in a position to accept these, a combination of PVR and a lower MRG could also be an option. From a reciprocity perspective it would be appropriate to not only protect the downside, but also share in the upside, such as through revenue sharing bands.

Although a Contingent Finance Support mechanism improves financeability, it is sub-optimal from a VfM perspective and creates contingent liabilities for the Agency. A CFS not only protects against revenue shortfalls, but also against operating cost overruns. As a result, it is likely to improve financeability by providing significant protection to Lenders. However, a CFS mechanism is sub-optimal from a VfM perspective, as the Developer is no longer incentivized to minimize lifecycle costs. Like a MRG, a CFS mechanism creates uncertain contingent liabilities for the Agency.

Combining Availability Payments and Revenue Sharing may be attractive from a financeability and VfM perspective, although it may be relatively difficult to implement. Combining an AP with revenue sharing, in which 50% or more of the toll revenues are exchanged with an AP, is likely to enhance financeability compared to a full revenue risk transfer, as the Developer is partially

protected from downside revenue risk. A mixed AP toll revenue structure could be confusing for Lenders (banks, bondholders, and credit rating agencies), however, since the Developer is compensated through two different payment approaches (AP and toll revenues). This could lead to sub-optimal debt pricing. Although this mechanism is likely to generate VfM, it creates fiscal liabilities for the Agency. In addition, it is relatively challenging to implement.

A Shadow Toll mechanism is likely to decrease financeability and VfM but could create positive economic externalities. Transferring the full traffic risk to the Developer may result in higher financing costs and lower VfM compared to other mechanisms. However, depending on the exact nature of the road and concession agreement, Shadow Toll mechanisms can be enhanced to increase public welfare by incentivizing the Developer to optimize the number of vehicles on managed toll lanes. Such considerations could provide an economic rationale for using this mechanism. Although a Shadow Toll mechanism requires reliable traffic counting and electronic tolling technology, implementation difficulties are expected to be relatively limited in the U.S. context.

A RRM may be relatively challenging to implement and the VfM and fiscal impacts will depend on the adjustment mechanism used to achieve the target IRR. If a contract extension is used to achieve the required IRR, the RRM will have the same impacts as the PVR mechanism. If a government subsidy is used to achieve the required IRR, the RRM will have direct fiscal impacts. The disadvantage of a RRM is that it may be complex to implement, particularly if the adjustment mechanism is based on net revenues, which will require re-optimizing the Developer's financial model to maintain the target equity IRR. If the Developer is compensated for higher-than-expected O&M costs, a RRM may have high monitoring costs, low VfM, and poor public perception.

Although Innovative Financing mechanisms may not directly address revenue risk, they may help improve financeability. Innovative Financing mechanisms such as the USDOT's Transportation Infrastructure Finance and Innovation Act (TIFIA) program or state infrastructure banks help ease short-term liquidity by providing low interest rates, long tenors, flexible backloaded repayment terms, and interest capitalization, thereby improving financeability. Although innovative financing mechanisms do not typically pose implementation challenges, they may contradict the P3 philosophy of efficient risk transfer and VfM if they provide protection for overall project risks as opposed to revenue risk specifically.

The Present Value of Revenues and Minimum Revenue Guarantee appear to be the most promising revenue risk sharing mechanisms for the U.S. context, due to their relatively positive impacts on VfM, fiscal impact, financeability, and ease of implementation. The MRG, however, is less attractive from a fiscal impact perspective than the PVR, as it creates significant contingent liabilities. For Agencies that are not able to accept such contingent liabilities, a combination of a PVR and a lower MRG could represent a viable alternative. The variables in both of these mechanisms—including the sizing of the MRG and minimum and maximum contract term— allow for considerable tailoring to Agency requirements and the needs of individual projects.

Appendix I Review of Existing Revenue Risk Sharing Mechanism

This appendix provides detail on revenue risk sharing mechanisms and related P3 programs in Chile, Brazil, and Korea to illustrate the context in which the mechanisms were derived. As shown in Table 6, the appendix also reviews mechanisms in Canada, Spain, and the U.K., and those for transit in various countries. Lastly, this appendix also discusses some mechanisms used in the U.S.

Table 6: Summary of Revenue Risk Sharing and Related Mechanisms By Country

Country	Present Value of Revenues	Minimum Revenue Guarantee	Contingent Finance Support	Availability Payment & Revenue Risk	Revenue Distribution Mechanism	Internal Rate of Return Balancing[2]	Innovative Finance Programs	Shadow Toll	Price Cap	Rate of Return[2]
Chile	●	●			●					
Brazil						●	●			
South Korea		●					●			
U.K.	●	●			●			●	●	
Canada		●								
Portugal	●									
Spain	●	●		●		●				
Transit Cases[1]				●						
U.S.			●				●	●		●

[1] In Canada, Columbia, Spain, Sweden, and the U.K.

[2] In Section 3, these two mechanisms are discussed under the term "Regulated Return Mechanisms."

I.1 Chile: A Pioneer in Revenue Risk Sharing Mechanisms

Chile serves as a case study to understand the working of three risk sharing mechanisms: the least present value of the revenues (PVR), minimum revenue guarantees (MRGs), and Revenue Distribution Mechanisms (RDM). Its experience with more than twenty highway and infrastructure concessions spans over two decades.[1]

[1] This case primarily relies on published evaluations, in particular of Engel et al (2000, 2002, 2003, 2014) and Vassallo (2006).

I.1.1 Overview

Starting in 1992, Chile embarked on an ambitious P3 program for highways and other infrastructure. Many of the highway P3s were improvements of Highway 5, Chile's north-south road. They were implemented by the Chilean Ministry of Public Works (MOP). Table 7 shows the concessions awarded from 1992 to 2004.

