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Appendix 1
Case Studies

Report Phase 2
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pwc

1.1 Introduction

In order to take advantage of relevant experience from other large infrastructure development projects in assessing commercial and contractual strategies for HSR in Norway a number of case studies have been prepared. Through gathering and summarizing information about other rail projects and also projects for development of other kinds of infrastructure it is possible to extract and exploit the knowledge and competence that has accumulated worldwide.

In selecting case studies for this report emphasis has been put on relevance to development of rail infrastructure in Norway. Such infrastructure will potentially require significant expenditure over a number of years and will includes technology and challenges that are new to Norway. Therefore, and in accordance with the terms of reference for this study of commercial and contractual strategies, projects both from outside Norway and from other sectors have been selected as case studies. The primary focus has been high speed rail projects from other countries in different phases of development. Some of the projects are finished and in operation so that experience can be drawn from the end results. Other projects are at feasibility study stage which makes challenges associated with this stage of development more easily identifiable and accessible.

Case studies have been selected from other industries such as the off shore oil sector, aviation sector and road sector as these industries face many similar challenges to the rail sector regarding issues such as financing, size of project, market limitations, project management issues, risk arising at several levels, and approach to contractual structures and specification. Furthermore some large projects from Norway have been included to highlight issues that are specific to Norway.

1.2 Italy - TAV (Treno Alta Velocità) SpA

1.2.1 Project outline

TAV was given a concession from the Italian state railway, Ferrovie dello Stato (FS) SpA, to design, construct and operate a new 900 km high speed railway system.

The overall high speed railway project contained a number of large individual projects. The two main types of project were tratte and nodi. The tratte were the new (or upgraded) lines between the outskirts of individual city nodes. The nodi were the city nodes, comprising new or upgraded track within the city boundaries, and the stations for the high speed system. Other projects necessary to complete the overall system are SIGAV (Sistema Integrato Gestione Alta Velocita), various regional/local projects and the supply of the rolling stock to operate on the high speed lines.

1.2.2 Packaging of the project

The tratte projects comprised approximately 85% of the total works budget. Each of the tratte projects comprised the civil engineering works, track works, impianti tecnologici or technology systems and property expropriation necessary to complete the individual line.

Single design and build contracts were awarded for each tratte, each with a "General Contractor" consortium. Early conceptual design was carried out by FS lItalferr (the Engineering arm of FS). The General Contractor then took responsibility for the design and developed it further, supervised by Italferr. The agreement of all affected local authorities and public services was then obtained through the Conferenza dei Servizii (conference of services) process. Following this, any necessary changes were negotiated and the final contract was signed.

The General Contractor then progressed the design to the construction stage and built the line, again under the supervision of FS Italferr.

Impianti tecnologici (Systems Installation) elements of the projects were carried out by a single sub-contractor consortium across the three tratte contracts in order to achieve consistency and compatibility between the different lines.

The approach to developing the contracts was to transfer the maximum reasonable risk to the General Contractors in order to obtain early certainty of final cost for TAV. The contracts were lump sum fixed price.

1.2.3 Phasing of the project

The high speed line was split into three different sections:

Rome – Naples: Construction of this line started in 1994, and all but 25 km opened on 19 December 2005. The final 25 km, from Gricignano di Aversa to Napoli Centrale, opened on 13 December 2009. It was built by the Iricav Uno consortium, (Ansaldo Trasporti Sistemi Ferroviari, Astaldi SpA, Societa Italiana Condotte Acqua, Consorzio Cooperative Costruzioni, Vianini Lavori, and Italstrade SpA).

Milano – Bologna: After starting construction in 2000, this segment was brought into service on 13 December 2008. The consortium of ENI/CEPAV UNO—composed of Snamprogetti (50.1%), Saipem (0.26%), Consorzio Cooperative Costruzioni (21.34%), Impresa Pizzarotti (14.15%) and Grandi Lavori Fincosit (14.15%) were appointed to design and build the line.

Design approval 1993 – Construction 2000, Operation 2008.

Bologna – Florence: Construction of the line started in 1996 and the first train ran on 5

December 2009. The CAVET Consortium, where Fiat is the General Contractor with other members CRPL (Consorzio Ravennate di Produzione e Lavoro), Maire Engineering, Impregilo and CMC were responsible for the line.

1.2.4 Organisation

The organisation structure for the procurement of HSR in Italy is shown in Exhibit 1.

The Italian railway group Ferrovie dello Stato (FS) manages the infrastructure and performs all maintenance and repairs through the rail infrastructure company Rete Ferrovaria Italiana (RFI). TAV was set up to manage and deliver the high speed rail upgrades to the Italian rail system. TAV is approximately 40% state owned (through FS) and 60% privately funded. The arrangements for sharing the project and commercial operation make TAV the risk (and investment opportunity) centre for the project. TAV manages actively the delivery of the project and maximises the returns from its commercial operation.

Italferr sis.tav (100% owned by FS) had a key role. It was under contract to TAV to define, design and project manage the implementation of the high speed rail project. It was supported in this role by a number of consulting engineering firms. Under the second part of Italferr's role, it reported formally to FS (its owner and the largest shareholder of TAV) every six months on the conduct of the entire project.

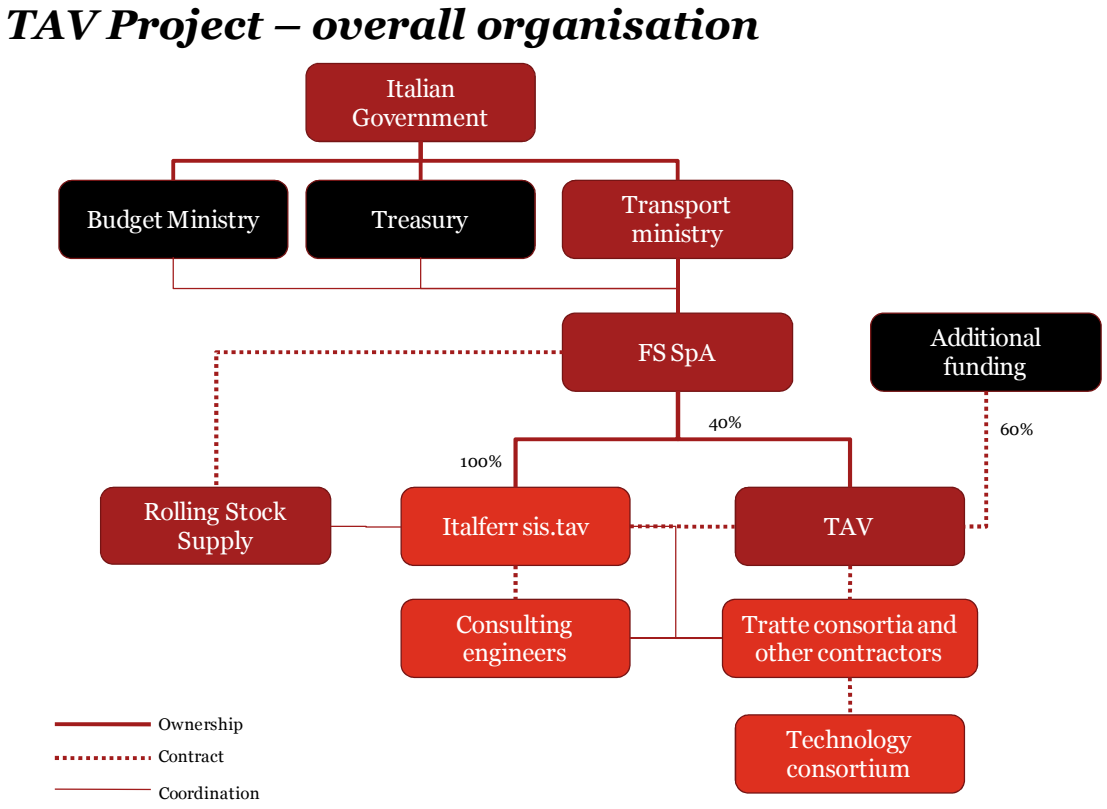


Exhibit 1 - Organisation of the TAV Project

TAV construction funds flow

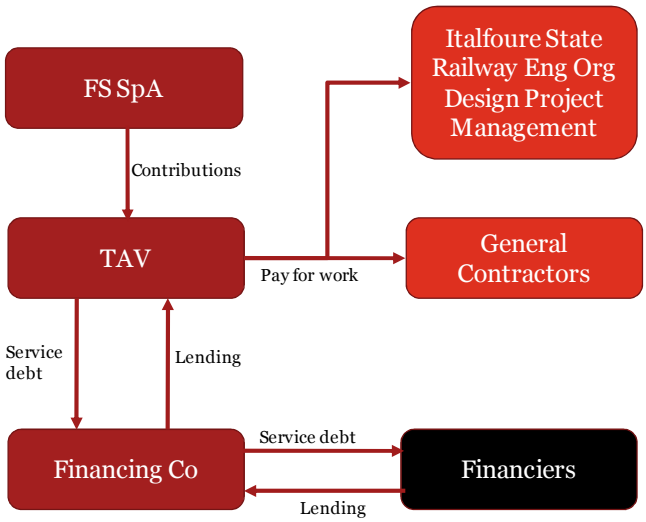


Exhibit 2 - Construction Funds Flow in the TAV Project

1.2.5 Key challenges

1. Integration of works undertaken by SIGAV, the systems integration contractor.
2. Timely delivery.
3. Resistance from the public with regards to environmental impact

1.2.6 Key stakeholders

1. FS SpA
2. Financiers of TAV

1.2.7 Funding and financing

Project costs are estimated to be €35bn.

In 2004 €18bn of the €35bn had been financed. €5bn Of the €18bn, came from state funding, including equity, €6.5bn came from the issuance of loan notes and €8bn was state guaranteed debt €140 million of EU funding was also made available as the projects were trans-European transport projects. The bond offerings were issued by Infrastrutture SpA, with funding via a loan agreement advanced to RFI. The notes benefited from indirect recourse to the Italian government, which covered interest during construction and repayment of the principle once the railway was operating.

The key sources of cash flow for the project are:

- Track access charges; and
- Rental of commercial space in stations

State transfers cover any shortfall in debt service.

1.2.8 Cost and budget

Rome – Naples: The line cost around €4.3bn

Bologna – Florence: The line was estimated to cost €1bn but ended up costing €5.2bn

Milano – Bologna: This was initially expected to take 69 months and cost €4.9bn. It ended up taking 96 months and costing €6.9bn.

1.2.9 Key contractual features

Key features of the tratte contracts:

- The General Contractor for each line had to provide a contract programme, with updates when necessary, and with Italferr having the right of review/approval.
- The General Contractor for each line had to provide monthly progress reports, in line with standards set by Italferr.
- The contract provided for a change control procedure.
- The contract did not provide for the provision of information on projected or actual resource requirements. Such information could be collected by Italferr site supervision staff. The contract did, however, provide for access to the General Contractor's accounting system for the project, for auditing purposes.
- Payments were made according to predefined percentages of the price to be paid on completion of individual elements of the work; and bonuses or penalties were paid or deducted for early or late completion.

1.2.10 Procurement strategy

Design and build / fixed price

1.2.11 Risks

1. Archaeological /geological finds
2. Technical modifications
3. Exchange rates
4. Construction inflation

Most risks were transferred to contractors.

1.2.12 Lessons learned

The Italian Government transferred planning and consent risk to TAV in 1991. However, land expropriation and compensation issues took considerably longer than anticipated to resolve as there were many public and private stakeholders affected by the individual rail projects. The inability of the private sector partners in TAV to effectively manage this risk contributed to their withdrawal from TAV in 1997.

To try to avoid further planning consent difficulties, the government introduced a majority rule decision making, for stakeholders which in general has sped up the process however on certain lines there have still been significant delays.

