Guidebook on Estimating Costs of Capital for Value for Money Assessments

February 2023

BUILD AMERICA CENTER
INNOVATIVE FINANCING AND DELIVERY
OF TRANSPORTATION INFRASTRUCTURE

Guidebook on Estimating Costs of Capital for Value-for-Money Assessments

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Commissioned by:
Build America Center

Date:
February 2023

Status:
Final

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Executive Summary

The Bipartisan Infrastructure Law (BIL) requires that the Department of Transportation develop guidance on the "expected rates of return" to be used in value-for-money (VfM) assessments for projects that could be delivered as a public-private partnership (P3). As P3 consortia generally finance their projects with a combination debt and equity, the following research guide aims to provide a set of guidelines for practitioners on estimating the costs of debt and equity and an overall weighted average cost of capital (WACC) for P3 projects for early stage VfM assessments.

Cost of Capital for Debt

In the US market, the majority of P3s projects rely on debt for most of their capital financing. While this debt may take a variety of forms (e.g., bank loans, private activity bonds (PABs), publicly offered project finance bonds, private placements), this analysis focuses on the initial offering pricing of publicly traded bonds as the proxy for the debt cost of capital in a VfM analysis. As base rates change through time, this paper analyzes the "credit spreads" for P3 transactions versus an interest rate benchmark at the time of pricing--the Municipal Market Data AAA General Obligation (MMD GO) yield curve. By calculating the difference between the yields on P3 transactions and the relevant maturity of the MMD GO, the Team analyzed if there are predictable credit spreads that can be used by practitioners to estimate the debt cost of capital for VfM estimates. Overall, the research confirmed general market practitioner expectations that the following factors lead to higher credit spreads, all things being equal: (1) lower credit ratings, (2) revenue risk exposure, and (3) longer maturities. However, while these factors were statistically significant, the predictive ability of the models was low, implying that other factors--likely including market conditions at the time, differences in state taxation regimes, and other project-specific risks--have an even more significant impact on the credit spread. Accordingly, the Team developed a series of "rules of thumb" that can be used for early stage VfM analyses. By adding the appropriate credit spread from the tables below to the then current MMD GO benchmark at the time of analysis, a practitioner can analyze potential P3 debt costs of capital:

Table 1: Historic credit spreads in bps based on credit rating

Credit Spread Metric	Credit Rating			
	A-	BBB+	BBB	BBB-
Average	81	87	103	186
Standard deviation	12	24	21	66
Range (average ± standard deviation)	69-93	63-111	82-124	120-252
Rule of thumb range	**70-90**	**65-110**	**85-120**	**120-250**

Table 2: Historic credit spreads in bps based on P3 type

Credit Spread Metric	P3 Type	
	Availability Payment	Toll Concession
Average	119	165
Standard deviation	51	80
Range (average ± standard deviation)	68-170	85-245
Rule of thumb range	**70-170**	**85-245**

Cost of Capital for Private Equity

The second rate of return necessary for calculating the P3 WACC is the expected rate of return for equity or target equity return. This is the return developers/equity investors anticipate when submitting P3 bids. This metric is often not publicly available information. However, some publicly available target equity returns are available. This research collected the publicly available expected equity internal rate of return (IRR) for 22 transportation P3 projects that reached financial close between 2007 and 2017. Again, the analysis confirmed market expectations that (1) equity rates of return were higher than debt rates, due to their increased risk exposure and (2) toll concession P3s commanded higher equity rates of return than availability payment transactions. Interestingly, the data also revealed that there was less volatility associated with equity returns than with debt rates of return. Discussions with equity providers indicate that this is due to the long-term return targets associated with their funds, which did not change significantly through the respective time period. For the purposes of early stage VfM analysis, this paper suggests that equity rates of return can be estimated using the following rules of thumb:

Table 3: Equity return range based on P3 type

Equity IRR	P3 Type	
	Availability Payment	Toll Concession
Average	11.48%	12.80%
Standard deviation	1.70%	0.66%
Range (average ± standard deviation)	9.78% - 13.19%	12.14% - 13.47%
Rule of thumb range (post-tax)	**10%-13%**	**12%-13.5%**
Rule of thumb range (pre-tax)	**11% - 14%**	**13% - 15%**

The equity return for availability payment P3s will be driven by the credit quality of the public owner.

Debt-to-Equity Ratio

Once the rates of return of each of the types of capital are calculated, the next stage is to determine how much of each should be used. This is expressed as the debt-to-equity (D/E) ratio and will differ based on the specifics of each transaction. However, the Team's research indicated some rules of thumb that can be used for early-stage VfM analysis. In particular, availability payment transactions tend to have higher D/E ratios, as can be seen in the table below. In addition, practitioners may want to select a different ratio within the typical range, depending on the risk of the project or the underlying owner:

Table 4: D/E ratio average and range based on P3 type

D/E Ratio	P3 Type	
	Availability Payment	Toll Concession
Average	89/11	73/27
Standard deviation	3	9
Range (average ± standard deviation)	86/14 – 92/8	64/36 – 82/18
Rule of thumb range	**85/15 – 90/10**	**65/35 – 80/20**

Weighted Average Cost of Capital

Finally, the pre-tax WACC captures the combined overall expected rate of return for the P3, and can be approximated using the following equation:

$$\mathrm{WACC}_{\text{pre-tax}} = \frac{\mathrm{D}}{\mathrm{D} + \mathrm{E}} \times r_{\text{debt}} + \frac{\mathrm{E}}{\mathrm{D} + \mathrm{E}} \times r_{\text{equity}}$$

Where:

$\mathrm{D} =$ Debt amount (in dollars) $\quad r_{\text{debt}} =$ Interest rate for average life of debt

$\mathrm{E} =$ Equity amount (in dollars) $\quad r_{\text{equity}} =$ Expected return on equity

A detailed example calculation can be found in Section 5.2.

It is important to note that these calculations and rules of thumb are most appropriate for early-stage VfM analyses where detailed information may not be available. For more advanced stages of a transaction, when a more sophisticated financial model and deeper insight into the current state of the market will be necessary, the Team recommends retaining qualified advisors to assist with implementing these analyses.

Furthermore, we note that 1) due to the limited sample size of publicly available transaction information and 2) the fact that most of these transactions closed in times of relatively low inflation, interest rates, and market volatility, these "rules of thumb" may not continue to hold in the future as market participants reevaluate credit and price risk in their bids. Specifically, in times of higher interest rates, inflation, and volatility, it could be reasonable to assume larger credit spreads, higher rates of return, and lower debt to equity ratios, maybe even beyond the ends of the ranges presented here. Consultation with experienced financial advisors, investment bankers, and other market participants is recommended in the earliest stages of analysis for markets that reflect higher rates and volatility.

1. Background and Objective

The Bipartisan Infrastructure Law (BIL) mandates that the Secretary of Transportation, in coordination with the Build America Bureau, develop guidance, among other things, on the "expected rates of return" to be used in value-for-money (VfM) assessments for projects that could be delivered in some form of a public-private partnership (P3).

