Modern public tendering (MEAT): Cornerstone for the rail mobility revolution

Perspectives and success stories

Report to the VDB

DIE BAHNINDUSTRIE.

VDB VERBAND DER BAHNINDUSTRIE IN DEUTSCHLAND E.V.

This report evaluates international case studies of innovative award procedures and is the result of joint research by McKinsey and the VDB. The findings are based on a large number of interviews with representatives of selected VDB member companies and their client companies to determine the advantages and disadvantages of applying MEAT criteria in the awarding of railroad projects. The interviews were documented and coordinated with the relevant companies and their customers. To place the interviews in the context of current challenges in the mobility and transportation sector in Germany, McKinsey also conducted fact-based analyses and research based on data from publicly available sources. Furthermore, a joint VDB and McKinsey steering committee guided the study. VDB thanks McKinsey for the preparation of the final report and the participating member companies and their customers for their broad support.

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Executive summary

The innovative strength of the rail industry is of great importance if the desired mobility revolution in Germany is to succeed. In this regard, the still prevailing tendering and award practice in this country – one that prioritizes the lowest acquisition price – is proving to be an obstacle to turning innovations into reality. This practice not only slows down innovation and competition for the best solution; it also increases the risk of higher costs in development and throughout the entire life cycle, as well as of supplements and budget overruns. Particularly in complex projects, the current practice of awarding contracts increases the risk that some of the manufacturers' execution expertise will not be used.

The European Union (EU) has recognized this problem – which is, in part, a consequence of current tender law – and introduced the MEAT (Most Economically Advantageous Tender) evaluation method in 2014. This approach can play a key role in the implementation of innovations. This is because when MEAT criteria are applied, the focus is not on the purchase price but on criteria such as life cycle costs, sustainability, quality in implementation and operation, functionality of the tender, degree of technology support, as well as design and accessibility.

Nevertheless, in the rail sector, especially in Germany, the acquisition price continued to be the decisive criterion in tenders. But recently, the chances have increased significantly that the MEAT method can soon play a key role in this country as well: The coalition agreement between the Social Democratic Party of Germany (SPD), Alliance 90/The Greens, and the Free Democrats (FDP) provides for a revision of German public procurement law. The parties aim to specify the requirements of public procurement procedures in Germany in line with European procurement law and ensure that public procurement accounts for sustainability and innovation as well as for economic efficiency.[1]

Our analyses of the approach taken in eight successful examples of MEAT tenders in the rail sector have revealed that no single path can be classified as the ultimate "best practice." This is because the clients (e.g., transport operators or infrastructure managers) have tendered a wide range of products and services with very different scopes of use. However, all eight examples of successful tenders in the areas of rolling stock and infrastructure show, without exception, a positive measurable effect on rail market share. Customers directly value a better offer, for example, higher punctuality and door-to-door speed in combination with an improved design.

The MEAT approach to a tendering and award practice upholds four criteria as non-negotiable considerations – cost, quality, functionality, and design. Our analysis of successful MEAT tenders in rail reveals important insights along each of these criteria specific to this industry:

Criterion I: Life cycle costs and sustainability

— When maintenance is integrated into the RFP for new vehicles, contractors are incentivized to optimize vehicle design and development in a way that equally minimizes maintenance and acquisition costs over the life cycle and provides the greatest possible transparency in variable costs. High energy, resource, and cost efficiency always means more climate protection.

[1] Coalition Agreement 2021 - 2025 between the Social Democratic Party of Germany (SPD), Alliance 90/The Greens, and the Free Democrats (FDP), p. 33; https://www.spd.de/fileadmin/Dokumente/Koalitionsvertrag/Koalitionsvertrag_2021-2025.pdf

— Outsourcing of inventories for spare parts and special tools as well as the external provision of training for the customer's own maintenance personnel reduces the customer's capital and investment costs for the maintenance of the new vehicle classes and significantly lowers its economic risk.

— In addition, there is the option to completely outsource the general operating and maintenance costs to the contractor and to agree on a contractual availability commitment. This makes it possible to set the variable costs for the client at a fixed price per kilometer (or similar indicators) and to provide a fully operational fleet throughout. For passengers, this means more punctuality and greater reliability in rail transport.

Criterion II: Quality in implementation and operation

— Tendering with high quality, depth of detail, and defined milestones for the contractor (RAMS process) on the one hand, and close monitoring on the client side on the other, can significantly increase quality and the likelihood of meeting time targets by linking them to bonuses.

— Pilot projects and multistage bidding procedures considerably improve quality in the execution of large procurement transactions. The prerequisite for this is that the tendering procedures include negotiations and discussions about technology and project management with the OEMs, while at the same time giving the client the opportunity to better adapt the tender to the cooperation with the contractor and its own goals.

Criterion III: Functionality of the tender and degree of technology support

— Technology-specific RFPs combined with an availability commitment and supply and maintenance obligations allow contracting authorities to promote and deploy new technologies without having to assume liability and risk for failures of that technology.

— Innovation and the development of the best technological solution for the contracting authority can be launched through functional, open-technology tenders with detailed requirements and a significant proportion of non-monetary decision criteria.

Criterion IV: Design and accessibility

— The prioritization of design and functionality over price and the inclusion of users in the development of the requirements for the new design creates, on the one hand, a clearly defined idea of the end product for the manufacturer even before the tendering process begins. On the other hand, this inclusive, user-centered tender process offers a public, media-effective marketing opportunity for the operator and client.

— Specific design requirements resulting from inclusion and consideration of the special needs of minority groups (e.g., handicapped people) among the customers/passengers can lead to innovations and the development of new vehicle types by means of industry dialogs and functional tenders.

In addition, five overarching success factors for convincing tenders can be derived from our analyses:

1. **Predefinition of the participation processes.** This applies in particular to very large projects.
2. **Long-term involvement of OEMs or contractors.** Ideally, this commitment is made at the beginning of the bidding process and applies to the entire life cycle of the products or services.
3. **Avoiding superfluous specifications and fixed budgets.** To incentivize cost-effective innovation, MEAT tenders are increasingly moving away from providing excessively detailed specifications or providing fixed budgets.
4. **Creating and providing additional requirements.** These include detailed preparation of the RFP process, staffing the RFP team with experienced personnel, providing a functional specification with room for innovation, offering a high-quality design, and applying proven industry standards.
5. **Efficient risk management.** Important components of the success of the overall project are fair and balanced contract terms and an allocation of contractual risks that is guided by the basic principle of better risk governance.

Applying the identified overarching success factors in MEAT tenders can strengthen, albeit indirectly, the rail and public transport ecosystem in many respects. This approach can help increase rail's market share of both passenger and freight transport and, in turn, increase the rail sector's contribution to achieving the climate targets.

Introduction

In order to reduce CO_2 emissions in the transport sector by more than 40% by 2030, Germany is striving for a mobility revolution in the rail sector. This revolution aims to address two demands that have previously been seen has mutually exclusive – protect the environment and increase transport and mobility. By offering attractive rail services, both objectives can be met.

The rail revolution would increase rail's share of the freight transport market by 7 percentage points to 25% by 2030 and double rail's share of passenger transport.[2] This is to be achieved through projects such as the expansion of local public transport (ÖPNV), Deutschlandtakt, digital rail, and line electrification.

Its innovation and strength put Germany's rail industry in a solid position to deliver forward-looking solutions with "Rail 4.0." But how can this innovative mobility framework become reality?

The prevailing tendering and awarding practices in Germany are proving to be an obstacle. The main characteristics of the current process include a comprehensive and detailed technical specification of the requirements by the customer and the subsequent public tendering competition on the basis of the most favorable purchase price. This is not the best approach for the planned mobility revolution for several reasons:

— Innovations and competition for the best solution are slowed down.

— There is a significant risk of higher costs throughout the life cycle, especially higher energy, operating, and maintenance costs.

— With no recourse to established industry platforms, there are sometimes excessive development costs.

— Both incomplete or incoherent tenders and the commercial strategy of the suppliers cause increased supplementary risks and budget overruns.

As a result, especially in the case of complex projects, the current award practice creates a considerable risk that a large part of the execution competence on the manufacturer's side will not come to fruition.

The EU has recognized this problem – which is partly due to tendering law – and therefore introduced the MEAT (Most Economically Advantageous Tender) evaluation method in 2014. This approach is used to determine the most economically advantageous tender and can play a key role in turning innovations into reality: In MEAT tenders, decisions are not made primarily on the basis of the purchase price, but based on criteria such as life cycle costs and sustainability, quality of implementation and operation, functionality of the tender and degree of technology support, as well as design and accessibility.

In this way, taxpayers consistently receive "best value" for their invested tax money – subsidized low-cost bids alone are no longer a guarantee of winning a contract. At the same time, tenders based on MEAT criteria – hereinafter referred to as MEAT tenders – make it possible to strengthen the entire rail and mass transit ecosystem in many respects. This helps to increase the share of rail in transport, both in passenger and freight, and puts the rail sector in a position to provide an even stronger impetus for achieving climate targets.

[2] Coalition Agreement 2021 - 2025 between the Social Democratic Party of Germany (SPD), Alliance 90/The Greens, and the Free Democrats (FDP), p. 49; https://www.spd.de/fileadmin/Dokumente/Koalitionsvertrag/Koalitionsvertrag_2021-2025.pdf

Despite these advantages and although the legal basis for broader tender criteria has existed since 2014, it must be stated: In Germany in particular, the decisive criterion in most tenders in the rail sector continues to be almost exclusively the purchase price.

This may be surprising for two reasons: Firstly, several successful examples already prove that the MEAT criteria can be applied well and with legal certainty in practice and that MEAT awards offer numerous advantages. Secondly, the public sector in Germany holds a dominant position in all rail segments – be it the municipalities in local public transport, the federal states in local rail passenger transport (SPNV), or the Federal Government in long-distance rail passenger transport (SPFV), freight transport and infrastructure. Thus, public procurement law applies to most award procedures in the German rail sector; accordingly, the public sector can exert considerable influence on tendering and award practices.

The aim of this study is to inform public-sector decision makers, in particular, about MEAT awards when tendering in the rail sector and to motivate them to apply them. In the following, we will first focus on key aspects of MEAT awards before going on to explain successful examples of MEAT awards, including their design, impact, and success factors.

1 Current tendering practice in the German rail sector offers considerable potential for improvement

In most tenders, the lowest price is the most important award criterion. According to the European Commission, price is the sole criterion in 55% of all award procedures, irrespective of the sector; in contrast, evaluation criteria such as environmental protection, social factors, or innovation are hardly used.[3]

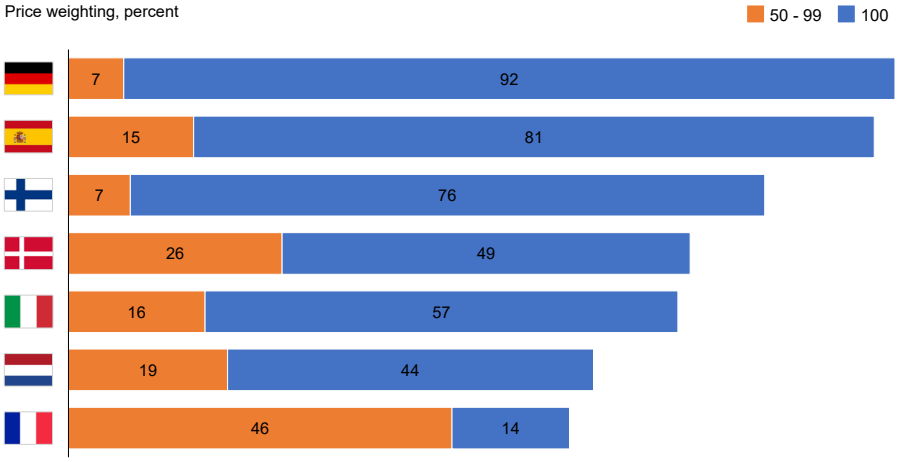
In the various EU member states, price is weighted differently in tenders in the rail sector: In Germany, approximately 92% of all public tenders are awarded solely on the basis of purchase price. In France, on the other hand, price is the sole criterion for awarding contracts in only around 14% of all tenders, and in around 40% it is weighted at less than 50%. Exhibit 1 shows the different degrees to which different EU countries weight price in their tenders.

Exhibit 1

Price is currently still the most important (or only) award criterion

Distribution of tenders in the rail sector according to price weighting in the evaluation[1]

Price weighting, percent



1 The analysis was conducted using a proprietary analytics tool and is based on 23,000 EU-wide tenders in the rail sector from 2013 to Q3 2020

Source: Tenders Electronic Daily

The large differences in price weighting illustrate that there is no uniform approach to the design of public tenders. While price is the most important award criterion in only around around two thirds to three quarters of the tenders in countries such as Italy, Denmark, or the Netherlands, the price focus is much more pronounced in countries such as Germany – where the acquisition price is the most important award criterion in 99% of all tenders in the rail sector.

The acquisition price is still the most important or only award criterion in many projects in Germany and other EU countries – the life cycle costs incurred are not taken into account. There are various reasons for this:

— The price of a good or service can be easily compared between bidders.

— Because of this clear and simple comparability, the awarding authority runs little risk of being sued for lack of transparency or unfairness.

— Evaluating a supply based on purchase price alone appears to have less (immediate) impact on the public budget. The public sector is committed to efficient budgeting. Therefore, decision makers emphasize the lowest possible purchase price and disregard actual life cycle costs or externalities.

[3] European Commission; https://ec.europa.eu/growth/single-market/public-procurement_en

In the long run, however, this practice may have numerous disadvantages. If the purchase price is seen as the sole or most important award criterion, other important criteria fall by the wayside, for example, longer-term cost effectiveness/total cost of ownership (TCO), innovation, sustainability, or design. This can have detrimental consequences (Exhibit 3) and increase the TCO for all parties involved (see text box “Case study: Purchase of a locomotive”).

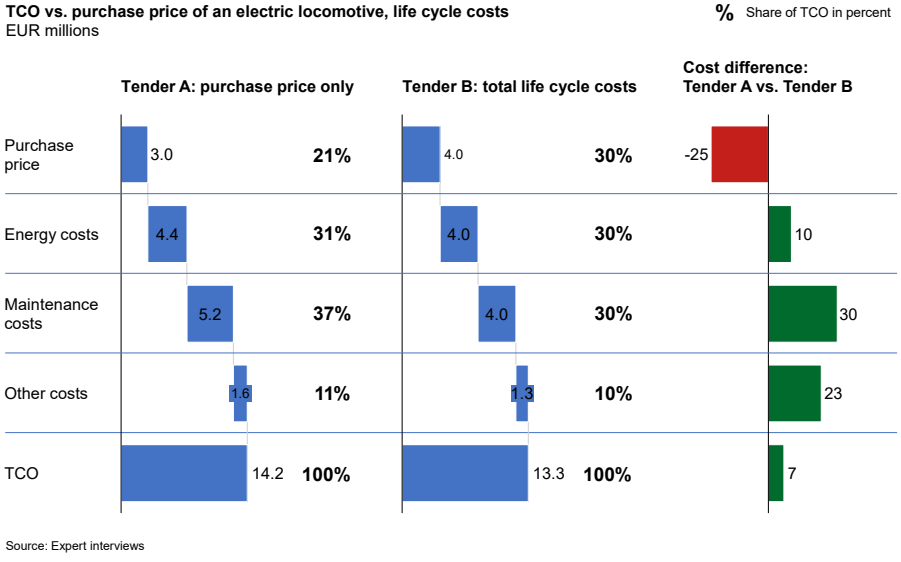
Case study: Purchase of a locomotive

A rail operator wants to buy a new electric locomotive and compares two offers (Exhibit 2). For offer A, the purchase price is lower. However, over the entire life cycle, offer B is the better deal because the operator would save money on energy and maintenance.