Trying to minimise land take and environmental costs by constructing lines next to existing motorways has led to high costs. In some instances highway works has accounted for 30% of total project costs.

1.2.13 Sources

- Experience of PwC staff from working on the TAV project
- High Speed 2 - International case studies on delivery and financing – a report for HS2 (Ernst & Young, 2009)

1.3 South-Africa – Gautrain

1.3.1 Project outline

The Gautrain project is estimated to cost in excess of €2,2bn. The line is made up of a link between Pretoria and Johannesburg and a link between Tambo International Airport and Sandton. The project includes:

- 7 over ground stations
- under ground stations
- 80km of track
- 15 km of tunnels
- 11 km of bridges
- 10,000,000 m^3 earthworks.

The Bombela consortium (engaged by the South African Government, through the Gauteng Province) operates a PPP franchise to both build and operate the trains over a 15 year period. Members of the consortium are Bombardier (17%), Bouygues (17%), Murray & Roberts (25%), Loliwe Rail Contractors (25%), Absa Bank (8%), and other local minority interests.

1.3.2 Packaging of the project

PPP – with Bombela providing financing and undertaking design, build, operations and maintenance.

Civil works were undertaken by Bouygues, Murray & Roberts and Loliwe Rail Contractors under contract with Bombela.

Bombardier and Loliwe Rail Express supplied Cityflo 250 train control technology, power supply and distribution systems, communications, fare collection, track work and maintenance equipment, as well as undertaking project management, systems integration and commissioning. Bombardier will ultimately supply a fleet of 96 Electrostar trains.

1.3.3 Phasing of the project

The Gautrain high-speed network was scheduled in two phases:

The first phase, construction of the line between Sandton and the international airport, began in 2006 and was completed and commissioned on 8 June 2010, two weeks ahead of the contractual completion date (to coincide with the World Cup which took place in June 2010).

The second phase, the construction of the Johannesburg-Pretoria link, is currently (early 2011) under way and involves the construction of two underground, one elevated and three at-grade stations at Rosebank, Johannesburg, Midrand, Centurion, Pretoria and Hatfield. This phase of the project is planned for completion in June 2011.

1.3.4 Organisation

Gauteng Provincial Government (GPG) has contracted with Bombela via a concession agreement. There is a Provincial Political Steering committee which acts as the main decision making body for the project. Bombela has two main contracts in place with subcontractors: a turnkey contract for the build of the railway; and an Operate & Maintain contract for its operation. GPG manages the interface between themselves and Bombela through a Province Representative Support Team, (PST). All work is independently certified by Arup (see attached organisation charts).

The turnkey contractor is made up members of the Bombela consortium. There are separate contracts for the civil works and the electrical and mechanical works under this contract.

The Bombela Operating Company will carry out operations and maintenance under a

subcontract with the Bombela Concession Company. The Operating Company consists of Régie Autonome des Transports Parisiens (RATP) Development in partnership with Strategic Partner Group (SPG) and Murray & Roberts.

During the development phase of the project (which includes design, construction, testing and commissioning of the Gautrain project), the role of the Operating Company is primarily to develop the procedures and operational plans for the safe and reliable operation of the rail system. Close interaction with the designers and constructors as well as external stakeholders including the Railway Safety Regulator, the Gauteng Provincial Disaster Management Services and the South African Police Service is required.

Trial running is carried out by the Operator upon successful completion of testing and commissioning. The purpose of trial running is for the Operator to demonstrate that it can operate the rail system in a safe, contractually compliant manner. Following commencement of commercial operations the Operator is responsible for operating and maintaining the rail system including the train and bus services, the stations and the railway infrastructure.

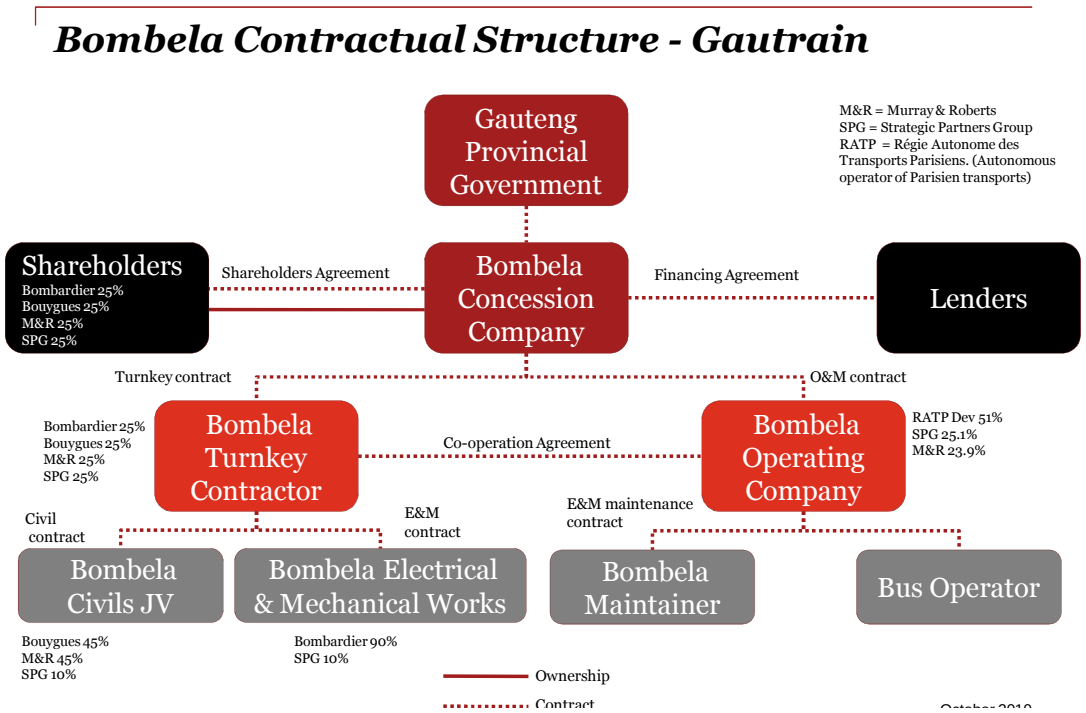


Exhibit 3 - Organisation of the Gautrain project

1.3.5 Key challenges

1. Gauge of train – Euro standard or Cape standard (narrow gauge)
2. Meeting delivery timescales – the airport link was required for the 2010 World Cup
3. Scale and size – 54 month anticipated project duration and finding the appropriate skills
4. Meeting political promises – e.g. unemployment reduction.

1.3.6 Key stakeholders

1. Railway Safety Regulator
2. Standard Bank of South Africa
3. Rand Merchant Bank
4. Department of Transport
5. Gauteng Province South African Football Association.

1.3.7 Funding and financing

Gautrain is financed from five different sources. These are:

- grants from the central government via the Department of Transport;
- contributions from the Gauteng provincial government;
- private sector equity;
- private sector borrowing; and
- debt from the provincial government.

The equity made available by shareholders in the Bombela consortium (which holds a 20-year concession agreement with the provincial government) covers their share of total project cost. Of the remaining 80 per cent, 71 per cent is provided by bank syndication and 9 per cent is through floating-rate mezzanine funding.

The Bombela Concession Company implements its concession obligations through diverse contractual relationships. The primary contract is the Concession Agreement between Bombela and the Gauteng Provincial Government.

Bombela's financing obligations are managed through funding agreements with the lender banks, Standard Bank of South Africa and Rand Merchant Bank through the agent bank, Nedbank.

The Concession company has also contracted with specialised entities, which carry the Bombela name, to specifically deliver the design, build and operate portions of the Gautrain system.

Financing:
Public: € 2.1bn
Private:€ 355 million (max)

1.3.8 Cost and budget

Total magnitude of the project was €2,5-2,6bn.

The project is still ongoing.

Bombela had requested an additional €0,1bn in funding to be ready for the World Cup. This was rejected.

1.3.9 Key contractual features

- PPP structure
- Single Consortium to plan, build etc
- Turnkey to build
- Concession to operate

1.3.10Procurement strategy

The Gautrain project is a Public-Private-Partnership between the Bombela Concession Company (Pty) Ltd (Bombela) and the Gauteng Provincial Government. It comprises a 54 month construction and development period followed by a 15.5 year operating and maintenance period.

1.3.11 Risks

1. Late hand over of land – risk of claims against province
2. Lead times to order, construct and deliver rolling stock
3. Cost escalation
4. On time delivery of the service
5. Availability of skilled resource and equipment
6. Interface issues between track and structures

1.3.12 Lessons learned

- Clearly defined reporting structures at contract start up facilitate the flow of information for decision making.
- Need for better understanding of lead times and processes to secure land and planning permission.
- Better understanding of the nature of ground to prevent civils delaying the track works. To try to avoid further planning consent difficulties, the government introduced a majority rule for stakeholders which in general has sped up the process however on certain lines there have still been significant delays.

Two possible track gauges were evaluated:

1. Cape (1065mm) gauge, which is the rail gauge used in the S A Rail Commuter Corporation rail network adjacent to the study area and also generally throughout the Spoornet rail network in South Africa.
2. Standard (1435mm) gauge, which is used in the vast majority of rail networks, worldwide.

Standard gauge was used in the end to allow for quick procurement of rolling stock and to alleviate safety concerns – e.g. vehicles more stable, crash standards.

1.3.13 Sources

- Gautrain Rapid Rail Link –Lessons Learned, PMSA Conference 2010. Jack van der Merwe (Pr. Eng) CEO : Gautrain Management Agency
- Gautrain website: http://www.gautrain.co.za/
- http://en.wikipedia.org/wiki/Gautrain

1.4 Sweden – HSR Feasibility Study

1.4.1 Project outline

The project is a study on the future for high speed rail in Sweden. High speed rail in Sweden is at a very early stage and the study was of a conceptual nature concluding with suggestions of how a high speed railway system in Sweden could be organized, developed and funded. Thus the case study does not represent an example of a project that has been done, merely an example of how it has been envisaged in Sweden.

The high speed rail project looks at two corridors for high speed rail in Sweden, one between Stockholm and Malmö and Stockholm and Göteborg.

Götalandsbanan, between Stockholm and Göteborg, had been through several stages of planning before this study. The corridor is 470 km long, of which 440 km is new double track between Järna and Almedal.

Europabanan is 300 km of new double track between Jönköping (half way from Stockholm to Göteborg on Götalandsbanan) and Malmö. The planning of this corridor is in an earlier stage than Götalandsbanan and the formal planning process has not yet commenced.

1.4.2 Packaging of the project

The recommendations from the study are as follows :

- Rolling stock should be procured by the service operator
- Depots for rolling stock and rolling stock maintenance should be the responsibility of the suppliers of maintenance of rolling stock, property owners and municipalities.
- Stations (i.e. station buildings) should be the responsibility of the property owner and/or the local authorities/municipalities. The platforms and the platform walkways should be the responsibility of the infrastructure operation and maintenance company.
- See 'Phasing of the Project' below for discussions surrounding packaging of infrastructure works.