Typically, P3 consortia finance projects with a combination of debt and equity. Debt is sourced from a variety of markets with pricing (i.e., interest rates) based on i) the project's unique risk profile, ii) comparable transactions, the data of which may or may not be available publicly, and iii) broadly available base rate indices—in particular, Treasury rates for taxable bonds and the Municipal Market Data AAA General Obligation (MMD GO)[1] index for tax-exempt bonds.

For equity pricing, the target equity rate of return is set by private equity funds or developers. In many cases, developers may not voluntarily disclose their estimations of the target equity rates of returns. However, in others, these estimates are publicly available, for example, when agencies incorporate the winning bidder's target equity return at closing in the P3 project agreement. This information provides a helpful source to determine target equity returns for past P3 projects. Along with expert judgments, these data points generally provide the basis for estimates of current target equity rates of return.

To support the U.S. Department of Transportation and public project sponsors, this research effort aims to provide guidance to practitioners in estimating the cost of debt and equity for P3 projects for early stage VfM assessments. We have taken the approach of developing "rules of thumb" that practitioners can use in early-stage VfM analysis to begin the work of analyzing if a P3 seems to make sense for them. While useful, these rules of thumb are not intended to be used in more advanced stages of project analysis when then-current market conditions will be important in making a final determination. Furthermore, we note that 1) due to the limited sample size of publicly available transaction information and 2) the fact that most of the transactions used in this analysis reached financial close in times of relatively low inflation, interest rates, and market volatility, the "rules of thumb" developed herein may not continue to hold in the future as market participants reevaluate credit and price risk in their bids. Specifically, in times of higher interest rates, inflation, and volatility, it could be reasonable to assume larger credit spreads, higher rates of return, and lower debt to equity ratios, maybe even beyond the ends of the ranges presented here. Consultation with experienced financial advisors, investment bankers, and other market participants is recommended in the earliest stages of analysis for markets that reflect higher rates and volatility.

[1] See: https://www.refinitiv.com/en/financial-data/market-data/municipal-market-monitor-tm3

2. Cost of Capital for Debt

2.1 The Concept: Expected Rate of Return on Debt

Private debt for transportation P3 projects can take various forms, including bank loans, private placements, publicly offered project finance bonds, and private activity bonds (PABs). In the US market, most transportation P3 projects rely on debt for the majority of their capital structure. Given the importance of the bond markets in financing transportation P3 projects, as well as the fact that pricing on bank loans and private placements are typically not publicly available, this analysis will focus on the pricing of publicly traded bonds as the proxy for inclusion as the debt cost of capital in a VfM analysis.

For the purpose of VfM analyses, the relevant debt pricing is the initial offering yield at financial close, which is the price that the project company agrees to pay bondholders for providing debt over the bond's life. From the borrower's perspective—regardless of how interest rates move in the future—they are locking in an interest cost at financial close, and all future interest rate risk is shifted to bondholders.

The pricing at financial close is driven by the base rate—US Treasury[2] rates for taxable bonds and the MMD GO index for tax-exempt bonds—as well as a risk premium (sometimes also called a "credit spread" or "margin") that reflects the project's risk profile for lenders.

Base rates are published regularly in both publicly accessible format (US Treasury) and in industry publications (MMD GO index). They can therefore be readily updated by practitioners for VfM analyses. However, practitioners then need to estimate the credit spread to apply to these base rates to develop an estimate for their cost of debt in a VfM analysis. Understanding the credit spreads of past debt issuances can therefore be informative in estimating the cost of debt for a P3 project given a certain base rate.

<u>It is important to note that understanding past credit spreads is no assurance that future credit spreads will remain the same.</u> In particular, this analysis covers a time period of relatively low inflation, interest rates and volatility, which should be considered when using these rules of thumb to perform VfM analysis.

2.2 Drivers of the Expected Rate of Return on Debt

As the credit spread ultimately reflects the risk premium that bondholders expect to receive in return for accepting the project-specific risk, the credit spread should logically take into consideration key risk factors, such as project complexity, revenue uncertainty, counterparty risk, and how long the bonds are expected to be outstanding. Credit rating agencies such as Moody's, S&P, and Fitch each have developed their own methodologies to assess these risks and assign a rating that provides lenders with a sense of how risky the project under consideration is. In particular, all other things being equal, bondholders in a toll concession P3 who are exposed to demand risk will require a higher credit spread than bondholders in an availability payment P3 with a similarly rated underlying project owner. Furthermore, the credit rating of the agency or project owner in an availability payment P3 will likely play a key role in determining the credit spread, as its ability to make timely availability payments will ultimately determine the creditworthiness of the project. Longer-term debt typically commands a higher credit spread as lenders are more constrained in their ability to redeploy capital in the future and are taking both interest rate and credit risk for longer periods of time. Another factor that can affect credit spreads and base rates are the unique tax characteristics of the

[2] See: https://home.treasury.gov/policy-issues/financing-the-government/interest-rate-statistics

municipal bond market. The pricing of bonds with similar credit characteristics can vary by state since states have different income tax rates, thereby affecting bonds' returns and demand.

2.3 Methodological Approach

To determine historic credit spreads, the base rate at bond pricing must be subtracted from the initial offering yield. The Team collected initial offering yields on 25 PABs and fully tax-exempt municipal bonds issuances for 22 transportation infrastructure projects. Each debt issuance had multiple maturities, providing a total of 227 data points. The issuances considered for the purpose of this analysis are all uninsured current interest bonds; capital appreciation bonds and insured bonds were excluded as the premium on those reflects not only the project's risk but also the liquidity risk associated with no payments being received until final maturity for capital appreciation bonds, and the reduction in bondholder risk due to the insurance provisions for insured bonds. The table below summarizes the data used:

Table 5: P3 bond issuances[3]

Project & Issuance	Maturities		Principal	Year	P3 Type	Rating
	All	≤30 yrs				
Central 70	17	16	$114.7M	2017	Availability payment	A-
Eagle P3	17	16	$397.8M	2010	Availability payment	BBB-
East End Crossing	6	3	$676.8M	2013	Availability payment	BBB
Goethals Bridge	18	17	$460.9M	2013	Availability payment	BBB-
I-69 Section 5	9	8	$243.8M	2014	Availability payment	BBB-
I-77 Express	7	6	$100.0M	2015	Toll concession	BBB-
I-95 Express	2	2	$242.0M	2012	Toll concession	BBB-
LBJ Express	4	4	$615.0M	2010	Toll concession	BBB-
Elizabeth River Tunnels	14	14	$663.8M	2012	Toll concession	BBB-
North Tarrant Segment 1 & 2	2	2	$400.0M	2009	Toll concession	BBB-
North Tarrant Segment 3A & 3B	2	2	$274.0M	2013	Toll concession	BBB-
Pennsylvania Rapid Bridge	29	29	$721.5M	2015	Availability payment	BBB
Pocahontas Parkway	8	7	$169.7M	1998	Toll concession	BBB-
Purple Line Series A	1	1	$100.0M	2016	Availability payment	BBB+
Purple Line Series B	1	1	$23.3M	2016	Availability payment	BBB+
Purple Line Series C	8	8	$27.5M	2016	Availability payment	BBB+
Purple Line Series D	21	20	$162.2M	2016	Availability payment	BBB+
SH 288	4	2	$272.6M	2016	Toll concession	BBB-
Southern Connector	2	1	$66.2M	1998	Toll concession	BBB-
Southern Ohio Veterans Memorial	15	14	$119.0M	2015	Availability payment	BBB
Teodoro Moscosos	10	10	$137.6M	2003	Toll concession	BBB+
Transform 66	4	-	$737.0M	2017	Toll concession	BBB
US 36 Phase 2	1	1	$20.4M	2014	Toll concession	BBB-
I-75 Modernization Segment 3	23	23	$419.6M	2018	Availability payment	BBB
I-395 Express Lanes	2	2	$233.0M	2017	Toll concession	BBB
Total	**227**	**209**	**$7,398.4M**			