If the operator were to base the decision on the purchase price alone, it would miss out on the better price-performance ratio of offer B.

Exhibit 2

Focusing solely on the purchase price obscures the fact that energy and maintenance costs could end up being significantly higher



Source: Expert interviews

Exhibit 3

The near-singular focus on price brings many disadvantages

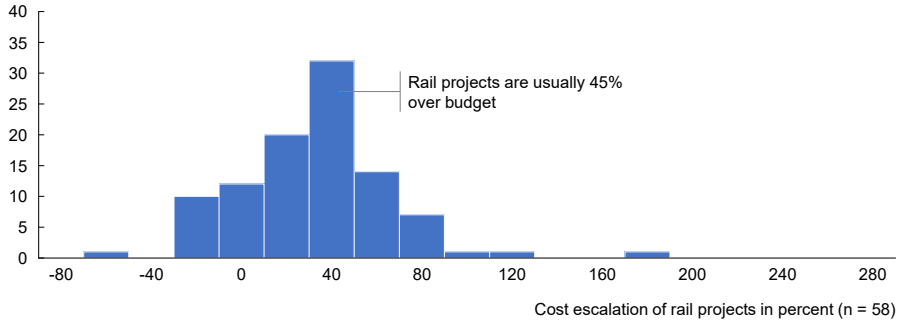
Disadvantages due to focus on price	
Low level of product innovation	Innovative technologies are not considered
Unpredictable life cycle costs	The lowest purchase price disregards all TCO-related effects after delivery
Negative environmental impact	The lowest price is often linked to a negative environmental impact (e.g., CO_2 emissions)
Less focus on qualitative and customer-oriented features	The experience of the end user as well as qualitative aspects such as longevity are neglected
No guarantee for availability of spare parts	Maintenance issues are the responsibility of the operator and procurer – the manufacturer is not liable

In the past, infrastructure projects in the rail sector often exceeded their original budget and schedule targets. Therefore, an unfavorable outcome can also be expected in today's tenders. On average, the original budget for international rail projects is exceeded by around 45%, and in some cases capital expenditures (capex) end up being twice as high (Exhibit 4).

Exhibit 4

Capex escalation in rail infrastructure projects

Historical cost escalation of 58 international rail projects (actual minus planned capex)[1]
Percent



1 According to an analysis of data from 58 rail projects in Europe, North America, Japan, and 9 emerging countries, historical cost overruns for major projects amount to 44.7%. A value of 0% would mean that actual costs are exactly as high as originally planned; figures are adjusted for inflation

Source: Flyvbjerg et al., "How common and how large are cost overruns in transport infrastructure projects;" McKinsey

2 Through its MEAT approach, the EU enables the redesign of public procurement

Today's tendering practice offers considerable potential for improvement. This is at least partly due to the former legal framework (valid for decades), which has only been revised in recent years and replaced by the MEAT approach in 2014. In order to demonstrate the potential and legal applicability of the MEAT approach, the significance of public procurement and its legal framework in the EU are explained below.

2.1 On the importance of public tenders

The tendering of contracts by public authorities is an essential feature of a fair market: The procedure ensures that taxpayers' money is handled carefully.

In Germany, contracts worth a total of around EUR 300 billion are put out to public tender every year – this accounts for around 10 to 15% of Germany's GDP.[4] The public sector plays a dominant role in all rail segments in Germany, be it local authorities in local public transport, the federal states in regional passenger transport, or the Federal Government in regional passenger transport, freight transport, and infrastructure (see excursus in the appendix "Overview of the structure of the rail sector in Germany"). Thus, public procurement law applies to most award procedures in the German rail sector.

Particularly for complex, expensive, and long-lived acquisitions such as rail technology, the following applies: An effective tendering process is the basis for ensuring that the product or service put out to tender is provided or rendered on time and in full and that the agreed life cycle costs are not exceeded.

2.2 On the legal framework for public procurement in the EU

The legal framework for public procurement is set at the highest level by the EU. The EU has the exclusive legislative right to establish the competition rules necessary for the functioning of the internal market.

The EU's public procurement directives regulate the award of contracts for goods, works, and services by public authorities and bodies.

In 2014, the European Commission adopted a new procurement law – the Public Procurement Directive (2014/24/EU). Its aim was to improve and simplify the tendering process, promote innovation, and serve society by taking into account social, environmental, and other aspects in award decisions. In addition, a separate directive was adopted for the award of contracts in the water, energy, and transport sectors (2014/25/EU). This directive specifically regulates procurement in formerly state-owned sectors such as the rail sector.

The European procurement directives are binding on member states in terms of outcome, but not in terms of methods. Individual countries can therefore regulate how they achieve these goals with their own laws.

[4] Federal Ministry for Economic Affairs and Energy, "Public Procurement in Germany," p. 3; https://www.europarl.europa.eu/cmsdata/138604/06%20-%20SOLBACH%20-%20Public%20Procurement%20in%20Germany.pdf

The EU public procurement directives[5] are based on three core principles:[6]

— **Transparency.** All relevant information must be accessible to all companies participating in the tender. The award decision must be based on clearly defined criteria.

— **Competition.** Invitations to tender for public contracts above certain thresholds must be published on the public platform "Tenders Electronic Daily" (TED). The project must be described in a neutral manner so that all qualified bidders have equal opportunity to participate.

— **Non-discrimination.** The bidder's origin is not a selection criterion; local bidders must not be given preference – rather, all bidders must be treated equally. Similarly, there must be no preference for goods from a particular member state or local content requirements.

Thresholds

If a public authority wishes to procure works, goods, or services, it must put them out to tender. If the volume is above a certain threshold, these tenders must in principle be published EU-wide so that every European company can participate.

These thresholds vary depending on the subject matter of the contract, as internal market competition occurs at different financial volumes. The thresholds were last updated in 2019 and are:

— EUR 5.35 million for works and concessions

— EUR 139,000 for general contracts awarded by supreme and higher federal authorities

— EUR 428,000 for contracts awarded by authorities in a certain sector (including the rail sector)

— EUR 214,000 for contracts in all other sectors.[7]

Projects below these thresholds must also be put out to tender by a public authority or body, but only at national level. These sub-threshold tenders are regulated by national legislation. Rail technology projects (e.g., the procurement of new rolling stock) are usually above the threshold and therefore must be tendered EU-wide.

Definition of the MEAT approach

With the introduction of the new procurement directives in 2014, the EU included non-monetary award criteria in the legislation for the first time. The MEAT approach aims to overcome the disadvantages of using only the initial price of products or services as a decision criterion in a tendering process. MEAT is an evaluation method for contracting authorities to determine the most economically advantageous offer: Contracts are not awarded primarily on the basis of purchase price, but based on categories such as cost effectiveness, quality and value, societal effect, and other criteria (Exhibit 5). To enable a holistic comparison between the different suppliers, the individual categories are included in the calculation of total life cycle costs (or alternative concepts).

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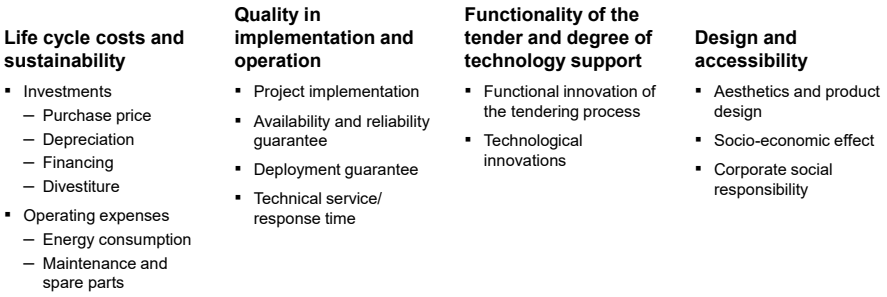
5 European Commission; https://ec.europa.eu/growth/single-market/public-procurement_en

6 Another principle is the support of small and medium-sized enterprises, which is promoted by the EU procurement directives. Details on fair competition in the rail sector can be found in VDB's discussion paper "Vorn bleiben. Mind-the-Gap-Strategie für einen freien und fairen globalen Wettbewerb in der Bahnindustrie" ("Staying ahead. Mind-the-Gap strategy for free and fair global competition in the rail industry"); https://bahnindustrie.info/fileadmin/VDB-Positionspapiere/VDB-Diskussionspapier-Vorn-Bleiben.pdf

7 Commission Delegated Regulation (EU) 2019/1828 of 30 October 2019; https://eur-lex.europa.eu/legal-content/en/TXT/PDF/?uri=CELEX:32019R1828&qid=1572978073922&from=en

Exhibit 5

Overview of MEAT criteria



Source: VDB (conceptual representation)

Each category will be evaluated against multiple criteria to determine the most economically advantageous bid.

Award decision

The EU Public Procurement Directive lists several criteria that an awarding authority can use to guide its decision. According to Directive 2014/25/EU[8], the most economically advantageous tender should be determined using a cost-effectiveness approach, for example, the calculation of life cycle costs in accordance with Article 83. This may include the optimal price-performance ratio, but also environmental effects or social aspects related to the subject of the contract in question. The MEAT criteria may be applied accordingly. In order to uphold the principle of equal treatment in the awarding of contracts, contracting authorities must publish the award criteria and their relative weighting. This weighting can be specified as a range with a maximum margin.

Transposition of the EU Procurement Directive into national law

Since the EU has exclusive competence for legislation in the area of procurement, EU law takes precedence over national law. Thus, the 2014 directives had to be transposed into national law. By 2019, all member states had ratified the procurement directives and transposed them into national law.

[8] Directive 2014/25/EU of the European Parliament and of the Council of 26 February 2014; https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0025

3 MEAT tenders make better use of the innovative power of the rail industry

Tendering and award practice in the German rail sector has so far largely ignored the MEAT approach. In the following, we first describe the four MEAT criteria (chapter 3.1), which we believe should be given greater weight in public tenders in Germany. We then describe and analyze the design and stakeholder effects of eight MEAT success stories along these criteria (i.e., two cases per criterion (chapter 3.2)). We conclude with an overview of findings and recommendations for successful tenders (chapter 3.3).

3.1 Key aspects of the MEAT criteria for the redesign of tenders

By considering one or more of the MEAT criteria, a tender can be designed to evaluate not only the purchase price but also the total costs and benefits of bids. In this context, the following aspects are of particular importance in each of the four MEAT criteria:

Criterion I: Life cycle costs and sustainability. If maintenance work is integrated into the bidding process for new vehicles, contractors will be moved to optimize the design and development of the vehicles in such a way that maintenance and acquisition costs are equally minimized over the entire service life and the greatest possible transparency is created for variable costs. High energy, resource, and cost efficiency always means more climate protection.

Outsourcing of inventories for spare parts and special tools as well as the external provision of training and education for the customer's own maintenance personnel reduce the customer's capital and investment costs for the maintenance of the new vehicle classes and significantly lower the economic risk.

In addition, there is the option to completely outsource the general operating and maintenance costs to the contractor and to agree on a contractual availability commitment. This makes it possible to set the variable costs for the contractor at a fixed price per kilometer (or similar indicators) and to provide a fully operational vehicle fleet throughout. For passengers, this means more punctuality and greater reliability in rail transport.

Examples of such an award are the procurement of streetcars for the city of Augsburg and of new vehicles in regional transport for the Rhine-Ruhr Express (see chapter 3.2, pages 20 and 25).

Criterion II: Quality in implementation and operation. Tenders with high quality, depth of detail, and defined milestones for the contractor (method for specifying and evidencing reliability, availability, maintainability, and safety (RAMS) on the one hand, and close monitoring on the client side on the other) can significantly increase quality and the probability of meeting time targets by linking them to bonuses.

Pilot projects and multistage bidding procedures considerably improve quality in the execution of large procurement transactions. A prerequisite for this is that the tendering procedures include negotiations and discussions on technology and project management with the OEMs, while allowing the client to better adapt the tender to the cooperation with the contractor and its own goals.

Examples of these awards include the rail technology for the Gotthard Base Tunnel in Switzerland and intelligent switch monitoring in Norway (see chapter 3.2, pages 30 and 34).

Criterion III: Functionality of the tender and degree of technology support. Technology-specific tenders in combination with an availability commitment and supply and maintenance obligations enable contracting authorities to promote and deploy new technologies without having to assume liability and risk for failures of this technology.

Innovation and the development of the best technological solution for the contracting authority can be launched through functional, open technology tenders with detailed requirements and a significant proportion of non-monetary decision criteria.

Examples of this are hydrogen-powered passenger trains for local transport in the Rhine-Main region and innovative maintenance vehicles for rail infrastructure in Norway (see chapter 3.2, pages 40 and 44).

Criterion IV: Design and accessibility. While the value of design and accessibility is difficult to quantify, as a criterion it will play an increasingly important role in the acceptance and attractiveness of rail as a means of transport in the future. In view of the rising expectations of local transport customers with regard to comfort and aesthetics (see excursus “Shifts in customer expectations”), both aspects must be seen as critical to success. This is especially true regarding competition with new forms of mobility that can respond more flexibly to customer preferences.

Examples of these innovations include new vehicles for the Bern–Solothurn regional light rail and the Giruno high-speed trains (see chapter 3.2, pages 48 and 53).

Excursus: Shifts in customer expectations

Shifting traffic to rail is essential for reducing CO_2 emissions and achieving climate targets. In order to increase the share of rail in passenger transport, rail must be seen as an attractive alternative to private cars or airplanes in urban areas and on long routes (Exhibit 6).

