Survey on the determination of costs of capital in the German railway infrastructure sector
March 2022
Executive summary[1]

The normative basis for determining the costs of capital in the railway infrastructure sector is provided by section 32(1) in conjunction with section 1(9) and by section 25(1) in conjunction with Annex 4 point 5 of the German Rail Regulation Act (Eisenbahnregulierungsgesetz – ERegG). The ERegG provides for costs of capital to be priced into access charges. The costs of capital must be determined in accordance with the German law.

The Bundesnetzagentur commissioned a consortium of consultants comprising Frontier/IGES/Prof Zechner/Prof Randl to update the report on costs of capital for the German railinfrastructure sector. The consortium was commissioned to:

- review the method in place to determine the cost of equity and the cost of debt;
- determine the parameters for the cost of equity and the cost of debt using the previous/updated method.

This report's (forthwith report 2022) quantitative results are presented as ranges. Below is a summary of the results of the full update.

Review of the capital market model

In June 2021 the consortium finalised a report on possible methods in which different capital market models were compared, evaluated and put out for consultation (forthwith report 2021). The report 2021 looked at different approaches that essentially provide for the basic requirements for determining costs of capital that are commonly used, namely:

- **capital market benchmark** – the expected interest rate must correspond to the interest rate for an alternative investment with a comparable risk structure;
- **risk diversification** – a risk that can be reduced by spreading the investment portfolio (diversification) does not need to be remunerated; only the remaining market (systematic) risk is remunerated;
- **quantification** – a suitable method must allow a quantitative analysis.

The report 2022 summarises the main results from the report 2021 on capital market models and considers the responses received to the consultation. The consultants conclude that the capital asset pricing model (CAPM) is still suitable for determining the cost of equity. The only change compared with the previous approach is to determine the beta values for companies from eurozone countries using a European reference market instead of a national reference market.

[1] Source: "Bestimmung der Kapitalkosten für Eisenbahninfrastrukturunternehmen – 2022", Frontier Economics/IGES/Randl/Zechner, page 5 et seq.

Risk-free interest rate (for cost of equity)

The consultants use long-term bonds to determine the risk-free interest rate. To increase consistency with the historical market risk premium and to avoid the possibility of excessive temporary national special effects, they use AAA euro zero-coupon bonds with a residual maturity of 10 to 15 years.

Depending on the residual maturity covered and based on a 10-year average for AAA euro zero-coupon bonds, the risk-free interest rate ranges **from 0.64% to 1.03%**.

Market risk premium

In the report 2021 the consultants also discussed different methods for determining the market risk premium. The results were put out for consultation. The report 2022 summarises the methods for determining the market risk premium and their advantages/disadvantages and considers the responses received to the consultation. The consultants conclude that the historical approach is the most suitable approach for estimating the market risk premium. They determine the market risk premium on the basis of the latest data available from Dimson, Marsh and Staunton[2] on the historical market risk premium for a global portfolio. The consultants estimate the market risk premium currently expected by investors compared with long-term government bonds in accordance with the long-term geometric and arithmetic mean calculated by Dimson, Marsh and Staunton to range **from 3.2% to 4.4%**.

Specific risk factor (beta factor)

The railway infrastructure sector is special in that there are no listed infrastructure managers that solely provide for the use of railway infrastructure and could therefore be used as peer/benchmark companies. The consultants therefore use a multi-level analysis to identify relevant peer companies, resulting in the ranges shown in Figure 1 for different infrastructure managers. The different infrastructure manager groups defined for the asset beta ranges can be described as follows: 100% passenger services[3], mixed passenger and freight services[4], and 100% freight services[5]. The ranges determined reflect the remaining uncertainties in terms of the transferability of the beta values for the peer companies identified to German infrastructure managers. The ranges ensure that a larger number of peer companies is used for each infrastructure manager group without giving the companies any particular weighting.

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[2] Dimson, Elroy, Marsh, Paul and Staunton, Mike, Credit Suisse Global Investment Returns Yearbook 2022

[3] Railway infrastructure, train formation facilities, storage sidings used for passenger services but not, or only to a negligible degree, for freight services, and passenger stations.

[4] Railway infrastructure, train formation facilities, storage sidings used to a significant degree for passenger and freight services.

[5] Railway infrastructure, train formation facilities, storage sidings used for freight services but not, or only to a negligible degree, for passenger services, freight stations and terminals, marshalling yards and ports.