[3] Official Statements for each issuance, obtained from http://emma.msrb.org

Next, the Team used the MMD GO yield curve on the day of each pricing as the base rate, using linear interpolation to estimate the appropriate base rate for each maturity. Maturities above 30 years were excluded as no base rate information was readily available for those maturities, resulting in a dataset of 209 data points. Subtracting the maturity-adjusted base rate from the initial offering yield provided the margin for each maturity considered.

Using this credit spread data, the relationship between credit spread (expressed as basis points, or bps, which equals 0.01%), and maturity, credit rating, and type of project (toll concession vs. availability payment P3) will be discussed in the next sections.

2.4 Analysis and Findings

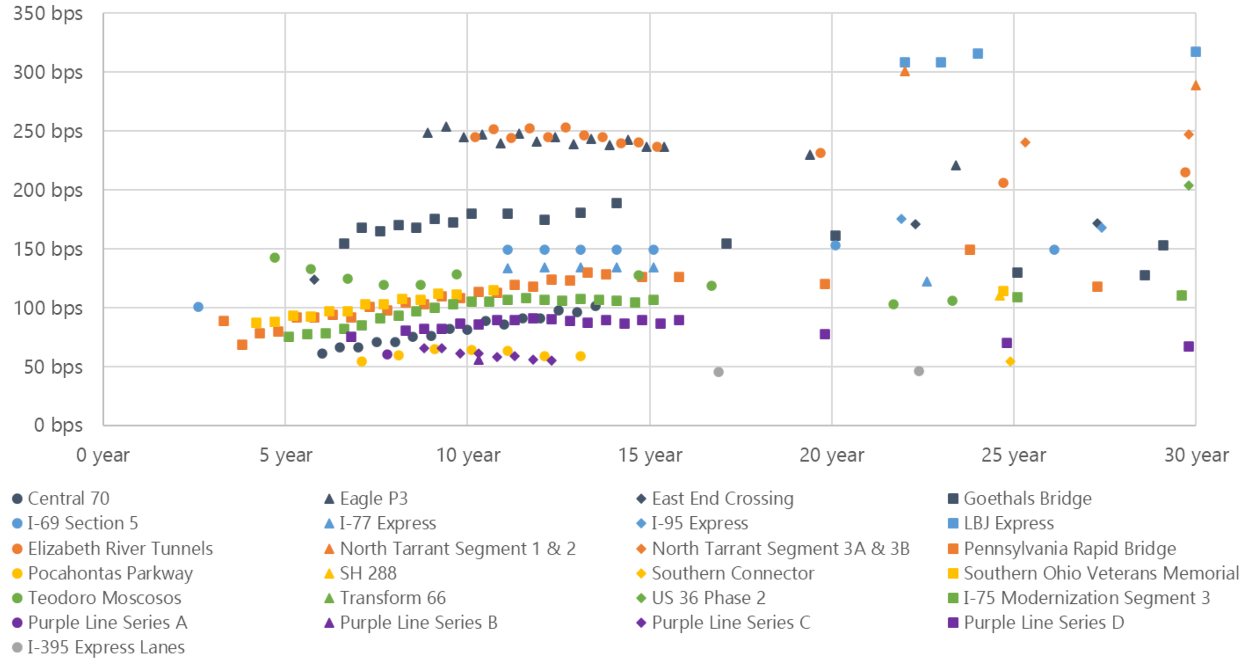
In the following sections, the effect of maturity, P3 type (toll concession vs. availability payment), and credit rating on credit spread for the selected transactions priced between 1998 and 2018 are analyzed. Whereas the next sections will analyze these variables in greater detail, readers should be aware that credit spreads not only depend on project-specific parameters but also the wider economic environment and therefore fluctuate through time depending on the risk appetite of the investing market. In fact, analyzing credit spreads over time shows that they were relatively low in the early 2000s, spiked around the 2008 financial crisis, and came down significantly over the following decade. This implies that times of higher interest rates, volatility and financial uncertainty generally result in higher credit spreads. In the remainder of this analysis, this paper will focus on how maturity, P3 type, and credit rating impacts credit spread while still acknowledging how that analysis may be influenced by wider market fluctuations.

2.4.1 Effect of Maturity on Credit Spread

Figure 1 below shows the relationship between credit spread and maturity for the various issuances analyzed. At the individual issuance level, most data points associated with a particular issuance closely fit a relatively straight line, demonstrating that at a single point in time, there is a clear—and usually positive—relationship between maturity and credit margin. This comes as no surprise, as maturities that are relatively close and associated with the same credit would not be expected to have large variations.

At an aggregate level, this relationship continues to exist, but the correlation is weak, which can be partially explained by the wider market fluctuations discussed earlier. Although running a regression using credit spread as the dependent variable and maturity as the independent variable confirms that maturity is indeed a statistically significant variable, this one-variable statistical model can only explain about 10% of the results (i.e., R squared equals 10%). Based on the data shown below, an average credit spread starts at 90 bps for a 0-year maturity bond and increases by about 3 bps for each year of incremental maturity. Based on this relationship, a 30-year bond would have a credit spread of about 180 bps. However, as is clear from the chart, there is a very large range, making maturity by itself a weak predictor of credit spread.

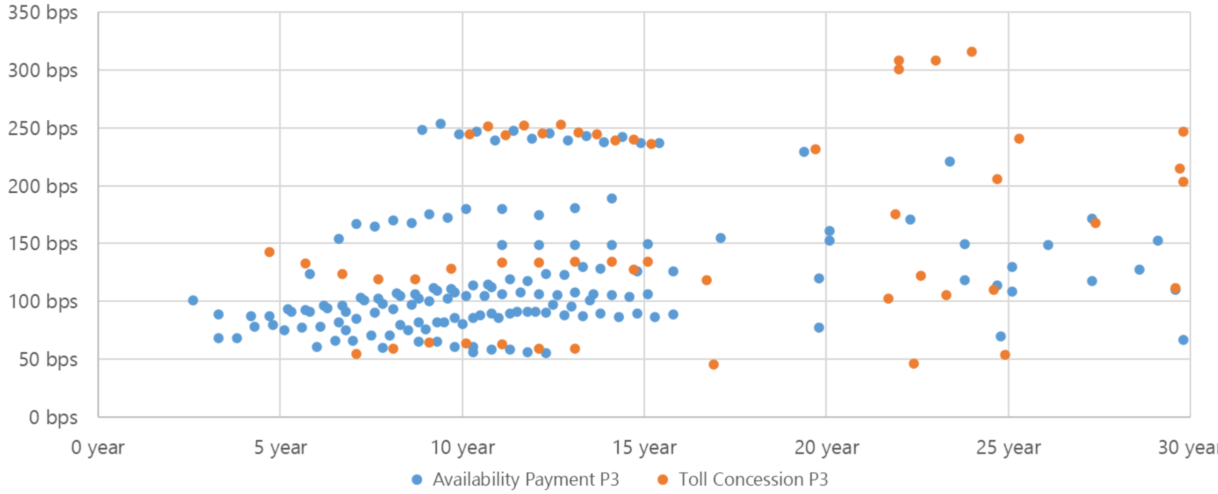
Figure 1: Credit spreads for 25 P3 bond issuances