Exhibit 6

Selected examples show that attractive and innovative offers in rail passenger transport can significantly increase its modal share

	Streetcar in Karlsruhe	High-speed train between Berlin and Munich	High-speed train between Paris and Brussels	Public transport in Vienna
Situation	Since 1970, trains on isolated regional lines in Karlsruhe have been integrated with inner-city streetcars and regional trains, allowing passengers to travel seamlessly from the city center to the suburbs	With the high-speed Berlin-Munich connection built in 2017, the travel time is now only **2.5 hours**	The introduction of high-speed trains was successful thanks to investments in a state-of-the-art high-speed line and trains that meet customer needs	The city of Vienna invested **> EUR 400 million** to offer inexpensive public transport tickets (EUR 365 for an annual ticket)
Impact	Passenger numbers increased by **> 50%** between 1996 and 2016 With the integration of neglected regional lines into the streetcar system, the number of passengers increased by up to **800%**	The modal share increased **from 23% to 45%:** Passengers are traveling by air less and less, which has already **saved ~ 188,000 tons of CO_2**	Rail operators doubled their share of traffic to **> 50%** of all trips between the 2 cities Air traffic almost came to a standstill on this route, and the share of passenger cars fell by **> 20%**	The modal share of public transport increased by **~ 10%** in the last 25 years and is currently **38%** for public local transport and only **29%** for passenger cars

Source: Bundesinstitut für Bau-, Stadt- und Raumforschung; System-Bahn; industr.com; Die Zeit; Der Spiegel

Rail should not be seen by customers as a “mode of last resort” or even as an occasional mobility solution. For rail to be a success, it should be seen, consistently, as the better alternative to private motorized transport in as many areas of their lives as possible. It is therefore crucial to understand and deliver on all of customers’ public-transportation preferences. But what are the most important decision-making criteria for customers when choosing a means of transportation? A McKinsey survey conducted in Germany investigated customer preferences in mass transit and what drives the decision making of frequent public transport users when it comes to which mode of transportation they choose (Exhibit 7):

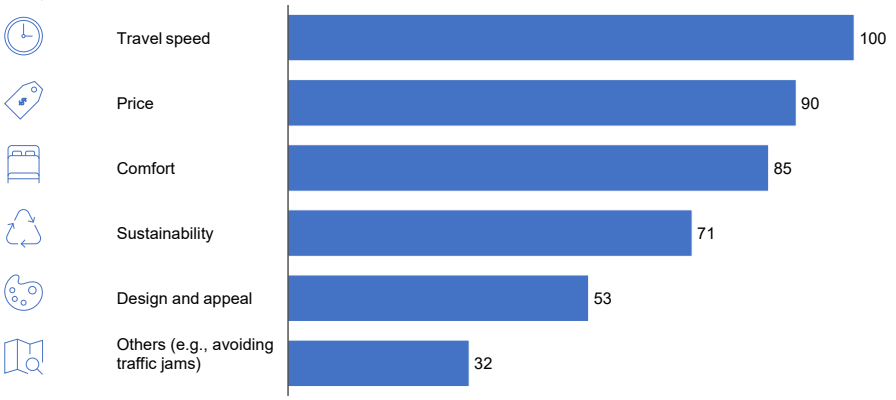
Exhibit 7

Consideration of customer preferences helps to increase the attractiveness of rail

Besides travel speed and price, there are other factors that are important to customers when choosing a means of transportation

Most important reasons for frequent public transport users’ choice of means of transport, percent[1]

n = 1,647



1. Multiple answers possible, indexed

Source: McKinsey Future of Mobility

1. Travel speed. When choosing a mode of transport, the availability of transport options and the time required to travel door-to-door are usually the most important decision criteria. Rail transport must be a fast and efficient option for customers along the entire travel chain. This requires high availability and good accessibility of public transportation. Where this is not possible, a seamless connection with short transfer times to other means of public transport is required. In addition, travel speeds should be comparable to motorized private vehicles or airplanes. High-speed trains, for example, meet these requirements: They are well connected to other means of public transport and faster than a passenger car, which makes them attractive to customers.

A study by the German Federal Ministry of Transport and Digital Infrastructure found that metropolitan regions where mass transit is easily accessible and perceived as an efficient and fast mode of transport have a much higher share of public transport users (modal split) than remote rural areas. In major German cities such as Berlin, Hamburg, or Bremen, more than 50% of respondents said they preferred to use public transport services. In remote areas, this is true for less than 30% of respondents. The share of motorized private transport in the overall transport market, on the other hand, is much higher in remote areas than in metropolitan areas. In Rhineland-Palatinate or Saxony-Anhalt, more than 80% of respondents prefer to drive, while in Hamburg or Berlin the figure is only around 50%.

The preference for the car in remote areas of Germany is also reflected in the assessment of the traffic situation. In the city states of Hamburg and Berlin, 27% of respondents rate the general situation in local transportation as very good, and about 50% rate it as good. In remote areas, only 7% rate the overall public transportation situation as very good, and about 35% feel it is good.

This study underlines the need for good accessibility of local transport in order to increase its modal split or market share.

2. Price. In addition to travel speed, attractive prices in local public transport are a decisive criterion for customers. According to a study conducted by ADAC in 2017, 73% of respondents consider the price of public transport to be the most important criterion for switching to public transport.

Two dimensions are decisive here: the cost of using individual transport and the cost of public transport itself. The first dimension cannot be influenced by public transport providers; this requires a change in legislation. For the second dimension, however, providers must offer attractive prices, especially for customers who can easily switch to their private cars. In Vienna, for example, an annual ticket costs EUR 365 and allows the use of all public transportation in the region.

In this context, it is also important to take into account the costs of private transport, which have so far mostly been externalized and thus borne by the general public (e.g., for fair parking management).

3. Comfort. Comfort is another important criterion in the decision for or against a means of transport. Today, hardly any commuters are willing to travel long distances standing up if they can sit comfortably in their cars. Adequate seating with enough space between passengers is essential – especially during the pandemic, but also afterwards – to attract people back to public transportation.

Comfortably designed and well-equipped trains are highly appreciated by passengers. Demand for universal internet access in stations and trains is also growing. Customers are quite willing to pay a higher price, for example, for integrated mobility offerings (seamless connections between modes of transport, e.g., the ride-hailing app Free Now) and additional services on board (e.g., open WLAN, USB chargers, and entertainment portals). An ADAC study found that 21% of respondents consider the availability of internet or WLAN to be the most important criterion for switching to public transport.

4. Sustainability. The topic of sustainability is becoming increasingly important. Here, rail has a decisive advantage over motorized individual transport. The introduction of new drive technologies – for example, the increasing procurement of hydrogen trains – will further expand this advantage.

Awareness among the population of ESG-compliant behavior (ESG: Environmental Social Governance) is increasing, particularly with regard to the environmental impact of companies. As a result, rail operators are also likely to face increasingly high expectations and pressures from passengers and other stakeholders. Requirements and public scrutiny regarding the sustainability and energy efficiency of trains and infrastructure projects are expected to become more stringent; rail projects will thus have to meet an additional requirement. According to a survey conducted by DB Regio in 2020, 64% of 16- to 29-year-olds consider public transport to be a crucial factor on the road to transport and climate change.

The success of the rail system will depend crucially on the extent to which it takes these different expectations into account.

5. Design and appeal. Most train orders still depend exclusively on life cycle costs and purchase price. Other industries are already further ahead here: Car manufacturers, providers of Mobility as a Service, and even bicycle manufacturers have long understood that design and an individual customer promise are essential additional elements for the success of their products. This also applies to the railroads: Customers appreciate good quality in the design and materials of a rail vehicle and reward this with higher usage.

A successful example in this context is the streetcar systems in France: They often feature special design elements and are thus very popular with residents, especially politicians.

3.2 Description and analysis of selected success stories for MEAT tenders

Eight successful tenders for rolling stock and infrastructure projects from several EU countries were selected as case examples for analysis. This allows a broad perspective on successful tenders in the railroad sector that are aligned with MEAT criteria (hereafter: “MEAT tenders”). Each tender focuses on one of the four MEAT criteria, but at the same time other (MEAT) criteria are taken into account. For reasons of clarity, the examples have been assigned to their respective central criterion (see text box “Overview of MEAT tenders”).

Overview of MEAT tenders

MEAT criterion I: Life cycle costs and sustainability

Case study 1: Streetcars for the city of Augsburg

What is the scope?	11 streetcars, including a maintenance contract for 16 years with a two-time option to extend the contract by 8 years each time and guaranteed technical fleet availability
What is the type of contract?	Focus on availability and reliability
Why is it best practice?	One of the first agreements in public transport in Germany in which the OEM is responsible for maintenance and cooperates with the transport operators in doing so
Facts and figures	Main contract partners: Stadtwerke Augsburg (SWA), Stadler Contract volume: EUR 57 million Year of contract award: 2019

Context and background

The city of Augsburg, with a population of around 300,000, has assigned responsibility for public transport to its municipal utility, Stadtwerke Augsburg (SWA), as a wholly owned subsidiary. It currently operates a network of about 97 kilometers with about 82 streetcars, attracting roughly 64 million passengers per year. Due to the expected increase in demand for public transport, SWA decided in 2017 to purchase new vehicles. From 2022, the network will expand to around 106 kilometers with about 90 streetcars. The project contributes to the larger public transport project “Mobility Hub Augsburg” by aiming for a more modern and attractive public transport system and supporting the mobility shift towards a more sustainable passenger transport system.

In the tendering and contracting process, the main objective was to be able to reliably assess the total life cycle costs. Therefore, SWA was eager to establish clear responsibilities, reduce their own risks, and implement a solution that would allow them to better plan maintenance costs over the entire life cycle. Thus, they decided to include a maintenance contract in the RFP. They also specified that the streetcars should have various state-of-the-art features (“intelligent streetcars”). These include, for example, advanced driver assistance systems, an event-based camera system in place of rearview mirrors, remote diagnostic systems with access via Wi-Fi, and passenger information displays with real-time connections.

Tender process and criteria

2017	SWA decides to purchase new vehicles
2019	SWA initiates a tender and awards Stadler the contract; the contract includes a maintenance agreement
2022	The vehicles are delivered and put into service
2038	The 16-year maintenance period ends; SWA has two options to extend the contract, each time for 8 years
2054	The maintenance period also ends with the life cycle if the option to extend the contract was used twice

The tender was prepared in 2018 with a core team of five SWA employees (operating engineer, lawyer, procurement staff). External support was provided by two engineering firms responsible for the mechanical and electrical specifications, another engineering firm as external consultant, and a law firm.

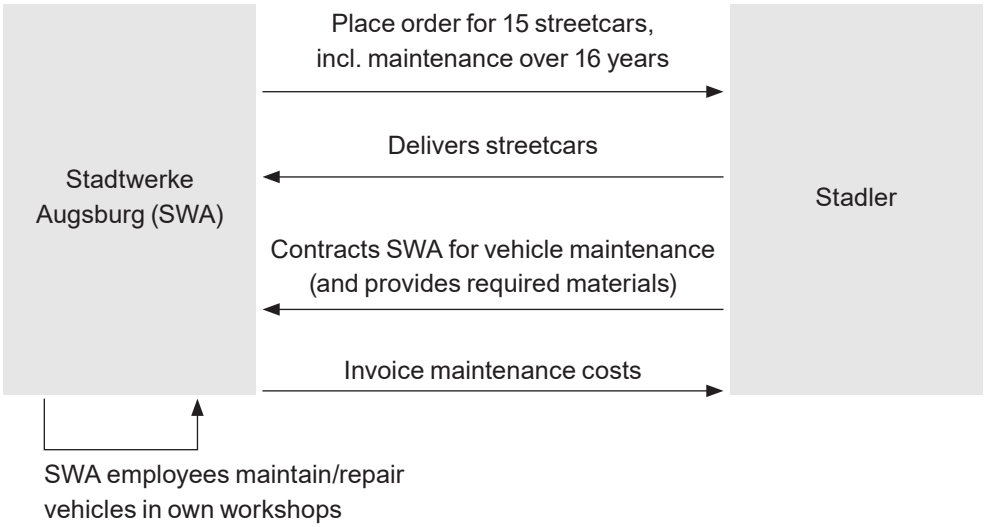
In 2019, the bidding process was initiated. The contract was awarded to Stadler at the end of the year in the amount of EUR 57 million. It is particularly noteworthy that the contract also covers a period of 16 years, during which Stadler will be responsible for maintenance. This is thus the first full maintenance contract for Stadler in public transport in Germany. The contract also includes an option for 16 additional streetcars that would replace and expand part of the fleet for a new line.

The new streetcar

Source: Stadtwerke Augsburg Holding GmbH

The tender was divided into one part for the streetcars and another part for the maintenance contract. Bidders had to submit bids for both parts; these had different requirement specifications. Submitting a bid for only one part would have resulted in exclusion from the process. However, consortia were allowed. In the evaluation, bids for both parts (streetcars and maintenance contract) were considered together. The focus of the tender criteria was on price.

Overview of contractual relations



The tender for the streetcars mainly included technical criteria. In addition, various criteria for improving passenger acceptance and comfort were taken into account, for example, passenger information systems, WLAN, or functions for the needs of people with disabilities. In addition, high design requirements were set to ensure visual uniformity and to ensure that SWA standards were met. The specification of these requirements posed a challenge, as they are subjectively perceived and can thus pose legal risks. Therefore, a major effort was made to define legally sound objective criteria that simultaneously describe the design ideas as well as possible.

Environmental and comparative sustainability aspects were integrated into the technical requirements. For example, values were defined for energy consumption as well as the environmental friendliness of the air conditioning system, based on CO_2 emissions.

The maintenance contract specifies a cooperation between Stadler and SWA for 16 years and includes an option for SWA to extend the maintenance contract twice for 8 years each time (maximum term of 32 years, corresponding to the predicted service life of a streetcar). In this construct, SWA is both customer and contractor, as SWA employees will perform the maintenance work in SWA's municipal workshops on behalf of Stadler. It is contractually stipulated that SWA will pay a fixed price per kilometer and Stadler will be responsible for the maintenance work in return.

SWA will retain sovereignty over the disposition of the vehicles. Even though the SWAs are consequently bound to the maintenance periods set by Stadler, which are based on the general legal provisions, they can plan the exact timing of the maintenance and repair work in coordination with the overall vehicle dispatching. Stadler thus offers availability guarantees based on technical rather than operational availability. Thus, Stadler guarantees a specific fleet availability that is subject to a penalty for non-compliance. In the event of major incidents with high projected repair costs, SWA must also inform Stadler immediately so that the company can determine how to proceed.

While all maintenance and repair work is performed in SWA workshops by SWA employees, Stadler provides all the necessary material. Thus, it is not on SWA's books. Standard materials are stored in SWA workshops, other parts are to be provided within a certain delivery time. Standard equipment for the workshops is provided by SWA, while Stadler provides highly specific tools. Stadler also provides training for SWA employees in advance, while SWA bears the cost of subsequent training due to employee rotation. SWA also carries out the maintenance work and invoices Stadler for it in accordance with a labor guide catalog. This catalog, which is also a tool to evaluate technical availability, specifies fixed times for all working steps.

Stakeholder effect

Overall, the tender and contract enable SWA (and, thus, the city of Augsburg) to increase passenger capacity as part of the future regional mobility concept and meet the needs of passengers as well as overarching expectations, such as local design guidelines. The project thus contributes to higher availability and attractiveness of public transport and is designed to support the mobility shift towards a more sustainable passenger transport system.

The contract is one of the first in public transport in Germany in which a private company is responsible for the cost of maintenance – in this case, a rail OEM – but the transport authority can continue to employ their own maintenance staff and use their local workshops.

From SWA's perspective, the combined tender (i.e., equipment plus maintenance contract) has several positive implications:

— First, SWA expects to save up to 40% in variable costs per kilometer and up to 50% in fixed costs for repairs and overhauls compared to previous costs when they were responsible for maintenance themselves. While a significant portion of these savings is achieved through the more economical vehicles, another significant portion can also be attributed to the advantageous contract and the resulting optimized processes. Because of the integration of maintenance into the RFP, SWA was able to transparently assess future maintenance costs during the RFP process, thereby capturing life cycle costs.

— Second, the approach increases planning reliability. This also reduces risks for SWA, as some of the costs are fixed costs (e.g., for an overhaul after 8 and 16 years) or they are entirely dependent on mileage and therefore easy to forecast.

— Third, SWA can better coordinate internal operational processes and make them more transparent, as the price list agreed with Stadler specifies a certain duration for all steps within the scope of the maintenance work. At the same time, however, the complex constellation in relation to the maintenance contract brings with it some challenges for both parties. During the preparation phase, the distinction between operational and technical availability in particular proved difficult. In addition, SWA must now digitize internal processes, specifically to track internal maintenance work and bill Stadler for it. Both parties must also integrate data systems such as the warehouse system. However, this approach offers SWA the opportunity to introduce modern digital management in their workshops and also improve the maintenance of old vehicles. Stadler, on the other hand, initially had to invest a lot of work in creating the extremely specific labor guide catalog that forms the basis for the maintenance contract.

