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The conference covers a wide range of topics related to traffic and transport engineering, with the aim of representing the importance of all modes of traffic and transport, especially the importance of improving these industries, and their compliance to the most significant principles nowadays, sustainable development and transport efficiency. ICTTE Belgrade 2018 gathers researchers, scientists and engineers whose fields of interest are traffic and transport engineering, and should provide them a good platform for discussion, interactions and exchange of information and ideas. ICTTE Proceedings have been indexed within CPCI - Conference Proceedings Citation Index, a Web of Science™ Core Collection database.

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PREFACE - ICTTE Belgrade 2018
Transportation Impact of Industry 4.0...

Ladies and gentlemen, distinguished guests and speakers, dear colleagues and readers,

Traditionally, ICTTE 2018 becomes an event which took place to highlight the remarkable contribution which transportation makes in so many areas of our lives.

A glance through the list of papers and presentations planned for the next two days reveals the amazing diversity of provided research from the universities and laboratories from 30 countries worldwide.

Nowadays, transport has had a profound impact on the way we live and the ICTTE 2018 is pleased to have been a partner in the growth of new technologies, mobility and digitalization era.

Our key role is to make transportation science and technology available to human wellbeing.

Conferences such as this provide a valuable opportunity for research scientists, industry specialists and decision-makers to share experiences.

I am grateful to the many experts who have come to share their knowledge and face challenges in implementation of Industry 4.0.

ICTTE 2018 Director

Dr Olja Čokorilo

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ENHANCING THE FINANCIAL FEASIBILITY OF PPP PROJECTS WITH HYBRID FUNDING

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Abstract: In transport infrastructure concessions, the sources of revenue to the private partner (or concessionaire) may include (i) the infrastructure users (e.g., tolling, in the case of roads), (ii) the government (e.g. through availability payments), and (iii) both users and government, which might be called a hybrid concession. An example of the latter is a road concession where the concessionaire is allowed to charge tolls to the road users but, because of relatively low revenues, the government agency might have to complement the toll revenue. This paper summarizes the cases where it may be justified for the government to complement users' revenues and describes a model developed for the financial assessment of road concessions involving both tolling and government payments. The methodology described for roads can also be applied to other forms of transport infrastructure. A practical application of the model is demonstrated in the paper. For example, given traffic volumes and maximum acceptable toll rates for a particular road project, the model can be used to estimate the minimum availability payment that would be required for the project to attract private sector interest, that is, potential bidders in a competitive bidding scenario. The model can also be used to carry out sensitivity analyses of the impact of key input parameters on outputs such as the investor's return on equity and annual debt service cover ratio.

Keywords: PPP, road concessions, tolling, availability payments, financial feasibility.

1. Introduction

Over the last couple of decades there has been an important contribution of the private sector to finance roads and other forms of infrastructure. In 2017, private investment commitments in energy, transport, ICT and water infrastructure in low- and middle-income countries totaled US$93.3 billion across 304 projects (World Bank, 2017). Private investment commitments in developed countries have also been substantial.
Driving policy makers' continued interest in attracting private financing to transportation projects is the need for greater investments to keep transport infrastructure in acceptable condition and carry out required expansions in a context of public budget constraints. When arrangements for private participation or, more generally, public-private partnerships (PPP) are designed well, they can lead to (Mladenovic and Queiroz, 2014):

(1) Greater financial efficiency, by leveraging public money through the mobilization of private capital, reducing the impact of investments in infrastructure on the fiscal budget, and creating fiscal space to expand public service delivery in other sectors;
(2) Better distribution of risks, by transferring design, construction, and performance risks to the private sector, which is best able to manage such risks; and
(3) Better governance, by increasing the accountability of the service provider through competitive bidding, disclosure policies, and public reporting.