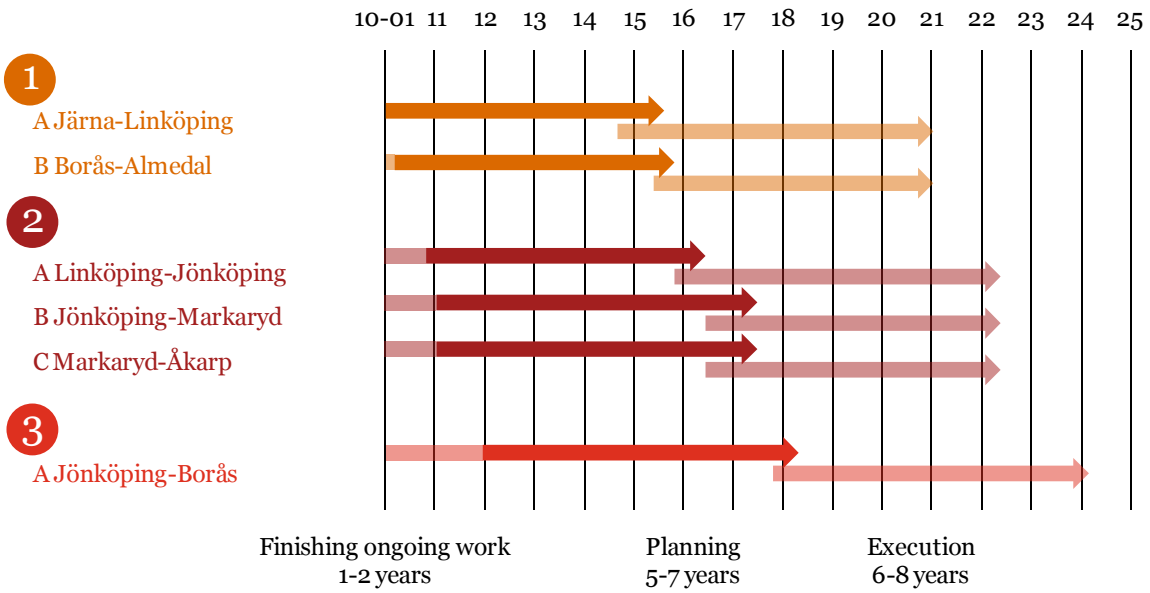
1.4.3 Phasing of the project

The study does not conclude on how the project should be phased and packaged, but points out the following issues:

- The various sections could be divided into a number of output based contracts, comprising ground works, structures, p-way, and systems, the size of which would be dependent on a range of issues including how risk is allocated to the private sector.
- For permanent way and systems it might be best to put together larger packages that include all the parts of the system.
- Packaging all the different elements for one section (geographical) of the HSR together could result in fewer contractors being able to respond to the tender, but improve interface issues and incentivise parties to take responsibility for operation and maintenance of the infrastructure for a longer period of time.

The assumptions for the phasing of the project are as follows:

- Planning is commenced in 2009/2010
- The infrastructure is in operation in 2025
- The concession for the operation of the high speed railway is for 30 years, until 2054



- Given normal conditions, it was considered that sections of 100 to 200 km of line could be planned and constructed over a 15 year period – 7 years of planning and 8 years of construction.

1.4.4 Organisation

The organisation is proposed as in the chart in Exhibit 4 below. It has the following features:

- The Project Company is the procuring entity and is 100% owned by the Government and funded through equity, grants, and loans from the Bank of Sweden, EU contributions and contributions from local authorities. The Project Company has limited equity and is therefore dependent on Government underpinning of loans.
  Revenue for the Project Company is comprised of access charges and other fees from operators as well as grants from the Government (through the Rail Administration). The Project Company has responsibility for planning, designing and procuring construction as well as the operation, maintenance and management of the high speed rail system. Its responsibilities include land acquisition. The Project Company will own the infrastructure and allocate track access and levy access charges. The Project Company is estimated to employ 250 people but the composition of competence will vary according to which phase the project is in. The Project Company will pay the Infrastructure Company based on the availability of the high speed rail infrastructure.
- The delivery entity is the Infrastructure Company which is responsible for the detailed design, construction, operation and maintenance of the high speed railway. After completion of the infrastructure the Infrastructure Company will be responsible for its operation and maintenance for 30 years through a contract with the Project Company. The Infrastructure Company is assumed to be privately owned with financing through equity from shareholders and loans from EIB, NIB, SEK, insurance companies and private banks. There can be one or more Infrastructure Companies depending on whether the project is divided in several sections. The Infrastructure Company will contribute to the financing of the investment and be reimbursed by the Project Company based on availability of the infrastructure during the operating phase.
- Passenger Train Operators will have access to the high speed rail tracks in return for paying a track access charge to the Project Company. The rail system will be accessed by several train operators. The train operators will fund and procure all rolling stock.
- Owners of Stations and Depots receive fees from the Train Operators on a commercial basis for use of the stations and depots.

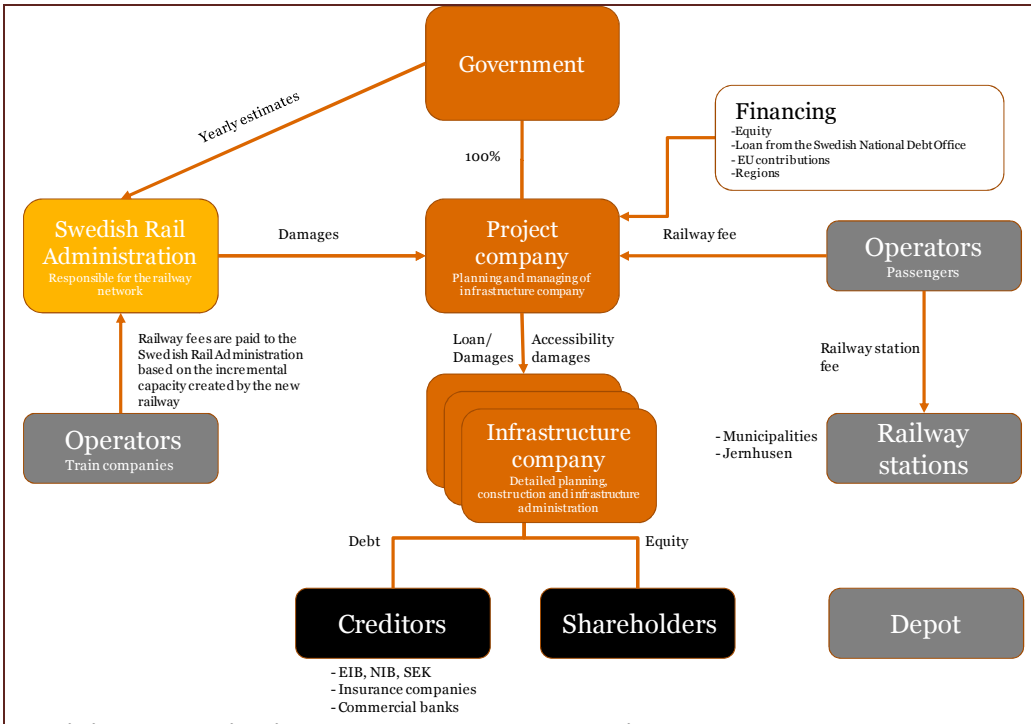


Exhibit 4 - Organisation of the HSR development in Sweden

1.4.5 Key challenges

1. Funding
2. Development of reliable traffic projections
3. Technical issues

1.4.6 Key stakeholders

1. Ministry of Finance
2. Ministry of Enterprise, Energy and Communications
3. Trafikverket, The Swedish Transport Administration
4. Affected municipalities and regions
5. Rail operators
6. Suppliers of material and rolling stock

1.4.7 Funding and financing

Two alternatives methods of funding the project have been considered:

- All funding, apart from contributions from EU and grants from regions and municipalities, is done in the traditional manner through the Government and governmental bodies and companies, directly to the Project Company.
- Public funding is supplemented by private finance through the Infrastructure Company. Private finance would in this case be maximised according to how much of the investment could be funded through access charges from the train operators.

The latter alternative is the one which is recommended in the study. Proportions of public and private finance are to be determined based on the actual size of the investment, the cost of financing and the risks in the project. This approach implies the following proportions at this stage:

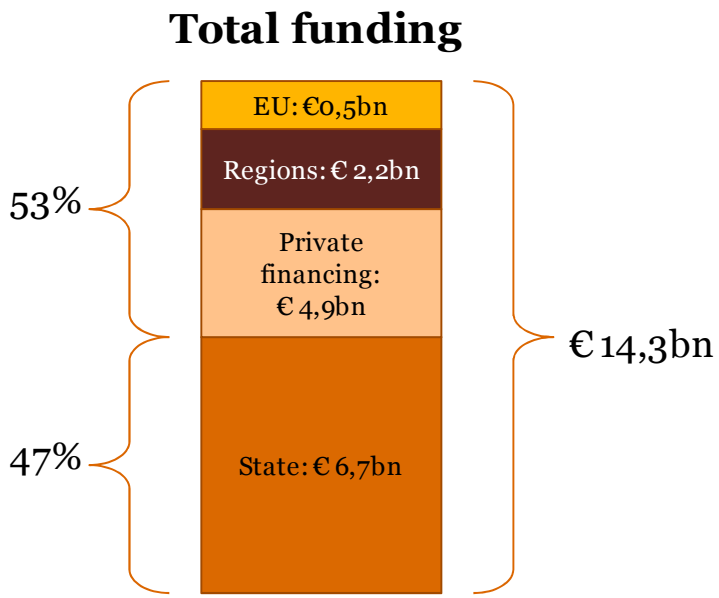
- Infrastructure Company private financing €4,9bn, 34% of the total costs), of which:
  - Equity (5% of private financing)
  - Subordinated loan (10% of private financing)
  - Loans (85% of private financing)

- Financing of the Project Company €9,4bn, 66% of total costs) public financing (the entity that owns the infrastructure :
  - Governmental financing through loan from "Riksgälden" (governmental body) or issuance of bonds (47% of total)
  - Contributions from EU (3% of total)
  - Regional and local grants/funding (15% of total)
  - Equity

According to Swedish law and relevant EC Directives it is the Rail Authority that should levy charges for use of the railway infrastructure and the study has not been able to establish whether and to what extent the access charges can be allocated to the Project Company.

The access charges are estimated at about €57,1 million a year (2025-figures).

In total, the proportion financed centrally by the Government (not locally, EU or private) amounts to 47%.



1.4.8 Total cost and budget

Total investment: €14,3bn

Annual maintenance costs are estimated at €57,1 million.

Only budgeted costs are available as the project is at feasibility stage.

1.4.9 Key contractual features

The infrastructure construction and maintenance is based on a DBFO-structure, in which the Project Company (the procuring entity) signs an availability based contract with an SPV, the Infrastructure Company.

See also section 1.4.4 and Exhibit 4 above.

1.4.10 Procurement strategy

The procurement of infrastructure (excluding depots and the parts of the stations that are not tracks, systems or platforms) is based on a DBFO strategy.

The rolling stock is assumed to be procured, maintained and financed by the respective train operators. The procurement strategy has otherwise not been assessed.

Stations (terminals, buildings etc. - the parts that are not tracks, systems or platforms) should be owned and managed by property developers or local stakeholders. The procurement strategy has otherwise not been assessed.

1.4.11 Risks

1. Determination of maintenance cost risk
2. Rolling stock (procurement, operation and maintenance)
3. Revenue risk (traffic risk)
4. Completion on time and at the budgeted cost
5. Risk regarding financing and refinancing (infrastructure and rolling stock)
6. Land acquisition
7. Permissions and environment

1.4.12 Lessons learned

Difficulties of achieving socioeconomic surplus and therefore justifying the investment in HSR.

It was a challenge to distinguish what interface issues should be addressed under the high speed rail project and what should be considered ”normal” investments.