Table 7: Characteristics of Chilean Highway Concessions (Vassallo, 2006)

Year of award	Concession	Highway	Investment	Total Investment	Main Economic Tender Variable
1992	Túnel del Melón	Interurban tunnel	$38M	$38M	Mix*
1994	Camino de la Madera	Interurban	$26M	$222M	Mix*
	A. Norte Concepción	Interurban	$196M		Tariff
1995	Santiago S. Antonio	Interurban	$180M	$371M	Tariff
	Nogales Puchancaví	Interurban	$12M		Tariff
	Acceso a AMB	Suburban	$10M		Tariff
	Talca Chillán	Interurban	$169M		Tariff
1996	Los Vilos Santiago	Interurban	$250M	$648M	Tariff
	Santiago Los Andes	Interurban	$152M		Tariff
	La Serena Los Vilos	Interurban	$246M		Tariff
1997	Chillán Collipulli	Interurban	$241M	$945M	Duration
	Temuco Río Bueno	Interurban	$200M		Upfront fee
	Río Bueno Pto. Montt	Interurban	$249M		Upfront fee
	Collipulli Temuco	Interurban	$255M		Upfront fee
1998	Santiago Talca	Interurban	$575M	$915M	Upfront fee
	Santiago Valparaíso	Interurban	$340M		LPVR**
1999	Costanera Norte	Urban	$384M	$384M	Upfront fee
2000	Norte–Sur	Urban	$442M	$546M	Upfront fee
	Red Vial Litoral Central	Interurban	$104M		Subsidy
2001	Vespucio Sur	Urban	$280M	$558M	Upfront fee
	Vespucio Norte	Urban	$240M		Upfront fee
	Talcahuano–Penco	Suburban	$19M		Subsidy
	Variante de Melipilla	Suburban	$19M		N/A
2002	Camino Internacional Ruta 60	Interurban	$180M	$180M	N/A
2003	Acceso Nororiente a Santiago	Suburban	$165M	$165M	LPVR**
2004	El Salto–Kennedy	Urban tunnel	$70M	$70M	Upfront fee

* Mix: Several economic variables are employed. N/A: Information not available. **LPVR is the same as the term "PVR" used elsewhere in the Discussion Paper.

Chilean law required that concessions be financed with no more than 70% debt. The intent was to ensure that Developers had enough "skin in the game" so that they were focused on the project throughout the concession.

As was common in early P3 programs, Chile experienced poorly designed competitions and concession contract designs, volatile traffic demand, and political pressures to renegotiate failing projects (Vassallo, 2006). During the 1998-2002 recession, many concessions experienced difficulties with significantly lower than expected revenues. Many Developers sought to renegotiate with MOP. Engel et al estimate that 50 Chilean concessions were renegotiated in total 144 times, or more than three times per concession (Engel et al, 2014). These renegotiations put into question the credibility of the entire P3 competition process.

I.1.2 Least Present Value of Revenues and Variable Term Contract

Chile has been closely associated with development of the PVR mechanism in 1998, although the U.K. first pioneered a similar technique for projects in the Dartford Bridge and the Second Severn crossing projects (Engel et al, 2014, p.67). Under a PVR, the MOP sets the following parameters:

- Construction program requirements;
- Operations and maintenance (O&M) requirements;

- Toll rate and schedule; and
- Discount rate.

The Developer prepares the construction and O&M cost estimates, secures debt and equity commitments, and submits its bid for the lowest PVR that is acceptable to it. The winning bidder receives toll revenues during the concession. The revenues are discounted each year by the discount rate set by the MOP. The concession ends once the bid PVR amount is reached.

While Chilean law establishes a maximum concession period of 50 years, MOP can terminate PVR contracts after twelve years, allowing flexibility should project circumstances change, including the need for enhancements that the original Developer would not be able to or willing to take on, or if there were any other issues with the Developer (Engel et al, 2014). This is not dissimilar to a "put and call option" suggestion of Quiggin (2005), allowing an Agency or a Developer to terminate a concession contract through a pre-determined payment structure. Some U.S. P3 contracts also have such a mechanism in which an Agency must pay a portion, but not all, of outstanding senior debt if it terminates the P3.

The first highway PVR was Route 68 in Chile (Engel et al, 2014). The project was procured through a PVR process and received a minimum revenue guarantee (MRG), as discussed below. The winning bid came in lower than MOP's estimates, possibly because the MOP had underestimated how much the PVR and MRG mechanisms had reduced project risks.

The advantages of the PVR mechanism for Chilean P3s were as follows:

- Revenue risk was reduced, thereby reducing the financing premium for such risk (Engel et al, 2000; Albalate, 2009).
- It reduced the required amount of MRG that was required.
- The early termination provision gave the MOP flexibility and leverage over the Developer in future negotiations, such as in pricing the cost of project expansions.
- Payments to the Developer typically did not begin until project completion, incentivizing the Developer to meet deadlines, similar to "milestone" payments in APs.

A disadvantage of PVR was the perception that the Developer would earn a return regardless of the Developer's quality of customer service. They might not adequately manage O&M and/or devote too few resources to it. Demand is inelastic in response to service quality, as can be the case for highways, ports, water facilities, and airport runways (Engel et al, 2014). However, Engel et al argue that this is less an issue in road concessions, where service quality can be easily monitored through contracts with clear performance measures.

Academics have suggested a remedy to this is to have Developers specify key O&M costs, such as annual upkeep costs or major overlays, allowing for these services to be bid separately. This may make negotiating these costs between Developer and Agency easier, in those circumstances when project changes result in much different O&M costs, such as a tunnel or a road in an area subject to greater snow removal (Rus and Nombela, 2000).

PVR contracts were first used in Europe in Portugal's first highway concession, the Litoral Centro Highway. In that P3, the contract would end if one of the following events would occur:

- If the present value of the revenues reached the bid mark (€784M) before the 22nd year of the concession, the concession would end in 2022. The year of award of the concession was 2003 (Vassallo, 2010).

- If the present value of the revenues reached the bid mark between the 22nd and 30th year of the concession, the concession would end when the bid mark was reached.
- If the present value of the revenues had not reached the bid mark by year 30, then the concession would end in that year, ostensibly at a reduced return or loss to banks and the equity investors, if they were not fully repaid.

The Litoral Centro Highway utilized the 12 month Euribor rate as the discount rate, providing a natural interest rate hedge. Later Portuguese P3 transactions, however, did not follow a flexible-term concession PVR (Engel et al, 2004, p.118).

I.1.3 Minimum Revenue Guarantees and Other Risk Mitigation Measures

Chile used the PVR mechanism in conjunction with other risk mitigation measures, including both direct and contingent subsidies (Engel et al, 2014). Of the 26 Chilean highway concessions between 1992 and 2004:

- 15 were awarded with some form of upfront grant or subsidies;
- 20 received MRGs; and
- 22 included revenue sharing.

MOP offered MRG bands as high as 80%-85% of expected revenue with MOP paying the MRG if it fell below that year's guarantee level, for which bidders would pay a guarantee fee of 0.75% of the MRG amount. In one competition, two of four bidders did not want the MRG as the PVR adequately mitigated risk. Furthermore, Developers who opted for the MRG requested them to be weighted to the early concession years, reflecting Lenders liquidity concerns (Gómez-Lobo, A., 2000).

MRG payments were treated as another form of revenue in PVR bid projects and therefore included in the PVR amounts that the Developer received (Engel et al, 2000). This meant that MRG and PVR mechanisms could effectively be combined. PVR was both a bidding criterion as well as a method to equitably share revenue risk. MRG played an important role in providing short-term liquidity essential to cover debt service.