Figure 1 Summary of how the ranges for asset betas were derived

IM with 100% customers in passenger services	IM with customers in passenger and freight services	IM with 100% customers in freight services
0,25 -0,58	0,25 – 0,58 0,25 - … 0,25 – 0,95	0,25 -0,95
Utilities (0,29 – 0,58) Energy networks (0,25 – 0,43)	Ports (0,51 – 0,83) Rail Freight company (0,58 – 0,95) Utilities (0,29 – 0,58) Energy networks (0,25 – 0,43)	Ports (0,51 – 0,83) Rail Freight company (0,58 – 0,95) Utilities (0,29 – 0,58) Energy networks (0,25 – 0,43)

Source: Frontier/Randl/Zechner/IGES; IM = infrastructure manager

Compared with the last full update of the report on determining costs of capital for infrastructure managers made in 2016, this study no longer considers rail passenger services to be comparable with German infrastructure managers and no longer uses them to determine the beta ranges.

Imputed capital structure

In accordance with Annex 4 point 5.2 ERegG, the regulatory authority sets the interest rates under current legislation on the basis of the actual capital structure of the infrastructure manager concerned. The explanation about deriving an imputed capital structure for infrastructure managers therefore – at least under current legislation – plays a minor role in the procedures. The consultants determine the imputed capital structure as in the past on the basis of the analysis of peer companies and international regulatory decisions.

The imputed capital structure ranges **from 40% to 60%**.

Cost of debt

For this report (2022) the consultants also use the above mentioned report on possible methods (2021) as the basis for determining the ranges for the rate of interest on debt by presenting the advantages/disadvantages of the previous approach compared with the use of a broader bond index and taking into account the responses received to the consultation. In contrast to the previous method, they now use the iBoxx indices from IHS Markit. They use the indices to determine two ranges: one range for the rate of interest on debt for federally owned infrastructure managers and one range for non-federally owned infrastructure managers.

Here, the following applies:

- **Relevant indices** – Given the obvious differences between the credit ratings of companies with a strong government influence and the credit ratings of private companies, the consultants consider it appropriate to differentiate between federally owned infrastructure managers and non-federally owned infrastructure managers when calculating cost of debt that are customary in the market. For federally owned

infrastructure managers they use the iBoxx Non-Financials AA[6] for residual maturities of 7-10 years and 10+ years. For non-federally owned infrastructure managers they use the iBoxx Non-Financials A and BBB for residual maturities of 7-10 years and 10+ years.

- **Calculation period for averaging** – It was considered appropriate to have a compromise for the calculation period to take account of the most important recent developments in the financial markets and at the same time level out short-term individual effects by including a longer observation period. The consultants propose averages of up to 10 years. Based on the annual averages currently used by the Bundesnetzagentur for calculating the cost of debt, the possible period for averaging ranges from 5 to 10 years.
- **Considering the effects of government-related infrastructure managers** – The Bundesnetzagentur's previous approach partially took into account the effects of government related enterprises on cost of debt through the use of corporate bonds for government**-related** infrastructure managers. Additional factors can be considered when ultimately determining the cost of debt within the range, such as the importance of federally owned infrastructure managers with respect to transport and the economy, and a validation using bond yields observable in the market for European government-related infrastructure managers.

Based on the relevant iBoxx bond index and a calculation period of between 5 and 10 years for averaging, the cost of debt for **federally owned infrastructure managers** ranges **from 0.6% to 1.6%** and for **non-federally owned infrastructure managers from 0.8% to 2.5%.**

Summary of results

Table 1 provides an overview of the individual ranges for the parameters for determining cost of equity and cost of debt.

Table 1 Overview of ranges

Range		2022	
		Min	Max
Risk-free interest rate		0.64%	1.03%
Market risk premium		3.2%	4.4%
Asset beta	100% passenger IMs	0.25	0.58
	Passenger/freight IMs	0.25	0.58
			0.95
	100% freight IMs	0.25	0.95
Debt-equity ratio (imputed capital structure)		40%	60%
Cost of debt	Federally-owned IMs	0.6%	1.6%
	Non-federally-owned IMs	0.8%	2.5%

Source: Frontier/Randl/Zechner/IGES

[6] As mentioned above, this index covers bonds with different ratings (such as AA+, AA, AA-).