2.4.2 Effect of P3 Type and Maturity on Credit Spread

Figure 2 shows the same data, but differentiates between credit spreads on availability payment and toll concession P3 bonds. Running a regression using credit spread as the dependent variable and maturity and the P3 type (toll concession vs. availability payment) as the two independent variables confirm that both are statistically significant variables. However, the explanatory power of this two-variable statistical model remains low, with only 19% of the data explained. The figure below also bears this out, as the credit spread on some toll concessions bonds is lower than that on certain availability payment P3 bonds. Whereas this may be counterintuitive, it is important to keep in mind that these bonds were priced at different times, in different macroeconomic environments, making such comparisons more difficult. Even though the data shows that some toll concession P3 bonds may have had lower credit spreads than availability payment P3 bonds, the regression shows that on average, toll concession credit spreads are about 37 bps higher than availability payment credit spreads. Furthermore, maturity continues to have roughly the same effect as under the one-variable model (about 90 bps at 0 years, with 3 bps more per incremental year of maturity).

Figure 2: Credit spreads for availability payment and toll concession P3s

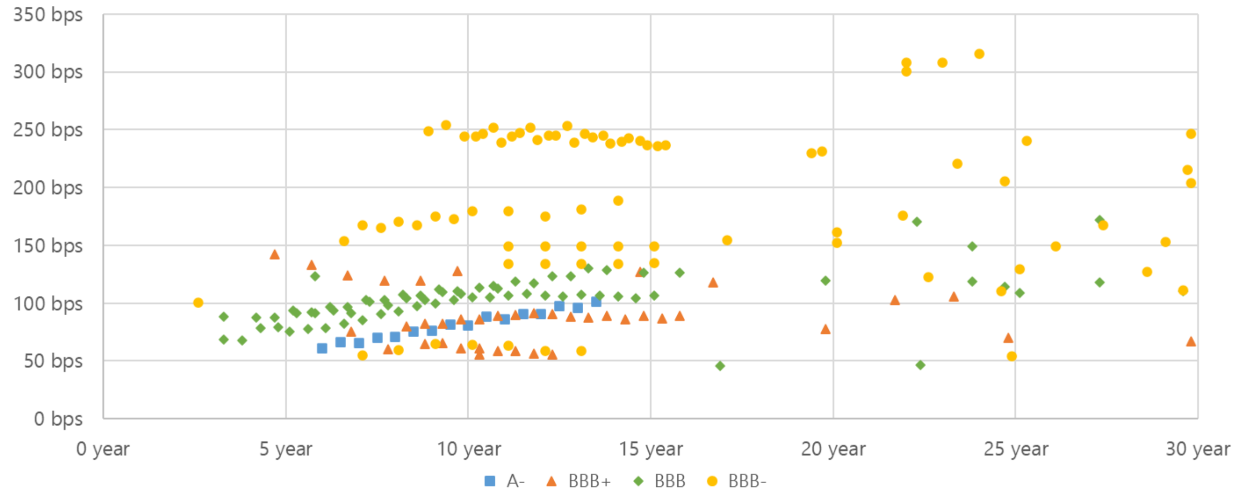


2.4.3 Effect of Credit Rating and Maturity on Credit Spread

As bond purchasers often rely on credit agencies to rate transactions and get comfortable with a credit structure, the Team also examined the effect of maturity and credit rating on credit spreads. Figure 3 below shows the same data once more, but now categorized by rating category. Like the P3 type (toll concession vs. availability payment) regression, the figure shows somewhat counterintuitive results, with some BBB- bonds experiencing lower credit spreads than better rated bonds. Again, such "inconsistencies" are to be expected based on the wider economic environment and fluctuations in financing markets that occurred over the 20 years represented in the data set.

When running a regression using credit spread as the dependent variable and maturity and credit rating as the independent variables, the predictive power of the model increases to 52%. However, the difference in credit spread between A- and BBB+ was not statistically significant, raising doubts about the reliability of the model. Still, the regression findings are in line with general expectations in that they confirm that higher rated bonds do indeed have on average lower credit spreads. More specifically, the regression shows that BBB- rated bonds are expected to have almost 100 bps higher credit spreads when compared to A- rated bonds. When comparing BBB and BBB+ rated bonds to A- rated bonds, the difference falls to about 20 bps and 3 bps, respectively. The relative differences between these rating categories, and in particular the small difference between BBB+ and A- rated bonds, should be viewed cautiously as not all variables in this model were found to be statistically significant. In this model, the maturity's impact on credit spreads is somewhat reduced, with a base assumption of around 70bps and an incremental 1 bp per year of maturity.

Figure 3: Credit spreads for different credit ratings



The Team also ran a regression using maturity, P3 type (toll concession vs. availability payment), and credit rating as independent variables. However, the results of this regression were not statistically significant, most likely because of the collinearity between the P3 type and credit rating variable. This also makes intuitive sense, as toll concession P3s tend to be rated BBB- more often than availability payment P3s, thus creating a situation where both the credit rating variable and the P3 type variable are effectively predicting that credit spreads should be higher for toll concessions, resulting in low statistical significance for both.

2.5 Practical Guidance

The various regressions yielded results that are in line with the general expectations of market practitioners. However, the relatively low predictive power of the statistical models in combination with issues around statistical significance, put limits on how accurately credit spreads can be estimated using a strict formulaic approach at any given point of time. It also points to the variability of credit spreads due to economic and financial market conditions at the time—in addition to project-specific credit considerations. This paper therefore develops a "rules of thumb" approach for early stage VfM analysis. These rules of thumb are best checked against current market conditions when developing a detailed VfM for an actual transaction. Consulting municipal advisors, P3 financial advisors, investment bankers, and other professionals active in the marketplace is likely to yield helpful insight into current market conditions at the time of analysis.

Notwithstanding these limitations, past credit spread data can provide some bookends on what reasonable estimates may be for preliminary VfM analyses. At such a preliminary stage, it is reasonable to use a single spread for all maturities. For that purpose, the table below provides average credit spreads and standard deviations for different credit rating categories. The average is based on all 207 data points and does not differentiate by maturity. Practitioners can use this table to estimate the credit spread based on the credit rating they expect to secure for their project. For example, if a project is expected to be rated BBB-, it would be reasonable to assume that the credit spread falls between the average credit spread for the BBB- category (186 bps) plus or minus its standard deviation (66 bps), for a total range of 120 bps to 252 bps. The table below also provided a rounded rule of thumb range that practitioners can use to select an appropriate credit spread in their early stage VfM analysis.