In non-PVR projects with a MRG, revenue sharing was triggered when the return of cumulative revenues reached an internal rate of return (IRR) of 15% (Gómez-Lobo, A. 2000). When that trigger was reached, the MOP would share with the Developer 50% of those revenues that exceeded the IRR trigger band (Vassallo, 2006). This cumulative IRR approach, a revenue "cap," is similar to many U.S. P3 provisions. In contrast, MOP paid the MRG on an annual basis when revenues were below the minimum, a revenue "floor," reflecting Lenders' needs. This is an "asymmetric" arrangement — cumulative for the cap and annual for the floor — but necessary to secure financing (Gómez-Lobo, A. 2000).

Table 8 shows that there were only four attempted Chilean PVR projects out of a total of 26 projects, two of which were successfully awarded (Vassallo, 2006). In the Talcahuano–Penco road (Ruta Interportuaria) concession, a PVR was offered, but bidders sought a subsidy instead.

Table 8: Use of LPV of Revenues on Toll Road Projects in Chile (Vassallo 2006)

Project	Year of Tender	Investment[1]	PVR[2]	Maximum Term	Number of Bidders[3]	Situation
Santiago–Valparaiso	1998	$340M	$381M	25 years	4	Successfully awarded, in operation
Costanera Norte	2000	$384M	—	30 years	0	Not awarded, tendered again a year later under other economic variable
Talcahuano–Penco	2001	$19M	—	31.5 years	2	Awarded, bidders requested a subsidy instead of PVR
Acceso Nororiente	2003	$165M	$346M	40 years	1	Successfully awarded, in operation

[1] Investment predicted by the government.

[2] Present value of the revenues offered by the granted bidder.

[3] Bidders in the last stage of the project.

I.1.4 Revenue Distribution Mechanisms

Due to the Chilean economic crisis of 1998 to 2002, many Developers sought to renegotiate concessions. To handle these renegotiations, MOP developed "Revenue Distribution Mechanisms (RDM)," which required Developers to make expansions to those projects in financial distress in return for one of three revenue guarantee alternatives, reflecting different annual revenue growth rates, of 4, 4.5, and 5 percent. Essentially, MOP required higher investments in return for guarantees of more revenues. These RDMs had a PVR element to them with the concession finishing early if certain revenue marks were achieved. It appears that most of these RDMs were carried out through bi-lateral negotiations, instead of open competitions, which raised the question whether MOP was receiving market-based bids. The renegotiations and the introduction of the PVR and RDM mechanisms are part of the evolution of the Chilean P3 program towards improved risk sharing arrangements, a theme common to many P3 programs.

I.1.5 Developer Exit Strategy

With the economy stabilizing and projects maturing, the ownership of the original Chilean P3s has changed. Chilean Developers have sold some or all of their concession interests to pension funds and other institutional investors once projects were completed and exhibited steady cash flows (Engel et al, 2014, p.88). This practice began in 2010 and as recently as July 2015, Hochtief sold a 50% share in the Tunnel San Cristóbal toll highway (Hochtief, 10/4/2012).

I.2 Brazil: Moving Towards More Revenue Risk Protection

Brazil evolved from providing internal rate of return balancing or regulated return mechanisms (RRM), contract extensions, relaxation of investment triggers, beneficial toll rate adjustments, to full MRGs. This evolution recognized the need to improve project financeability in light of overly optimistic T&R forecasts, yet it also increased the fiscal impact on Brazil's budget.[2]

I.2.1 Overview

Brazilian P3s were authorized under two laws passed in 1995 and 2004: The "Toll Concession Law" (N.º8987/1995) and the "Public-Private Partnership Law" (N.º11.079/2004), respectively. Under the first,

[2] This case was developed with published materials, an interview with representatives of ANTT on August 17, 2015 organized by the FHWA, and with Marcos Siqueira Moraes, Former Head of the PPP Unit of the State Government of Minas Gerais, and founding partner of the consulting company Radar PPP on 09/15/2015.

"Concessions" are projects that are fully funded by user fees, whereas under the second, "Public-Private Partnerships" are concessions that require a public subsidy (such as a capital grant or a service payment). Two entities under the Ministry of Transportation (MOT) manage P3s. The Brazilian Planning and Logistics Agency (EPL) manages national P3 policy, planning, and knowledge advancement and the Brazilian National Surface Transportation Agency (ANTT) directly manages concessions.

There are currently 28 highway contracts at the federal level, about 15 of which have been signed since 2000. A further 15 projects are to be tendered by 2016. Brazil experienced four distinct waves of P3 development, again demonstrating how P3 approaches evolve.

I.2.2 First Wave – 1980s to 2006

The first wave of Brazil P3s occurred in the 1980s and 1990s, during which the Brazilian government aggressively promoted P3s by offering heavily subsidized project debt from the National Bank for Economic and Social Development (BNDES). The debt tenor was generous, often matching the length of the concession of 25 to 30 years, similar to the TIFIA program's tenors of up to 35 years after substantial completion. Lenders typically required 30% equity contribution.

User demand during this first wave was very high, so actual revenues often exceeded forecasted revenues. In addition to strong demand, the more limited need for capital investment in these brownfield projects allowed Developers to earn healthy returns.

During this time, revenue risk was mostly assumed by the Developer. Concessions were awarded to the Developer offering the highest upfront fee, assuming a fixed tariff indexed to inflation that was determined by the Developer's business plan, which incorporated the Developers forecasts for traffic, revenue, operations costs, equity returns, and taxes. However, the Developer's demand risk was somewhat mitigated through adjustable tariffs. ANTT would track the project's actual rate of return against the Developer's forecast rate of return and ensure they "balanced" by adjusting the tariff appropriately. Known as the "balancing equation," this mechanism indirectly protected the Developer from revenue changes.

