Summary Final report Public-Private Comparator ERTMS

The PPC ERTMS[A]

In the period up to and including 2028, ERTMS Level 2 will be implemented on large sections of the Dutch railway network; it must be installed in all existing rolling stock that uses the Dutch railway network by 2022. This decision was made by the State Secretary of I&M in the Preference decision ERTMS of 11 April 2014. The Government has set aside EUR 2.57 billion for this purpose (price benchmark 2014).

The Public-Private Comparator (PPC) ERTMS provides an insight into the financial added value in terms of the different forms that the programme could take. This PPC investigates a range of possible packages (a package concerns a number of ERTMS elements that are combined and put out to tender within one contract) and implementation variants. This concerns a total of 4 packages and 11 implementation forms. This number of packages and implementation forms investigated within this PPC is much higher than usual. The high number of packages and implementation forms investigated also contributes towards the realisation of the tendering and procurement strategy; this encompasses tasks such as choosing the tendering packages.

This PPC was drawn up on the basis of the following modules:

- Module 1: Start note. Within this, the PPC's points of departure are outlined. The PPC Core team[1] drew up the Start note, with input from the PPC Programme team[2].
- Module 2: Qualitative analysis. The cost components that could vary per implementation form are set out herein. These differences are expressed qualitatively. The PPC Core team prepared the qualitative analysis. The PPC Programme team carried out the qualitative analysis by means of meetings (2 morning/afternoon sessions) and individually completed questionnaires.
- Module 3: Quantitative analysis. This encompassed a translation of the qualitative analyses into added value percentages on the basis of expert judgement within the PPC Programme team. The PPC Core team prepared the quantitative analysis and carried out the calculation aspects. Quantification took place over two sessions, each of which lasted one morning/afternoon (one session focussing on railway-related elements and one session focussing on the rolling stock related elements). Quantification took place on the basis of translating qualitative differences into a bandwidth. This bandwidth was then applied to the elements in the estimate of costs to which the differences related.
- Module 4: Final report. This module provides the result of the previous modules. The PPC Core team drew up the final report, with input from the PPC Programme team and the Ministry of Finance.

Packages and implementation forms to be investigated

When the PPC was executed a decision had not been taken regarding how the ERTMS programme would procure; it could take the form of one large package or multiple smaller packages. That is why this ERTMS PPC carries out an added value test for the following pro forma packages:

[A] The letter and this annex are translated from their original Dutch versions. The translations are a courtesy to stakeholders, other governments and the market. The original versions in Dutch form the basis for the next phases and decision making. In case of debate on interpretations or translations the original Dutch versions are always the leading documents.

[1] The PPC Core team comprises Infram team members.

[2] The PPC Programme team comprises the PPC Core team and experts from the Ministry of I&M, the Ministry of Finance, ProRail and NS.

Integrated package

This package assumes the inclusion of the full ERTMS programme scope within one package, thus infrastructure and rolling stock combined.

Infrastructure package

This package concerns the total ERTMS Infrastructure scope, i.e. underground infrastructure, trackside safety elements (interlockings and radio bock centres) and outside elements (e.g. railroad switches). It is, in fact, a complete ERTMS infrastructure package.

Railway system package

This package comprises trackside safety elements and outside elements and varies from the infrastructure package insofar as the underground infrastructure (e.g. cables and pipes) is not part of the railway system.

Rolling stock package

Finally, the PPC considers rolling stock investments as a separate package.

Package	Reference	Alternative 1	Alternative 2
Integrated	DBM[1) 2) 3)]	DBM[1) 2)]	DBFM[1) 2)]
Infrastructure	DBM[1) 2)]	DBFM[1) 2)]	
Railway system	DBM[2)]	DBFM[2)]	D+B+M
Rolling stock	DB	DBM	DBFM

1) Underground infrastructure included as DB

2) Outside elements included as DB

3) Rolling stock included as DB

Diagram 1: Summary of implementation scope per package

Diagram 1 shows the reference and alternative implementation forms per package, to be investigated in the PPC.

DB stands for Design Build. This involves tendering design and build in one contract and contracting the maintenance aspect in a separate contract. The party (usually a combination of players) that takes on design and build does not have to be the party that carries out maintenance.

DBM stands for Design Build Maintain. This involves contracts for design, build and maintenance in one integrated contract with one (combination of) contractor(s).

DBFM stands for Design Build Finance Maintain. This is the same as a DBM contract with the understanding that the client does not pay on delivery but for a longer contract period (usually 15-30 years) on the basis of availability. The contractor finances the programme, the client pays a regular availability fee which incorporates a payment component that is used by the contractor to pay his interest and repayment obligations. DBFM works on the basis of risk-transfer, integrated scope, life-cycle approach, performance incentives and private financing. The client can apply discounts to the availability fee if the contractor does not perform in line with the set requirements.