Key findings

— In this modern maintenance model, the OEM contracted SWA as the transport operator to perform vehicle maintenance. SWA employees can carry out the maintenance work in the local workshops, while at the same time reducing risks and uncertainty for SWA.

— Because life cycle costs, including maintenance costs, were considered in the bid evaluation, SWA was able to forecast operating costs over the entire life cycle and then select the most economically advantageous bid.

— The integration of design criteria in the tender created the conditions for a vehicle design that is adapted to local requirements and provides the desired customer experience, including a high level of comfort for passengers.

Case study 2: Regional trains for the Rhine-Ruhr Express (RRX)

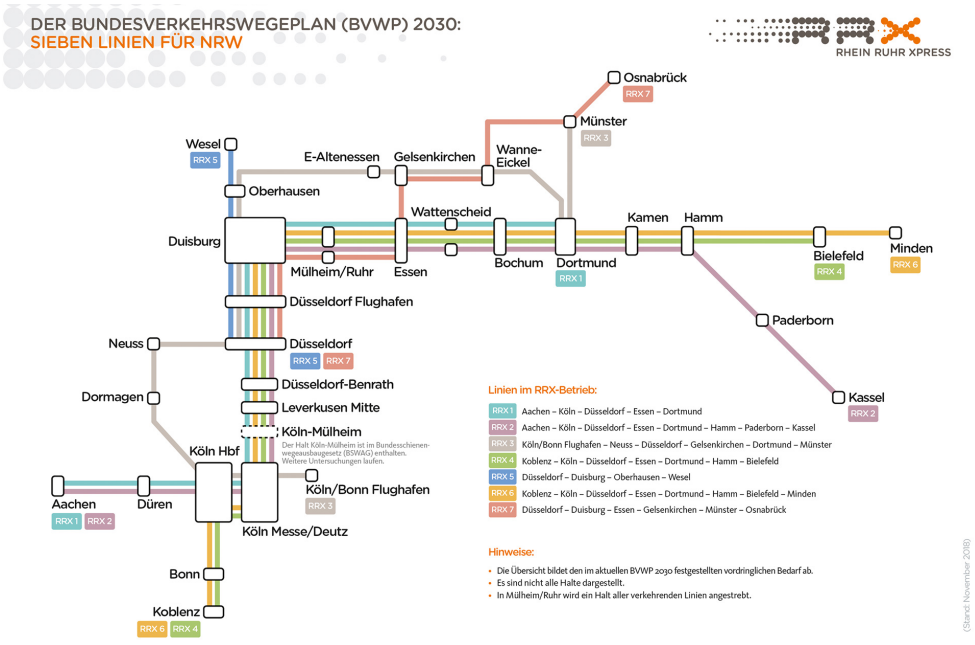
What is the scope?	84 multiple units, including a maintenance contract over a period of 32 years and guaranteed availability of the fleet
What is the type of contract?	Focus on availability and reliability
Why is it best practice?	One of the first agreements in the German public transport market where the manufacturer bears full maintenance responsibility over the entire life cycle
Facts and figures	Main contract partners: Transport authorities (led by VRR plus NVR, NWL, SPNV-Nord, and NVV), the state of NRW, Siemens Contract volume: EUR 1.7 billion Year of contract award: 2015

Context and background

The Rhine-Ruhr Express (RRX) is a major infrastructure project in North Rhine-Westphalia (NRW). It is designed to strengthen local public transport and provide a competitive solution for modal shift with more capacity, higher quality, and greater reliability. The project is led by Verkehrsverbund Rhein-Ruhr (VRR) and funded by the state of NRW.

In the future, the RRX will run at least every 15 minutes on the core route between Cologne and Dortmund. To this end, the infrastructure is being upgraded – tracks and stations are being modernized, new RRX trains are being put on the rails, and a modern operator concept is being implemented.

The RRX network in its target state in 2030



Source: Kompetenzcenter Marketing NRW

The project is expected to benefit 8 million people living in cities with RRX connections. This corresponds to 45% of the population in NRW. Capacity is to be increased by 50% on these lines so that the RRX provides better connectivity and reduces congestion on the train network and on highways. The broader goal is to contribute to the transport turnaround towards a more sustainable transport system – in particular by reducing emissions. This is to be achieved with energy-efficient trains and a target shift of 418 vehicle kilometers per year to rail.

In this case study, the main focus is on the tender and contract for the new trains. Notably, the OEM assumes major responsibility for the entire life cycle of the train.

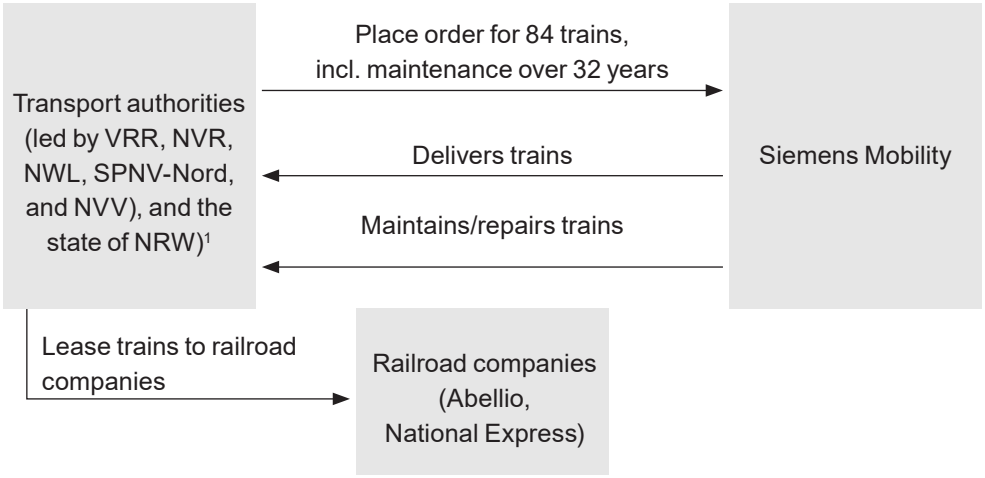
Tender process and criteria

2005	Memorandum of understanding for the entire RRX infrastructure project is signed
2012	Preparation of tender documents for the trains starts
2013	Tendering process officially begins
2015	Siemens receives order for delivery of 84 multiple units
2018	First multiple unit is delivered
2020	Last multiple unit is delivered
2050	32-year maintenance period ends

The general RRX infrastructure project was already initiated in 2005 with a declaration of intent and a memorandum of understanding. The actual process did not start until 2012, when the responsible transport authorities put together the tender documents with a core team of around 15 people. The official tender was launched in 2013 with a prequalification round. Following a negotiated procedure with a competitive bidding process, Siemens was awarded the contract in 2015 to deliver 84 multiple units from 2018 to 2020.

Several players were involved in the design and implementation of the tender. The main responsibility was given to the five regional transport authorities that manage the RRX rail network: Verkehrsverbund Rhein-Ruhr (VRR), Nahverkehr Rheinland (NVR), Zweckverband Nahverkehr Westfalen-Lippe (NWL), Zweckverband Schienen-personennahverkehr Rheinland-Pfalz Nord (SPNV-Nord), and Nordhessischer VerkehrsVerbund (NVV). The process was supported by the state of NRW.

Overview of contractual relations



1 Note: Simplified presentation. The state of NRW and the NVV were involved in the bidding process but are not part of the special-purpose entity that owns the trains

The contract consists of a framework agreement, which includes a contract for the delivery of the trains and a maintenance contract. Siemens is to deliver 84 double-deck multiple units and maintain them over a period of 32 years.

Under the operator model, the special-purpose entity that owns the trains will then lease them to the rail companies. The transport contract was awarded to the two operating companies Abellio and National Express. However, there is no formal contractual agreement between Siemens (maintenance) and Abellio and National Express (operation); the main contractual partners are the transport authorities.

The aim of tendering the trains was to ensure that, with the improved passenger flow and greater number of seats, punctuality would also be improved. Other goals included a modern design with high equipment standards such as Wi-Fi and special windows for better cell phone reception and more comfortable travel on regional services, especially for passengers with limited mobility. Large, barrier-free doors and toilets, reading lights, and power sockets were installed for this purpose. In addition, quiet compartments, for example, were designed to reduce noise pollution. Overall, the innovative tender, which not only placed high demands on the train design but also required a modern operating model, meant that Siemens developed a completely new vehicle platform based on optimized life cycle costs. This was essentially achieved through a sophisticated tendering and evaluation system.

The new RRX train

Source: Siemens Mobility GmbH

In the evaluation criteria in the tender process, the total price was weighted at 84.2%. This is divided into the costs for the trains, energy consumption, and maintenance. The design-related quality of the passenger flow was evaluated according to fixed criteria, included in the evaluation, and weighted up to 0.8%. The remaining 15% was allocated to assessing the OEM's ability to also fulfill the contract. OEMs with an unsound financial position and track record were devalued as a result. Overall, then, price was the decisive factor in the evaluation; however, acquisition costs only account for about one-third of the total price. The other two price elements, which also accounted for about one-third each (energy consumption and maintenance), are described in more detail below.

With regard to the costs for energy consumption, Siemens guarantees the contractually agreed consumption values. For maintenance and general operating costs, the contract provides for a comparatively strict regulation: In almost all cases, the contractor is responsible for the functioning of the trains. In return, Siemens receives a fixed price per operating kilometer. From defective reading lights to the total failure of a train, all types of defects are classified according to their severity. Siemens must repair these defects within a certain period of time and – depending on their severity – pay penalties if the agreed standards are not met. In return, Siemens is held harmless for damage that is not its responsibility (e.g., vandalism) – according to a catalog of fixed damage groups. After 15 years, the contract provides for extensive modernization.

Siemens guarantees the availability of the trains for ongoing operation as well as an operating reserve. This reserve for multiple units in maintenance and repair was not stipulated in the invitation to tender; Siemens was thus able to determine it according to its own calculations and risk forecasts and decided to provide 84 trains.

Stakeholder effect

Initial results show that passenger flow and thus punctuality have indeed improved. Passengers are very satisfied with the new trains. So far, the RRX trains are successfully contributing to a more attractive local transport system.

Thanks to the tender structure, the transport authorities as customer and client were able to estimate the life cycle costs as far as possible and thus realize an economical solution over the entire product life cycle. The tender design provided OEMs with high incentives and benefits for developing a high-quality product with low operating and maintenance costs, for example, by improving energy efficiency and pursuing a design-to-maintain approach that lowers maintenance costs. This reduces energy consumption per seat offered by up to 50%, which can be attributed at least in part to the innovative tender design. For the transport authorities, this approach thus proved to be significantly more cost-effective than conventional tendering.

The tender design even led to innovations in the train market because it used evaluation criteria related to quality, such as passenger flow. Specifically, Siemens developed a completely new vehicle platform for this tender, which was also used by other customers in subsequent years.

The operating model and contract design clearly define responsibilities for day-to-day operations and ensure that defects are repaired reliably and promptly. The individual components in the train were arranged in such a way as to shorten maintenance times. Siemens has also installed a sophisticated sensor system that enables predictive maintenance as well as 3D printers in its workshops, for example, to produce spare parts on demand. Taken together, these measures promise higher availability and better functionality of the trains, and in turn contribute to a more attractive transportation system.

Key findings

— Due to the life cycle approach in the tender, the manufacturer was able to optimize total costs through a design-to-maintain approach – which simplifies maintenance – and by optimizing operating costs. With this approach, energy consumption per seat is expected to fall by up to 50%.

— The RFP also evaluated passenger flow based on the manufacturer's train design. This led to the development of an innovative vehicle platform that improves passenger flow and enhances customer satisfaction.

— In this operating model, the manufacturer must always provide a certain number of operational trains and fix any defects. This creates clear responsibilities and makes operating costs predictable for the transit authority over the entire life cycle.

MEAT criterion II: Quality in implementation and operation

Case study 3: Rail technology for the Gotthard Base Tunnel

What is the scope?	Rail technology for the 57-kilometer-long Gotthard Base Tunnel
What is the type of contract?	Focus on meeting time and cost targets with an extended warranty period
Why is it best practice?	On-time completion of the highly complex project due to strict adherence to the RAMS model
Facts and figures	Main contract partners: AlpTransit Gotthard Ltd (ATG), Transtec Gotthard (consortium) Contract volume: CHF 1.7 billion Year of contract award: 2008

Context and background

This example describes the tender for the railroad engineering of the Gotthard Base Tunnel. The tunnel, consisting of two single-track tubes, is the first railroad line to cross the Alps flat and at low altitude. At the time of construction, its length of 57 kilometers made it the longest tunnel in the world.

The project was preceded by a referendum in which the population voted in favor of building the Gotthard Base Tunnel as part of the New Rail Link through the Alps (NRLA). AlpTransit Gotthard Ltd (ATG) was founded in 1998 for the construction of the Gotthard axis of the NRLA with the two main tunnels, the Gotthard and Ceneri Base Tunnels. This company carried out several separate invitations to tender for the base tunnel – in particular for the tunnel structure, the rail technology, and the construction work. The rail technology included tracks, overhead contact line, power supply, cables, telecommunications and radio installations, safety, automation and control systems, and the connection to the rail network.

Gotthard Base Tunnel with rail infrastructure

Source: AlpTransit Gotthard Ltd

The NRLA is expected to increase capacity by more than 40%, especially for freight traffic, while at the same time significantly reducing travel times for goods and passengers. The Gotthard Base Tunnel was planned primarily as a freight tunnel with a utilization concept of up to six train paths for freight traffic and two train paths for passenger traffic per hour and direction. Together with the Ceneri Tunnel (opening in 2020), it offers a flat rail infrastructure without significant gradients. This allows operators to increase payloads or run with lower traction power, making rail transport more competitive with road transport. The project thus makes a major contribution to the transport transition towards a more sustainable transport system by shifting passenger and especially freight traffic from road to rail.

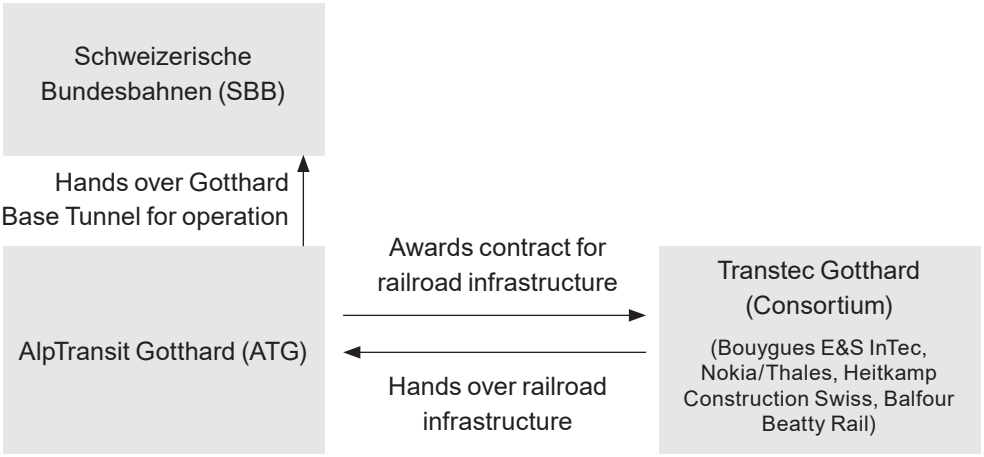
Tender process and criteria

1992	Referendum decides in favor of the construction of the Gotthard Base Tunnel as part of the New Rail Link through the Alps (NRLA)
1998	AlpTransit Gotthard (ATG) is founded
1999	Excavation work for the Gotthard Base Tunnel begins
2005	Tendering process for the rail technology starts
2007	Transtec Gotthard consortium is awarded the contract
2010	Tunnel driving is completed; installation of the railroad technology by Transtec Gotthard begins
2016	SBB commences operation of the NRLA
2024	8-year warranty period for Transtec Gotthard ends

In 2005, ATG launched the tender for the rail technology. It included the precise design and execution of the fixed installations in the base tunnel as well as maintenance up to commissioning. In May 2007, the contract was awarded to the Transtec Gotthard consortium. Transtec was thus awarded the contract as general contractor for the installation of the rail technology in the base tunnel. Work on this began in 2010, and the tunnel was put into operation in 2016. In the end, ATG handed over the project to SBB, which then took over responsibility for train operation.