Table 6: Historic credit spreads in bps based on credit rating

Credit Spread Metric	Credit Rating			
	A-	BBB+	BBB	BBB-
Average	81	87	103	186
Standard deviation	12	24	21	66
Range (average ± standard deviation)	69-93	63-111	82-124	120-252
Rule of thumb range	**70-90**	**65-110**	**85-120**	**120-250**

Accordingly, to arrive at the overall average interest rate assumption for a preliminary VfM analysis, practitioners would use the above spreads and add them to the then current base rate matching the weighted average life of the bond[4]. As described, the base rate for this analysis is the MMD AAA GO yield curve. To the extent that practitioners do not have access to this data they can use a Treasury rate. It is important to note however that, depending on the average life of the issue and market conditions at the time, Treasury rates can deviate substantially from municipal rates.

Furthermore, if a practitioner has no information on the project's expected credit rating, the table below provides credit spread estimates based on whether the P3 project is structured as an availability payment or toll concession transaction.

Table 7: Historic credit spreads in bps based on P3 type

Credit Spread Metric	P3 Type	
	Availability Payment	Toll Concession
Average	119	165
Standard deviation	51	80
Range (average ± standard deviation)	68-170	85-245
Rule of thumb range	**70-170**	**85-245**

As the analysis shows that maturity has a relatively modest impact on the overall margin and given that the relatively wide range in the overall credit spread, it appears reasonable not to adjust for maturity in the context of a preliminary VfM analysis. Practitioners are also cautioned that in times of high interest rates and market volatility, the high end of these ranges may still underestimate the credit spread required in the market. If more detailed data is necessary, practitioners should consult their financial advisors for additional guidance and current market information.

2.6 Incorporating TIFIA/RRIF Loans

Because many P3 transactions have included TIFIA and RRIF loans, a practitioner may wish to include TIFIA financing in their VfM analysis. This is relatively straightforward to accomplish. Because TIFIA is typically limited to 33% of a project's eligible costs, the TIFIA loan amount can be calculated using 33% of total capital costs. Once the total amount of debt to be borrowed is determined, a weighted average cost of debt can be calculated using the different principal amounts as a weighting factor. The TIFIA loan will carry an interest rate of the State and Local Government Series (SLGS) rate[5] plus one basis point (0.01%) for the final

[4] Weighted average life refers to the average amount of time that the principal amount is outstanding. Debt that is repaid only at final maturity (i.e., a bullet payment) has a weighted average life that is equal to its final maturity. Debt that amortizes over the life of the bond has a weighted average life that is less than the final maturity, with a more aggressive repayment schedule further reducing the weighted average life.

[5] See: https://treasurydirect.gov/GA-SL/SLGS/selectSLGSDate.htm

maturity of the loan. If SLGS rates are not available, the US Treasury security rate for that maturity can be used as a proxy (without adding the 0.01%). A detailed sample calculation can be found in Section 5.2 below.

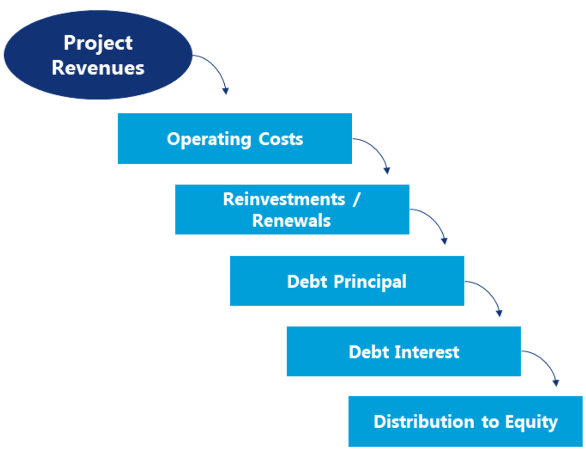
3. Cost of Capital for Private Equity

3.1 The Concept: Expected Rate of Return on Private Equity

The expected rate of return for private equity refers to the return developers/equity investors anticipate when submitting their bids for a P3 project. This rate of return is also often referred to as the target equity return. The actual equity return may be higher or lower than the target equity return, depending on the performance of the project—i.e., higher/lower than expected revenues, higher/lower than expected costs, longer/shorter than expected construction period—and will not be known until the end of the concession. It is the target equity return that determines a developer's bid price, which is why this metric is the most appropriate equity return figure to be used in a VfM assessment.

Compared to other financing sources, equity investors take on the highest amount of risk and are the first impacted by lower revenues or higher costs, as distributions to equity are located at the bottom of the cash flow waterfall (see Figure 4). Whereas debt providers are typically repaid at fixed rates and times over a defined term, equity investors only have a residual claim after all other project costs and obligations have been met. This is why equity investors expect a higher rate of return, given they are exposed to more risk and uncertainty than debt providers.

Figure 4. Waterfall of the Project Cash Flow Payments



Because equity is more expensive than debt, P3 developers generally maximize the amount of debt while still achieving an "investment grade" rating of BBB- or above, using the equity for the balance. Accordingly, debt generally makes up more than 50% of project financing on most US P3 projects.

3.2 Drivers of the Expected Rate of Return on Private Equity

The expected equity internal rate of return (IRR) will vary depending on the level of risk that equity investors take on. Infrastructure equity investors' required rates of return are expected to be driven by both project-specific risks, such as the project's complexity and the extent to which investors are exposed to revenue risk, as well as the wider macro-economic environment—i.e., the opportunity cost of deploying equity for infrastructure projects when compared to other investment opportunities (in other words, the expected rates of return in the overall equity markets.)

Whereas the focus of this guidebook is on estimating the target equity return at bid (which will be most relevant for the VfM analysis), it is worth noting that target equity return for investors deploying equity later in the project cycle—for example, at substantial completion or after a few years of operations in the case of an asset sale—will likely be lower as the project is significantly de-risked once construction has been completed and operations have started.

Regarding revenue risk, equity investors are exposed to materially different risk profiles depending on whether the P3 is structured as a toll concession or availability payment transaction. Under a toll concession, the concessionaire obtains compensation by collecting tolls on the facilities. These toll revenues are used to cover project costs, as well as debt service and returns to equity.[6] Accurately forecasting demand on toll roads is challenging and therefore toll revenue tends to be highly uncertain,[7] particularly for "greenfield" projects.[8] As the equity investor takes on most of the toll revenue risk, the target equity IRR needs to be commensurate with this level of uncertainty. In contrast, under availability payment P3s, the public agency pays the concessionaire periodically based on whether the facility meets a pre-determined performance level and retains traffic risk. In that case, the equity investor's revenues do not depend on tolls, thus reducing their risk and allowing for a lower target equity IRR compared to toll concessions.

