Design, build, finance and maintain: Public Private Partnership in the Beatrixsluis project in the Netherlands

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Abstract

In recent years Rijkswaterstaat has built up experience with PPP contracts in both road projects and lock projects. The contracts were issued as DBFM-agreements. This paper describes the setup and experience with DBFM on lock projects, specifically the Beatrixsluis in Nieuwegein in the province of Utrecht.

The Beatrixsluis is an existing lock complex in the Lek Canal, that consists of two identical lock chambers. The locks were constructed in 1938. The project consists of the construction of a third, large lock chamber to the eastern side of the existing locks, combined with a significant widening of the canal. Included in the DBFM-agreement is the maintenance of the canal, the new lock and the two existing locks for a period of 27 years.

The financial framework of the DBFM contract stimulates the contractor to optimize the interaction between construction or upgrading and maintenance activities, as he will benefit from low maintenance costs. Payment is based on the availability of the lock system during the maintenance period, resulting in a reduction on life cycle costs and optimization of the performance.

The DBFM contract provides a reliable, long term source of income to the contractor and the partnering financial institution. On the other hand, the financial partner will only benefit if the contract requirements are met by the contractor and therefore keep control over the performance of the contractor. Consequently, lower overhead and contract management effort is needed from the (public) administrator.

From a technical management point of view, important PPP aspects of the Beatrixsluis project are risk distribution, (technical) cooperation between Rijkswaterstaat and the contactor and planning.

Introduction to the Beatrix lock

The main waterway network in the Netherlands that is maintained by Rijkswaterstaat consists of 1,700 kilometers of canals and rivers, 6,200 km of waterway on open water, 80 locks, 400 bridges, 9 traffic control centers and 14 traffic posts.

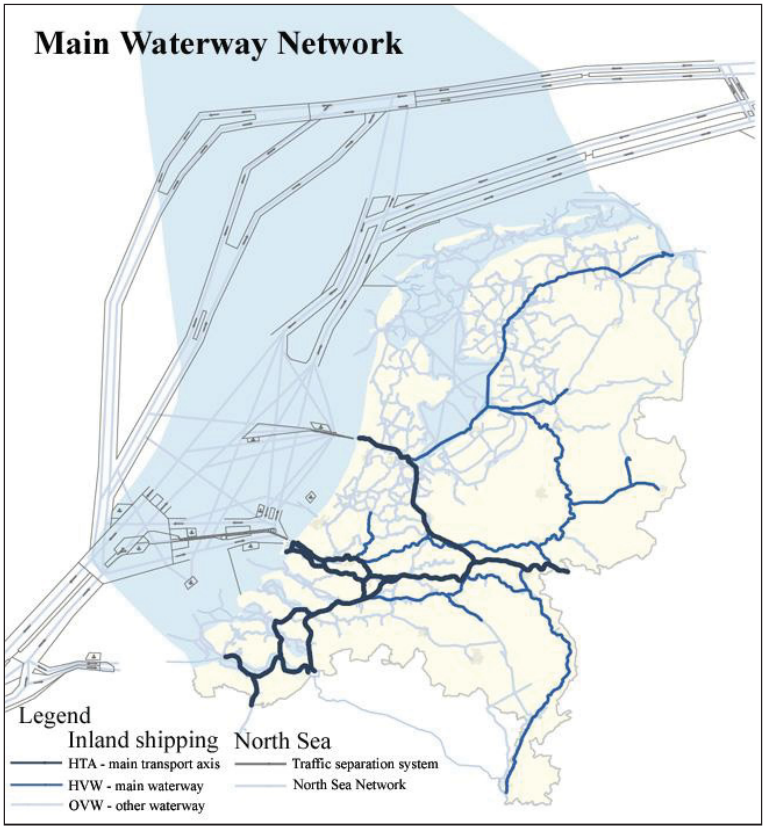

Figure 1: Main Waterway Network in The Netherlands.

The Beatrix lock complex is situated in Nieuwegein in the Lek Canal. It is the only lock in the waterway connection between Amsterdam and Rotterdam. Each year 50,000 vessels pass the locks.

Figure 2: Location of the Beatrix lock complex.

The original lock site was constructed in 1938. It consists of 2 lock chambers with vertical lift gates. The chambers are 225 meters long and 18 meters wide. The maximum draught is 3.5 meters.

Apart from provide passage to shipping, another important function of the lock is flood protection. The southern lock gates serve as flood protection gates, as the river Lek at this point has an open connection with the North Sea.