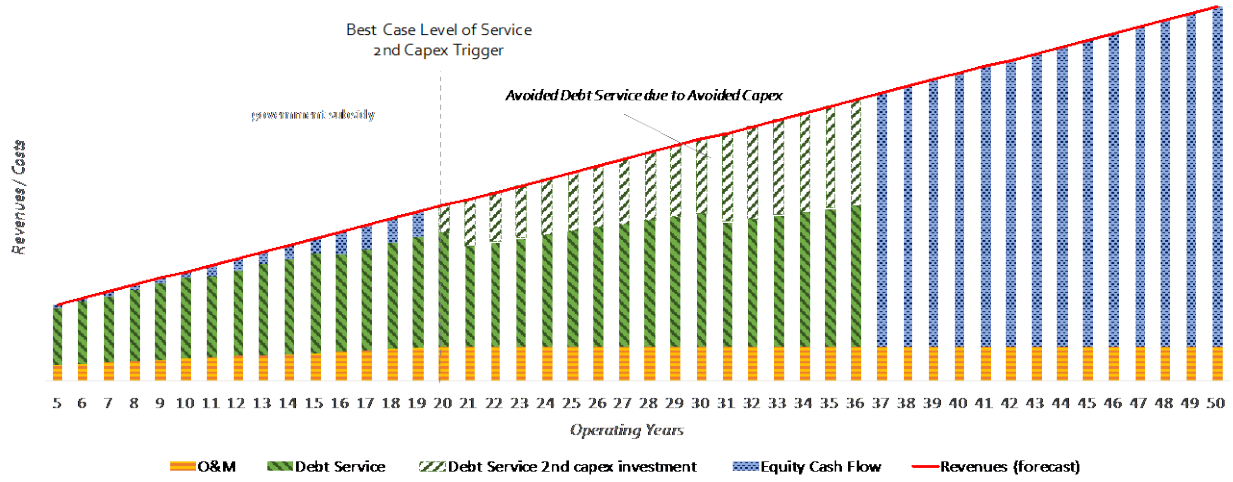
As a result of Brazil's high inflation during the 1980s and 1990s (Stratfor Global Intelligence, 2015), risk free returns were very high, driving up Developer IRRs to as high as 45%. Once macroeconomic conditions stabilized, equity IRRs settled to around 10%. ANTT introduced other mechanisms during this period to ensure performance, such as penalties and incentives for safety, construction delays, accident rates, etc.

I.2.3 Second Wave – 2006 to 2008

During the second wave of P3s, ANTT required higher levels of investment**.** Because it was imposing higher capital investment requirements on Developers, ANTT decided to assume more demand risk and alleviate the financing risk, making the following changes:

- ANTT removed the upfront concession fee requirement and used the tariff level as a bidding criterion.
- ANTT introduced a demand risk mechanism, the "investment trigger," allowing the deferral of 2nd stage capital investments (capex) based on traffic. For example, new lane construction would be triggered when demand met a pre-defined threshold. As illustrated in Figure 10, if the investment trigger was not achieved, the Developer would not make the 2nd stage capex and not take on more debt.
- To prevent excess Developer profits, ANTT defined the IRR contractually in the concession, limiting it to 9% (Amorelli, 2009, p. 20).
- In order to ensure fairness of rates for both users and the Developer, ANTT permitted toll rates to be revised every five years (Amorelli, 2009, p. 22).

Figure 10: Illustration of Brazilian Investment Trigger Mechanism



I.2.4 *Third Wave – 2009 to 2014*

Following a period of failures experienced during the second wave which were exacerbated by the global financial crisis, ANTT introduced additional modifications to the "balancing equation:"

- It included a schedule of tariff increases in the tendering criteria.
- It relaxed the investment trigger requirement, permitting lower traffic levels of service before initiating the trigger.
- It allowed Developers to extend the concession, although this has not yet occurred.
- It also allowed direct payment for revenue shortfalls by ANTT throughout the entire operating period, called the "marginal cash flow mechanism."

I.2.5 *Fourth Wave – 2014 to Present*

By 2014, ANTT decided it needed to absorb more demand risk, as toll roads in this wave were not located in areas with as strong demand as those in the previous waves. ANTT introduced formal revenue sharing bands, with 50% of revenues in excess of ANTT's revenue forecasts shared with ANTT and shortfall of revenues below 40% of the forecasts paid as a subsidy. Through this mechanism, ANTT effectively provided a MRG, reducing the revenue risk.

Table 9 shows the evolution of the Brazilian federal P3 program's revenue and financing mitigation measures.

Table 9: Evolution of Brazil's P3 Program Related to Revenue Risk-Sharing

Risk Management Mechanism	Focus of Mechanism	Wave	Function and Benefits
Balancing equation	Revenue	1st	Tariff adjusted so that actual revenues matched forecasted revenues. Provided downside protection but no MRG.
Investment trigger	Financing	2nd	Capital investment triggered by demand milestones. Not a revenue guarantee mechanism, but reduced financing risk.
Toll rate revisions	Revenue	2nd	Tariffs could be revised every five years. Not a revenue guarantee mechanism, but did reduce revenue risk. Same as IRR Balancing.
Relaxing of investment trigger	Financing	3rd	Further reduced financing risk by allowing demand to increase beyond original trigger's threshold.
Concession extension	Revenue	3rd	Extended revenue collection period. Has not been used to date.
Marginal cash flow mechanism	Revenue	3rd	Provided a subsidy in the event of a revenue shortfall.
Revenue bands	Revenue	4th	50% of excess revenues are shared with ANTT, whereas the shortfall below 40% of the forecast are paid as a subsidy.

As can be seen in the table above, the early measures allowed the Developer to adjust tariffs or defer capital expenditures, addressing revenue and financing risks. The later measures provided subsidies in downside situations through a limited and then more comprehensive MRG.

I.3 South Korea: Evolving Minimum Revenues Guarantees

South Korea's experience best illustrates how a MRG mechanism evolved over time from being generous to one that appears to have a better balance of benefits between Agency and Developer. South Korea also used of innovative financing through government loan guarantees and upfront capital subsidies.[3]

I.3.1 Overview

Spurred by rapid economic growth in the 1990s, South Korea initiated a number of P3s with the signing of the 1994 PPP Act and subsequent amendments in 1999-2000 that included a MRG (Park 2014). The South Korean government's institutions dedicated to promoting P3s included: 1) PIMAC (South Korea's key P3 agency), 2) the affiliated South Korean Development Institute (KDI), South Korea's leading think tank, and 3) South Korea's Credit Guarantee Fund, established to support P3s in 1994.

Under these acts, most projects were eligible for a 20-30% construction subsidy. The lowest required construction subsidy became the primary basis for award. Concession terms were fixed at 30 years but could be shortened or extended.

I.3.2 Minimum Revenue Guarantee Scheme 1999-2009

The initial MRG mechanism guaranteed 80% to 90% of revenues for the entire operations period. For example, the Soojungsan Tunnel had a 90% guarantee and 110% cap on forecasted revenues, while the Incheon Grand Bridge had an 80% guarantee and a 120% cap (Macquarie 2015).

Project debt was frequently guaranteed by South Korea's Credit Guarantee fund or provided by the government, so that the MRG served effectively as a "double guarantee" for debt, which helped in case the payments from South Korea's Credit Guarantee fund were delayed.

[3] This case study drew upon both published materials and an interview with Soojin Park, the head of the Policy Team for South Korea's Public and Private Infrastructure Investment Management Center (PIMAC).