The Transtec Gotthard consortium was formed by Bouygues E&S InTec, Nokia/ Thales, Heitkamp Construction Swiss, and Balfour Beatty Rail, each with a 25% stake. The four partners shared project management and overarching tasks.

Overview of contractual relations



All relevant product, technology, and quality requirements as well as other expectations were specified in the invitation to tender and were thus considered mandatory prerequisites that all bids had to meet. Therefore, there was no need for an extensive additional catalog of criteria with an evaluation system: If a bid met the specifications of the invitation to tender, all of ATG's expectations were automatically met. Since almost all the specifications had been clarified, the award procedure was almost exclusively a matter of price.

The tender itself was based entirely on the reliability, availability, maintainability, and safety (RAMS) process model and the RAMS milestones, according to which all construction lots had the same predefined structure. The requirements were specified in detail according to the RAMS criteria. Although this resulted in extensive tender documents, the quality of the tender was, in the opinion of both project partners, excellent and a decisive factor in the success of the project. The entire contract, all work steps, and all project progress were based on the RAMS milestones. The individual trades and process steps according to the RAMS process were not considered complete until all RAMS requirements had been met. Only then could the next step be started.

In addition to the technical specifications and the RAMS process requirements, the contract contained further points to ensure economical, first-class completion on schedule: On the one hand, precise life cycle costing (LCC) values were specified, and on the other hand, the invitation to tender provided for a warranty period of eight years from commissioning. The burden of proof was on the contractor for the first three years and then on the customer, ATG, thereafter.

To ensure that the schedule was adhered to, the general contractor was promised a bonus for punctual commissioning. Initially, the plan was to gradually reduce this bonus as construction delays increased, but ultimately the bonus was tied solely to the deadline and would have been eliminated entirely in the event of any delay.

Stakeholder effect

Despite the size and complexity of the project, time and cost targets were largely met. Particularly helpful throughout the project was the political will, clearly formulated from the outset, and the decision made by the public in favor of the Gotthard Base Tunnel via the referendum. This meant that the project had the backing of politicians and the

public – even when the balance of political power in the country changed. In the event of major obstacles in the course of the project, it was also possible to ensure good planning and good decision-making processes. For example, the bonus proved to be a strong incentive for the contractor to complete the project on time.

The decisive factor for the project's success was probably the fact that the tender and project were based on the RAMS process model without exception. The detailed tender laid the foundation for the transparent execution of all steps. Of central importance were the RAMS milestones, which precisely defined the sequence of all process steps right from the start. A process step was not considered complete until it had been documented in accordance with the RAMS requirements and this documentation had been handed over. Only then could the next step begin. Based on the milestones and specifications, the individual subcontractors in the consortium handed over all work phases of the individual construction lots to the general contractor as early as possible and documented them accordingly. The RAMS process specified exactly how handoffs were to be made when transitioning to a new phase. Once a trade reached a milestone, it was documented and reported to ATG. This documentation and joint inspections allowed ATG to track and review performance and progress at any time.

ATG took advantage of this transparency offering and closely monitored the process. To this end, it deployed numerous technical consultants to monitor progress with the necessary expertise and sufficient capacity.

Nevertheless, the RAMS process also presented some challenges for those involved. The biggest difficulty was that several stakeholders, especially at the management level, were not familiar with the RAMS process. They had reservations and saw the RAMS requirements as a nuisance and unnecessary bureaucracy. It therefore took some effort to convince these parties, especially at the beginning.

In terms of life cycle costs, the LCC values and the extended warranty period offered a suitable compromise solution. In this way, the contractor ensured a longer warranty without causing additional complexity that would have arisen if the maintenance work had been transferred to the contractor.

Key findings

- The design of the tender and contract according to RAMS criteria laid the foundation for reliable execution and adherence to the schedule, among other things through the prescribed step-by-step procedure, in which all milestones are documented and handed over.
- The client took advantage of the high transparency of the detailed documentation to monitor progress. Among other things, he sent several technical consultants to monitor the project.
- The LCC values required in the RFP are a suitable compromise to account for life cycle costs without transferring life cycle maintenance to the contractor and thus potentially increasing complexity.

Case study 4: Countrywide rollout of the ERTMS/ETCS signaling system in Norway

What is the scope?	Digitization of the Norwegian rail network through implementation of the ETCS Level 2 train control and signaling system, including a maintenance period of 25 years after completion
What is the type of contract?	Functional specification with a focus on quality and timely delivery
Why is it best practice?	High weighting of quality and reliability of execution, based on a sophisticated tendering and negotiation process
Facts and figures	Main contract partners: Bane NOR, Siemens Mobility Contract volume: EUR 800 million Year of contract award: 2018

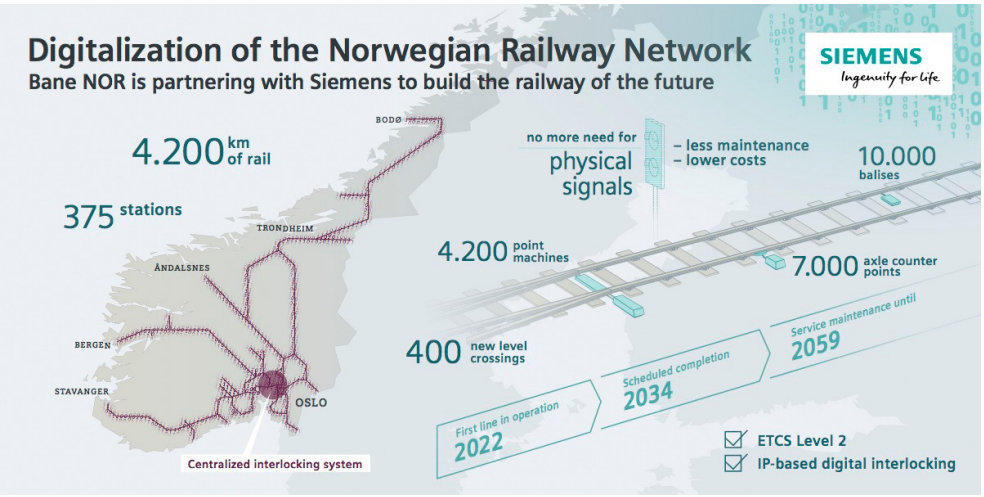
Context and background

This case study addresses the planned digitization of the Norwegian railroad network by 2034, led by Bane NOR (previously Jernbaneinfrastrukturforetaket), the Norwegian state-owned company responsible for the national railroad infrastructure. To achieve the goal of digitization, ERTMS (European Rail Traffic Management System) will be implemented nationwide, which includes the train control and signaling system component ETCS (European Train Control System). In addition, the interlockings, the train control system, and the associated main systems will be centralized. Furthermore, IP-based communication between the centralized and decentralized equipment will be introduced nationwide.

The project was divided into three tenders: one for the modernization of the entire signaling system infrastructure (ETCS trackside equipment), one for the rollout of the ETCS vehicle units, and one for the construction of a traffic control center and a traffic control system. The case study focuses on the train control and signaling system component, for which Siemens Mobility was awarded the contract in 2018.

The project involves the modernization of 4,200 kilometers of rail track with 375 stations within 15 years (2019 to 2034) – including a spare parts service that will run until at least 2059 – while the system remains in operation. The aim is to completely convert the Norwegian rail network to ETCS Level 2 Full Supervision so that physical signals are no longer required for train traffic on the main line.

Project overview



Source: Siemens Mobility GmbH

With this project, led by Bane NOR, Norway will be one of the first countries to fully implement the ERTMS program. This will make the country a pioneer in the digitization of the railroad network. The project is based on the European Commission's Directive and Deployment Plan. Their goals are a standardized, interoperable trans-European rail network and the digitization of the entire train control and signaling system. The standardized interfaces between the individual systems comply with the EULYNX standard. Therefore, Bane NOR can directly replace elements and subsystems of the infrastructure that are no longer used or have reached the end of their life cycle.

Tender process and criteria

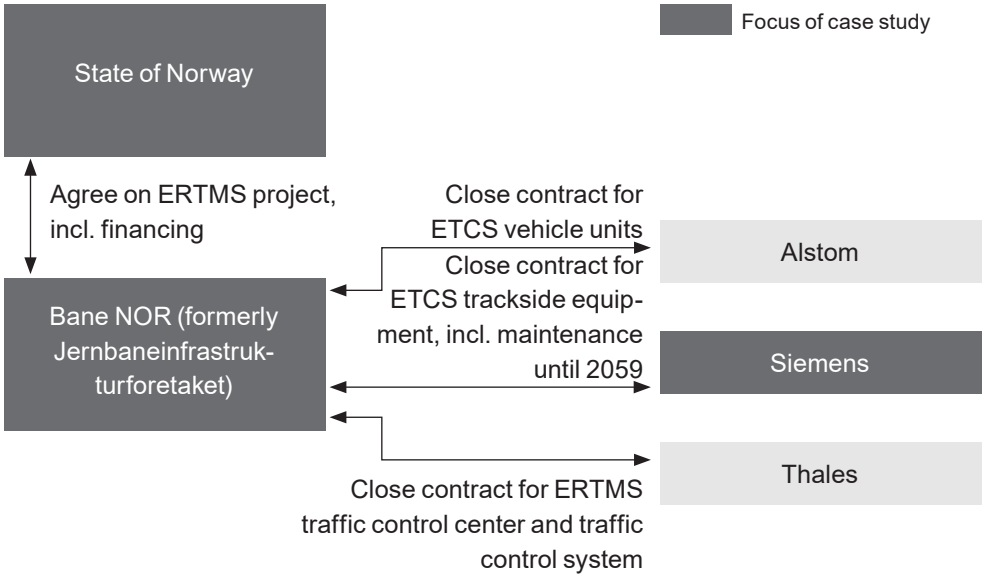
2012	ERTMS/ETCS pilot project is put out to tender (for only one district/one route)
2016	Tendering process for ERTMS/ETCS project in Norway starts
2018	Siemens Mobility wins contract for ETCS trackside equipment
2021	Installation in the Norwegian rail network begins
2022	First line with ETCS Level 2 is put into operation
2034	Project is completed with introduction of ETCS Level 2 on the remaining lines
2059	Contractually agreed maintenance period ends (extension option)

Due to the size and uncertainties of the project, Bane NOR started the ERMTS program in 2012 with a pilot project on a smaller railroad line. Based on the experience gained there, the tender for the overall project was prepared starting in 2015. The tender process itself was divided into three phases, which were carefully structured and coordinated. After a prequalification, based on previous experience and references, the tender documents were issued; the first bids had to be submitted by the end of 2016. After negotiations and some adjustments to the RFP, as well as an anonymous internet-based Q&A process, OEMs were given the opportunity to submit a second bid in late 2017. In the third round in March 2018, changes were mainly made to the rollout dates. Ultimately, Siemens Mobility was awarded the contract for the train control and signaling system (ETCS trackside equipment) and Thales was awarded the contract to build a traffic control center and traffic management system. Alstom was contracted to provide the ETCS on-board units (OBUs).

The contract with Siemens provided for installation to begin in 2021. ETCS Level 2 operation on the first line is scheduled to start at the end of 2022, with installation on the last lines to be completed by 2034. If all three OEMs keep to the schedule, they will receive a bonus if the contract is properly fulfilled. Subsequently, Siemens is committed to a maintenance period of at least 25 years, with an extension option for Bane NOR.

Bane NOR decided to divide the ERTMS project into three tenders in order to find an optimal solution for all three components. OEMs could participate in more than one tender at a time, but in the end, different OEMs won the tenders.

Overview of contractual relations



For the ETCS trackside equipment, a predominantly functional tender was used, but with some detailed specifications as well as minimum quantity requirements. In the specifications, Bane NOR's focus was largely on standardized solutions, as the company was aware that any special request could complicate or limit interchangeability and interoperability. The functional specifications were based on the European specifications and were mainly driven by the TSI requirements.

The award criteria were weighted as follows: 30% for the quality of the technical solution, 40% for implementation, and 30% for life cycle costs.

— First, the quality of the technical solution was integrated into the product and process specifications (e.g., RAMS criteria and requirements). This building block was used to describe the technical solution that Bane NOR was aiming for.

— The second step looked at execution to assess the reliability of the deployment. For example, OEMs had to outline which staff they would use and how they envisioned planning and implementing the project. Requirements such as standards for reporting and approval had to be considered. Key personnel had to be contractually assured. Next, qualifications and skills such as project management were evaluated.

— Finally, implementation and maintenance costs were reviewed. Although a life cycle cost approach was taken, only a portion of the actual life cycle costs were considered because the contract included only selected maintenance work (service levels 3 and 4).

The contract stipulates that Siemens will convert the entire rail infrastructure in Norway to ETCS Level 2 Full Supervision and provide spare parts for this system. It also stipulates that the technology is not only backward compatible, but that the entire infrastructure system – based on the original objective of Bane NOR – is uniform and thus at the same technological level. So, if Siemens were to install, for example, ETCS Level 3 or other technological updates at a later date, it would not only have to ensure backward compatibility, but also modernize the infrastructure.

The maintenance contract stipulates that Siemens will perform maintenance services in accordance with the defined service levels 3 (support by experts in Norway) and 4 (remote support by experts in Germany). As the maintenance contract is limited to expert support, the extensive maintenance tasks of preventive and corrective maintenance (service levels 1 and 2) remain the responsibility of Bane NOR. Siemens thus assigns experts to provide on-site, around-the-clock maintenance support (Level 3) to Bane NOR staff. For larger maintenance cases, Siemens also provides remote experts (Level 4). Siemens is also responsible for the supply of spare parts. In return, the company receives a fixed annual payment for the maintenance work, which is subject to the price escalator clause. The IT systems are a central component of the digital rail network, and the issue of security is an important field of action in this context. Siemens is therefore responsible, up to a defined maximum budget, for implementing security patches to meet the security requirements that evolve over time.

The negotiations and the evaluation approach were thus aimed at supporting the overall objectives of Bane NOR. After the first bids were received at the end of 2016, several days of negotiations took place between Bane NOR and all OEMs, where technological aspects and project management were discussed. Bane NOR used the meetings to inform the OEMs of how they compared to the competitors and on which components they exceeded expectations. This allowed the OEMs to adjust their bids for the next round. For example, if one component of the proposed technical solution was far above expectations, that element could be eliminated and the price adjusted accordingly. This made the offers more comparable. Bane NOR also used the negotiations to adjust the tender for the next round by taking into account comments and suggestions from the OEMs.