Project scope: third lock chamber and widening of the Lek Canal

The amount of vessels passing the Beatrix Lock has been stable in the last decades: approximately 50,000 vessels each year. However, the average transported cargo per ship has risen significantly. In 1990, 46 million tonnes of cargo passed the locks. In 2015, with the same number of vessels, the yearly cargo had risen to 115 million tonnes. Ergo, the average size of the vessels has risen significantly and the original locks became literally a bottleneck. A new lock chamber was required. The dimensions of the new chamber are 270 meters long and 25 meters wide. The maximum draught is 4.0 meters.

The construction of the third lock chamber was combined with a significant widening of the Lek Canal. This was not only necessary for the outports of the new chamber, but also to create extra berth capacity for passing vessels. The widening of the canal from 85 meters to 130 meters delivered berth possibilities for eleven large vessels.

Public Private Partnership

Often, PPP is mentioned as a solution for efficiency improvement and cost reduction. As there is no unambiguous definition of PPP we state the European Union circumscription as:

"PPP are forms of cooperation between the public and private sectors for the funding, construction, renovation, management or maintenance of an infrastructure or the provision of a service."

The main purpose of such arrangements should be to bring in a party with a shared interest in optimizing the life cycle of the asset, form the first design drawings to the long term maintenance plans.

DBFM (design, build, finance and maintain) provides contracts with financial incentives for the contractor to aim for optimal performance of the system during its complete lifecycle. The management of the system assets and compliance with the performance requirements is the contractor's responsibility, including most risks during those phases.

General DBFM principles

The DBFM contract integrates the Design, Building, Finance and Maintenance of an (infrastructure) system into one contract with one contractor (or consortium). By integrating those value-adding disciplines the (public) client aims to create higher *Value for Money* due to more *Integrated Life-Cycle Costing and Design*. Additionally, DBFM provides for *Private Financing and Public Funding*.

The contract aims for an optimal risk transfer between public client (Rijkswaterstaat) and private contractor. Increasing responsibilities for the contractor through the combination of design, build, finance and maintain leads to increasing risk management and control potential. The contractor's responsibility ends with the availability of a well functioning lock system that meets the performance requirements.

A) Life-Cycle Integration and Interface Optimization

As the contractor is both responsible for the design and construction, as well as for the management and maintenance of the system, he has the position to think out a system in such way that costs and benefits are optimized over those life-cycle phases. This means that sufficient design space must be provided and system requirements are specified functionally.

Secondly, as the contractor is responsible for all life-cycle phases of the system several risks related to the interfaces between different parties/contractors within the system are no longer a burden on the overhead of the public client. Also interfaces between life-cycle phases of the system are now within one hand. Hence, it is the contractor who has the overview and the responsibility of connecting them. These synergy-benefits will eventually lower total costs and also reduce the procurement and contract management activities of Rijkswaterstaat.

B) Availability Payment and Network Performance Optimization

Contrary to traditional contracting, the DBFM contractor will be paid for providing the required services in terms of *Availability*, instead of the object or product. The actual availability requirements are based on overall network performance. This incorporates the incentive to the contractor to optimize or increase network performance.

In case of a lock system, the service required is the availability of the operational system network for shipping passage and flood protection. Periodic payments are made if the availability requirements are met. Technical failure of the system leads to withholding of payments based on the duration of non-availability. The contractor will try to prevent this by delivering a solid, robust and reliable system and is triggered to prevent failure and carry out repair activities as quickly and smoothly as possible.

In a DBFM context, the contractor first develops the system and will only get paid by the actual availability of it. This means that the pre-investment should be recuperated during the maintenance phase by meeting availability requirements. Availability payments will be reduced if the asset is not available. As a result, the private contractor bears the risk of the asset's operation.