1.4.13 Sources

- SOU2009:74 - Höghastighetsbanor – ett samhallsbyggande för stärkt utveckling og konkurrenskraft (Swedish Public Report 2009:74 – High speed rail – infrastructure for strong development and competitive power)
- Swepro Project Management AB,
- Discussions with staff in the Swedish PwC office

1.5 Netherlands (HSL Zuid)

1.5.1 Project outline

HSL-Zuid (Dutch: Hogesnelheidslijn Zuid, English: High-Speed Line South) is a 125km high-speed railway line in the Netherlands. Using existing tracks from Amsterdam Centraal to Schiphol Airport, the dedicated high-speed line continues to Rotterdam Centraal and to the Belgian border. 160 km/h services on the HSL-Zuid began operating on 7 September 2009 between Amsterdam and Rotterdam. From December 2009, Thalys trains from Amsterdam to Brussels and Paris have been using the HSL-Zuid and by late 2011 Fyra trains will serve all HSL-Zuid stations between Amsterdam Centraal and Brussel-Zuid/Bruxelles-Midi.

The line was originally scheduled for completion in 2007. It will be served by newly renovated Thalys trains from Amsterdam to Paris and Brussels.

1.5.2 Packaging of the project

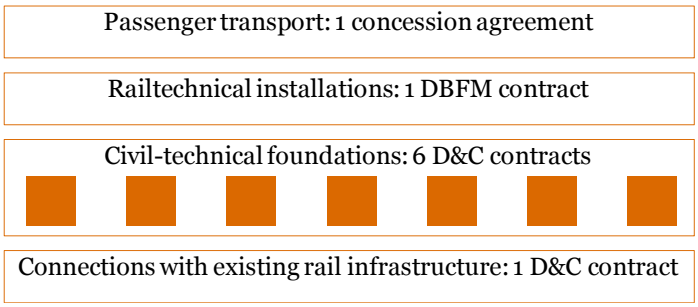
The project consists of the following components:

- Civils Assets/sub-structure: procured and funded by Dutch State through separate Design & Construct contracts (6 sections).
- Systems Assets/super structure1): 30-year infraprovider DBFM-contract.
- Train operations: 15-year TOC concession incl. rolling stock.
- Interface with existing infrastructure: one Design & Construct contract.

1.5.3 Phasing of the project

The State acting as central counterparty to the private contract parties. This s believed to have resulted in price efficient separate contracts for discrete parts of the project. The project was originally approved in 1997, the route finalised in 1998 and construction begun in 2000.

1.5.4 Organisation



1.5.5 Key Challenges

1. Requirement for the private sector to participate on a risk-bearing basis in the development of the project
2. State wished to maintain control over the major project components by functioning as the central counterpart
3. State wanted to limit complexity of the sub-projects by grouping similar type of risk.
4. International arrangements (these were very important as the HSL is part of an international network.)
5. Getting the payment mechanism (performance fee) right

1.5.6 Key stakeholders

1. Ministry of Transport
2. Rijkswaterstaat
3. NS/Prorail
4. Belgium Government

5. Local Governments (stations, permits)
6. Investors/Clients

1.5.7 Funding and financing

The Dutch government finances:

- The substructure of the HSL
- The PPP infrastructure payments to Infraspeed
- These are partly financed by revenue from HSA
- The value of the PPP element of the project was approximately €1,2bn. The financing for this element of the project was achieved through 90% gearing.

The €1,2bn project financing for the PPP includes:

- Loan facilities provided through an international commercial banking consortium with the lead arranging banks being Bayerische Hypo-und Vereinsbank, ING, KBC, Kreditanstalt für Wiederaufbau, Dexia Credit Local and Rabobank:
- €605 million syndicated term loan (comprised of two Senior loans with a term of approximately 27 years)
- €119 million subordinated debt bridge facility
- €15 million working capital facility
- The project's "TEN" status made it eligible for a loan from the EIB with a principal value of approximately €400 million.

1.5.8 Cost and budget

Total cost of the project was €7.2bn.

Delays to the construction timetables and cost overruns have been attributed in press articles and technical reviews to several factors:

- Late delivery of the train sets from the HSA joint venture contractor.
- Political procedures and the lack of competitors (market tension) resulted in an overrun for the sub-structure (e.g. political procedures lead to a bored tunnel that costed 1b extra).
- The ERTMS (European Rail Traffic Management System) modifications due to a change in protocol were underestimated.
- Upgrading of the signalling system.
- The equipment for testing the upgraded safety system was not delivered on time as the specification was changed.

According to the report from the Dutch Audit Commission, these delays will result in a loss of income to the Government from access charges totalling around €222 million.

Capital costs rose from a projected €3-5bn in the mid-1990s to over €6bn in 2006. The report also predicts that the whole HSL-Zuid project will only achieve break even about 2022.

1.5.9 Risks

1. HSA ==> revenue risk
2. Infraspeed ==> availability risk of the infrastructure
3. Constructors substructure ==> construction risk
4. Government ==> risk interfaces

1.5.10 Lessons learned

1. Potential to use PPPs to finance rail infrastructure
2. Management of the interfaces is very important. The interfaces led to a lot of issues e.g. the substructure did not meet the expectations of Infraspeed.

1.5.11 Sources

- HSL-Zuid Presentation titled "Master the Project to it's goals" made by the Ministerie van Verkeer en Waterstaat
- http://www.fluor.com/projects/Pages/ProjectInfoPage.aspx?PrjID=13#
- Press articles and input from PwC staff in local office
- High Speed 2 - International case studies on delivery and financing – a report for HS2 (Ernst & Young, 2009)
- Fast Forward – Funding Report, Delivery of High Speed Rail in Britain (PwC, 2010)

1.6 Japan – Tohoku Shinkansen

1.6.1 Project outline

This was an extension to an existing line in the North of Japan from Hachinohe to Shin-Aomori procured by East Japan Railway Company ("EJRC"). This reduces the journey time from Tokyo to Shin-Aomori by nearly 40mins to 3hours 20mins. Two new stations have been built – these being Shichinohe-Towada Station and Shin-Aomori Station. The length of the extension is 81.8km and includes a 26km tunnel. The line features extensive snow mitigation measures, including a hot water spray system to melt snow.

1.6.2 Packaging of the project

EJRC has split the project into relatively low value, skill specific contracts. There is a range of contractors with Hitachi being the single largest contractor. The contractors have experience of working together to deliver other high speed rail projects in Japan as a result this approach does not lead to significant interface risk. In addition, the culture in Japan is to share and resolve problems rather than deny responsibility. Part of the reason for this is the flow of projects and the risk of missing out on the pipeline by not taking responsibility for problems on a project (risk to reputation). In effect EJRC and its contractors share the risk, but this is not explicitly reflected in the contracts.

The need to address explicitly the allocation of risk is becoming more prevalent as more international companies become involved in the market.

1.6.3 Phasing of the project

The new extension was constructed and opened as a single project.

Tohoku Shinkansen project was originally approved in Aug. 1991. At this point, the rolling stock used was assumed to be smaller than that used for conventional Shinkansen lines. The plan changed in 1994 – 1996 to introduce full-sized rolling stock. In 1998, the plan was officially approved.

Construction commenced in 1999.

The line commenced operations: December 2010

The construction period was extended because the cost for the civil construction was born by Central and Local Government and both bodies found it difficult to allocate sufficient amounts for the construction budget each year.

New Trains being delivered in March 2011.

1.6.4 Organisation

EJRC has managed the procurement and delivery of the new line within its existing organisation structure. This is possible because it has been a relatively small procurement following a well established and understood methodology.

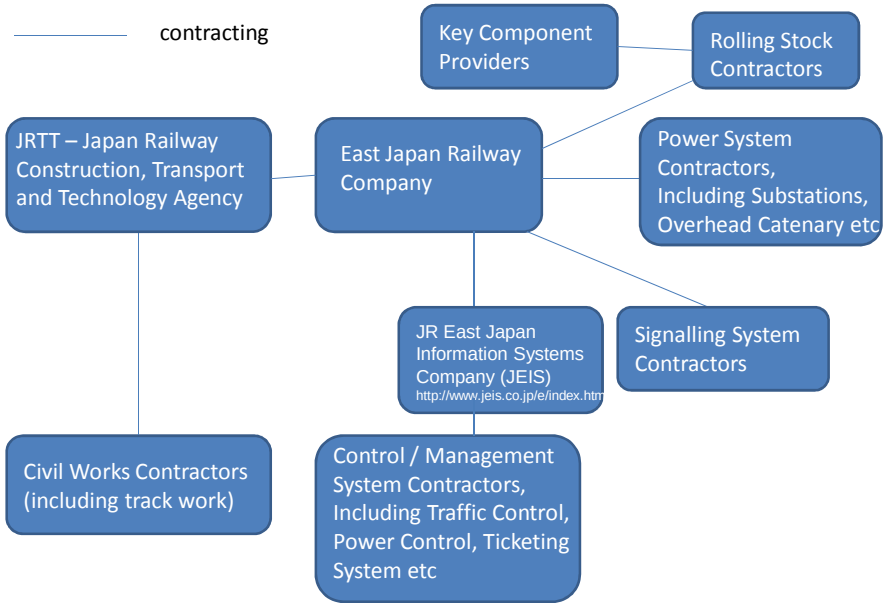


Exhibit 5 – Japanese HSR Organisation

1.6.5 Key challenges

Setting realistic timescales for construction and delivery – aspirations can be unrealistic, in particular with regard the lead time for designing, manufacturing and commissioning a new class of rolling stock.

1.6.6 Key stakeholders

East Japan Railway Company

1. MLIT – Ministry of Land, Infrastructure, Transportation and Tourism
2. MOF – Ministry of Finance
3. JRTT – Japan Railway Construction, Transport and Technology Agency

1.6.7 Funding and financing.

Unlike the main Shinkansen lines, in this case the East Japan Railway Company did not bear the whole cost – the cost for the civil construction has been part funded by the public sector. EJRC has funded the financing of its share of construction costs out of its operational revenues.

1.6.8 Cost and budget

Based on similar projects for which data is available, the cost of the construction of Shinkansen is between €0,05bn and €0,06bn/km. On this estimate the cost of this extension would be around €4,6bn.

Cost overruns are not generally a problem in Japan because of the close working relationship between procurer and contractor. In addition, there is considerable experience of building HSR infrastructure in Japan which can be drawn upon when developing budgets.

Prices bid are usually fixed price. If a cost overrun occurs there will be a discussion and whoever is responsible for the overrun will cover the cost.

1.6.9 Key contractual features

Contractors are paid in full once the work is completed and they have milestone payments –

some of which are based on key delivery dates and some are simply time based.

1.6.10 Procurement strategy

The procurement strategy is fixed price contracts for discrete pieces of work. EJRC manages the interface risk but in practice contractors are expected to work closely to manage this risk.

1.6.11 Risks

- Political Change destabilising the project
- The widely varying costs between different HSR technologies
- New contractors from elsewhere in the region (China and Korea) are entering the market and are not as mature and do not have the same experience as Japanese contractors

1.6.12 Lessons learned

- Time estimates for the construction and testing of the infrastructure need to be realistic and take into account the time it takes for funding to be sought by government organisations.
- As the operator separately procures equipment from many manufactures, there is no manufacturer consortium and the operator takes the full responsibility for interface issues.

1.6.13 Sources

- JRTT website (www.jrtt.go.jp)
- www.mlit.go.jp/tetudo/shinkansen/shinkansen6_QandA.html
- www.jreast.co.pp/e/aomori
- Wikipedia article on Shinkansen
- Press articles and input from PwC staff in Tokyo who have worked on the project

1.7 France (TGV) - Mediterranean High Speed Line (HSL)

1.7.1 Project outline

Extension of the HSL Paris-Lyon to Marseille : 250 km-long new high speed line with three new stations (Valence, Avignon and Aix-en-Provence). All infrastructure is newly built.

1.7.2 Packaging of the project

The project was part of a plan to build four new high speed lines to create a North-South European route, after the success of the HSL Paris-Lyon : Northern France + Paris area Junction + Lyon-Valence + Valence-Marseille.