Stakeholder effect

The technology landscape envisioned for the Norwegian rail network promises a standardized and homogeneous system with state-of-the-art digitization solutions that will make Norway a pioneer in rail digitization and interoperability in Europe. Among other things, the infrastructure will enable significant improvements in operations. It will also enable the introduction of driverless technologies and help reduce maintenance work.

The functional tender, which is based on a standardized system and aligned with the EULYNX initiative, not only creates the conditions for interoperability; it also paves the way for interchangeable components and modular design in the rail industry.

In the tender process, the negotiation rounds with bilateral feedback and insights played a crucial role. This ensured that Bane NOR tendered the optimal solution as well as a product that was functional and could be properly provided by the OEMs. In addition, the approach resulted in OEMs bringing their bids to a comparable level. The comprehensive bidding criteria, including evaluation of quality and execution, combined with a multi-round bidding process with negotiation sessions and feedback to the OEMs, aimed to ensure that all bids basically met the required criteria. In the end, the bids differed almost only in price, with some vendors exceeding the minimum standards in some criteria. The final evaluation of the OEMs could be made on the basis of the three award criteria mentioned above by evaluating the willingness to pay for the respective additional services beyond the minimum standards.

The cooperation between Bane NOR and the three major OEMs in the course of the ERTMS project has gone very well so far. The contracting parties emphasize the central role of the charter for cooperation. This was drawn up at the beginning of the project and defines the principles for interaction between the parties. The charter is also intended to encourage open and honest discussions and help clarify roles and responsibilities. For example, it can ensure that the contracted companies take responsibility for their tasks, support the division of labor, and share information for optimal collaboration.

Key findings

— The implementation of a pilot project prior to the tender helped to clarify uncertainties regarding the large-scale project.

— The functional specification is based on proven European standards. Eliminating special requests enabled an interchangeable and interoperable solution that can be scaled quickly.

— Extensive negotiation rounds and repeated feedback to the OEMs meant that all offers were highly comparable in terms of quality and execution. This allowed for a transparent and comprehensive basis on which the decision could be made.

MEAT criterion III: Functionality of the tender and degree of technology support

Case study 5: Hydrogen-powered passenger trains for local transport in the Rhine-Main region

What is the scope?	Purchase of 27 hydrogen trains, including maintenance contract over a period of 25 years (hydrogen supply and provision of the necessary refueling infrastructure)
What is the type of contract?	Life cycle contract with focus on innovation
Why is it best practice?	Promotion of innovative drive technology
Facts and figures	Main contract partners: Rhein-Main-Verkehrsverbund (RMV), Alstom Contract volume: over EUR 500 million Year of contract award: 2019

Context and background

This case study is about a tender for innovative hydrogen fuel-cell rail vehicles in the Rhine-Main region. From 2022, iLint hydrogen trains will replace the diesel trains used on regional rail lines around Frankfurt. Fuel cells in the new trains generate electric power from the conversion of hydrogen and oxygen and ensure sustainable and emission-free propulsion.

Public transport in the greater Frankfurt area is organized by RMV. In 2019, the system carried 805 million passengers and has been able to increase demand for passenger transport by 3% per year over the past five years. In the coming years, RMV is aiming for even stronger growth (4% per year) to crack the 1 billion passenger mark by 2025. Another goal is to promote sustainability throughout the region, paying particular attention to environmental, economic, and social sustainability. By using new technologies, stricter emission standards, and quieter vehicles, RMV aims to strengthen the positive image of public transport. At the same time, protecting the environment remains the overriding goal. This also includes further shifting trips made by private motorized transport to public transport.

Tender process and criteria

2014	Lower Saxony, Baden-Württemberg, NRW, and the RMV in coordination with the state of Hesse sign memoranda of understanding on the use of hydrogen trains
2016	iLint is presented by Alstom for the first time at InnoTrans
2017	RMV Supervisory Board expresses support for the use of hydrogen trains and initiates tendering process
2019	Alstom is awarded the contract
2022	Operation in Taunus region officially begins

Due to the high level of public interest in the topic of environmentally friendly transport and decarbonization, RMV reviewed its options for tendering new rail vehicles in 2014, taking alternative drive technologies into account. As parts of the route network are not electrified, diesel trains are usually used on these routes.

Also in 2014, the German states of Lower Saxony, Baden-Württemberg, and North Rhine-Westphalia together with RMV and in coordination with the state of Hesse, signed declarations of intent on the use of hydrogen trains, thus confirming their interest in the further development of this technology.

With the support of the state of Hesse, RMV commissioned TÜV to conduct a complex feasibility study. The subject of the comprehensive study was, among other things, a comparison of procurement prices, infrastructure investments, and operating costs over a life cycle of 25 years. The study showed that the procurement of hydrogen trains would probably be less than 10% more expensive than diesel trains. One of the reasons for this relatively small price difference for a new and sustainable technology was that the Federal Government would provide 40% of the funding for the price difference between conventional and hydrogen trains. The funding was provided as part of the National Hydrogen and Fuel Cell Technology Innovation Program (NIP), which supports sustainable mobility initiatives on behalf of the German Federal Ministry of Transport and Digital Infrastructure. For example, Infraserv GmbH received EUR 9.5 million in 2019 under this funding program for the market activation of hydrogen infrastructure.

The iLint hydrogen train was developed by Alstom's teams in France and Germany and first presented at InnoTrans in 2016. Alstom benefited from funding from the German Federal Ministry for Economic Affairs and Energy.

In 2017, the RMV Supervisory Board advocated the use of hydrogen trains, and the RMV subsidiary Fahrzeugmanagement Region Frankfurt RheinMain GmbH (fahma) carried out a corresponding tender. As a wholly owned subsidiary of RMV, fahma is responsible for financing and procuring rail vehicles. In addition, as the owner of the vehicles, it is also responsible for maintaining their quality and value and uses a quality and asset management system for this purpose.

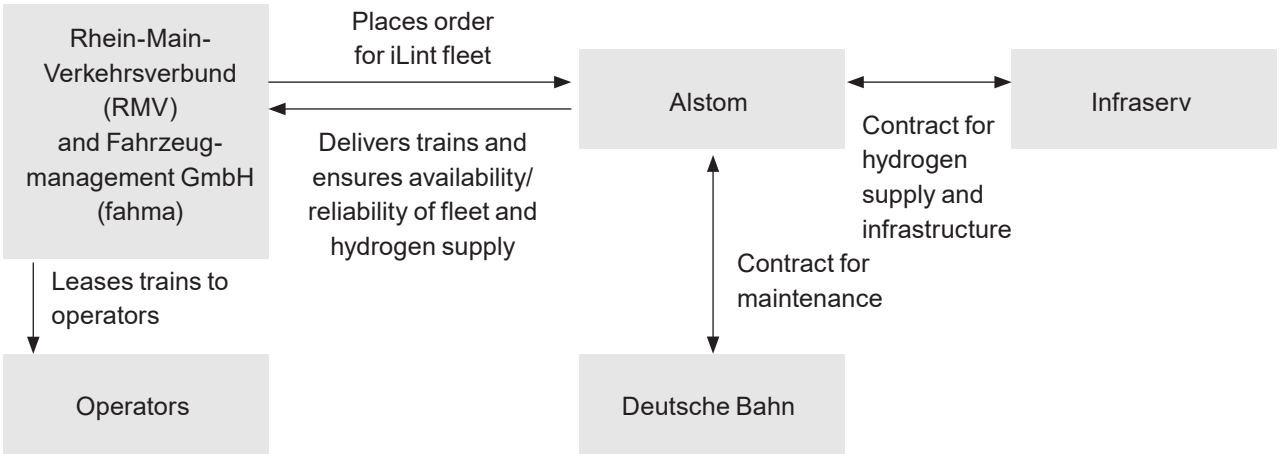
The invitation to tender for the new trains was technology-specific: Bids were specifically solicited for fuel cell drive systems, with price being the decisive criterion. The hydrogen supply and maintenance services were also part of the tender. In addition to a fixed price per kilogram of hydrogen, the tender also called for a fixed price for mileage-based maintenance services. The prices for fuel and maintenance are subject to dynamic clauses over the years that take inflation and potential disruptions into account.

Hydrogen train iLint

Source: Alstom

In 2019, Alstom was awarded the contract for 27 fuel cell trains, making it the world's largest order in this area. The total order volume amounts to more than EUR 500 million and also includes the hydrogen supply and infrastructure as well as the maintenance of the train fleet. Maintenance services will be provided over a period of 25 years. Deutsche Bahn will be responsible for the maintenance work and the provision of workshops as a subcontractor to Alstom, although Alstom will retain liability. The hydrogen is provided by Infraserv and is a by-product of an industrial park (Höchst), where the trains are refueled. In this context, Infraserv acts as Alstom's consortium partner, with responsibility for hydrogen supply in return for a guaranteed off-take quantity.

Overview of contractual relations



Stakeholder effect

The final contract is a significant milestone for sustainable passenger transport in the region and across the country, as the initiative serves as a beacon project for environmentally friendly and innovative transport solutions. In addition to locally emission-free operation, the iLint offers the added benefit of being quieter: Noise emissions are 60% lower than conventional diesel trains. This makes for a more pleasant journey for passengers.

RMV and its subsidiary fahma succeeded in conducting the tendering process and awarding the contract in such a way that only a few (monetary) risks remain with the transport authority itself. Funding from the German government helped to ensure that there is only a slight price disadvantage compared with conventional diesel trains. Each year, 19,000 tons of CO_2 emissions are saved with the help of the iLint fleet.

For the future, RMV is investigating possibilities for the use of fuel cell trains on other route sections without defined electrification plans. The iLint lighthouse project has thus opened up further potential for making rail transport more sustainable. Following successful tests and comprehensive feasibility studies, Alstom's successful development and expansion in the promising field of fuel cell mobility benefits from positive press coverage and its contribution to Germany's decarbonization initiatives. However, Alstom also bears certain risks: The company assumes full liability not only for the train systems, but also for the smooth operation and provision of the necessary hydrogen infrastructure.

In addition, RMV customers will benefit from better service: Each train has 160 seats, increasing the current capacity on the line by 40%. The new trains not only have modern passenger information systems, but also WLAN technology and space for bicycles and wheelchairs.

Key findings

— The willingness of the transport authority to test a new and not yet fully established technology is a significant step towards a more widespread use of hydrogen trains and acts as a global beacon project for more sustainable train transport.

— By including hydrogen-supply and maintenance agreements in the contract, monetary risks for RMV are being limited. Alstom has succeeded in forming a consortium of partners that are suited to meet all the requirements of the contract.

— The operational model based on consortium partnerships over the entire life cycle ensures the allocation of clearly defined joint responsibilities with a focus on core competencies.

Case study 6: Innovative maintenance vehicles for rail infrastructure in Norway

What is the scope?	Tender from Bane NOR, the state-owned railroad infrastructure company in Norway, for 12 maintenance vehicles (awarded to WINDHOFF Bahn- und Anlagentechnik GmbH in 2020); delivery as of Q4 2022)
What is the type of contract?	Functional contract with a focus on technical parameters
Why is it best practice?	Function at the center of the tender; non-monetary criteria decisive for the award (price only with a weighting of 40%)
Facts and figures	Main contractors: Bane NOR, WINDHOFF Bahn- und Anlagentechnik GmbH Year of contract award: 2020

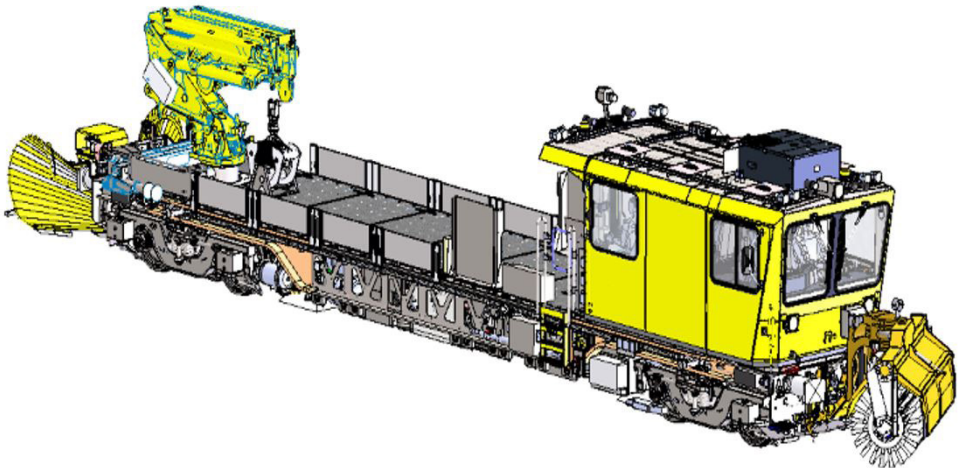
Context and background

For the maintenance of track systems and overhead lines, the Norwegian railroad infrastructure company Bane NOR issued a call for tenders for 12 self-propelled rail vehicles. Bane NOR is a state-owned company responsible for the ownership, operation, maintenance, and development of the Norwegian railroad network, including tracks and stations. The company operates about 375 stations and 4,200 kilometers of rail network in Norway, of which nearly 2,500 kilometers are electrified. In the coming years, Bane NOR intends to improve connections within Norway. To this end, the company will build new double-track lines with a length of 270 kilometers by 2034. Thanks to this investment, 1.5 million inhabitants will benefit from shorter travel times and more travel options.

In 2020, the German company WINDHOFF Bahn- und Anlagentechnik GmbH was awarded the contract to supply 12 maintenance vehicles. WINDHOFF specializes in specialty rail vehicles and heavy industrial equipment, focusing on the development, manufacture, and supply of a wide range of high-tech products – from rail vehicles to rail construction, rail depots, and shunting technology. WINDHOFF has been a subsidiary of Georgsmarienhütte Holding GmbH since 2002.

The contract between Bane NOR and WINDHOFF includes options for 20 more rail vehicles. WINDHOFF plans to deliver the first two vehicles to Bane NOR in the 4th quarter of 2022.

Maintenance vehicle for Bane NOR – illustrative



Source: WINDHOFF

Tender process and criteria

2019	Bane NOR decides to procure new maintenance vehicles and conducts tender process
2020	WINDHOFF awarded contract for production of 12 maintenance vehicles with an option to order an additional 20 vehicles
2022	WINDHOFF delivers the first vehicles
2024	The project is completed

In 2019, Bane NOR decided to procure new maintenance vehicles and launched a tender process, as the old vehicles had reached the end of their service life. The vehicles needed by Bane NOR had to be able to withstand Norwegian weather – temperatures as low as -40°C, large amounts of (frozen) snow, and hurricanes – and extreme terrain, such as mountainous and winding roads.

In addition, the vehicles should be suitable for a wide range of maintenance tasks, such as clearing snow from the tracks, transporting equipment, pulling wagons, or maintaining the tracks and track environment.

For the procurement of the new maintenance vehicles, Bane NOR conducted a functional tendering process that focused on vehicle functions rather than predefined standards. The tender included descriptions of the functional and technical parameters for the vehicles (e.g., operation under extreme temperature and weather conditions).

This gave the tender participants several options for the vehicle design as well as the freedom to decide for themselves how they wanted to design the vehicle to meet the tender conditions.