D+B+M stands for separate tendering of design, build and maintenance. This involves three consecutive contracts. The client engages an engineering bureau to draw up a specification (or does this himself). The builder then realises the programme on the basis of the specification. A maintenance form is contracted thereafter.

In all cases, i.e. for the DBM and DBFM implementation alternatives, the PPC includes the items underground infrastructure and outside elements as DB (without maintenance). This is due to the fact that infrastructure has a

low-maintenance level and because both underground infrastructure and outside elements are of a different nature than trackside safety elements (radio block centres and interlocking).

The PPC contains both a qualitative and quantitative analysis. Particularly in terms of the quantitative analysis, it is important to note that a few of the estimates made in this context correspond to a substantial degree of uncertainty. In order to include this uncertainty, there has been worked using bandwidths instead of single value estimates.

The uncertainty is caused by a variety of factors. The most influential are:

- Firstly, the fact that ERTMS as a new subsystem[3] of an existing railway system has not previously been contracted in a DBFM or a D+B+M setting. Not in the Netherlands and, as far as we know, not in Europe or anywhere else in the world. There are therefore, no contextual historical figures to hand that could provide guidance when estimating values for this implementation variant.
- Secondly, the early timing of this PPC implies that much of the relevant programme characteristics have not yet been properly defined.
- Thirdly, the complexity in the sense of the relatively long duration period and the huge scope of the programme also plays a significant role.

That is why a number of effects that are hard to estimate on a quantitative basis have been translated into bandwidths. This results in the following two variants:

- minimum added value variant: derived, where there are bandwidths, by choosing the most extreme value that will lead to a minimum added value effect;
- maximum added value variant: derived, where there are bandwidths, by choosing the most extreme value that will lead to a maximum added value effect;

The PPC usually calculates the added value of implementation alternatives on the basis of the cash value method. This method weighs up the time value of cash. In the PPC ERTMS, this method however would lead to undesirable effects for implementation variants that demand a longer preparation and transaction term. The PPC shows that this longer preparation and transaction time does not translate into a shorter realisation period. The undesirable effect is then that the programme becomes cheaper in today's Euros simply because the programme is realised later. It is not the intention that later implementation alone is an added value factor. This is considered against the backdrop that later implementation may be beneficial in a financial context but has the disadvantage that a) the planning milestones would probably not be achieved and b) the social benefits would also be realised later. It also takes longer for the social profit from ERTMS to be realised. In this case, for the time being, the real added value figure is therefore a better indicator.

[3] ERTMS not only involves the implementation of a new train protection system but also has to contribute towards a transition (system leap), whereby more and quicker trains can use the existing main railway infrastructure.

Results

Table 2 provides the PPC results

Package	Reference	Alternative 1	Alternative 2
integrated package	Reference: **DBM**[1) 2) 3)]	Alternative 1: **DBM**[1) 2)] added value compared to reference DBM[1) 2) 3)] minimum + 0.5% / maximum + 2%	Alternative 2: **DBFM**[1) 2)] added value compared to reference DBM[1) 2) 3)] minimum +/- 4.5% / maximum + 3.5%
infrastructure package	Reference: **DBM**[1) 2)]	Alternative 1: **DBFM**[1) 2)] added value compared to reference DBM[1) 2)] minimum +/- 6.5% / maximum + 3.5%	n/a
railway system package	Reference **DBM**[2)]	Alternative 1: **DBFM**[2)] added value compared to reference DBM[2)] minimum +/- 7% / maximum + 3.0%	Alternative 2: **D+B+M** added value compared to reference DBM[2)] minimum +/- 1% / maximum + 0.5%
rolling stock package	Reference: **DB**	Alternative 1: **DBM** added value compared to reference DB minimum + 2.5% / maximum + 7%	Alternative 2: **DBFM** added value compared to reference DB minimum + 0.5% / maximum + 5.5%

[1)] Underground infrastructure included as DB
[2)] Outside elements included as DB
[3)] rolling stock included as DB

Table 2: Actual added value per package per implementation form per variant in percentages (rounded up to half percentages. Negative percentages and amounts signify a negative added value (the implementation alternative is then more expensive than the reference). The red sections indicate, per package, which implementation form is preferable on the basis of the PPC.
NB: this table shows *per package* the added value of the alternative implementation forms compared to the reference. The PPC makes a financial comparison between the implementation forms *per package* and not between the packages themselves. The PPC comparison is therefore horizontal (between implementation forms) and not vertical (between packages).

Conclusions

The coloured sections in table 2 indicate, per package, which implementation form is preferable on the basis of the PPC. These preferences are elaborated below. There are then a few conclusions regarding the package composition. The PPC does not focus on a comparison of implementation packages, nevertheless the insights herein obtained during the PPC will be considered as a form of 'by-catch'. During PPC analyses, the differences between the packages are therefore explicitly and openly discussed.