3.3 Methodological Approach

This research updated and complemented the data on target equity returns contained in the "Guidebook on Financing of Highway Public-Private Partnership Projects" (2016), published by the Build America Transportation Investment Center (BATIC) and the Federal Highways Administration's (FHWA) Office of Innovative Program Delivery.[9]

An initial list of 44 transportation P3 projects that reached financial close between 2007 and 2022 was developed. In order to obtain data on the expected equity IRR, the following sources were reviewed:

- **Project agreements and procurement documentation:** Agencies may incorporate the winning bidder's target equity return at closing in the P3 project agreement. Therefore, publicly available PAs, as well as the procurement documentation (i.e., selected bidder's financial submission) were reviewed. For some P3 projects, these documents were not publicly available or the information on target equity returns was redacted or simply not included.
- **Financial reports published by major infrastructure funds, investors, and asset managers:** Major infrastructure funds, investors, and asset managers publish annual financial reports, which may include an assessment of their projects' expected equity returns. This includes annual financial reports published by key players, including Transurban, Meridiam, Plenary Group, Kiewit, Cintra, and Macquarie Group Limited.
- **Prior studies**, including in particular Morteza Farajian's doctoral thesis titled "Structured project finance for P3s in the U.S.: An enhanced approach to better achieve financial and policy objectives"[10] (hereafter, "Doctoral Thesis").

[6] Federal Highways Administration. "Financial Structuring and Assessment for Public-Private Partnerships: A Primer". 2013. https://www.fhwa.dot.gov/ipd/pdfs/p3/p3_primer_financial_assessment_1213.pdf

[7] Buckberg, E; Mudge, R; Sheffield, H. "Rising Tide of Next Generation U.S. P3s —and How to Sustain It". February 2018. https://www.brattle.com/wp-content/uploads/2021/05/13441_rising_tide_of_next_generation_us_p3s_-_and_how_to_sustain_it.pdf

[8] In the context of highways, a "greenfield" project refers to an entirely new facility whereas a "brownfield" project improves upon an existing facility (for example, by adding additional lanes or converting general purpose lanes into HOV lanes). Brownfield projects benefit from having proven historic demand whereas demand for greenfield projects is more uncertain.

[9] Federal Highways Administration & Build America Transportation Investment Center, U.S. Department of Transportation. "Guidebook on Financing of Highway Public-Private Partnership Projects". December 2016. https://www.fhwa.dot.gov/ipd/pdfs/p3/p3-toolkit_p3_project_financing_guidebook_122816.pdf

[10] Morteza, F. "Structured project finance for P3s in the U.S.: An enhanced approach to better achieve financial and policy objectives". 2014. https://drum.lib.umd.edu/handle/1903/16437

- **Infrastructure journals and project finance magazines**, such as IJGlobal [11] and Public Works Financing[12].

Expected equity IRRs may be defined and/or presented in different forms and therefore, may not be directly comparable. In order to overcome this, the Team reviewed the definition of equity IRR provided by each source. For all P3 projects listed in this Section 3 for which the target equity IRR data was obtained from project agreements and other procurement documentation (11 in total), the equity IRR represents the nominal post-tax internal rate of return on the total amount of committed investment. The phrase "post-tax" refers to U.S. Federal and State income tax only and excludes any foreign income tax and other tax of any kind. Additionally, for these P3 projects, the Team recorded the “initial”, “base case”, “original”, or “preliminary” equity IRR, which refers to the expected equity IRR under the base case financial model at financial close, which is developed during the procurement stage based on the anticipated capital and operating expenditure as well as traffic and revenue forecasts.

For P3 projects for which the expected equity IRR was obtained from the Doctoral Thesis (10 in total), the equity IRR refers to the nominal targeted post-tax equity IRR under the base case financial model.[13] The Team was able to confirm the expected equity IRR value for two of these projects with the BATIC and FHWA’s “Guidebook on Financing of Highway Public-Private Partnership Projects (2018)”.[14] Finally, for the project for which the data was obtained from IJGlobal, the Team was unable to pinpoint a definition for the expected equity IRR.

3.4 Analysis and Findings

Of the original list of 44 transportation P3 projects, the Team was able to identify the expected equity IRR for a subset of 22 projects, which reached financial close between 2005 and 2017.

As previously mentioned, the expected equity IRR may vary depending on the level of risk that equity investors take on and market conditions at the time. Bearing in mind that under a toll concession, equity investors are exposed to a considerably different risk profile than under an availability payment transaction, Table 8 and Table 9 differentiate between these two types of P3 projects. Overall, of the 22 projects included in the database, 9 are availability payment P3s and 13 are revenue risk concessions.

[11] Lovell, R. IJGlobal “Port of Miami Tunnel P3 Project”. October 10, 2010. https://www.ijglobal.com/articles/59358/port-of-miami-tunnel-p3-project

[12] Public Works Financing. “ACS Finances Florida I-595 Availability-Pay Project (2/09, p. 1)”. February 2009. https://www.pwfinance.net/document/research_reprints/595_case.pdf

[13] Morteza, F. “Structured project finance for P3s in the U.S.: An enhanced approach to better achieve financial and policy objectives”. 2014. https://drum.lib.umd.edu/handle/1903/16437

[14] Federal Highways Administration & Build America Transportation Investment Center, U.S. Department of Transportation. “Guidebook on Financing of Highway Public-Private Partnership Projects”. December 2016. https://www.fhwa.dot.gov/ipd/pdfs/p3/p3-toolkit_p3_project_financing_guidebook_122816.pdf

Table 8. Expected Equity IRR for availability payment P3 projects

	Project Name	Financial Close	P3 Type	Source	Expected Equity IRR
1	Central 70	2017	DBFOM	Project Agreement	9.52%
2	Pennsylvania Rapid Bridge	2015	DBFM	Project Agreement	10.43%
3	I-4 Ultimate	2014	DBFOM	Project Agreement	12.00%
4	I-69 Section 5	2014	DBFOM	Doctoral Thesis	9.93%
5	East End Crossing	2013	DBFOM	Project Agreement	10.34%
6	Goethals Bridge	2013	DBFM	Doctoral Thesis	13.80%
7	Presidio Parkway	2012	DBFM	Doctoral Thesis	14.46%
8	I-595 Corridor Roadway Improvements	2009	DBFOM	Project Agreement	11.54%
9	Port Miami Tunnel	2009	DBFM	IJ Global / BATIC	11.33%
				Average expected equity IRR	**11.48%**

Table 9. Expected Equity IRR for toll concession P3s

	Project Name	Financial Close	P3 Type	Source	Expected Equity IRR
1	SH 288	2016	DBFOM	Project Agreement	12.00%
2	I-77 Express	2015	DBFOM	Project Agreement	14.39%
3	US 36 Phase 2	2014	DBFOM	Project Agreement	13.68%
4	North Tarrant Segment 3A & 3B	2013	DBFOM	Project Agreement	12.58%
5	Elizabeth River Tunnels	2012	DBFOM	Doctoral Thesis	12.50%
6	I-95 HOV / HOT Lanes	2012	DBFOM	Doctoral Thesis / BATIC	12.50%
7	LBJ Express	2010	DBFOM	Project Agreement	12.76%
8	North Tarrant Express Segment 1 & 2	2009	DBFOM	Doctoral Thesis	13.12%
9	SH 130 (Segment 5 & 6)	2008	DBFOM	Project Agreement	12.00%
10	Capital Beltway HOT Lanes	2007	DBFOM	Doctoral Thesis / BATIC	13.00%
11	Pocahontas Parkway	2006	Lease[15]	Doctoral Thesis	12.60%
12	Indiana Toll Road	2006	Lease	Doctoral Thesis	13.00%
13	Chicago Skyway	2005	Lease	Doctoral Thesis	12.30%
				Average expected equity IRR	**12.80%**