1.7.3 Phasing of the project

- Initial studies started in 1989
- SNCF (French national operator) started to implement the project in 1990
- The scheme was approved in 1991
- Dialogues were carried out in 1990 (mission Querrien) and 1992 (college of experts)
- The public use survey report was published in 1993
- SNCF started its field research in 1994
- The project was declared of public value in 1994 and the transport ministry approved it in 1995 although the Nîmes-Montpellier section was cancelled
- Works started in 1995
- RFF (French infrastructure operator) was project owner from 1997 onwards and SNCF was project manager
- The high speed line started operating in June 2001

1.7.4 Organisation

- RFF created the new high speed line
- SNCF was project owner for new stations
- SNCF was project manager for the project
- Construction works were undertaken by private building companies

1.7.5 Key challenges

- Delivering planned journey time improvement (approx. 1hour)
- Increasing the attractiveness of rail in order to compete with airlines
- Technology and construction issues surrounding developing the high speed rail offering

1.7.6 Key stakeholders

1. SNCF Great Projects
2. SNCF Stations
3. SNCF InfrastructureSNCF Rolling stock
4. RFF
5. Government

1.7.7 Funding and financing

Construction costs were €4,362 million which was close to the initial budget €4.2 million. (+3.8% overrun). The financing was split between RFF (95%) and SNCF (5%)

In addition, SNCF had to spend €491 million to buy 21 new TGV

The cost of the 3 new stations reached €234 million, split between RFF (51%) and SNCF(49%).

1.7.8 Risks

- Time overrun : beginning of operations was initially planned for 1998
- Construction costs increased
- New rolling stock had to be purchased
- Transport times were not fully compliant with objectives, depending on relations
- Operation costs were not fully compliant with objectives
- A large section had to be cancelled

The project line had also to be modified due to the environment, flooding and earthquake risks.

The French Accounts Commission for Transport evaluated in 2009 the HSL programme (Paris-Lyon-Marseille) and concluded that it would contribute appositive balance with a net present value of €45.9bn (2005 prices) for the south east France area.

1.7.9 Sources

- Jean-Francois Paix and Anne deMartel at SNCF
- Wikipedia articles on TGV and LGV Bretagne – Pay de la Loire
- Desk top research of press articles

1.8 Spain - Alta Velocidad Española (AVE): Madrid – Sevilla Line

1.8.1 Project outline

This case study focuses on the Madrid-Seville Lines (first High Speed Rail line in Spain). It also draws out lessons from the other high speed lines constructed or under construction since then.

Alta Velocidad Española (AVE) is a service of high-speed trains operating at speeds of up to 300 km/h (186 mph) on dedicated tracks in Spain. The AVE project started in October 1986. The AVE line between Madrid and Sevilla commenced operations on April 21st 1992 in time for the opening of the International Exhibition of Seville, Expo92. Once trains reached its optimum speed, the duration of the Madrid-Seville route was shortened to two hours and twenty minutes from six hours.

The project was fully financed by the Spanish Ministerio de Fomento (Ministry of Public Works) which owned the infrastructure through its public company RENFE. In 2003, the Spanish railway sector was restructured by the Railway Sector Law, according to which the main infrastructures (railway, electrification, signalling and security equipment) are owned by the Ministry of Public Works.

Rail infrastructure is designed, built, financed and partly operated by the public company Railway Infrastructures Administrator (ADIF), which makes the infrastructure available to the public company RENFE Operator, which provides the rolling stock and operates the service.

1.8.2 Packaging of the project

There were various contracts, with the Rolling Stock and the Signalling being procured in the same package and won by Alstom. The majority of the rest of the packages were let to Spanish companies.

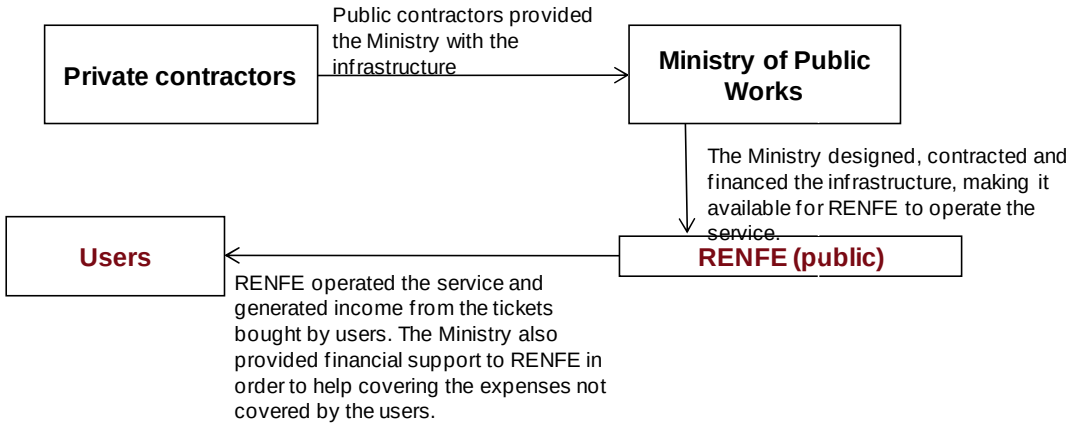
1.8.3 Phasing of the project

Due to the scheduled inauguration of the Expo '92 in Sevilla for the year 1992, the project (Madrid – Sevilla HSR Line) was structured in one phase. Construction of further HSR lines was structured in different phases, such as for the following lines:

The construction of the 471 km (Madrid – Sevilla) line took six years, a remarkably short time for that distance. Its cost was about 30% lower than similar lines, in part due to the strong commitment of the central and regional government to delivering the railway in time for Expo '92.

1.8.4 Organisation

The Madrid – Seville line, as well as the all the HSR lines developed so far in Spain, were contracted by the Ministry of Public Works and its operation was entrusted to RENFE, according to the following structure:



1.8.5 Key challenges

- Opening of the railway services for the inauguration of the Expo '92
- Elaborating a project of this size, taking into account that Spain is the second most mountainous country in Europe, only behind Switzerland

1.8.6 Key stakeholders

1. Renfe is a Public Enterprise under the Ministry of Development of Spain, and is also the public principal operator of services on the Spanish railway.
2. Ministry of Public Works: Main public Authority of the Spanish railway sector who designs the strategy for the sector and conducts political guidance.
3. ADIF, the Administrator of Railway Infrastructure in Spain is a public company under the Ministry of Development that has been established to build and manage the high speed railway in Spain.
4. Contractors: Main Spanish construction firms for the civil works and railway sections of the infrastructures (ACS, FCC, Ferrovial, Sacyr and OHL being the main ones). For the electricity and signalling equipment and the rolling stock, the contractors are usually some of the leading international firms (Bombardier, Siemens, Alstom) as well as Indra.
5. Utility companies: The construction firms and the rest of the contractors were hired by the Ministry in order for them to develop specifically designed construction projects, which did not include the construction of electricity stations and connecting points. These were developed by the electricity companies which owned the electricity lines where the connection was done. Given that contracts only entailed construction and provision and installation of equipment, the risk of these facilities not being ready at the start of the operating phase was borne by the government.
6. Local Authorities: The Ministry of Public Works reached agreements with relevant local authorities in order to obtain support for the projects being carried out.
7. Environmental agencies: According to Spanish regulations, the Ministry of Public Works has to present each project to the Ministry of Environment to obtain a positive Environmental Impact Declaration prior to the project's construction phase being started.

1.8.7 Funding and financing

The works for the Madrid-Sevilla high speed railway were partially financed by the European Regional Development Fund (ERDF), aid amounting to €267.3 million.

Financing:
All the HSR projects built so far have been 100% financed by the public sector including EU finance.

1.8.8 Cost and budget

The final overall cost of construction of the Sevilla-Madrid HSR rose to over €2,000 million.

Significant costs overruns actually took place for the Madrid – Seville project, as well as for some of the projects carried out subsequently, mainly in the areas which are more mountainous and tunnels have to be built.

1.8.9 Key contractual features

According to Spanish regulations on costs overruns for public contracts prices bid are usually fixed prices for a specific construction project agreed before the construction starts. When a cost overrun occurs there will be a discussion between the relevant parties and if the cost overrun has been caused by an increase in construction prices it is assumed by the contractor and where there have been changes to the construction project, the cost increase is assumed by the Authority.

1.8.10 Procurement strategy

The Madrid – Seville AVE was procured for different infrastructure areas, with several construction and equipment contracts for the different infrastructure sections that were awarded to private contractors individually. The same structure has been applied to the rest of the high speed railway procured in Spain.

1.8.11 Risks

The Madrid – Seville AVE projects provided a good experience of what a high speed rail project involves and which of the risks initially identified actually materialized. The following having proved to be the most significant risks:

- Geological risk: Some of the projects have experienced significant cost overruns given the occurrence of geological risk.
- Completion risk: With the exception of the Madrid – Seville project, which was finished on time for the Expo92, the remainder of high speed rail projects have experienced significant delays, being the Madrid – Barcelona project the one with longer delays in reaching the operating phase.

1.8.12 Lessons learned

When the Madrid-Seville line was built, Iberia (Spain's airline) was under state control. One of the reasons the line was so successful is that the government of Spain did not allow the airline to compete over the same route.

Significant cost overruns and claims of non - profitability and too high subsidies for the construction, maintenance and operation of the AVE have been raised after each of the lines have been completed. The Spanish government is nevertheless confident that the social and economic benefits involved offset the significant costs entailed in the delivery of high speed rail infrastructures. Commentators have suggested that one of the reasons why the Ministry of Public Works is planning to tender future high speed rail projects through concessions, is so that the private sector gets more involved in the delivery of such infrastructure thereby minimising of costs overruns risk.

1.8.13 Future plans for the Spanish high speed railway

In 2003, the Railway Sector Law was approved and SEITT, S.A. was created. Private operators were allowed. Nevertheless, the liberalisation has not proved successful as few private railway operators are actually operating in the Spanish market. In the high speed rail subsector, there are no private operators.

From 2003 onwards, the following structure was used in order to promote high speed rail projects in Spain, the construction of the railway infrastructures being directly contracted and paid by the either SEITTSA or ADIF to the contractors.