Conclusion 1. Integrated package: DBM implementation (alternative 1) offers the best perspective for the greatest added value.
The DBM implementation alternative which includes maintenance of the rolling stock leads to a lower added value between 0.5% and 2%. This added value is primarily made up from the life-cycle advantage of the rolling stock package aspect. In this context no account has been taken of possible extra added value effects as a result of integrating trackside safety elements and rolling stock in the same DBM contract. The added value of DBFM is

uncertain. This could end up being positive but also significantly negative. The reasons, on the basis of the PPC, for preferring DBM over DBFM are:

- DBM provides more certain positive added value than DBFM;
- DBFM requires such a long preparation and transaction term that the rollout dates in the Preference decision are unlikely to be achieved;
- privately financing a total package of around EUR 2.57 billion is very difficult via DBFM, see also conclusion 5:
- the use of DBFM in this context is a new concept. The teething problems that are likely to go hand-in-hand with a new concept increase the risk profile of the implementation form in an unquantifiable manner.

Conclusion 2. Infrastructure package: DBM implementation (reference) offers the greatest and most reliable added value.
DBM provides more certain added value than DBFM. DBM has the same advantages as an integrated use of DBFM and the preparatory costs are lower than for DBFM. The fact that private financing is not an issue with DBM means that, in contrast to DBFM, there are also no costs for obtaining private financing.

Conclusion 3. Railway system package: DBM implementation (the same as the reference, whereby outside elements are included as DB) offers the most and/or most reliable added value.
Only in the variant with the maximum conceivable positive scope-effect does DBFM lead to modest added value. D+B+M offers no added value compared to the reference. The development costs are higher and the advantages, for the time being, do not outweigh the disadvantages. This package also corresponds to a high risk that ongoing development will not keep up the pace or will do so for high costs.

Conclusion 4. Rolling stock package: By actively working on life-cycle management, the DBM implementation form (alternative 1) offers the most added value.
A DBM implementation form offers a better added value perspective than a DBFM implementation form because DBM encompasses the advantages of design, realisation and maintenance but not the disadvantages of a (much) longer and more complex preparation period. In addition, DBM offers great opportunities for integrating performance incentives that focus on the most efficient use of ERTMS rolling stock for the entire life-cycle.

Conclusion 5. Disadvantages of an integrated package are greater than the advantages as a result of larger scope.
If the client chooses to award the contract for the ERTMS programme within one package to one consortium, there is a huge degree of dependence on this single consortium. When awarding to multiple players, it is possible to transfer work to another player/consortium in the event of underperformance by one of the other players/consortia (assuming, of course, that this is organised via the tendering process beforehand). This fall-back scenario does not exist if there is just one contractor. Account must also be taken of the risk that a programme involving EUR 2.57 billion would simply be too much for the capacity offered by one consortium, particularly if the rollout of ERTMS takes place simultaneously in other European countries. One integrated package means, in fact, that DBFM as an implementation form would be difficult, if not impossible. It would be extremely difficult to obtain private financing for a programme of such a size[4].

[4] Obtaining large-scale traditional bank-based financing has become more difficult because, as a result of the Basel III agreements, banks have to hold greater reserves and thus have a more limited financing capacity. An alternative, such as programme bonds, are less useful for ERTMS given the high realisation and operational risks.

Conclusion 6. Underground infrastructure possibly better realised in a separate package.
The conclusion for the railway system package (excluding underground infrastructure) is that the DBM implementation form offers most added value. If underground infrastructure is added to this package as DB, the added value percentage decreases. The ratio of investment and maintenance is out of balance. Maintenance amounts to just 0.4% per year and, as a result, the theoretical possibility of life-cycle optimisation via a contractor does not lead to real, significant advantages.

Recommendations

The discussions conducted within the PPC programme team and the implementation of the added value analyses have provided greater insights into the ERTMS programme in general and the possible implementation forms in particular. In addition to the already presented PPC conclusions, these insights have led to several recommendations. Now that DBM has transpired as the seemingly most suitable option, these recommendations may help to achieve optimisation within this area.

Recommendation 1. Conduct a limited update of this PPC.
At various points, this PPC has worked with broad bandwidths in order to reflect the current degree of uncertainty within the project. This is due to reasons such as:

- ERTMS is a major, complex, brownfield project with many different stakeholders and diverse elements (railways, rolling stock, physical investments, ICT investments). Moreover, no decisions have yet been taken regarding the tendering scope. Furthermore, there is a lack of experience in relation to the implementation of similar, large-scale projects.
- A PPC is usually conducted once there is sufficient clarity regarding the scope of the programme and tendering process (what is put on the market and in how many tenders, contracts and/or lots, what are the corridors?), the risks and interfaces so that an effective and accurate added value estimate can be made.