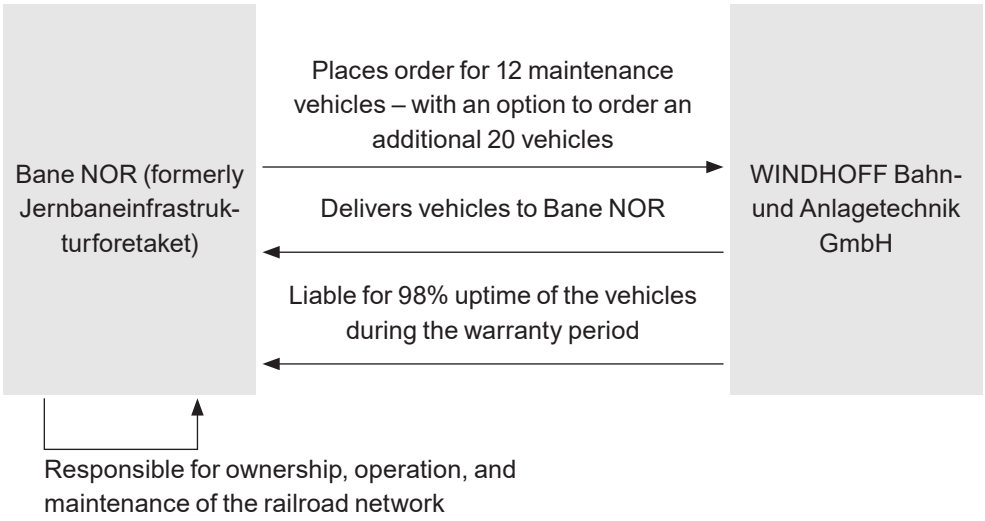
To participate in the tender, interested parties had to meet a number of prequalification criteria and prove that they were capable of building such vehicles. These included good credit, adequate staffing, the ability to provide appropriate design services, and experience in snow removal.

Four companies participated in the bidding process. The contract was awarded based on four criteria (with 560 requirements and specifications):

- Price (weighting of 40%): the highest weighted criterion, based on the purchase price for the vehicles)
- Solution delivery (weighting of 30%)
- Practical experience (weighting of 15%)
- Delivery and project execution (weighting of 15%), e.g., delivery planning, design phase, and quality management (presentation of the product development process by the participants).

In 2020, WINDHOFF was awarded the contract and signed a contract for the delivery of 12 maintenance vehicles by 2024. The contract did not include the maintenance of the vehicles, which Bane NOR will carry out itself. However, a guaranteed operating time of 98% (excluding regular maintenance) was contractually agreed. During this guarantee period, the manufacturer is obliged to pay contractual penalties if the vehicles break down for more than 2% of the total year. In addition, the wheels are covered by a contractual warranty of 300,000 kilometers before replacement is due. The warranty for technical parts is two years, while the system warranty (broken axles, broken machinery) is approximately ten years.

Overview of contractual relations



The Bane NOR team in charge of managing the tender was continuously staffed with five to six people throughout the tender process. It moderated discussions with the tender participants and was primarily responsible for assessing their competencies.

WINDHOFF is currently manufacturing the first maintenance vehicles, which will be delivered to Bane NOR in the 4th quarter of 2022. Delivery of the 12 ordered vehicles is scheduled to be completed in 2024.

Stakeholder effect

The project is not yet completed - as the delivery phase starts at the end of 2022, only past effects can be considered here.

The functional tendering process was particularly innovative, as it gave the participants freedom to develop their own innovative solutions. By focusing specifically on technical parameters, WINDHOFF was able, for example, to decide freely on the design that was best suited to the vehicle's intended use. During the development phase, there was close cooperation between WINDHOFF and Bane NOR in accordance with the RAMS procedure (EN 50126).

The innovative character of the tender was also enhanced by the fact that several non-monetary criteria were included in the award decision. The bids were evaluated on the basis of four criteria, which included more than 560 requirements and standards to be met. While price was the highest-weighted criterion, non-monetary criteria were also considered. In this way, Bane NOR ensured the procurement of high-quality maintenance vehicles with the best value for money for the public budget.

Key findings

- By opting for a functional tender process, Bane NOR was able to focus on technical parameters and give the tender participants the freedom to develop the vehicles best suited to Bane NOR's requirements.
- The tender included approximately 560 required vehicle specifications. This allowed Bane NOR to specify the exact technical standards for the desired vehicles.
- Since Bane NOR holds the manufacturer liable as soon as the life cycle costs exceed the contractually agreed limits, the company avoids unforeseeable costs once the vehicles are in service.

MEAT criterion IV: Design und accessibility

Case study 7: New vehicles for the Bern–Solothurn regional light rail

What is the scope?	Purchase of 14 commuter trains for the S7 line in Bern, Switzerland; design with ideas from passengers solicited through a crowdsourcing process
What is the type of contract?	Focus on design and functions
Why is it best practice?	Involvement of local population; focus on functional award criteria; final award decision based on non-monetary criteria; acquisition price with 40% weighting
Facts and figures	Main contract partners: Regionalverkehr Bern–Solothurn (RBS), Stadler Contract volume: CHF 134 million Year of contract award: 2015

Context and background

RBS is a Swiss regional transport company that transported 26 million passengers in 2019. While relatively small, RBS meets the highest standards and attaches great importance to customer satisfaction and environmental sustainability: Since 2017, all RBS trains have run on 100% renewable energy. At the same time, RBS has been able to increase the load factor of its trains by 3 percentage points since last year.

RBS wanted to develop and purchase new trains to replace the old trains on the subway-like narrow-gauge line of the S7 from Bern to Worb. Both the Canton of Bern and the Federal Council approved the purchase of new trains, with two challenging conditions to be met: First, RBS wanted to increase train capacity without lengthening trains; second, stopping time at stations should not increase despite higher passenger numbers. On the regional lines, RBS expects an increase in passenger volume of 30% by 2030.

To get their buy-in and engender a level of personal connection with the new trains, RBS sought the participation of customers in the design process. First, a precise design was developed and then a manufacturer was sought who could implement the design and build a corresponding train.

Tender process and criteria

2014	Crowdsourcing campaign for design and functional ideas for the new trains starts
2015	Customer surveys and workshops to develop the concepts take place
2015	Design brochure is conceptualized and created with TRICON
2015	Tendering and award of contract to Stadler take place
2018	First new trains are used for S7
2019	All 14 trains are delivered and old fleet is completely replaced

Due to the special technical requirements (narrow gauge, space restrictions, etc.), RBS could not buy standard trains but needed a product tailored to these special conditions.

In 2014, RBS decided to launch a crowdsourcing project before the tendering process began in order to involve customers in the design process of the new trains and to find out what was important to them. The associated communications campaign was designed to convey two key messages:

— Inform customers that the old trains (after about 40 years) would be replaced.

— Encourage customers to contribute their ideas for the design of the new trains. Customers also had a say in the name: In a public vote, they chose “Worbla,” in reference to a small river along the rail line.

In the first step, open questions were distributed via social media and conventional marketing channels in order to reach as many participants as possible. Several hundred people came forward, making suggestions and answering questions such as “What would you improve on a crowded train to make the journey from boarding to disembarking as pleasant as possible?”

In total, more than 700 ideas were submitted, especially on boarding, disembarking, and interior design: from traffic lights that indicate when the doors will be closing or how full the train already is, to the arrangement of seats and standing areas, or the separation between boarding and doors. Even though many ideas were not really new to RBS, the company learned a lot about how different generations weighted their preferences. For example, younger passengers cared more about a power outlet than a seat. The next step was for RBS to develop a survey that specifically targeted those passengers who regularly traveled on the S7. The survey included consideration questions to understand customers’ preferences in detail.

Customer ideas which were implemented for new trains – illustrative

Source: RBS

RBS then commissioned TRICON, an agency specializing in the interior and exterior design of transport vehicles, to jointly develop a design brochure that incorporated several of the ideas and features solicited via crowdsourcing and became an integral part of the further process for acquiring the trains. The brochure also included all design-related requirements for the interior and exterior appearance of the railcars.

The invitation to tender was issued in the summer of 2015. The focus was on the functionality and on the design of the wagons. RBS wanted to achieve the best possible quality and design for the interiors of the trains.

For the evaluation of the bids, 25 award criteria were formulated, which could be divided into three categories:

— Technology (weighting of 50%)

— Costs (divided into acquisition and maintenance costs; weighting of 40%)

— Services (weighting of 10%).

A clear evaluation structure and a manageable number of award criteria were very important to RBS.

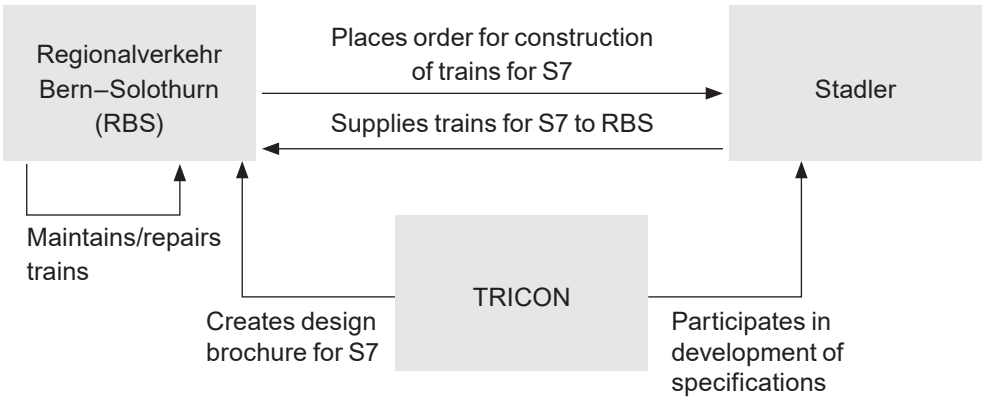
Stadler-built "Worbla"

Source: RBS

The invitation to bid also included a contract for work (draft), specifications (including design brochure), maintenance specifications, and specifications for documentation, training, and project organization. Bidders were required to accept these specifications when submitting their bids or make changes.

In 2015, two bidders participated in the tender. The contract was ultimately awarded to Stadler, which was commissioned to build 14 trains with a total contract volume of CHF 134 million.

Overview of contractual relations



Stakeholder effect

Thanks to the design-oriented approach, RBS was able to involve its passengers in the development process and incorporate their ideas into the new design. In the end, RBS remained true to its purchasing philosophy: The operator's trains are not only trains for decades to come, but also "ambassadors" and part of the identity of the transport company and the region in which it operates.

Passengers on the S7 in Bern were very satisfied with the results; more than 85% said they felt comfortable or very comfortable on the new trains; 80% said they noticed a significant improvement when boarding and disembarking.

Today, the S7 is one of the busiest lines in the region, carrying up to 24,000 people daily. The new design was completely tailored to the needs of local passengers. Through the crowdsourcing campaign, for example, RBS learned that many short-distance travelers would willingly give up a seat if a more comfortable standing room was available and boarding and disembarking were quicker. Given the expected increase in passenger numbers on the line, reducing seating capacity and increasing standing capacity was a good way to meet the increased demand. In addition, the new trains have eight doors instead of the previous six, while remaining the same length as the old trains. This allows more passengers to board without exceeding the standard stopping time of 20 seconds per station. Thanks to the more efficient boarding process, RBS has managed to meet Switzerland's high punctuality standards despite rising passenger numbers: Its trains consistently achieve a punctuality rate of 99.3%.

The clear focus on excellent design, material quality ,and attention to detail are reflected positively. For example, the floors are predominantly carpeted, which has a sound-absorbing effect and, according to RBS, is no more expensive to maintain and clean than conventional flooring. The surfaces in the interiors are made of high-quality materials such as glass, stainless steel, or coated aluminum. On the one hand, this increases cleaning costs, but on the other hand it leads to significantly less vandalism in the new trains.

The focus of the tender was on innovative interior and exterior design and technological compliance. The clear design principles established prior to the tender provided a clear framework for the specifications of the trains. Stadler delivered all 14 trains on schedule.

Key findings

- Involving the local population in the design process was a completely new form of customer orientation in public transport.
- The consideration of functional design aspects such as more doors for faster boarding and exiting ensured high customer satisfaction and enabled punctuality targets to be met despite the expected increase in passenger numbers.
- Since the acquisition price did not play a central role in the award criteria, Stadler was able to concentrate on the demanding functional aspects and play to its strengths in terms of technology and service.

Case study 8: The Giruno high-speed trains

What is the scope?	29 high-speed multiple units for the Swiss north-south axis, including the connection to Italy as the world's first single-deck, low-floor, high-speed trains
What is the type of contract?	Functional tender
Why is it best practice?	Focus on customer-oriented innovations in a complex environment with international business activities (Switzerland, Italy, Germany)
Facts and figures	Main contract partners: SBB, Stadler Contract volume: CHF 970 million Year of contract award: 2014

Context and background

This case study presents the procurement of new high-speed trains by SBB (Swiss Federal Railways). On the occasion of the construction of the Gotthard Base Tunnel (see case study 3) – the only low-level flat railroad through the Alps, put into operation in 2016 – SBB expected an increasing demand on its north-south routes. It therefore wanted to expand its capacity and launched a tender for a new generation of high-speed trains. The aim was to run these trains through the Gotthard Base Tunnel and connect Zurich and Basel with Milan, and at a later date even Frankfurt with Milan, as well as to significantly reduce connection times.

Main connecting route (Swiss north-south axis, including connection to Italy)

Source: SBB

With the new trains, SBB wanted to improve various factors of its service. First, the capacity of the trains and the comfort for passengers were to be increased – by increasing the frequency of service and reducing connection times. Furthermore, by tendering for trains with elaborate interior design, the project was aimed at improving comfort and accessibility for passengers. In terms of accessibility, barrier-free access played an important role in the process. Taking into account Swiss legislation on equality for persons with reduced mobility, the trains had to allow autonomous boarding for wheelchair users. Among other factors, this ultimately led to the construction of the world's first single-deck, low-floor, high-speed train, which at the same time promoted innovation in this market segment.

The Giruno train

Source: SBB

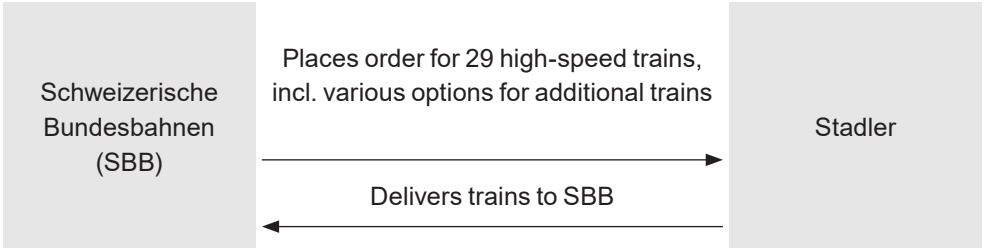
The project resulted in the procurement of 29 eleven-car electric multisystem multiple units. All trains are equipped identically, which brings the advantages of a uniform fleet. The maximum speed is 250 km/h. The trains offer low-floor access at all doors, thus allowing wheelchair users step-free and autonomous boarding from platforms with a height of between 550 and 760 millimeters. Thus, the different platform standards in Switzerland, Italy, and Germany have been taken into account. This step-free access at all entrances is achieved in some places by the use of ramps. The trains have a length of 200 meters and a capacity of 405 seats per train. Since two trains can be coupled together, the capacity can be doubled accordingly. All trains have areas for first and second class and are equipped with onboard restaurants. They also offer special seats for passengers with reduced mobility, a wheelchair-accessible toilet, and regular and gender-specific toilets. In addition, there are areas for bicycle stowage as well as Wi-Fi and cellular boosters.