The Seoul Incheon International Airport was procured as a P3 at end of the Asian Financial Crisis in 1999 with the selected Developer bidding an IRR of over 20%. At the time the project was considered a national priority in preparation for the 2002 World Cup. PIMAC has had to pay a large amount of revenue guarantees.

Because of projects such as the airport, PIMAC realized it was over-exposing itself to revenue risk, so in 2003 it changed the scheme to cover just 15 years of operations with its exposure progressively reduced over time: 90% of the revenue was guaranteed for the first five years of operations, followed by 80% for the next five years, and 70% for the final five years, as shown in Table 10.

One of PIMAC's chief concerns with regard to the MRG mechanism was its continued exposure to most revenue risk while higher returns were all but assured to the Developer. Moreover, the scheme incentivized Developers to overestimate future demand, thereby allowing them to make more claims on revenue shortfalls. In fact, according to Kokkaew and Chiara (2011), PIMAC significantly exposed itself to this contingent liability because in most cases, actual revenues were falling well short of the guarantee levels.

In 2006, the revenue guarantee period was reduced from 15 years to 10 years, with 75% of the revenues guaranteed during the first five years and 65% guaranteed during the final five years. The MRG would also now apply only to solicited (but not unsolicited) proposals. The updated MRG scheme addressed PIMAC's concern regarding overly optimistic Developer forecasting by stipulating that the MRG was only valid if actual revenues were greater than 50 percent of the forecasted revenue ("50 percent feasible exercise condition"). The Seoul-Chuncheon Expressway, completed in 2009, followed this model (Macquarie 2015). This unique feature meant that Developers had to be highly confident of their forecasts, since there was no support below 50% of forecasted revenues.

The degree of revenue sharing by PIMAC varied by project, but only occurred when actual revenues exceeded the Developer's forecasted revenues. In the case of OOO Urban Railway PPP project, completed in 2002, PIMAC collected revenues exceeding 120% of forecasted revenue from operations years 0 to 5, and exceeding 130% from years 6 to 10 (Park, 2013).

I.3.3 Minimum Revenue Guarantee Scheme -- 2009 to Present

In 2009 PIMAC abandoned the MRG scheme and replaced it with a "New Risk Sharing Scheme." In addition, since September 2015, PIMAC has been developing a standard concession agreement, financial model, and RFP tailored to this new scheme, which works as follows:

- The "Designated Risk Sharing Revenue" is no longer based on the Developer's forecasted revenue, but rather on an economically determined cash flow correlated to the project's investment cost and the risk free cost of capital. In essence, it is the gross operating revenue that guarantees an internal rate of return, only on initial capital costs, comparable to a five-year government bond, which can be updated every five years. This has some similarities to a rate of return approach as discussed below.
- When the actual operating period revenue is less than the risk sharing revenue, PIMAC makes up the difference and pays the Developer the shortfall amount. The Developer is eligible for this scheme throughout the operations period.
- In order to be eligible for the subsidy, actual revenues must still be 50 percent or more of the risk-sharing revenue.
- When actual gross operating revenue exceeds the Developer's gross forecasted revenue, excess revenue is either used to lower toll rates or to fund future subsidies.

According to PIMAC, the new scheme has the following benefits:

- It supports the private sector's investment **throughout the operating period**.
- It reduces PIMAC's exposure by setting a maximum amount upfront rather an amount that could vary during the P3 term. It reduces Developer's moral hazard associated with the forecast "optimism bias" by anchoring the risk sharing revenue to the project's cost and the IRR at the government's risk-free rate of return.
- It promotes interest only from Developers who can confidently bear significant downsides particularly during earlier years.
- It reduces the overall cost to the public by transferring excess revenues back to the public to fund future subsidies or lower user tolls.

Table 10 shows how MRG levels progressively decreased from 80%-90% of forecasted Developer revenues for the entire concession period to 75%-65% in the first and second five years respectively, and to the latest scheme which was based on PIMAC's forecasts.

Table 10: Evolution of South Korea's MRG Levels, 1999 to 2009 (Park, 2014)

Period	Years 0 to 5	Years 5 to 10	Years 10 to 15	Whole Period	Additional Requirement
1999 to 2003				80% to 90%	No minimum revenue requirement.
2003 to 2006	90%	80%	70%	N/A	Actual revenues must be at least 50% of forecasted revenues.
2006 to 2009	75%	65%	N/A	N/A	Actual revenues must be at least 50% of forecasted revenues. Only solicited projects eligible.
2009 to present	N.A. (New Risk Sharing Scheme introduced)				Actual revenues must be at least 50% of forecasted revenues. The revenues are forecasted by the Agency based on investment costs and risk free interest rate.

Even with the 50 percent feasible exercise condition, past MRG schemes were subject to public criticism for excessive Developer profits and the disproportionate PIMAC revenue risk transfer, forcing PIMAC to substitute its own forecasts for the Developer's in the latest scheme. It is too early to know if this creates more VfM since new projects are not yet operational. However, competition under this scheme continues to be strong, so it does not appear to be a deterrence.

I.4 Evolution of P3 Programs in Chile, Brazil, and South Korea

The P3 programs in Chile, Brazil, and South Korea have evolved over the last two decades as these and other Agencies struggle to find the right revenue risk sharing balance. In order to understand why countries affected by the same revenue risk sharing issues take different approaches, it is important to acknowledge the differences in experience and issues each country encountered. In the case of Chile, frequent renegotiations led the government to conclude that Developers should be better protected from revenue risk. As a result, Developers were offered various mechanisms including PVR and MRG. Similarly, in Brazil the mechanisms offered to Developers provided increasingly more revenue risk protection.

In the case of South Korea, the rationale for changing their approach was different. South Korea started with a very lucrative revenue sharing mechanism, from the Developers' perspective, that resulted in returns perceived as excessive by the general public. In the face of public criticism, the Agency scaled back and reformed its generous MRG. Furthermore, it introduced a clause that would keep Developers from receiving public support if less than 50% of the projected revenues were realized. This unique clause exposed Developers to significant downside revenue risk, which is the opposite of what other countries struggling with

revenue risk sharing have done. However, taking into consideration the previous experience with perceived excessive returns, the South Korean approach is understandable.

Programs in other countries have evolved as well, including in Colombia and Mexico. For instance, the short concession terms and low actual traffic in Mexico forced the government to bail out many road concessions.

Extrapolation from the experience of these countries to the U.S. must be done carefully. The general takeaways for the U.S., discussed in Section 3, are that:

- Imperfect revenue risk transfer has resulted in renegotiations, which were either less transparent and/or threatened the competitive processes' credibility.
- Contingent support mechanisms, such as MRGs, are promising mechanisms that U.S. Agencies may consider in improving financeability.