In addition, the risks in this PPC have been expressed mainly qualitatively, pending the further substantiation and quantification of the risk dossier.
The recommendation is to hone this PPC selectively via an update at a later stage. This update should aim to reduce the bandwidths and further quantify the risks and shall be drawn up on the basis of insights gained from the general procurement and contracting strategy, the quantified risk dossier and the market scan which is to be held.

Recommendation 2. Develop specific performance incentives and smart tendering in order to achieve the very best results and manage risks as effectively as possible.
Irrespective of the implementation form, in order to ensure that ERTMS is completed on time and within budget, it is very important that the contractor(s) is (are) incentivised in order to perform at an optimum level and manage risks effectively. To this end, a range of experiences must be put to good use (whether these are positive or negative). This could include projects such as the HSL Zuid, Hanzelijn, Betuweroute, but also the incentive structure that is applied in countries such as Denmark, Austria, Switzerland and the UK, which are more advanced in terms of ERTMS implementation. In this context, do not rely on the implementation form as such but ensure that specific performance incentives are included in the tendering process and the contracts that are ultimately signed. This concerns not only the development of the appropriate performance incentives but also the compliance herewith; the recommendations from the Netherlands Court of Audit[5] and the Parliamentary

[5] Publication “Contractmanagement bij DBFMO-projecten” (Contract Management within DBFMO projects), The Netherlands Court of Audit (Algemene Rekenkamer), 6 June 2013

Committee on Government ICT projects (Elias Committee)[6] must therefore also be taken into account. Specific focus areas include:

- specifying the question as functionally as possible and ensuring that suppliers not only take responsibility for delivery systems but also for the effective functioning thereof;
- developing specific performance incentives in order to limit the risk of vendor lock-in and mitigate other risks;
- ensuring there is effective compliance with contract agreements or stringent contract management in order to actually impose the performance incentives;
- considering, within non-DBFM implementation forms, working with a system of (limited) delayed payments, dependent upon the performance realised by an individual supplier or multiple suppliers together.

Naturally, these performance incentives must take account of the fact that different types of (maintenance) contractors are active within the areas of both rolling stock and railways.

Recommendation 3. Investigate whether enrichment of the implementation form via an alliance could lead to more effective risk management.

The conclusions show that the disadvantages of an integrated package are more significant than the advantages. It is also possible to partially realise the advantages of an integrated package if the decision is made to have one tender, but split the contract into multiple lots so that multiple contractors are involved. This could involve an alliance of contractors whereby each contractor could have its own implementation contract but where the risks in relation to the effectiveness of the total system are managed collectively. It could also encompass alliances between client and contractor that focus on risk-management during design and implementation. In principle, any form of implementation may be enriched via the use of an alliance.

Recommendation 4 Conduct further research into the optimum breadth and duration of the maintenance obligations in a DBM implementation form for trackside safety elements and rolling stock.

Now that it seems that DBM offers the most and most certain added value for both railway and rolling stock, it may be useful to further define the maintenance scope within this implementation form. This involves specifying which maintenance aspects will (and will not) be included in a DBM contract and also the maintenance period. For instance, one can think of the distinction between 1st line and 4th line maintenance.

The duration period applied via modelling in this PPC for the maintenance period for all implementation forms is the same as the optimum maintenance period for the most complete implementation form (DBFM) and covers 25 years. However, in contrast to what is common in other railway projects, the ERTMS programme has a realisation period with various partial delivery moments over 10 years. Maintenance periods begin and end at different moments. Specific attention must be paid to defining suitable moments for terminating (parts of) the contract. Banedanmark (Denmark) also assumes a period of 25 years with possible exit moments every 5 years[7]. It is, of course, the intention that the maintenance period is optimised: it must not be too short (resulting in a reduction in the strength of DBM) and not be too long (resulting in the loss of possible flexibility).

Recommendation 5. Draw up an accurate business case for ERTMS, including funding sources, cash rhythm for expenditure and the relationship with the business cases for train operators

[6] Publication "Parlementair Onderzoek naar ICT projecten bij de overheid" (Parliamentary Committee on Government ICT projects), Parliamentary documents 33 326 no 5, 15 October 2014

[7] NB: For the client, every 5 years; for the contractor only after 10 years initially.

A PPC focuses on the added value of alternative implementation forms compared to the reference and not on their affordability. Affordability is however an important aspect. This concerns who provides a financial contribution to which element and when. It involves, after all, a high level of investment. It thus encompasses a business case that not only shows costs but also the cash-rhythm of funding (contributions) per player. For train operators, it also concerns the relationship with their own business case, i.e. which element of investment is cost-effective and which is not. A complete business case binds these issues with one another and provides the client with a tool which unites ambitions, cost-effectiveness, costs and funding.