Government support to potential PPP projects is justified when an economically feasible project does not offer, without such support, the financial benefits required to attract private concessionaires. The mixing of public and private funding to get projects completed is a way to leverage scarce public resources, not just replace them. Because transport infrastructure is so essential to a well-functioning, growing economy, it is vital that subsidy funding is well spent and helps to deliver infrastructure services people really need at the least possible cost (World Bank, 2012).
How a government contributes financial support to a concession project, and how much it contributes, are often limited to what is required to attract private financing and promote the success of the project (World Bank, 2012). Mechanisms that governments use to support private financing of roads include (Queiroz et al. 2013):

- Availability payment, which is paid to the concessionaire by the government on the basis of the availability and quality of the required capacity (e.g., number of lanes in acceptable condition), regardless of demand (e.g., traffic volume).
- Capital grants, or subsidies, to cover part of the construction cost. Where user charges (e.g., toll revenue) would not be enough to recover the full construction cost of a project, reducing the privately financed construction cost may make the project financially attractive to the private sector.
- A per-vehicle subsidy (a toll subsidy) which is paid to the concessionaire based on traffic volume.
- Minimum revenue guarantees, in which the government pays the concessionaire compensation if revenue falls below a specified minimum (for example, 90 percent of the expected amount).

Recent practice in transport projects has seen the use of a mixed payment mechanism consisting of an availability payment and a direct user charge, or toll (Yescombe, 2007). Such an arrangement is designed to cover operating expenses, debt service and equity return.

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There are several toolkits available for the analysis and ex-ante assessment of highway PPP projects. These toolkits provide a wide range of tools and manuals that may assist stakeholders involved in PPP projects from early phases of project development to financial closure and implementation, as summarized below.
The Government of India (2010) released a web-based toolkit for the improvement of the decision-making process in PPP arrangements for the delivery of infrastructure projects. The toolkit can be used for the assessment of highway projects, which is one of five sectors covered. It is suitable for detailed analysis of greenfield and brownfield projects. The primary resources of revenues considered are user charges, shadow tolls, or annuities. Results consist of a set of accounting ratios such as debt service coverage ratio, loan life cover ratio, return on assets, net profit margin, and return on equity. Also, results cover a set of output parameters related to the project such as the project's internal rate of return and net present value, and shareholder accounts, such as the equity internal rate of return and the equity net present value.
Beaty and Lieu (2012) developed an Early-Stage Toll Revenue Estimation Model. The model is standalone, spreadsheet-based, and prepares early stage traffic and toll revenue estimates, and allows a user to simultaneously examine the interaction of multiple tolling variables and traffic scenarios, so the agencies can make an informed decision about future toll road projects.
In 2013, the Federal Highway Administration's (FHWA) Office of Innovative Program Delivery launched a new toolkit, P3-Value, Public-Private Partnership Value-for-Money Analysis for Learning and Understanding Evaluation (FHWA, 2013). Although the main purpose of the toolkit is to help decision makers in the "value-for-money" analysis, it covers other important aspects of PPPs such as risk evaluation and financial feasibility. This toolkit consists of four tools, namely a risk analysis tool, a public sector comparator (PSC) tool, a shadow bid tool, and a financial assessment tool, all Microsoft Excel based and supported by associated manuals.
The World Bank (WB), supported by the Public-Private Infrastructure Advisory Facility (PPIAF), has developed a Toolkit for Public-Private Partnership in Roads and Highways (PPIAF, 2009) - the Toolkit - to assist policy makers in implementing procedures to promote private sector participation and financing in roads. The WB Toolkit includes financial models (in graphical and numerical formats) that can be used for the financial assessment of PPP toll roads. Based on the Toolkit toll road graphical financial model, a model was developed to assess the financial feasibility of road concessions involving availability payments (Mladenovic and Queiroz, 2014).
This paper focuses on availability payments (also called annuities, as in South Asia), as a complement to toll revenues, where such revenues are not enough for the project to attract private partners. This would occur, for example, because of relatively low traffic volumes and/or toll rates. The paper presents the development of a user-friendly tool for financial assessments of road concession projects that involve both tolling and availability payments based on the existing World Bank Toolkit (2009) and the model for availability payments (Mladenovic and Queiroz, 2014). In view of the brief summary provided above on existing financial models, as well as a comprehensive related literature review carried out by Vajdic (2016), it appears that the new model will fill an important gap in the set of tools available for the financial assessment of road PPPs or concessions.
Several practical applications of the model are demonstrated in the paper. For example, given traffic volumes and maximum acceptable toll rates for a particular road project, the model can be used to estimate the minimum availability payment that would be required for the project to attract private sector interest, that is, potential bidders in a competitive bidding scenario. The model can also be used to carry out sensitivity analyses of the impact of key input parameters (e.g. capital cost, concession life, loan terms) on outputs such as the investor's return on equity and annual debt service cover ratio.
While launching a concession project that involves availability payments (AP), a country should be aware that AP creates future liability for the government, and hence limits its future resources to invest in other needed projects. Nevertheless, when a "users pay" type of project is not feasible (due, for example, to user inability or unwillingness to pay the minimum required toll rate), AP may be used to complement the limited toll revenues.