I.5 Combined Availability Payment and Revenue Risk Mechanisms

This section presents the experience in other countries that have utilized revenue risk sharing mechanisms in toll road and transit financings. Since there is less of a toll road tradition in these countries, these are more "one-off" examples rather than descriptions of evolving revenue risk approaches or programs.

I.5.1 A25 Bridge Availability Payment and Revenue Risk, Canada

The Autoroute 25 concession in Québec, Canada is a unique example of an AP P3 coupled with a revenue risk sharing mechanism. The project includes a four-lane 4.5 mile road and six lane 0.75 mile cable-stayed bridge between Montréal and Laval. Operations commenced in 2011. A dynamic toll system allows tariffs to increase beyond the maximum rate when the traffic reaches a certain threshold, serving as a congestion management mechanism (Parsons, 2015).

The 35-year concession includes four years for design and construction activities and 31 years for operation, maintenance, and rehabilitation activities. The Developer, "Concession A25," is responsible for design, construction, financing and operations. The Ministry of Transport has responsibility for toll collection and remittance of the toll revenues via APs. The APs are subject to availability and performance deductions (APEC 2014).

The revenue sharing mechanism works as follows:

- Provided that the toll lanes are available and the electronic toll equipment is operational, the Agency will guarantee up to 60% of the Agency's forecasted revenues.
- The Developer receives actual revenues between 60% and 120% of forecasted revenues.
- The Agency and Developer share equally all actual revenues exceeding 120% of forecasted revenues.
- An additional lane may be added in each direction should demand require it.

The AP component of this transaction is effectively a MRG. By including both downside protection for the Developer and upside revenue sharing, the Agency helped reduce the risk profile of the project while also potentially securing its own future revenues.

I.5.2 Variable Availability Payments in Spain

Some AP mechanisms in Spain allow the Developer to charge higher tolls depending on the Agency's road condition evaluation. This is similar to the remedy that Brazil allowed Developers in that country's IRR balancing mechanism. Such an approach only works if the demand is sufficiently inelastic, which has not been

the case for Brazil and U.S. P3s. This approach contrasts with most U.S. AP mechanisms, which impose a penalty for poor road conditions (Vassallo, 2006).

I.5.3 Transit and Rail Examples

In transit concessions, Agencies can shift some of the revenue risk of bus, light rail and rail operations, and intermodal facilities to Developers. These are primarily arrangements in which the Developer is incentivized to increase ridership while still receiving a minimum payment for providing the service in the form of an AP. Some examples are listed below.

- In the U.K., the $9B Channel Tunnel Rail Link concessionaire receives a partial AP. Approximately 60% of total revenues are based on availability and funded by the U.K. government. The remaining revenues are exposed to demand risk, from international rail companies. Besides this demand risk, the company is also subject to retail and parking revenue risk (Fitch Ratings, 2015).
- In Vancouver, Canada, the $1.47B Canada Line, a light rail system, shifted some revenue risk to the Developer (10% of the AP). The other payment criteria were vehicle availability (70% of the AP) and quality of service (20% of the AP) (USDOT FTA, 2009).
- In Stockholm, Sweden, private bus operators acquire their own vehicles, take fare revenue risk, and are responsible for collections and service quality. They do not control fares or service design, but can suggest routing and frequency efficiencies (APTA, 2015, p.10).
- In Bogota, Colombia, the $1B TransMilenio bus rapid transit system shifted ridership risk to the trunk, feeder system, and fare collection operators. Each Developer receives a certain portion of total farebox revenue collected based on a pre-determined formula as well as availability and quality of service (USDOT FTA, 2009; Acosta, C., 2015).
- In Madrid, Spain, Developers of five underground bus intermodal facilities are subject to some demand revenue risk based on the number of passengers per bus. This risk is partially mitigated since approximately 36% of revenues are derived from urban and regional bus operators who are required to use the facilities. A further 28% of revenues comes from interregional bus operators that are not required to use the facilities. The remaining 36% of revenues consist of commercial rent, parking, and other income. In a form of PVR, the concession term can be adjusted to ensure that the Developer's revenues are equal to the NPV of the original investment. The contract was subsequently modified to add an MRG which was set above the estimated number of users in the early years. This made it a deliberate subsidy, apparently as a way to compensate the Developer for construction requirements beyond those set in the concession agreement (Ciommo et al, 2009).

I.6 Shadow Tolls

Under the shadow toll approach, an Agency pays a Developer based on the traffic on a non-tolled highway or on a tolled highway whose revenues the Agency retains. The shadow toll concept was developed in the U.K. to incentivize Developers to complete construction projects more quickly and/or carry out capital improvements in a way that minimized traffic impact.

While shadow tolls eliminate tolling risk—the risk that users will find the cost or inconvenience of using the toll road too onerous—they do not mitigate traffic risk for the Developer. Furthermore, revenue risk remains with the Agency if the road is tolled. Shadow tolls complicate financing and create contingent fiscal liabilities. The U.K. has moved away from shadow tolls and instead uses the AP method extensively. U.S. Agencies have considered shadow tolls, but no major projects have employed this approach.

Florida DOT (FDOT) considered an innovative approach to shadow tolling in the case of a managed lanes project, the I-595 express lanes project in Broward County, Florida. In that project FDOT would have entered into an agreement with a Developer to manage both the managed lanes and general purpose lanes, incentivizing it to maximize traffic on both facilities, within the constraints of the managed lanes free flow requirements, "thus better aligning the concessionaire's compensation with FDOT's policy emphasis of maximizing throughput for the overall facility" (Florida Department of Transportation, 2009, p.11). This was intended to address poor managed lanes use when general lanes were full and toll rates or technological issues became a barrier to their optimal usage. Such an approach could provide greater public benefits (DeCorla-Souza and Barker, 2005, p.65), while still taking advantage of the Developer's superior management capabilities to operate the facilities. Such an approach might be achieved through a two part payment, consisting of an AP sufficient to cover debt service and O&M and a shadow toll payment based on peak period vehicle throughput. This payment structure could incentivize concessionaires to maximize use of managed lanes during periods of congestion (thereby reducing congestion on regular lanes).

In comparing shadow tolls with AP and design build finance (DBF) approaches, FDOT rated the shadow toll inferior to both approaches, with FDOT ultimately deciding to award the concession on the basis of an AP. FDOT's rationale was that Developers perceived the payment mechanism as riskier. Compared to the AP, FDOT's shadow tolls alternative assumed:

- A lower debt to equity ratio, or leverage;
- Higher interest rate or related costs;
- Higher required Developer rate of return;
- Lower tolls in earlier years, increasing in later years as demand increased.