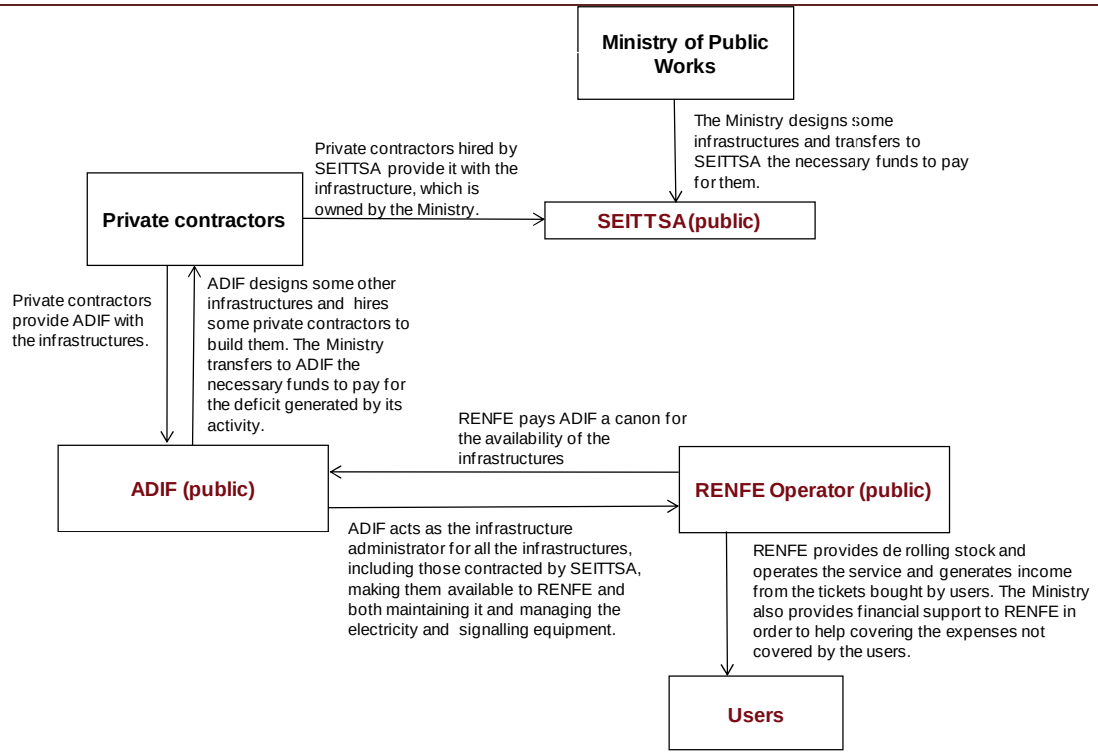


Exhibit 6 HSR structure in Spain

The most recent development of the Spanish High Speed Railway System came on 7 of April 2010, when the Spanish government introduced the new Extraordinary Plan of Infrastructures ("PEI"). PEI Spain's greatest PPP infrastructure program and will allow tendering of concession contracts in 2010 and 2011 amounting to €17bn(1,7% of the Spanish GDP). The main characteristics of the PEI are:

- €11.9bn will be used to improve the railway.
- In common with typical Project Finance structures used for concessions in Spain, both private and public banks are expected to provide a high percentage (between 70% and 85%) of the financing needs, while the constructing companies or private investors will provide the rest.
- The concessionaire will assume construction risk (will not receive any payment until the construction is finished) and availability risk, as the Ministry has decided to use availability payment to pay investors for the construction and maintenance of the projects. The scheduled concession periods will be about 25 years.
- PEI is adopting availability payments instead of transferring revenue or demand risk in order to improve the access of the concessionaires to the financial markets (less uncertainty). The Spanish Government has signed agreements with BEI, ICO, AEB and CECA to help the concessionaires to access finance.

1.8.14Sources

- Ferrocarriles de Alta Velocidad (www.technologyreview.com)
- Ministry of Public Works web site
- PwC staff members in Spain who have advised on delivering high speed rail in Spain

1.9 Taiwan – HSR in Taiwan

1.9.1 Project outline

The Taiwan North-South High Speed Rail Project was initially planned to be built as a public sector project with all risk taken by the Government. Due to the increased public fiscal burdens, the Legislative Yuan withdrew the budget allocated to the High Speed Rail Project and the Government decided to have the railway built by a private sector venture using a Build-Operate-Transfer ("BOT") model.

The Encouragement Statute stating the required rules and policies for the project was passed in December 1994. A tender invitation for Private Participation in construction and operation of Taiwan North-South High Speed Rail Project was issued by the Government on October 29, 1996. With a construction value of €13bn, the HSR Project is one of the largest privately managed and funded BOT Projects that has been undertaken.

The Taiwan High Speed Rail Consortium was formed in November 1996 to bid for the HSR BOT Project and was selected as the winning bidder in September 1997. Taiwan High Speed Rail Corporation ("THSRC") was incorporated in May 1998 as the Concessionaire to build and operate the HSR service. On July 23, 1998, agreements were signed between MOTC (representing the ROC Government) and the THSRC, which granted THSRC a concession to finance, construct, and operate the High Speed Rail System for a period of 35 years and a concession for high speed rail station area development for a period of 50 years.

The high speed railway links Taipei to Kaohsiung at a total length of 345km with a 90 minute journey time. The line will have four stations.

1.9.2 Packaging of the project

THSRC teamed up with GEC-Alsthom, the main maker of the French TGV, and Siemens, the main maker of the German ICE, to win the bid for the project; hence, the original design of the high speed rail system was based on the high speed technology platform of Eurotrain. The THSRC consortium won the contract for all the construction work. This included civil works, rolling stock, E&M signalling systems, stations and depots. The Consortium then engaged different sub-contractors for different aspects of the work. THSRC later switched to Japanese Shinkansen system in 2000, including rolling stock and E&M signalling core system.

1.9.3 Phasing of the project

The project was built as one line from Taipei to Kaohsiung (Zuoying). However, due to construction delays, it was not until March 2007 that the line between Taipei and Banciao started operating while the remaining part of the line, from Banciao to Kaohsiung (Zuoying), has been operating since January 2007.

Currently, there are four additional stations under construction:

- Nangang is expected to start operating in 2012.
- Miaoli is expected to start operating in 2015.
- Changhua and Yunlin stations are expected to start operating in 2015 as well.

It was always envisaged that these stations would be phased into the project at this stage of the timetable.

Key milestones of the project are outlined below:

- 1993 – the government decided to apply the BOT model to deliver HSR in Taiwan.
- Oct. 1996 – the government commenced the procurement process.
- Jul. 1998 – the government signed the concession contract with THSRC.

- Jan. 2007 – Operations commenced.

The high speed railway was supposed to start operating in Oct. 2005. However, due to delay in construction of mechanical and electrical system as well as the signalling systems, completion was postponed by just over one year.

1.9.4 Organisation

Public Sector:
The "Preparatory Office for Bureau of High Speed Rail ("POHSR")" under Ministry of Transportation and Communications ("MOTC") was founded officially in July 1990 to manage all works relating to planning and executing the construction of the high speed railway.

The Executive Yuan set up the Bureau of High Speed Rail (BOHSR), MOTC on January 31 1997 to complete the remaining tasks in the planning stage of the high speed railway including the acquisition of land, commencing execution of the project and promotion of private investment and establishment of the project.

Construction started on March 27 2000. The Central District Engineering Office of BOHSR took charge of the supervision, coordination and control of construction schedules and quality during the construction period of HSR.

Private sector:
Taiwan High Speed Rail Consortium (THSRC) teamed up with GEC and Siemens to bid the HSR project. The group was renamed and formally established as the Taiwan High Speed Rail Corporation (THSRC) in May 1998 after it won the BOT project.

1.9.5 Key challenges

- Estimating ridership to assess the feasibility of the project.
- Sourcing enough finance and funding for such a large scale project
- Knowledge transfer from system provider to the operator in order to run the railway safely and smoothly
-

1.9.6 Key stakeholders

1. Financial institutions (funding)
2. Shareholders of THSRC (funding)
3. System provider
4. General population
5. Rail operator and airlines

1.9.7 Funding and financing

When THSRC and the government signed the final contract in October 1999 construction costs were estimated at €9.5bn. Actual construction costs totalled €12.2bn. Three-quarters of the project's funding in the construction phase came in the form of syndicated loans from banks.

In February 2000, THSRC and a group of 25 domestic banks signed an agreement for a €8,2bn financing package, of which €6,1bn came from government deposits in the banks.

After a delay in opening, in July 2006, eight banks agreed to provide a second loan package of €1,7bn.

In Jan, 2010, THSRC refinanced by borrowing a third syndication loan worth €9,1bn from 10 banks. Of the €9,1bn, €7,8bn and €1,3bn were used to pay off the debt from the first and the second package of loan respectively, €0,5bn was used to support operations, and €0,1bn was

used as performance bond to the government.

To raise its own capital, the company sought investors. From January 2002, the government also invested via state-owned companies, with its share reaching 37% in November 2005. From December 2003, THSRC also issued preferred stock. As of Dec., 31, 2009, THSRC had common stocks of €1,6bn and preferred stocks of €1,0bn.

1.9.8 Cost and budget

The project had a total cost of €11.1bn and is one of the largest privately-managed and funded transport schemes to date.

The actual cost exceeded the originally planned amount by about 8% mainly because of:

- changes in building codes, in particular seismic design criteria in the wake of the 1921 earthquake; and
- delays in opening due to various reasons mentioned in question 5.

1.9.9 Key contractual features

THSRC, was contracted to build the high speed rail infrastructure and run the business exclusively for 35 years, including the time spent in construction. In addition, THSRC has the right to use the land within certain station area for 50 years. These stations include Taoyuan, Hsinchu, Taichung, Chiayi, and Tainan.

The government was responsible for land acquisition, planning, design, supervision and civil work for understructures in Taipei sections. Private contractors were responsible for civil works, stations, track work, electrical and mechanical system, maintenance bases, and their portion of funding costs.

1.9.10 Procurement strategy

Prior to construction, the government spent about €2,7bn to acquire the land along the route of the line.

The procurement of construction, maintenance and operations was structured as a BOT project.

1.9.11 Risks

1. Financing
2. Political change causing a change in scope to the project. Nature disaster (earthquake, typhoon, flood)
3. Technology

1.9.12 Lessons learned

1. Change of Core Systems
   THSRC's winning bid for the THSR franchise was based on Eurotrain's technology and specifications, and THSRC granted Eurotrain the status of preferred bidder for the supply of the core system technology, however, it chose TSC in the end, citing "technology, price, finance and maintenance merits". At a time THSRC had difficulty raising capital for the project, both the Japanese government backing TSC and Eurotrain offered beneficial financial terms; TSC later agreed to buy a 10% stake in THSRC.

   On the TRUPO section in Taipei, THSR tracks were to replace two of TRA's four tracks, leading to capacity concerns and reduction of TRA services. The rail unions repeatedly protested the arrangement.

   THSRC had disputes with core systems contractor TSC over technology and responsibility for delays. During the final contract negotiations, TSC objected to THSRC's intent to mix

European and Japanese technology, citing safety reasons, and negotiations were drawn out. Prior to the planned opening in 2005, THSRC also blamed TSC for construction delays, identifying that as reason for the postponement of the opening. THSRC's opponents also made claims about poor quality of construction, which the company rejected, deeming them routine problems that had already been dealt with.
A longer running controversy emerged when high-tech firms in a business park close to the line expressed concerns regarding vibrations. The dispute led to design changes and the development of track buffers that was fraught with difficulties. Vibration levels during actual test runs were lower than expected.

2. Difficulty in funding
THSRC experienced difficulty in raising finance for construction through the capital markets and ended up raising more debt. Investors' insecurity came from there being no proven record of operation and profitability as the project is the very first high speed rail project in Taiwan. Even though THSRC successfully raised finance through syndicated loans, the majority of the participating banks are state-owned or semi-state-owned.

   THSRC's proposal that no investment would be funded or financed by the government was an aggressive strategy and made the raising of finance very difficult.. This demonstrates the importance of a viable financial planning to the success of a large scale project.

1.9.13Sources

- THRSC web site (www.thsrc.com.tw/en/)
- Article in Taipei Times 3 February 2000
- Review by PwC local staff of local press articles
- Wikipedia article on Taiwan High speed Rail

1.10 Crossrail

1.10.1 Project outline

Crossrail Ltd (CRL) was established in 2001 to promote and develop direct rail links across London.

Crossrail will run 118 km from Maidenhead and Heathrow in the west, to Shenfield and Abbey Wood in the east through new 21 km, twin-bore tunnels constructed under central London. Crossrail is planned to bring an additional 1.5 million people within 60 minutes commuting distance of London's key business districts.

The Crossrail route will link new stations at Paddington, Bond Street, Tottenham Court Road, Farringdon, Liverpool Street and Whitechapel. The railway will divide at Stepney Green, with the southeast spur running underground to Plumstead and then onto Abbey Wood via the Isle of Dogs and the north east spur running underground to Pudding Mill and then onto Shenfield in Essex. This equates to 42km of bored tunnels located beneath London. Crossrail will service 37 stations including existing Network Rail stations, and includes the construction of 7 new sub-surface stations in central London.