2. Developing a Financial Model for Tolling and Availability Payment Concessions

Based on the WB Toolkit toll road graphical financial model, a model was developed to assess the financial feasibility of road concessions involving both tolling and availability payments.
As in the original model, the new financial model comprises five worksheets (Data Sheet, Cash Flow Graph, Debt Graph, Dividend Graph, and Summary of Assumptions and Results), the main functions and outputs of which are described in the next sections. Default values are provided for each parameter defining a hypothetical road concession project. The user can change the parameter values using the arrow keys (scroll bars) provided in the Data Sheet and Cash Flow Sheet (or any of the other graph sheets), to define the project to be financially assessed.
The **Data Sheet** (Figure 1) summarizes the main characteristics (assumptions) of the PPP project. A few assumptions, identified by arrow keys, can be changed using this sheet. The other key characteristics can be changed directly from any of the graph sheets.
Two types of loan repayment are incorporated in the model:

- P+I constant: A constant amount (including Reimbursement of Capital and Interest) is paid each year;
- Linear: The same amount of capital is reimbursed each year. The interest is calculated from the non-reimbursed capital.

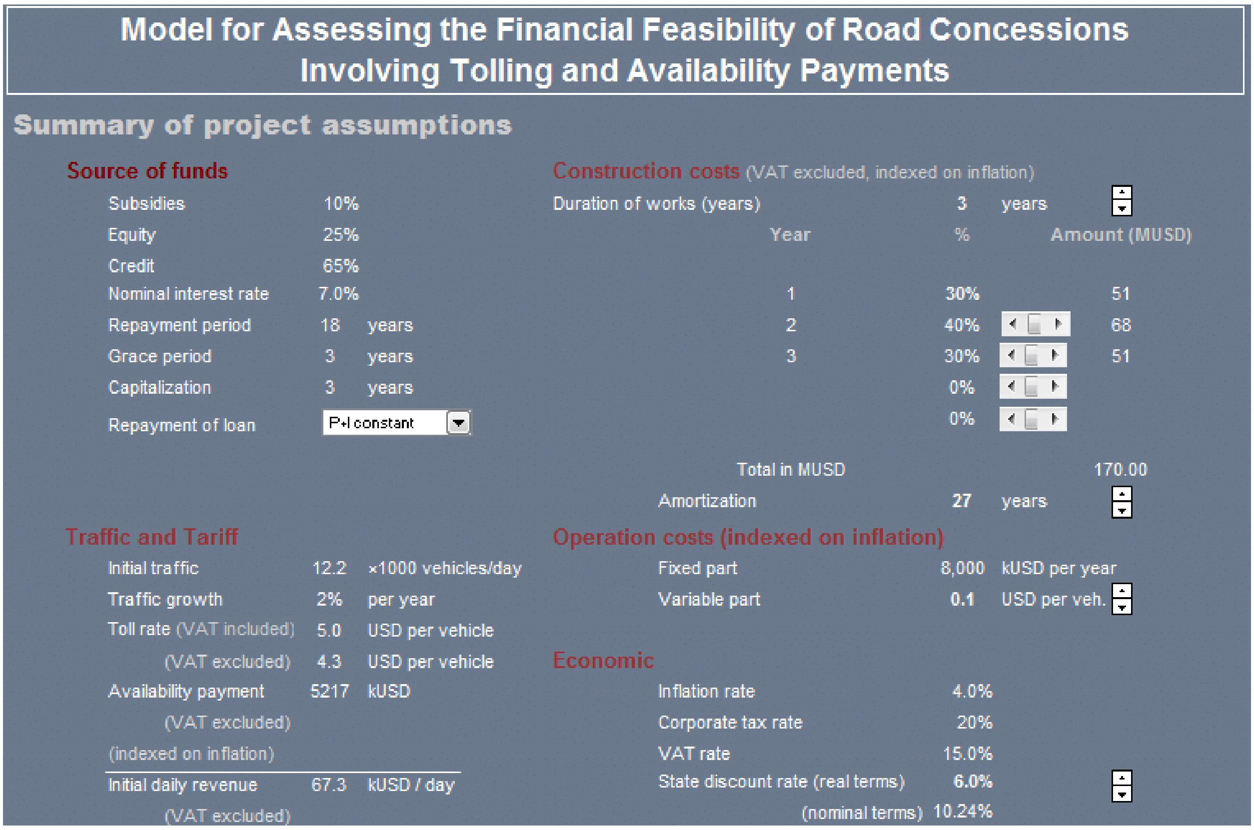

Fig. 1.
Data Sheet

The duration of works can vary from 1 to 5 years. The user enters the duration of works and default values for distribution of works are displayed. The user can modify the default values by using the scrolling bars. The percentage of the first year is calculated as: 100% - sum (% year 2 to % year 5).
The capitalized items are assumed to be depreciated on a straight-line basis throughout the amortization period. The amortization period is equal to, or less than, the difference between the concession life and the construction period.