The shadow toll mechanism FDOT considered was intended to align the Developer's financial incentives with the Agency's broader societal goals such as maximizing efficient use of the managed lanes facility. Such societal benefits could also be achieved under an AP, in which the payments to the Developer could, for example, be subject to 1) lane availability, 2) performance standards (including minimum speed on the managed lane), and 3) throughput on the managed lanes, provided that the Developer maintains full control over the dynamic tolling. Moving from a shadow toll to an AP transaction would potentially reduce the perceived risk while still allowing the Agency to pursue its broader economic goals.

I.7 Other Revenue Sharing Mechanisms

I.7.1 Rate of Return

The Rate of Return (ROR) model is used extensively to regulate electric utilities, which are natural monopolies. It allows firms to recover costs and earn a "fair" return by setting a regulated price, which is calculated by establishing the rate base and the value of all fixed assets used to produce the infrastructure at the agreed upon a rate of return. As discussed, South Korea provides its MRG on a similarly calculated rate base, but does not regulate the setting of toll rates.

Public utility commissions or their equivalent state regulatory agencies generally set prices on a periodic basis (such as every five years). The price base must guarantee financial feasibility, be lucrative enough to attract investment, and provide companies with returns similar to others with comparable risks (Buckberg, Kearney, and Stolleman, 2015).

ROR has rarely been used to regulate U.S. P3 toll roads. One private toll road, the Dulles Greenway, in the Washington, D.C. area, is regulated on the basis of ROR by the Virginia State Corporation Commission (VSCC), Virginia's public utility commission. The project entered technical bankruptcy in the 1990s, was

restructured, and sold to Macquarie. Because of this loss of equity, VSCC has allowed Dulles Greenway to set its tolls as necessary, which Dulles Greenway has done subject to elasticity constraints.

I.7.2 Price Cap Regulation

Price Cap regulation gained popularity as a result of the deregulation of infrastructure in the U.K. in the 1980s and 1990s. Just as in the ROR model, the price cap mechanism protects consumers from excessive prices, while allowing the project sponsor to transfer the demand risk entirely to the private partner. The company is subject to price ceilings; yet the amount of revenues it receives are not regulated. The company maximizes its profits by fostering cost efficiency mechanisms. Price caps may also be set on a periodic basis, such as every five years.

As with ROR, U.K. price cap regulation has mostly been applied to large monopolies, such as utilities or commercial airports. It has generally not been applied to P3 toll roads.

I.7.3 United Kingdom's PF2 Public Equity

The United Kingdom (U.K.) is rethinking its approach to P3s under its new P3 program, PF2. This has included a new policy allowing the national government to serve as a minority investor in future P3 projects. The purpose of this approach is to:

- Have greater alignment of interests between the public and private sectors;
- Ensure that the public sector has greater access to project information and allow for increased transparency, including financial performance of the project company; and
- Increase VfM, including more optimal sharing of project financial risk (HM Treasury 2012).

This approach is somewhat new for the U.K. and many other countries. However, some countries, such as Mexico, have required partial public ownership in infrastructure project companies, such as airports. Several questions will need to be answered in assessing this approach as a revenue risk transfer mechanism:

- Does it increase the overall level of project equity and thereby reduce debt?
- Will private shareholders receive a preferred dividend as has been the case in some similar arrangements?
- Does this arrangement change the contractual obligations of shareholders to lenders?

This approach may be another way for Agencies to better share risk and is an area that needs to be researched once relevant cases and data become available.

Appendix II Valuing Cost of Revenue Sharing Mechanisms

Determining the cost of a revenue risk sharing mechanism for an Agency can be challenging. In particular, mechanisms that include contingent liabilities, such as MRG and CFS, are difficult to evaluate quantitatively. However, in order to compare different mechanisms, an Agency may want to estimate the cost of different revenue risk sharing mechanisms. This Appendix provides a number of key considerations for evaluating revenue sharing mechanisms.

- **Traffic and revenue (T&R) projections**: To evaluate any revenue risk sharing mechanism understanding the T&R projections is essential. Best practice suggests that Agencies should work with an investment grade T&R forecast from a reputable firm, sometimes prepared for the Developer, and a "Lender's" forecast prepared on behalf of the Lender. One or both of these forecasts should employ risk analyses to project T&R levels in severe downside cases, preferably in the form of a probabilistic T&R analysis (see Section 2.3 for more discussion). All of these forecasts should be reviewed and revised by Agency officials, T&R professionals, and others who are well-acquainted with the facility. The final base case and downside forecasts will form the basis of the analysis discussed below.
- **Fiscal impact**: The nature of the revenue risk sharing mechanism and its underlying cash flows need to be fully understood. In particular, the Agency will need to evaluate how the Developer will be protected by each of the mechanisms under various (probabilistic) revenue scenarios as well as the fiscal implications on the Agency's balance sheet. This evaluation can be carried out using a separate financial model for each revenue risk mechanism to determine the cost to the Agency (and the protection to the Developer) under downside scenarios. The financial model developed for this Discussion Paper does this for each of the mechanisms. The model should consider both the costs to the Agency as well as potential toll revenues that the Agency may receive under the mechanisms. If the analysis uses a probabilistic T&R study, the Agency can develop a probabilistic projection of the fiscal impact of the mechanisms in any given year. The resulting cash flows give the Agency a clearer idea of the liabilities it is accepting.
- **Impact on financing conditions**: Financing conditions depend to a large extent on the project's risk profile. If a mechanism reduces project risks from the Developer's perspective, financing conditions will most likely become more attractive. Specifically, Lenders may accept higher leverage, lower interest rates, and/or lower debt service coverage ratios. Equity investors may also lower their required return on equity. As a result, a revenue risk sharing mechanism that decreases the project risk profile will most likely result in a lower weighted average cost of capital (WACC) compared to a project with full revenue risk transfer. Bidders can therefore improve their bids (i.e. higher concession fee, lower required subsidy, more revenue sharing, and/or lower AP) knowing that they will be exposed to lower revenue risks, thus creating more value for the Agency. However, it is difficult to determine to what extent the WACC will be reduced under different mechanisms. As guidance, one could look at two extremes in revenue risk allocation. Under an AP, there is no revenue risk transfer to the Developer, which should be reflected in a lower WACC. Under a revenue risk concession, the full revenue risk is transferred to the Developer, leading to a higher WACC. A mechanism that shares the revenue risk between the Agency and the Developer would logically result in a WACC that lies between the two. However, the WACC is always project specific so generic numerical guidance is not possible. In order to evaluate the potential impact of a given revenue risk sharing mechanisms on P3 bids (and therefore ultimately on the Agency's budget/balance sheet), the Agency could develop a financial model and perform a sensitivity analysis on key P3 financing conditions (leverage, interest rates, debt service coverage ratios). This would help the

Agency understand how a change in P3 financing conditions as a result of more or less revenue risk protection for the Developer may impact the Agency.