The average expected equity IRR for revenue risk P3 projects presented in Table 9 (12.80%) is higher than for availability payment transactions shown in Table 8 (11.48%). This is reinforced by a prior study showing that, on average, expected equity returns for revenue risk concessions are approximately 120 bps higher than for availability payment projects (Farajian, 2014). Furthermore, the data shows that the target equity IRR distribution for both toll concessions and availability payment transactions are relatively narrow, with a standard deviation of 0.66% and 1.70%, respectively. However, as with any data set, there are outliers, such as Goethals Bridge and Presidio Parkway (Phase II), which are availability payment concessions, but have target equity IRRs that would be more typically expected for a toll concession. This points to another relevant consideration: in addition to target equity IRR there are many other factors that also contribute to a concessionaire's bid price, including expected overall construction and operating cost and risks, cost of

[15] Refers to long-term operating lease.

debt, and D/E ratio. As such, it is entirely possible that a competitive procurement process leads to the selection of a preferred bidder that offers the best value and/or lowest price through innovation or lower construction and operating costs, but not necessarily with the lowest target equity IRR.

In addition, from past discussions with equity investors, the Team notes that not all equity investors change their target equity IRR based on whether the transaction is a toll concession or an availability payment transaction. In fact, a particular investor's target equity return can be based on numerous considerations, including target returns set by its own investors. These considerations combined may help explain why certain P3 transactions may have higher (or lower) target equity IRRs than others.

3.5 Inflation

The available P3 pricing data for equity returns covers a relatively short period, twelve years. As such, certain macroeconomic trends may not be fully captured by the data. In particular, the inflation rate throughout the 2005-2017 period was relatively low, ranging from -0.4% in 2009 to 3.8% in 2008, with an average of 2.0% per year.[16] Logically, target equity returns should increase in periods of high inflation. At the same time, given the long-term nature of P3 contracts, target equity returns are likely mostly concerned with medium- to long-term inflation expectations, assuming that near-term inflation risks associated with construction can be effectively transferred to the DB contractor.[17] As such, short-term spikes in inflation may not have a large direct impact on target equity returns. However, it could be expected that if long-term inflation expectations rise above 2%, target equity returns could also rise. As of the time of writing, it is not yet clear if/how target equity returns will react to the changing inflationary and interest rate environment.

3.6 Practical Guidance

Based on the above analysis, this paper suggests that equity rates of return can be estimated using the following rounded rules of thumb:

Table 10: Equity return range based on P3 type

Equity IRR	P3 Type	
	Availability Payment	Toll Concession
Average	11.48%	12.80%
Standard deviation	1.70%	0.66%
Range (average ± standard deviation)	9.78% - 13.19%	12.14% - 13.47%
Rule of thumb range (post-tax)	**10%-13%**	**12%-13.5%**
Rule of thumb range (pre-tax)[18]	**11%-14%**	**13%-15%**

[16] U.S. Bureau of Labor Statistics. "CPI for All Urban Consumers (CPI-U), 2007-2017, 12-month percent change, all items in U.S. city average, not seasonally adjusted (series ID: CUUR0000SA0)". n.d. https://www.bls.gov/data/. We note that mid-year variability was higher, with June 2008 year-over-year inflation at 5.6%, and June 2009 at -2.1%.

[17] The pricing of construction risk transfer to a design-build contractor is an important element of any VfM analysis and has been the topic of significant discussion in the P3 market over the past few years. However, it is beyond the scope of this paper—which is focused on the cost of capital. As of the date of this paper, it continues to be a standard feature of US P3s that construction risk is passed on to the design-build contractor, despite recent challenges associated with higher and unpredictable inflation.

[18] While corporate tax rates typically exceed 25% (Federal tax rate of 21% + state and local taxes), in our experience, the time value of money and effects of depreciation and NOL carry-forwards result in post-tax equity rates of return that are typically around 90% of pre-tax rates of return, although the exact relationship between pre- and post-tax equity rates of return will depend from project to project.

The equity return for availability payment P3 transactions will be largely driven by the underlying credit quality of the public owner.

4. Debt-to-Equity Ratio

4.1 The Concept: Debt-to-Equity Ratio

The debt-to-equity (D/E) ratio (also known as "gearing") is a key driver of the overall cost of capital. Because P3 equity investors generally maximize the amount of debt they can obtain at a reasonable price, they will typically increase the D/E ratio until either they reach a BBB category rating or the minimum amount of equity their lenders require. That said, projects tend to be highly leveraged, meaning that debt—rather than equity—generally provides more than half of the financing required.

The D/E ratio is linked to the project's risk profile, including factors such as the complexity of the project and revenue uncertainty. Projects with low levels of risk may be highly leveraged, featuring D/E ratios of as much as 90% debt and 10% equity (or 90/10). On the other hand, projects with riskier profiles may require more equity financing and therefore, have D/E ratios ranging between 70/30 to 60/40.[19]

As previously mentioned, all other things being equal, in toll concessions—which are exposed to demand risk—the share of equity will be higher than for availability payment P3s. In general terms, while availability payment transactions may only require 10% to 20% of equity, toll concessions generally require a higher level of equity—often exceeding 25%. Additionally, exogenous economic factors that increase the riskiness of even availability payment transactions could drive D/E ratios lower in volatile and risky markets.

4.2 Methodological Approach

To determine the D/E ratio of the 22 P3 projects included in Section 3, the data was collected on the financing sources and amounts for each transaction from the FHWA P3 project profiles.[20] To the extent possible, this information was also confirmed using the Inframation transactions database.[21] It is important to note that D/E ratios are calculated by excluding any capital grant funding and short-term financing; only long-term financing instruments that need to be repaid are considered in the D/E ratio.

4.3 Analysis and Findings

Table 11 and Table 12 provide the D/E ratio for 13 toll concessions and 9 availability payment transactions.

Table 11: D/E ratio for P3 toll concessions

	Project Name	Financial Close	D/E Ratio
1	SH 288	2016	64/36
2	I-77 Express	2015	54/46
3	US 36 Phase 2	2014	83/17
4	North Tarrant Segment 3A & 3B	2013	65/35

[19] FHWA. "Guidebook on Financing of Highway Public-Private Partnership Projects". December 2016. https://www.fhwa.dot.gov/ipd/p3/toolkit/publications/other_guides/financing_of_highway_p3_projects/ch_3.aspx

[20] FHWA. "Project Profiles. n.d. https://www.fhwa.dot.gov/ipd/project_profiles/

[21] Infralogic. "Transactions". n.d. https://www.inframationnews.com/

	Project Name	Financial Close	D/E Ratio
5	Elizabeth River Tunnels	2012	80/20
6	I-95 HOV / HOT Lanes	2012	66/34
7	LBJ Express	2010	68/32
8	North Tarrant Express Segment 1 & 2	2009	71/29
9	SH 130 (Segment 5 & 6)	2008	84/16
10	Capital Beltway High Occupancy Toll (HOT) Lanes (I-495)	2007	77/23
11	Pocahontas Parkway	2006	82/18
12	Indiana Toll Road	2006	80/20
13	Chicago Skyway	2005	75/25
		Average D/E Ratio	**73/27**