The operation costs include all operating and maintenance costs that are incurred during the operation period (i.e., from completion of the construction period until the end of the concession period). The operation cost is expressed in terms of the annual equivalent amount of all operation, maintenance and rehabilitation costs during the operation period. The operation costs are adjusted for inflation every year.
State discount rate is the rate used to calculate the present value (PV) of government cash flows. The user should input the state discount rate in real terms (DR_r). The model then computes the state discount rate in nominal terms (DR_n) through the formula:

$$DR_n = DR_r + \text{Inflation} + DR_r \cdot \frac{\text{Inflation}}{100} \quad (1)$$

The **Cash Flow Graph** (Figure 2) represents the concession company cash flows during the concession period. They are classified by order of repayment priority: Operation costs > Taxes > Debt service > Dividends > Shareholders account.
The shareholder account represents a bank account controlled by the company shareholders (fiscal restrictions generally limit the authorized distribution of dividends to the project net income) to which the cash balance is transferred (or drawn from if negative) until it can be distributed as dividends.
When the shareholders' account is insufficient to service the debt, shareholders have to fill the gap and this appears in the graph in the form of negative dividends.
The **Debt Graph** (Figure 3) represents, for the first 30 years of the concession period, separately on the left and right vertical axes, respectively:

- Annual payment of principal and interest during the debt servicing period (grace period + repayment period);
- The two main bank ratios over the repayment period: Annual Debt Service Coverage Ratio (ADSCR) and Loan Life Coverage Ratio (LLCR).

The ADSCR represents, for any operating year, the ability of the project company to cover/repay the debt taking into account the assumptions made in the model. This ratio is determined as follows:

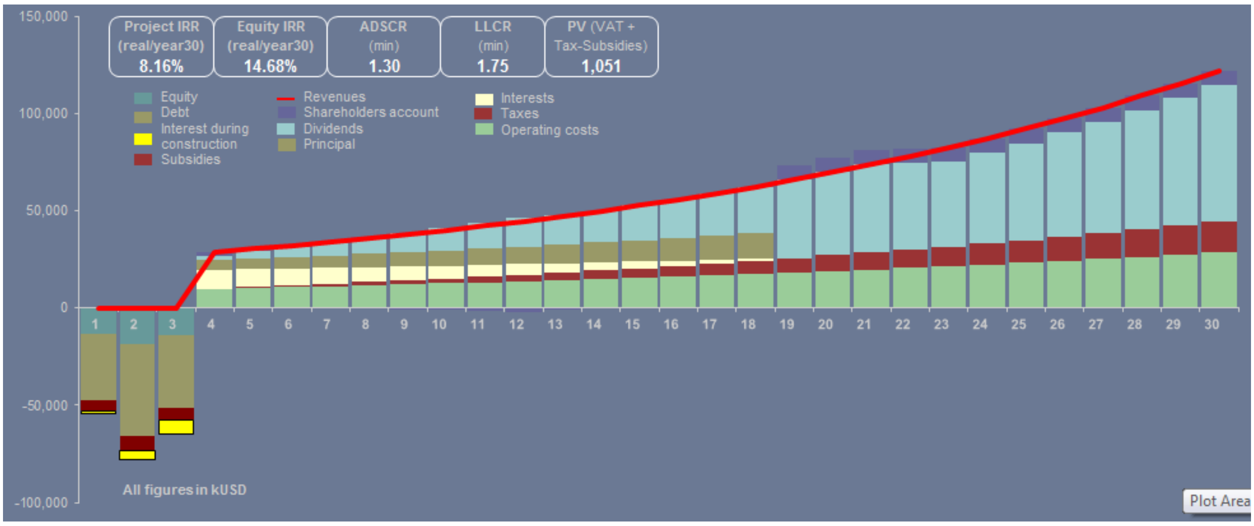

Fig. 2.
Cash Flow Graph

$$ADSCR_i = \frac{CBDS_i}{DS_i} \tag{2}$$

where:
CBDSi - the net cash flow before debt service in year i (i.e., the amount of cash remaining in the project company after operating costs and taxes have been paid), and
DSi - the debt service to be paid in year i (principal and interests).

The project is considered viable for the lenders when the ADSCR is greater than 1. If a margin of say 20% is deemed appropriate, then the ADSCR should be at least 1.20, for every year of the project life. This means that if, for whatever reason, the project revenue is 20% below what has been forecast in the financial model for a given year, the project company should still be able to repay the debt in that year. In high risk circumstances, a minimum ADSCR of 1.4 is sometimes used.
The LLCR indicates, for any operating year, the capacity for the project company to bear an occasional shortfall of cash while maintaining its debt service to the end of the debt. This ratio is calculated as follows:

$$LLCR_i = \frac{NPV(CBDS_i \rightarrow end)}{DS_i \rightarrow end} \tag{3}$$

where:
NPV (CBDSi→end) - the present value of the net cash flow before debt service from year i to the end of the debt repayment period, and
DSi→end - the total of debt service remaining at year i (principal and interests).

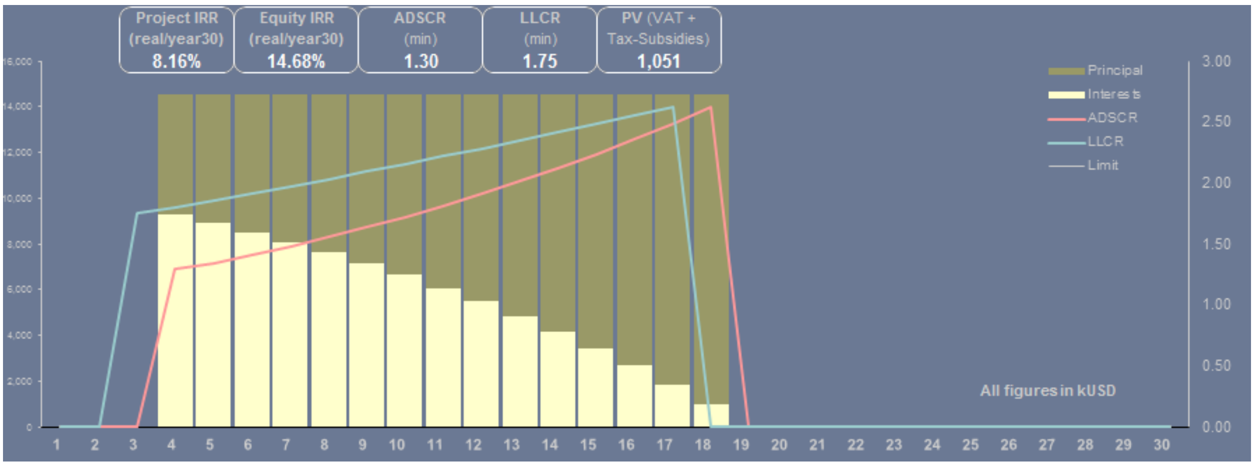

Fig. 3.
Debt Graph

The project is considered viable for the lenders when the LLCR is higher than 1 (in practice usually higher than 1.3) for every year of the project life. The ADSCR and LLCR are used by the lenders to check the project capacity to repay debt in adverse scenarios, including if revenues are below forecasted levels. Nominal interest rate is used to calculate the annual interest paid.