Permanent works required for the project are:

- twin-bore tunnels;
- stations;
- emergency intervention points, escape and ventilation shafts;
- train depot and stabling facilities;
- track works;
- traction power and signalling systems;
- communications systems; and
- a route control centre.

1.10.2 Packaging of the project

Following competitive tender processes framework agreements for design works and enabling works were awarded to contractors for the Crossrail construction project.

In 2008 Design framework agreements for 19 tunnel portals and stations were awarded to:

Package C154 - Victoria Dock Portal - Hyder
Package C156 - North Woolwich and Plumstead Portals - Capita Symonds
Package C132 - Bond Street Station - WSP
Package C130 - Paddington Station - Scott Wilson
Package C138 - Liverpool Street Station - Mott MacDonald
Package C140 - Whitechapel Station – Hyder
Package C150 - Royal Oak Portal - Capita Symonds Ltd
Package C121 - Sprayed Concrete Lining - Mott MacDonald
Package C122 - Bored Tunnels - Ove Arup & Partners International Ltd
Package C134 - Tottenham Court Road Station - Ove Arup & Partners International Ltd
Package C100 - Architectural Component Design - Atkins
Package C152 - Pudding Mill Lane Portal - Scott Wilson
Package C124 - Tunnels and Shafts Aerodynamics and Ventilation - Mott MacDonald
Package C136 - Farringdon Station Design - Scott Wilson
Package C123 - Intermediate Shafts - Jacobs
Package C164 - Bulk Power Distribution & HV Power - Scott Wilson
Package C175 - Tunnelling Academy Design - Capita Symonds
Package C125 - M&E in Tunnels - Mott MacDonald
Package C162 - Signalling, traction power

1.10.3Phasing of the project

Preparatory works were carried out throughout 2009 with the main construction programming planned to start in 2010 and tunnelling in 2011. The above ground sections will be completed early and used to operate services and to test trains before the completion of the tunnel section.

The Crossrail Act received Royal Assent on 22 July 2008, granting the powers to build the railway. The planned opening of Crossrail was 2017, however it will now be in 2018 as a result of the Government spending review.

1.10.4 Organisation

CRL is a fully owned subsidiary of Transport Trading Limited ("TTL"), which is itself a subsidiary of Transport for London ("TfL"). Delivery of the Crossrail project is through its own Programme Directorate ("PD") who, with the help from a Programme Partner (PP) and a Project Delivery Partner ("PDP"), manage the main contractors and the interfaces with other entities such as Network Rail and London Underground.

Transcend, a joint venture between AECOM, CH2M Hill and Nichols Group (established private sector contractors), will be the Programme Partner for the Crossrail project. The Programme Partner activity is a €118,9 million contract, and one of the major roles within the project. Responsible for "strategic programme management", the Programme Partner will monitor and manage the project timetable and ensure that everything is delivered to time, budget and to the required quality.

The Project Delivery Partner is Bechtel Ltd (an established private sector contractor). They have been contracted to manage the safe delivery of the central tunnel section to time, cost and quality. The tunnel section will be designed and constructed through a number of contracts. The Project Delivery Partner is responsible for the procurement and management of these contracts and for managing all the consequent interfaces, reporting to the CRL Implementation Director and his team.

The CRL PD is split in to 6 main areas:

Crossrail Central Implementation:
This team has overall accountability for the Central Section of Works (CSW) from Royal Oak to Pudding Mill Lane and Plumstead. The team is client focused as they manage the project delivery partner, who is responsible for managing the contractors and sub-contractors to build the railway and new stations within the Central Section. They also liaise closely with the Industry Partners – London Underground, Docklands Light Railway, Canary Wharf Group and Berkeley Homes.

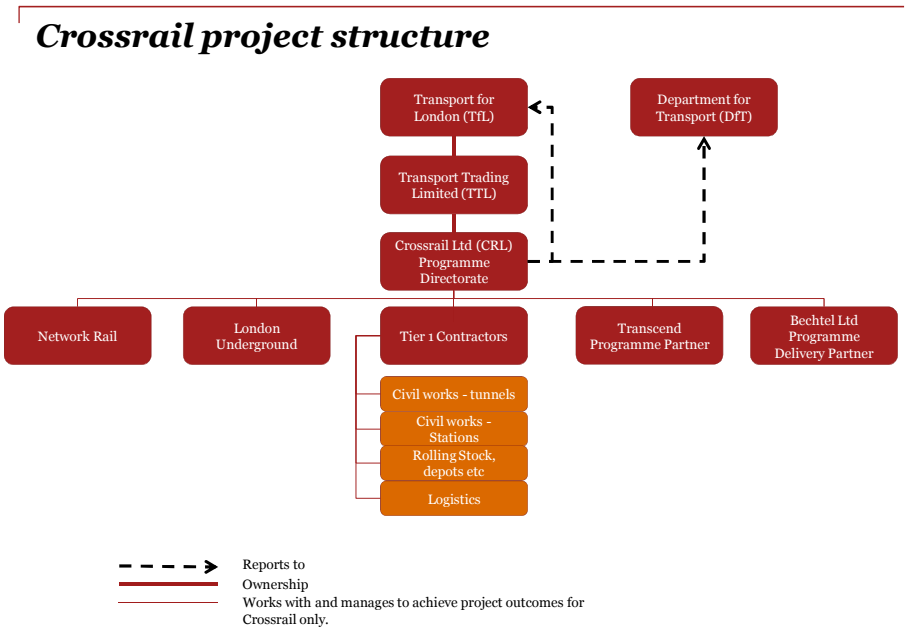


Exhibit 7 - Organisation of the Crossrail project

1.10.5Key challenges

1. Public Resistance to the project due to disruption and loss of business.
2. Getting the budget contributions agreed and the risk of reductions in funding in the future arising from wider public spending cuts.
3. Logistics during construction in Central London, e.g. removal of spoil, getting large machinery in place.

1.10.6 Key stakeholders

1. Mayor of London.
2. Secretary of State for Transport.
3. Transport for London
4. Transcend
5. Bechtel
6. businesses who are providing financial support for the project (see above)

1.10.7Funding and financing

A €18,9bn funding framework was put in place in October 2007 when the Prime Minister announced that Crossrail's cost would be met by Government, TfL and London businesses. The Government is contributing during construction by means of a grant from the Department for Transport amounting to over €5,9bn.

Crossrail farepayers will contribute to funding the debt raised during construction by TfL and Network Rail. London businesses will contribute through a variety of mechanisms, including the Business Rate Supplement, a supplement to business rates bills which will be used exclusively to fund €4.9bn of the Greater London Authority's contribution.

There are also financial contributions from key beneficiaries of Crossrail:

- The City of London Corporation has agreed to make a direct contribution of €237,7 million and in addition will seek contributions from businesses of €178,3 million, and has guaranteed €59,4 million of these contributions.
- BAA has agreed to a €273,4 million funding package.
- Canary Wharf Group has agreed to contribute €178,3 million towards the costs of the new Canary Wharf Crossrail station at Canary Wharf. Canary Wharf Group will also design

and build the new station.
- Berkeley Homes has agreed to construct a station box for a station at Woolwich.

Financing:
Public with significant private contributions, albeit relatively small compared to the overall costs of the project.

1.10.8 Cost and budget

The €18,9bnbudget for the project is a fully inclusive cost, allowing for both contingency and expected inflation – this has been reduced by €1,2bn in the 2010 Government spending review.

The construction is on going.

1.10.9 Key contractual features

CRL was originally a joint venture between Transport for London (TfL) and the Department for Transport (DfT). In 2008 it became a wholly owned subsidiary of TfL. CRL however is still accountable to both TfL and DfT boards due to the funding arrangements. CRL is responsible for delivering the Crossrail project.

CRL works with and manages both Network Rail and London Underground, who are responsible for delivering upgrades to existing infrastructure to allow an interface with the Crossrail project.

CRL has appointed Transcend and Bechtel Ltd as delivery partners to help manage and deliver the Crossrail project.

Direct procurement by CRL at values above the EU thresholds is advertised through the Official Journal of the European Union (OJEU). Smaller direct contracts (below EU thresholds) are advertised on CompeteFor – a website that enables pre-qualified businesses to compete for contract opportunities with major public and private sector buying organisations.

Design Package Contracts, valued up to €29,7 million, are contracted using NEC3 Contracts with suppliers, which are set at a fixed target price i.e. CRL will not pay additional fees associated with overruns by the contractor. Guarantees are required from the parent companies of all contractors.

As well as providing a great degree of flexibility in managing risk and avoiding a “blame culture”, the standard form NEC3 contract structure provides transparency in relation to both time and money. With the early identification of delay and cost increases, budgets can be adjusted and time and cost certainty maintained. In addition, CRL has employed the Target Cost option (Option C of the Engineering and Construction Contract) to price works in order to encourage appropriate contractor behaviours.

As taxpayer money is being used to fund Crossrail it is important that there is a large degree of transparency and contracting parties anticipate delays and cost increases. The flexibility in the management of risk during the life of the project provided by the NEC contract was key in its choice for the Crossrail project in addition to TfL favouring the NEC3 contract.

Land is acquired through a joint panel formed by Transport for London (TfL) and CRL. CRL will buy and directly manage a relatively small number of contracts with Tier 1 (major top level) contractors. The Tier 1 contracts will in turn buy a variety of goods and services from smaller suppliers and contractors which will form the delivery supply chain.

It is estimated that up to 14,000 people will be employed on the project at the peak of construction between 2012 and 2015.

1.10.10 Procurement strategy

NEC3 target price with a pain/gain mechanism

CRL will omit all entitlement to payment of Fee under NEC3 Option C target contracts on costs incurred above the target i.e. they will be paid their costs but not the corresponding fee in order to incentivise them to work to achieve the target.

1.10.11 Risks

1. Funding - Government spending review, increasing scope, cost overruns being met by TfL. However, the scale of the project is such that even modest overruns are likely to be very difficult to fund.
2. Unexpected physical conditions – CRL holds this risk
3. Exceptional weather – CRL holds this risk
4. Impact on existing infrastructure and residential areas.
5. Climate change – pressure to reduce CO2 emissions could affect construction techniques and therefore costs.

1.10.12 Lessons learned

Government spending review delayed works on the tunnel section by 1 year.

1.10.13 Sources

- Crossrail website http://www.crossrail.co.uk
- Experience of PwC London staff members who have been involved with the Crossrail project

1.11 Aviation and Rail – The Gardermoen Project

1.11.1 Project outline

The project comprised construction of new main airport in Oslo as well as infrastructure to travel to and from the airport. The transport infrastructure comprises both road and rail. For the purpose of this case study the focus will be on development of the Airport (OSL) and the Airport Express Train (Gardermobanen). The project was finalized in 1998. After completion of the Gardermoen project, a group was appointed by the MTC to evaluate the planning and execution of the project. The evaluation was reported 1 September 1999 in a Norwegian Official Report (NOU 1999:28 – Gardermoprosjektet – Evaluering av planlegging og gjennomføring) and the information for this case study is largely extracted from this report.

OSL is a new build airport with two parallel runways built on the location of an older domestic airport 50 km North of Oslo. The airport was specified to handle 17 million passengers per year and equipped technically for weather conditions in order to ensure 99.9% availability. It was to comprise 40 gates connected to the terminal building by walking bridges. The limited company responsible for the development of the airport, Oslo Lufthavn AS (OSL), was founded in 1992 (originally the name was Oslo Hovedflyplass AS but this was later changed to Oslo Lufthavn AS). OSL was wholly owned by the MTC.

The airport was opened 8 October 1998.