Table 12. D/E ratio for availability payment P3 projects

	Project Name	Financial Close	D/E Ratio
1	Central 70	2017	89/11
2	Pennsylvania Rapid Bridge	2015	92/8
3	I-4 Ultimate	2014	93/7
4	I-69 Section 5	2014	85/15
5	East End Crossing	2013	87/13
6	Goethals Bridge	2013	90/10
7	Presidio Parkway (Phase II)	2012	88/12
8	I-595 Corridor Roadway Improvements	2009	87/13
9	Port Miami Tunnel	2009	89/11
		Average D/E Ratio	**89/11**

As shown in the tables above, the D/E ratios ranged between 54/46 to 84/16 for toll concessions and between 85/15 to 93/7 for availability payment transactions. As expected, on average, the share of equity is substantially higher for toll concessions (27% on average) than for availability payment P3s (11% on average). Additionally, the data shows that the D/E ratio distribution for availability payment transactions is considerably narrower compared to toll concessions, with a standard deviation of 2.52% and 9.15%, respectively. Nevertheless, similar to the expected equity IRR, there are outliers within the data set, such as the I-77 Express, which has a lower share of debt than may be expected for a toll concession (54/46). In this context, it is important to acknowledge that even between toll concessions, there can be substantial differences in the level of revenue uncertainty, which one would expect to be reflected in the D/E ratio. Furthermore, as discussed earlier in the context of expected equity IRR, besides revenue risk, there are many other considerations that will determine the project's overall risk profile, and market conditions may vary through time. As such, a project's financing structure, including the D/E ratio, will depend not only on whether the transaction is structured as a toll concession or as an availability payment P3, but also on other risks that the investors may be exposed to. With that in mind, it is only natural to see deviations from the average D/E ratios. These variations are particularly pronounced for toll concessions. Availability payments—which are backed by much more stable and predictable revenues—tend to have more consistent D/E ratios.

4.4 Practical Guidance

Similar to the guidance provided for the cost of debt and equity, the table below provides practitioners with a rule of thumb range for D/E ratio for both availability payment and toll concession P3s.

Table 13: D/E ratio average and range based on P3 type

D/E Ratio	P3 Type	
	Availability Payment	Toll Concession
Average	89/11	73/27
Standard deviation	3	9
Range (average ± standard deviation)	86/14 – 92/8	64/36 – 82/18
Rule of thumb range	**85/15 – 90/10**	**65/35 – 80/20**

5. Weighted Average Cost of Capital

The weighted average cost of capital (WACC) captures the overall expected rate of return for debt and equity combined, taking into consideration their relative share in the capital stack as well as the effects of the debt tax shield if and when appropriate. For the purpose of early stage VfM assessments, pre-tax returns are best used, as post-tax returns require detailed calculations on tax liabilities, which are typically not available at such an early stage. In addition, for availability payments, the public sponsor—which is typically not a taxable entity—will have to pay the full amount of the pre-tax return to the concessionaire.

While conceptually calculating the WACC is relatively straightforward, calculating a project specific WACC requires a detailed financial model that captures the full financing structure of the project. For the purposes of an early stage VfM analysis, the simplified calculations below should suffice for the WACC.

5.1 Estimating the Weighted Average Cost of Capital

The pre-tax WACC can be calculated from the various elements discussed in this paper: expected returns on debt and equity and the relative share of debt and equity in the long-term capital stack (i.e., the D/E ratio). In formulaic terms, a simplistic version of the relationship can be expressed as follows:

$$\mathrm{WACC}_{\text{pre-tax}} = \frac{\mathrm{D}}{\mathrm{D} + \mathrm{E}} \times r_{\text{debt}} + \frac{\mathrm{E}}{\mathrm{D} + \mathrm{E}} \times r_{\text{equity}}$$

Where:

D = Debt amount (in dollars)

E = Equity amount (in dollars)

r_{debt} = Interest rate for average life of debt[22]

r_{equity} = Expected return on equity

Similar to what was discussed previously in the context of the D/E ratio, the pre-tax WACC is calculated based on the amount that was financed using long-term capital. Capital grants are to be excluded because they do not have a repayment expectation.

5.2 Sample Calculation

Below is a sample calculation of the pre-tax WACC for a hypothetical $500M availability payment project with a TIFIA loan:

Project details

- Capital cost = $500M
- Capital grants = $100M
- Financed amount (capital cost minus capital grants) = $400M

[22] Using the interest rate applicable for the average life of debt is a simplified assumption. Theoretically, a duration-weighted cost of debt like All-In True Interest Cost (TIC) should be used. This also assumes a blending of all debt sources like bonds, bank loans and TIFIA/RRIF loans. For the purpose of early stage VfM assessments, using the interest rate for the average life of debt is a good approximation.

- D/E ratio = 80/20
- P3 type = Availability payment
- Concession term (incl. construction) = 35 years
- Debt average life = 25 years

Equity financing

- Equity amount (20% of financed amount) = 20% x $400M = $80M
- Expected pre-tax equity IRR = 12.00%

Debt financing

- Debt amount (80% of financed amount) = 80% x $400M = $320M
- TIFIA debt amount (33% of capital cost) = 33% x $500M = $165M
- TIFIA interest rate = 4.00% (30-year[23] SLGS rate + 0.01%)
- PABs debt amount (debt amount – TIFIA amount) = $320M – $165M = $155M
- PABs interest rate (base rate[24] + credit spread) = 3.75%* + 1.25% = 5.00%

WACC calculation

$$\mathrm{WACC}_{\text{pre-tax}} = \frac{\mathrm{D}}{\mathrm{D+E}} \times r_{\text{debt}} + \frac{\mathrm{E}}{\mathrm{D+E}} \times r_{\text{equity}}$$

$$= \frac{\text{TIFIA debt amount}}{\mathrm{D+E}} \times r_{\text{TIFIA}} + \frac{\text{PABs debt amount}}{\mathrm{D+E}} \times r_{\text{PABs}} + \frac{\mathrm{E}}{\mathrm{D+E}} \times r_{\text{equity}}$$

$$= \frac{\$165M}{\$320M + \$80M} \times 4.00\% + \frac{\$155M}{\$320M + \$80M} \times 5.00\% + \frac{\$80M}{\$320M + \$80M} \times 12.00\%$$

$$= 5.99\%$$

[23] TIFIA interest rate is based on loan tenor, not average loan life.

[24] Base rate for PABs is based on average loan life.

Glossary

Acronym	Term
BAC	Build America Center
BATIC	Build America Transportation Investment Center
BIL	Bipartisan Infrastructure Law
Bps	Basis points
D	Debt
D/E	Debt-to-equity
E	Equity
FHWA	Federal Highways Administration
IRR	Internal rate of return
MMD GO	Municipal Market Data AAA General Obligation
P3	Public-private partnership
PAB	Private Activity Bond
r_{debt}	Interest rate
r_{equity}	Expected return on equity
SLGS	State and Local Government Series
VfM	Value-for-money
WACC	Weighted average cost of capital

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