The **Dividend Graph** (Figure 4) displays, for the first 30 years of the concession period, respectively on the left and right vertical axes:

- The equity mobilized by company shareholders during the construction period and the dividends received by them during the operation period.
- The two main financial indicators over the concession: the financial Internal Rate of Return of the project (Project IRR) and the Equity IRR.

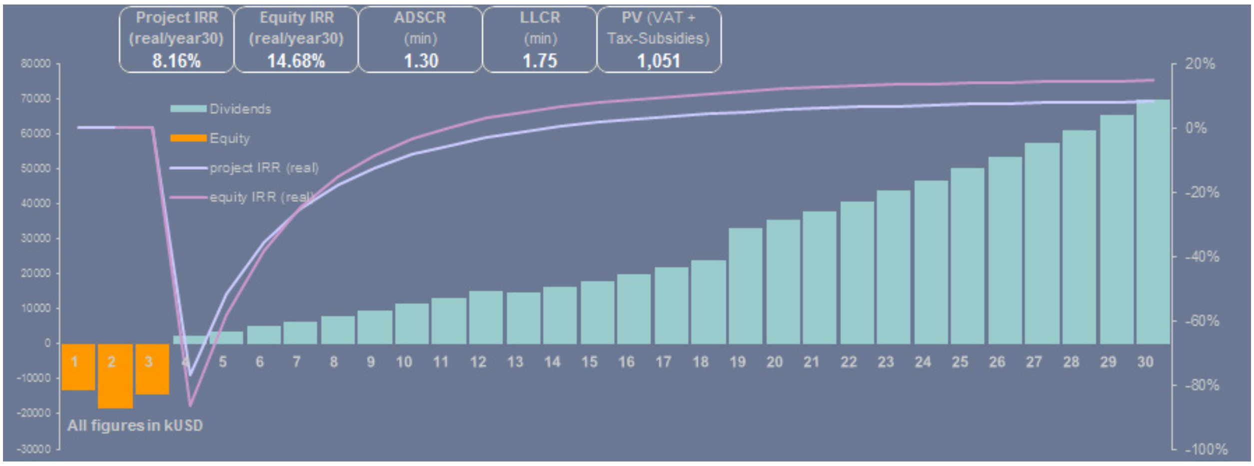

Fig. 4.
Dividend Graph

The model allows a rapid verification that Project IRR is independent from the project financial structure (i.e., the proportion of subsidies, equity, and loan) while Equity IRR is directly related to it.

The assumptions and results of the project financial assessment are summarized on the **Summary of Assumptions and Results** sheet, presented in Figure 5.

SUMMARY OF THE MAIN ASSUMPTIONS

GENERAL

Concession life	30	years
Construction Period	3	years
Construction costs	170,000	kUSD
Amortization	27	years

FINANCIAL STRUCTURE

Subsidy	10%	of the construction costs
Equity	25%	of the construction costs
Debt		
Maturity	18	years
Interest rate	7.0%	
Grace period	3	years
Repayment of loan	P+I constant	

TOLL AND TRAFFIC

Toll, VAT included	5	USD per vehicle
Initial traffic	12,200	vehicles / day
Traffic growth	2.0%	

AVAILABILITY PAYMENT

Availability payment in the first year (VAT included)	6,000	kUSD

OPERATING COSTS

Fixed part	8,000	kUSD per year
Variable part	0.1	USD per vehicle

OTHER KEY PARAMETERS

Inflation rate	4.0%
Corporate tax	20.0%
VAT rate	15.0%

SUMMARY OF THE RESULTS

FINANCING PLAN

Uses (in kUSD)	196,776
Construction costs (nominal terms)	183,957
Capitalised Interests	12,819