- **Combined fiscal impact on Agency**: The ultimate fiscal impact of a revenue risk sharing mechanism depends on the payments it makes and the revenues it receives under the mechanism as well the change in bid values due to more attractive financing conditions. Ideally, Agencies would determine the net present value of both the fiscal impact of the revenue risk sharing mechanism cash flows on Agency as well as the change in bid costs due to different financing conditions, for all revenue risk sharing mechanisms. Due to the uncertainty of many of the assumptions, such quantitative assessment may be difficult. However, by undertaking the above steps, the Agency will be in a better position to evaluate qualitatively (and to a certain extent quantitatively) the potential fiscal impacts of alternative revenue risk sharing mechanisms.

Besides valuing the fiscal impacts of the alternative revenue risk sharing mechanisms, the Agency must also consider the mechanisms' impact on Agency accounting and budgeting. For example, the rules for accounting for contingent liabilities vary by state making it difficult to budget for liabilities beyond the current planning period, often no more than five years. The same is true for the credit rating agency recognition of toll revenues. As discussed, credit rating agencies will generally fully count APs on Agency balance sheets if they are reliant on toll revenues for at least the first three years of a new project.

Appendix III Glossary

Term	Definition/Explanation
Agencies	DOTs and other public transportation agencies that provide highway and/or transit infrastructure and/or services.
AP	Availability payment.
B	Billion.
Concession	Used interchangeably with P3, a long-term contract between a Developer and an Agency in which some or all of the following services are provided: design, construction, financing, operations, maintenance.
CFS	Contingent finance support
Developers	Usually organized as a special purpose vehicle, a company or a group of companies that provide some or all of the following services in a highway or infrastructure P3: design, construction, financing, operations, and maintenance. Developers are usually dominated by Strategic Investors, yet may include Financial Investors (see definitions).
DOT	Department of transportation at a local, state, or federal level.
DSCR	Debt service coverage ratio.
Equity Investors	Strategic and Financial Investors. Most Developers include Equity Investors.
Financial Investors	Private equity funds, pension funds, and other institutions that invest in infrastructure projects, independent of "strategic" motives, such as those of contractors, suppliers, or operators. See Strategic Investors.
IFI	International Financial Institution (such as the the World Bank, Inter-American Development Bank, European Investment Bank).
Lenders	Financial institutions and their intermediaries that provide debt in the form of loans, bonds, and private placements. These can include commercial banks, credit agencies, investment banks, insurance companies, and government lenders (such as the USDOT TIFIA program or state infrastructure banks). Providers of deeply subordinated capital would be consider Equity Investors in this Discussion Paper.
M	Million.
MRG	Minimum revenue guarantee.
O&M	Operations and maintenance.
PVR	Present value of revenues.
P3	Public-private partnership, used interchangeably with concession.
Secondary Market	The market of primarily Financial Investors that buy into concessions once the project has been completed and is operating successfully.
RRM	Regulated return mechanism.
Strategic Investors	Strategic investors are firms that make equity investments in a P3 with the goal of obtaining strategic benefits, such as a related construction, O&M, and/or supply contracts. Strategic Investors usually are the primary shareholders of most Developers. Once a project is completed and demonstrates stable cash flows, the strategic investor may sell some or all of its ownership in the P3 to Financial Investors, depending on the ownership requirements of the P3.
T&R	Traffic and Revenue
TIFIA	Transportation Infrastructure Finance and Innovation Act
VfM	Value for Money
WACC	Weighted Average Cost of Capital

Appendix IV Respondent Organizations

From July 2015 to October 2015, in-person and conference call discussions were held with more than 25 representatives of the following types of institutions:

- Agencies: primarily state departments of transportation and related state agencies;
- Developers: U.S. and international firms active in the US;
- Law Firms: Firms active in the U.S. P3 market;
- Lenders: commercial banks, investment banks, and credit rating agencies; and
- University, Think Tank, Policy Office: U.S. and international institutions whose academics, researchers, or policy analysts actively participate in this field.

Respondent Type	Respondent Entity
Agency	Brazilian National Surface Transportation Agency (ANTT)
	Former P3 executive with the State Government of Minas Gerais, Brazil
	Colorado High Performance Transportation Enterprise
	Maryland Department of Transportation
	North Carolina Department of Transportation
	Texas Department of Transportation
	Virginia Office of Public-Private Partnerships
Developer, Strategic Investor	ACS Dragados
	Cintra
	Macquarie
	Fluor
	Former U.S. executive of US-based Developer
	Kiewit
	Plenary Group
	Transurban
Financial Investor	Meridiam
Law Firm	Nossaman LLP
Lender	Bank of Montreal
	Barclays Capital
	Fitch Ratings
	Moody's
	Standard and Poor's
	Sumitomo Mitsui Banking Corporation
University, Think Tank, Policy Office	Cornell Program in Infrastructure Policy
	Polytechnic University of Madrid
	Reason Foundation
	South Korea's Public and Private Infrastructure Investment Management Center
	University of Minnesota, Department of Civil, Environmental, and Geo- Engineering
	U.S. Department of the Treasury

Appendix V Literature Review

The academic literature is rich on major revenue risk sharing mechanisms as shown below. Engel et al have written extensively on PVR and on the challenges of P3 negotiations and economics worldwide. Vassallo has also written on Chile's PVR method as well as on other risk sharing guarantees and mechanisms used in P3s. A number of economists have written on estimating the costs of guarantees, such as Aldrete, R., A. Bujanda, G. Valdez-Ceniceros. The World Bank has published a number of case studies on country-specific P3 programs and guides on guarantees and P3 tools. The Discussion Paper relied on trade publications for data on more recent transactions and tweaks to MRG, CFS, and AP + Revenue mechanisms.

In Brazil, Chile, and South Korea, P3 programs and their respective revenue risk sharing mechanisms have evolved over the last two decades as Agencies struggle to find the right risk sharing balance, seek VfM, and ensure that Developers maintain interest in their P3s. Other countries, including Colombia, Mexico, and Spain, have undergone similar evolutions. Engel et al, 2014 has a comparative chapter and the USDOT FHWA, USDOT FTA, and trade groups like APTA have commissioned international case studies that provide analysis comparing country approaches.

The greatest literature challenge is to find analysis that gets "into the weeds" of specific transactions to evaluate how respective mechanisms actually worked—for Agencies, Developers, Lenders, and others. This analysis would require confidential forecasts and financial models from both Agencies and Developers. For some projects, a conclusive analysis of the value of the revenue risk sharing mechanisms cannot be made until the concession contracts are complete or at least nearly complete—in twenty plus years.

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