Tender process and criteria

2011	SBB decides on general concept for the procurement of new trains
2012	SBB launches invitation to tender
2014	Contract awarded to Stadler and contract signed
2017	Market launch of the first train takes place with subsequent testing in Switzerland, Italy, Germany, and Austria
2019	Vehicles receive Swiss operating permit and operations begin
2020	European Railway Agency (ERA) operating approval for Italy, Germany, and Austria is granted
2021	Last trains are delivered

In 2011, SBB began preparations for the procurement of new high-speed trains for the north-south axis, especially since an increase in demand was forecast for this route. The invitation to tender was issued by SBB and published in 2012. The contract was finally awarded to Stadler in 2014. Upon conclusion of the contract, SBB ordered 29 eleven-car multiple units from Stadler, all of which were delivered by 2021. In addition, the contract included several purchase options – these included potential modifications to the Giruno, such as a version without an onboard restaurant and a scaled-down version for routes within Switzerland only.

Overview of contractual relations



Prior to the tender, SBB made use of industry dialogs to clarify the feasibility of a potential target vision for the train. The publicly announced dialogs were used to discuss SBB's requirements and to outline trade-offs between the ambitious technical functions and their costs or the resulting complexity. In the course of these industry dialogs, among other things, the original goal of the tender was abandoned – away from a high-speed train with a maximum speed of 300 km/h and tilting technology to a less complex system with a maximum speed of 250 km/h and without tilting technology.

After the bids had been submitted, SBB invited all the tender participants to clean-up meetings to clarify technical aspects. The submitted bid was discussed in detail with each tender participant. On the one hand, this served to discuss elements that did not meet the tender expectations. On the other hand, both sides were able to correct technical details in some cases. The participants in the tender were then allowed to submit an adjusted offer based on the results of the discussions.

The tender itself followed a functional approach. With a clear focus on the customer, various elements were identified for which SBB was seeking a high-quality solution. The aim was, among other things, to achieve optimal solutions in the following areas: passenger boarding and disembarkation, equality for people with disabilities, baggage storage, catering, restrooms, and perceived passenger safety. For all these functional aspects, the tender called for specific concepts that addressed passengers' needs – giving the industry design freedom and enabling innovation. If SBB had a clear idea of how a specific element should be implemented (e.g., in terms of common design elements in the trains), very precise requirements were added for it in the functional tender to ensure that it was in line with SBB's target image.

Four factors were considered in the tender evaluation:

— **General cost effectiveness with 40% weighting.** This included initial investment costs, energy consumption and track charges, LCC maintenance costs over 25 years, and external maintenance costs over 15 years. Therefore, in addition to the purchase price, various categories of life cycle costs were also considered. If the guaranteed LCC values are not met, penalties are incurred. If, on the other hand, the costs are significantly undercut, this is associated with bonus payments. As is usual for most high-speed trains, SBB as operator is responsible for the maintenance of the trains. Apart from the normal guarantees including the specified life cycle values, no long-term support has been agreed with Stadler, for example a maintenance contract.

— **Technical solution with 20% weighting.** The focus here was on the proposed implementation of ambitious functional targets (e.g., high speed without tilting technology).

— **Concept for obtaining type approval,** including a proposal for project structure and procedure for fulfilling the contract, with a weighting of 15%. Here, it was of high importance (and associated with a high degree of complexity) to obtain operating approval in various countries.

— **Degree of innovation with 25% weighting.** Consideration was mainly given to the design and other technical aspects resulting from the customer-oriented concepts as described above. To this end, the invitation to tender included detailed guidelines on how the concepts offered by the industry were to be evaluated. For example, the concept for achieving equality for people with disabilities was evaluated by Swiss disability organizations based on a predefined point system. Similar approaches were taken, for example, for the concepts on train design, individually perceived passenger safety, and restrooms. Thus, the tender explicitly included subjective evaluations, where necessary, clearly indicating how and by whom the evaluation would be made in the end.

Stakeholder effect

Overall, this tender succeeded in taking into account a number of relevant criteria, including life cycle costs, design and accessibility, and project-related aspects. Therefore, in addition to the purchase price, other aspects were also taken into account when evaluating the various bids. The tender thus demonstrates how the MEAT criteria, which aim to find the most economically advantageous offer, are implemented in practice and how the procuring entities can benefit from them, for example, with a product that takes into account the total costs over the entire life cycle and is optimally geared to the needs of passengers. In addition, a targeted incentive structure was implemented, for example, by linking LCC values not only to penalty payments but also to potential bonus payments.

In the functional tender, passengers benefited from the customer-oriented concepts designed to improve the travel experience on the Giruno: among other things, barrier-free access at all entrances in all countries through which the train passes, spacious and modern interior design, and a modern sanitary solution that includes the introduction of gender-specific toilets. Here, the functional tendering process granted scope for design; the industry was able to draw on its expertise, but also to innovate on the issues.

Stadler entered the high-speed segment for the first time with this project. Given the prevalence of high-floor, high-speed trains on the market, the requirements for barrier-free boarding, and its own expertise in low-floor vehicles, Stadler developed a new platform for low-floor, high-speed trains. By integrating criteria for innovation into the tender, as described above, SBB explicitly rewarded innovative solutions that could best meet the advanced requirements in this project. As the Giruno is the world's first single-deck low-floor, high-speed train, it can be stated that the project successfully promoted innovation in this market.

With regard to the interaction between the tendering body and the industry, the initial industry dialogues turned out to be particularly helpful for SBB. This enabled it to ensure that a viable and balanced product was tendered. Furthermore, the precontract clean-up meetings helped both sides to agree and discuss technical details and avoid misunderstandings. This process step also served to identify potential pitfalls. It also reduced the risk of obstacles arising later in the process, for example, from problems with or misunderstandings about the technical solution, which would require change requests – which in turn would involve a great deal of additional work for both sides. The intensified exchange between all parties contributed to the successful implementation of the project.

Key findings

— A functional tender with a clearly specified evaluation scheme and based on transparent subjective evaluations, where appropriate, can encourage innovation and help identify the most economically advantageous offer (MEAT criteria).

— Branch dialogues can prove helpful in discussing the feasibility of key requirements and tendering marketable solutions; after submission of bids, clean-up meetings allow both sides to align on technical details before the final contract is awarded.

— The inclusion of purchase options for different versions in the tender gives the tendering body the flexibility to expand the vehicle portfolio later according to the conditions.

3.3 Overarching success factors for MEAT tenders

The MEAT tenders described and analyzed earlier show that there is more than one winner in successful tender design and implementation. The analysis also reveals five key factors in the development of successful tenders:

1. Predefinition of the participation processes – especially for very large projects. Successful MEAT awards often include market analyses or the involvement of a wide range of stakeholders at an early stage of the project, so that there is a high degree of coordination with the public (e.g., in the construction of new infrastructure). This simplifies the subsequent implementation process and increases the acceptance of end customers. The latter express, for example, how proud they are of "their" rail system, which ultimately also translates into higher passenger volumes.

2. Long-term involvement of OEMs or contractors. Ideally, this is done from the beginning of the bidding process throughout the life cycle of the products or services. This can be supported, for example, by using a life cycle cost approach. Long-term involvement leads to greater responsibility on the part of OEMs or contractors for the products or services to be provided. This in turn has benefits for the entire rail sector. In addition, risk management is often shifted to the party best suited to cover risks – for example, maintenance costs can be largely covered by OEMs.

3. Avoiding superfluous specifications and fixed budgets. To incentivize cost-effective innovation, MEAT tenders are increasingly moving away from providing excessively detailed specifications or providing fixed budgets. This is because both result in a lack of incentives to increase product benefits and/or reduce long-term costs through better functionality.

4. Creating and providing additional requirements for investments. These include detailed preparation of the RFP process, equipping the RFP team with experienced staff, a functional specification with room for innovation, a high-quality design, and the application of proven industry standards.

5. Efficient risk management. Often, non-monetary award criteria are reflected in the contract terms. For example, the product features considered in the evaluation process may be contractual commitments, some of which have penalties or other forms of bonus/penalty payments attached to them. This makes sense in principle; however, care must be taken to ensure a balanced and fair allocation of risks. This means that the risks are borne in each case by the contractual partner who can influence their realization the most, as the latter can best estimate the costs of the respective risks. Experience has shown that ignoring this principle leads to avoidable cost increases in the overall project.

Applying the identified overarching success factors in MEAT tenders can indirectly make an important contribution to strengthening the rail and public transport eco-system in many respects. It can lead to better bids from the bidding companies, to a more informed evaluation of the bids, and thus to more successful rail transport projects. With this approach to tender and awards, the rail sector can better increase rail's share of passenger and freight transport and, thus, strengthen its contribution to climate targets.

Appendix: Overview of the structure of the rail sector in Germany

Put simply, rail transport in Germany comprises five segments, each of which is dominated by the public sector:

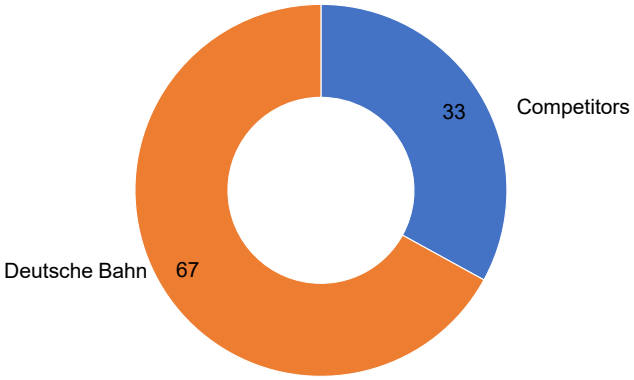
Urban public transport (subways, light rail and streetcars). Apart from a few exceptions, operation is carried out by municipal companies; infrastructure and vehicles are generally owned by the municipalities. Technology is put out to tender by the municipalities, although there have been isolated cases of joint procurement (e.g., in the vehicle sector).

Regional transport/SPNV. Regional transport in Germany is regulated at the level of the federal states. Since 1996, the federal states have been responsible for organizing regional rail transport and for meeting the demand for regional transport. There are a total of 27 SPNV authorities in Germany. Operation by the public transport authorities is put out to public tender and provided by more than 20 rail transport companies (RUs) under multi-year transport contracts (Exhibit 8).

Exhibit 8

Operation of regional rail transport is provided by more than 20 railway companies

Deutsche Bahn's market share in regional rail transport by pkm, 2020
Percent



Source: Bundesnetzagentur

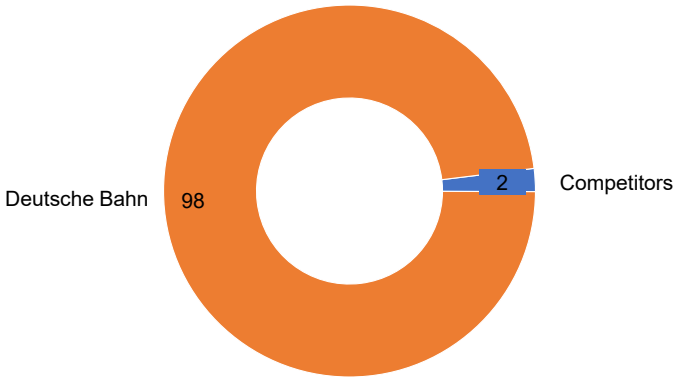
In its order, the contracting authority specifies (often in great detail) the parameters of the vehicles to be used. The actual vehicle provision or procurement is handled very differently depending on the task manager: Either the task managers take over the procurement of the vehicles and offer them to the respective RUs (obligatory) or they require the RUs to provide the vehicles, with some RUs resorting to vehicles from (private) leasing companies. In between, there are various models in which, for example, the task manager issues a buy-back guarantee. DB Netz AG provides the infrastructure to a large extent.

Long-distance transport/SPFV. Here, various RUs run the operation commercially under their own management and generally decide themselves on the transport services to be offered. The RUs procure the rolling stock and make partial use of leasing companies – in this way, the RUs can decide which vehicle they want to use for operations. Since there are no subsidies from the public sector in SPFV, tenders are not necessary. The infrastructure is largely provided by DB Netz AG (Exhibit 9).

Exhibit 9

Long-distance passenger rail transport is commercially operated by various railway companies under their own management

Deutsche Bahn's market share in long-distance passenger rail transport by pkm, 2020
Percent



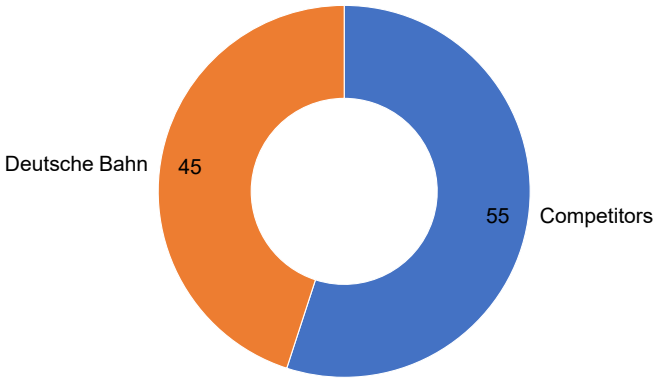
Source: Bundesnetzagentur

Freight traffic. As in the case of long-distance transport, freight transport is operated by more than 250 RUs on their own account (Exhibit 10). Rolling stock is increasingly no longer procured directly by the RUs but by leasing companies. In this segment, too, DB Netz AG provides the infrastructure to a large extent, although some municipalities, companies, and ports also operate larger networks.

Exhibit 10

Freight transport is operated by more than 250 railway companies on their own account

Deutsche Bahn's market share in freight transport by tkm, 2020
Percent



Source: Bundesnetzagentur

Rail infrastructure. With the exception of local public transport, most rail traffic is handled on the infrastructure of DB Netz AG. DB Netz AG is a subsidiary of Deutsche Bahn AG and is wholly owned by the Federal Government. Its central task is to provide the more than 420 RUs with a safe and efficient rail infrastructure; to this end, DB Netz AG currently operates more than 33,000 kilometers of track in Germany. The infrastructure also includes DB Station & Service, which mainly manages the stations, and DB Energie.

New and expansion projects in infrastructure are determined by the Federal Transport Infrastructure Plan (BVWP) and voted on and confirmed by public bodies. As a rule, the projects are financed by federal funds. Maintenance and replacement investments are carried out on an ongoing basis and are also primarily financed by federal funds under the Performance and Financing Agreement (LuFV).

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Verband der Bahnindustrie in Deutschland (VDB) e.V.

Universitätsstraße 2
10117 Berlin
Phone: + 49 (0)30 - 206289 - 0
Fax: + 49 (0)30 - 206289 - 50
E-mail: info@bahnindustrie.info
www.bahnindustrie.info

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Content contributions

Dr. Carsten Lotz, McKinsey & Company

Dr. Anselm Ott, McKinsey & Company

Moritz Motyka, McKinsey & Company

Steffen Köpke, McKinsey & Company

Production team

Editing: Jörg Hanebrink, McKinsey & Company

Layout: Frank Breuer, McKinsey & Company

Copy Editing: Lena Bolanz, McKinsey & Company

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