Sources (in kUSD)	196,776
Investment subsidy	18,396
Equity	45,989
Debt	132,391

FINANCIAL RATIOS

Minimum ADSCR (Annual Debt Service Coverage Ratio	1.30
Minimum LLCR (Loan Life Coverage Ratio)	1.75
Minimum PLCR (Project Life Coverage Ratio)	2.91

PUBLIC AUTHORITIES' FINANCIAL FLOWS

PV on Subsidy (kUSD)	-15,145
PV on the VAT (kUSD)	48,063
PV on the Corporate Taxes (kUSD)	26,004
PV on Availability Payments (kUSD)	-57,870
PV on the State revenues (kUSD)	1,051

SHAREHOLDERS' RETURN

Project IRR after tax (real terms)	8.16%
Project IRR after tax (nominal terms)	12.49%
Equity IRR (real terms)	14.68%
Equity IRR (nominal terms)	19.27%
Equity return period (years)	11

Fig. 5.
Summary of Assumptions and Results Sheet

Each one of the three graphs (Figures 2 to 4) displays five key project financial indicators:

- Project IRR – the project financial Internal Rate of Return for the concession period (in real terms);
- ROE – the Return on Equity for the concession period (in real terms);
- Minimum ADSCR - the minimum Annual Debt Service Coverage Ratio;
- Minimum LLCR - the minimum Loan Life Coverage Ratio;
- PV – present value of the net financial contribution from government. The government pays the required annual availability payment (or annuities) to the concessionaire and may also pay subsidies during the construction period, and recovers corporate taxes and VAT during the operation period. The indicator shows the present value the financial balance for the government throughout the concession period. When PV is zero, the project is fiscally neutral for the government. If PV is negative, it is shown in red in the graph sheets. The tax amounts (corporate tax and VAT) are considered positive (for this purpose), while government payments are considered negative.

Fifteen key project characteristics (Figure 6) can be modified in any of the three graphs. Following any change in parameters, all the worksheets are automatically updated. The ranges of variables included in the model reflect realistic conditions in most projects. When required, such ranges can be changed by model specialists.

Fig. 6.
Key Project Characteristics

Comments are triggered by the model to inform of unrealistic or impossible data entries. For example, if the concession life is set at a value less than the debt maturity, a message is displayed to alert the user and the model automatically corrects the debt maturity to ensure consistency. Comments are also provided if results deemed unfeasible are obtained (e.g., ADSCR less than 1.2).

3. Numerical Example

Assuming that previous studies have shown that a proposed PPP project to build a road is economically justified, and socially and environmentally sound, the following numerical example shows how the financial model can be used to estimate the minimum Annual Availability Payment that a potential concessionaire will require from the government to undertake the project. Table 1 provides a summary of data for the proposed PPP project.

Table 1
Example of basic assumptions used to estimate the minimum availability payment for a PPP project to attract private investors

A. Project Parameters
Concession term: 30 years
Construction cost: $170 million
Capital structure: Equity, 25%; Subsidies, 10%; Loans, 65%
Three-year construction period, with progress rates of:
Year 1: 30%; Year 2: 40%; Year 3: 30%
Initial traffic: 12,200 vehicles per day
Traffic growth rate: 2%
Maximum acceptable toll rate (VAT included): $5.0 per vehicle per 100 km
Operating expenses: $8 million per year (at opening year) plus variable expenses of $0.1 per vehicle
Discount rate (real terms): 6%
Inflation=4% per year
Tax rates: (a) VAT: 15%; (b) Corporate tax: 20%
Amortization period: 27 years
B. Loan Terms
Nominal Interest rate=7% per year
Loan grace period: 3 years;
Loan repayment period=15 years

Let us also assume that the following targets (or constraints) will have to be met for the project to be able to attract private investors:

- Equity Internal Rate of Return (or Return on Equity): ROE $\geq$ 14%

- Annual Debt Service Cover Ratio: ADSCR ≥ 1.2.