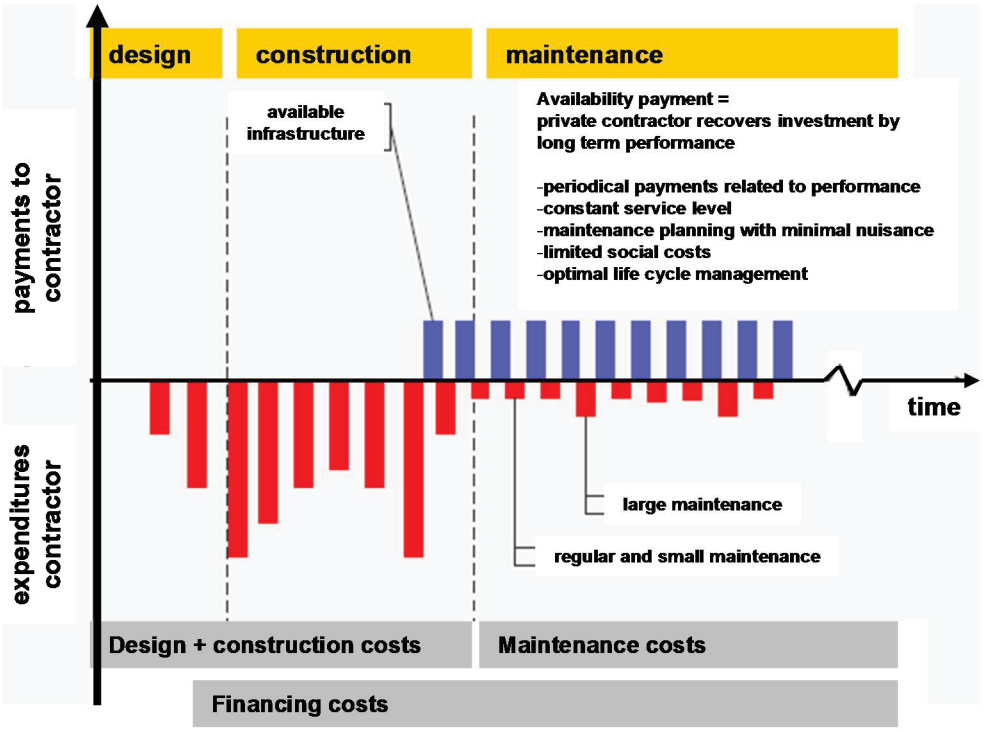

Figure 3: Schematic payment regime of the DBFM contract.

Note that *Availability Payment* is a payment for performance made irrespective of demand. The requirements are to be met, even if there is momentarily no shipping activity.

C) Pre-Financing and the incentive of the financial partner

DBFM provides for *Private Financing and Public Funding*. The private sector builds the infrastructure by attracting debt financing from a third party (financial institute). The public client commits to make predetermined payments (availability fees) to the private party during a certain period (contracting period). These payments are only due if the construction has been completed and if the infrastructure meets its availability requirements under quality/service levels agreed to in the contract.

Under the DBFM model, the private contractor will embrace a financial institute as to provide (pre)financing for construction and maintenance. Availability payments are then used to pay interest and principal repayment on the loan. As the third financing party evidently has a large stake in return on investment, its critical eye will be on risk management and operational performance. This aligns their incentives with those of the public clients' performance goals for the system – poor performance reduces the payment stream and places their expected returns at risk.

Lessons learned on the Beatrixsluis project

As the DBFM-agreement focuses on the functional availability during the exploitation phase, the contractor is given a lot of room to design and construct his own solution to meet the high availability level that is required. In the case of the Beatrixsluis project, this led to a design with a redundant lock gate system: each lock head consists of two rolling doors. If one door is not available due to maintenance or failure, the second door can be used, without loss of availability of the lock function.

In addition operating and control systems are almost fully redundant and design and maintenance plans had a primary focus on reliability, availability and maintainability of components.

Components that are potentially vulnerable and hard to maintain (e.g. the rails in the lock heads) are given extra consideration in the design phase.

Figure 4: Overview of the construction of the new lock chamber.

The construction of the new lock chamber of the Beatrix locks is in its final stage. Large scale renovation of the original locks is the next step in the project. Till today the experiences on this project are positive. Progress is according to planning, scope and risk distribution are clear and cooperation with the contractor is excellent. However, naturally there are opportunities for improvement and personal experiences and aspects that must be highlighted.

Risk balance: information on the state of the assets in the tender phase

In principle the risks concerning the state of the assets lies with the contractor. DBFM is most applicable when systems are (re)built or significantly upgraded/modernized. If existing infrastructure is part of the contract scope, it does not mean that the current state of the assets must be excellent, but thorough insight in the technical state of the objects is essential for the contractor to make a realistic risk assessment and to prevent discussions between contractor and client in a later phase.

Intensive cooperation between client and contractor

One may come to the conclusion that the setup of the DBFM-agreement involves less technical involvement of Rijkswaterstaat as client. After all, for a long period the contractor carries the responsibility for a highly available and reliable lock system and his performance is guarded by the strict view of the financial partner.

However, interfaces between contractor and client still exist, although on a different level. The emphasis in the role of the client shifts from control to collaboration. The total extent of the efforts may be reduced, the cooperation between both organisations is still intensive and essential for a satisfactory result.

Planning incentive

The financial setup of a DBFM-agreement encourages the contractor in the tender phase to keep the design and construction phase as short as possible. After all, payments start only after delivery of the new lock system. This may introduce unforeseen planning risks for the contractor and must therefore be carefully considered.