The model can now be used to estimate the minimum Annual Availability Payment that a potential concessionaire will require from the government to undertake the project. As a first step, the user should enter the data provided using both the Data and the Cash Flow Graph worksheets.
The user can now go to the Cash Flow Graph and obtain the minimum Annual Availability Payment ($ million) by trial and error, by varying the Availability Payment so that the financial indicators calculated by the model are equal to or just above the minimum required threshold for ROE and ADSCR. By doing this, the user should find that an Availability Payment of $6 million (VAT included) is the minimum amount that would satisfy the two indicators.
In conclusion, an Annual Availability Payment of $6 million (in the first year of operation, in present value terms); payments in subsequent years would be adjusted according to inflation) should be able to attract private investors. The corresponding two financial indicators are ROE = 14.68%, and ADSCR = 1.3.
The financial model, as currently developed, does not directly address the uncertainty in model parameters, such as construction cost and traffic and revenue forecasts. Nevertheless, the model can be used to carry out sensitivity analyses. The user can change the value of an input parameter (e.g., construction cost) and obtain the resulting impact on the financial indicators. For example, if the construction cost increases to $200 million, ROE would reduce to 11.92% and ADSCR to 1.06, which would turn the project not financially feasible (according to the financial targets adopted above).
Similarly, the amount of availability payment can be adjusted to keep the project financial indicators at an acceptable level. Table 2 and Figure 7 present the needed availability payment if construction cost varies in the range from $140 million to $200 million.

Table 2
Needed availability payment as a function of construction cost

Construction cost (MUSD)	Availability payment (MUSD)	Project IRR (%)	Equity IRR (%)	ADSCR	LLCR
140	2	8.17	14.47	1.24	1.73
155	4	8.17	14.59	1.27	1.74
170	**6**	**8.16**	**14.68**	**1.3**	**1.75**
185	8	8.16	14.76	1.32	1.76
200	10	8.15	14.83	1.34	1.76

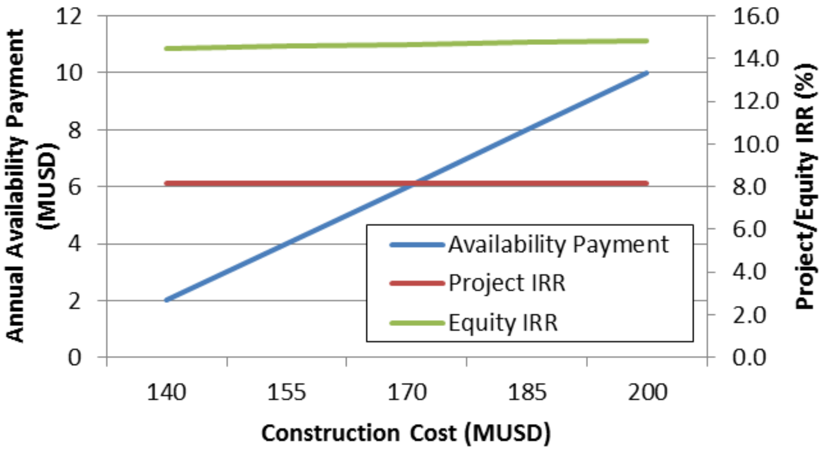

Fig. 7.
Variation of needed Availability payment with change of construction cost

Such a simplified model is particularly useful when only preliminary project data is available.

4. Summary and Conclusion

This paper focused on availability payments (also called annuities, as in South Asia), as a complement to toll revenues, where such revenues are not enough for the project to attract private partners. This would occur, for example, because of relatively low traffic volumes and/or toll rates. The paper presented the development of a user-friendly model to assess the financial feasibility of road concessions that include tolling and availability payments. The tool is based on the graphical financial model of the Toolkit for Public Private Partnership in Roads and Highways, which was developed by the World Bank.

Based on a comprehensive related literature review, it appears that the new model will fill an important gap in the set of tools available for the financial assessment of road PPPs or concessions.
A practical application of the model was demonstrated in the paper. For a set of road project parameters, traffic volume and maximum acceptable toll rate, the model was used to estimate the minimum availability payment that would be required for the project to attract private sector interest, that is, potential bidders in a competitive bidding scenario. The model can also be used to carry out sensitivity analyses. The user can change the value of an input parameter (e.g., construction cost) and obtain the resulting impact, for example, on the investor's return on equity and annual debt service cover ratio. Such a simplified model is particularly useful when only preliminary project data is available.

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