The infrastructure (Gardermobanen) for the Airport Express Train (Flytoget) consists of new double track railway from Oslo S (Oslo Central station) to Gardermoen airport and further to Eidsvoll, 63 km in total. The railway is specified to accommodate speeds of up to 200 km/h. Initially the section between Oslo S and Gardermoen was planned to be finished by the opening of the airport. Later it was decided to advance the completion of the section further on to Eidsvoll so that this also was finished by the opening of the airport. The construction was organised in a limited company owned by the MTC through NSB – NSB Gardermobanen AS (NSB-GMB). This company was also supposed to be responsible for operating the railway.

The Gardermobanen was open for traffic in August 1998. Romeriksporten, the section of tunnel between Oslo and Lillestrøm, was not opened until 22 August 1999 and the whole railway was therefore not officially opened until this date.

The Gardermobanen was planned to be commercially profitable, based on a minimum 53% market share of travellers to and from the airport and 50% market share of commuters on the relevant routes.

The project ran into problems regarding Romeriksporten, a 14 km tunnel from just outside of Oslo Central station towards Lillestrøm. The problems were related to four different issues:

- general problems with progress and contractual relations between NSB-GMB and the contractors
- structural damages to houses on the land above the tunnel
- application of a poisonous sealant Rhoca-Gil, and
- water leakage from the forest areas East in Oslo with partial drainage of two small lakes.

These issues resulted in a delay to the completion of the railway project of 10 months and a total of €0,2bn of extra costs. The evaluation of the project concluded that the organisation and allocation of responsibilities in the project was not sufficiently robust to handle such complex problems during construction. One of the reasons attributed for the organization reacting late to the water leakage was the strong focus on progressing the project and meeting the timetable.

Gardermobanen AS was for a short period responsible for the operation of the rolling stock

and the infrastructure. In 2001 the infrastructure was transferred from Gardermobanen AS to NRA, the name of company was changed to Flytoget AS which became a rail operating company. The infrastructure was transferred without financial compensation. In 2003/ 04, ownership of Flytoget AS was transferred from NSB to the Ministry for Trade and Industry which is the usual owner of the Government's shareholdings in commercial enterprises.

1.11.2 Packaging of the project

OSL:
The development of Gardermoen was, for political reasons, expected to have a positive effect on local business activities. The contracts were therefore divided into relatively small contracts in order to make it possible for Norwegian suppliers/developers to compete for the contracts. This resulted in 190 different contracts to be managed.

Gardermobanen:
The general contracts for the permanent way were split into 12 different parts. The split were based on municipality boarders, topography and the economic size of the projects. This made it possible to start work at several locations simultaneously.

The tracks were established as general contracts which included power supply, signalling and telecommunication installations, adjusted to the disciplines distinctive character.

The building of the terminals at Oslo Central Station and at Gardermoen, were packaged in general contracts.

1.11.3 Phasing of the project

OSL:
Projecting started 1 January 1993 and the airport opened 8 October 1998.

The project was phased as follows:
Start projecting – 1 January 1993
Start construction – 1 January 1994
Opening of the airport – 8 October 1998

Gardermobanen:
The project was passed in the Parliament October 1992 and was scheduled for completion in 1998. The railway was ultimately completed 22 August 1999.

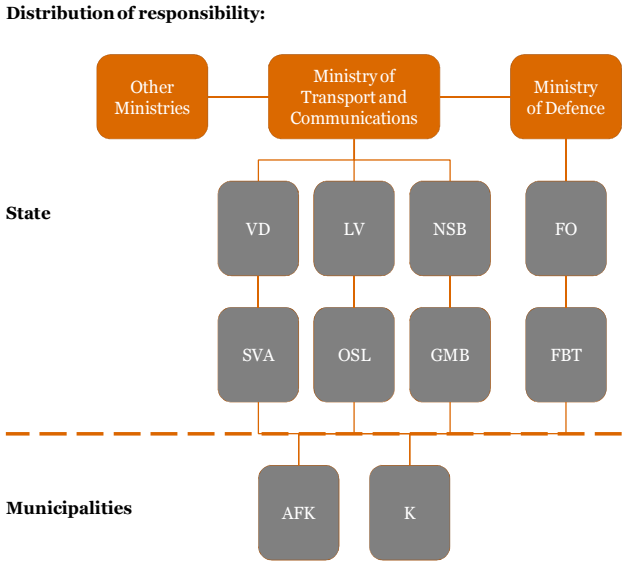
1.11.4 Organisation

The MTC was the supreme agency responsible for the project. MTC established its own project organization (GAROL) to safeguard the Ministry's responsibilities and leadership in the project.

Different liaison bodies were established to support MTC in the project. The result of this structure was that the project was well coordinated, both on an overall level and between the different stakeholders, the distribution of responsibility between the parties was relatively clear and the interfaces were clearly defined between the bodies.

Construction of the Airport and the Gardermobanen was organised in designated limited companies owned by the Airport Administration and the NSB respectively.
The companies' own boards and general assemblies were therefore responsible for delivering the projects.

After the planning phase The Ministerial project group was renamed GARPRO and continued into the construction phase.



Liaison bodies:

IKU
Inter Ministerial Contact Unit

SPG
MTCs Projectforum Gardermoen
(SD, LV, NSB, VD)

SOG
Coordination Unit Gardermoen
(SD, FD, LV, OH, NSB, GMB, VD. LO, NHO, ND)

TKU
Technical Coordination Unit (The developers)

KUF
Contact Unit Airport
(The developers, The Norwegian Defence, Ullensaker/ Nannestad, AFK)

KUT
Contact Unit Offering Transportation
(GMB, SVA, municipalities and AFK)

SVA - Directorate of Public Roads Akershus	**OSL** – Oslo Airport Gardermoen	**K** – Affected municipalities
FD - Headquarters Defence Command Norway	**GMB** – NSB Gardermobanen AS	**NSB** – Norwegian State Railways
FBT - Norwegian Defence Estate Agency, Hamar	**AFK** - Akershus County municipality	**VD** – Directorate of Public Roads
		LV – Directorate of Civil Aviation

Exhibit 8 - Organisation of the Gardermoen project

1.11.5 Key challenges

- Time
- Ground conditions
- Commercial profitability (Gardermobanen)

1.11.6 Key stakeholders

1. MTC (owner)
2. Other Ministries (Environment, Defence)
3. Local municipalities
4. The Aviation Administration
5. The Rail Administration
6. The Roads Administration and NSB

1.11.7 Funding and financing.

OSL:
The airport is financed through loans and funded through airport fees and ticket revenues. The project was not intended to draw on the National Budget.

Gardermobanen:
The Gardermobanen was planned to be financed through loans and funded through fees and ticket revenues. The development of Gardermobanen was financed through subordinated and ordinary loans from the Government to NSB Gardermobanen AS, totalling of €0,96bn. The loans were written off entirely in 2000 so the public sector ultimately funded Gardermobanen.

1.11.8 Cost and budget

OSL:
The total cost was equal to the budget of €1,4bn (1992). This amount did however include a contingency amounting to €0,3bn which was used in its entirety. As a result of the contingency, the cost overrun did not entail extra budget appropriations.

Gardermobanen:
€0,98bn (€1,07bn including financial costs) (1998)

The total budget was €0,8bn (1998) whereas the total cost was €0,98bn (1998) before financial costs. The cost overrun of 28% was due to extra cost incurred in connection with sealing of the main tunnel and delays resulting from this work, and for connecting with the main rail network at the northern end of the Gardermobanen.

1.11.9 Key contractual features

OSL:
Size and scope of each contract was based on:

- Singular responsibility within physical and functional interfaces
- Singular projecting within each construction contract
- Progress in the project – parallel projecting and construction and a focus on investment at a latest possible time
- Allocation of risk – sizing of the contracts based on the capacity in the market
- The builder's capacity – resources and competence

The contracts were based on a combination of fixed prices and adjustable elements based on agreed upon rates.

There was a policy of applying proven technology and traditional procurement models. Procurement of equipment and outfitting was defined using output specifications.

The Gardermobanen:
Only one section of the construction, between Ålborgveien and Eidsvoll South, was done as a Contractor Designed contract (No: Totalentreprise). The reason this type of contract was chosen for this section was that it included about 500 meters of tunnel in uncompacted material/ground conditions. This kind of tunnel had not been done in Norway previously and the type of contract was chosen to reduce the risk for NSB-GMB by doing the planning, design, development and construction on one contract.

The permanent way was let using separate traditional contracts (hovedentrepriser). The electric work was awarded on contractor design contracts based on type of work/discipline so that the respective suppliers could project for and support their own systems.

The projects were subject to "REFSA" - the "Statens Regelverk for anskaffelsesvirksomhet m.v.". Contracts were deliberately packaged in sizes that would enable Norwegian suppliers to compete for them. Although 90% of the contracts were awarded to Norwegian contractors, this also had a negative impact in the form of interface issues between the constructors (in particular for the Airport) that cost both time and money.

1.11.10 Procurement strategy

Three forms of contract strategies were applied – Design and Construct Contract, Management Construction Contract and Construction Contracts. Most of the large construction contracts were done on the Design and Construct format. For the second wave of contracts the project chose to a larger extent from tenders (focusing on price) to bids (focusing on quality as well as price) as the latter allows for negotiations during the tendering process. See also "Packaging" above.

1.11.11 Risks

- Ground conditions
- Cost- and time overruns
- Environmental issues

1.11.12 Lessons learned

The MTC was responsible for the project. In order to effectively manage the process and attend to its overall responsibility the MTC appointed a dedicated project group (GAROL). This has been seen as an important move in clarifying responsibilities and tasks with each of the stakeholders early in the project.

Incorporating the project organisations responsible for construction of the airport and the Gardermobanen respectively as limited companies facilitated financing through loans. This made it possible both to start the construction earlier and do all the construction in one go.

This form of incorporation also proved flexibility regarding hiring and salary levels, making the organisations able to recruit highly skilled personnel and it clarified the overall responsibility for the project.

More time should have been set aside for defining the specifications before start of detailed planning (regarding OSL). Experience was that a lot of new issues, that increased costs, arose during construction – both due to lack of experience of some of the consultants and due to inadequate planning.

On the basis of the experiences from the Gardermoen development it was recommended by the MTC appointed group that evaluated the project, that treatment of uncertainty in large public projects should be reviewed and that a guide should be developed to ensure consistent application of principles for assessing uncertainty. Also the importance of External Quality Assurance of the planning documents was emphasized following the project. After this the Parliament has introduced a system for External Quality Assurance in large public projects which includes assessment of uncertainty.

1.11.13 Sources

- NOU 1999:28 – Gardermoprosjektet – Evaluering av planlegging og gjennomføring (The Gardermoen Project – evaluation of planning and execution)
- PwC experts in Norway

1.12 Road - PPP E-18 Grimstad-Kristiansand

1.12.1 Project outline

The project comprises design, construction, financing, and operation for 25 years of a road between Grimstad and Kristiansand. This project is the third of three PPP pilot projects that the Norwegian Roads Administration has tendered to test a PPP procurement strategy in Norway.

The three PPP pilot projects are:

- E39 Klett to Bårdshaug won by Skanska Norge (Orkdalsvegen AS), funded by Skanska BOT and Laing Roads, with financial close April 2003.
- E39 Lyngdal to Flekkefjord won by Veidekke ASA (Allfarveg) with financial close April 2004.
- E18 Grimstad to Kristiansand won by Bilfinger Berger BOT/E.Pihl & Son AS/Sundt AS (Agder OPS Vegselskap AS) with financial close June 2006.

The objective for testing PPPs was to establish whether the procurement method could deliver best value for money in the development of infrastructure in Norway.

PPP E18 from Grimstad to Kristiansand consists of 38.3 km of four lane highway, including 75 km of local roads and access roads, 61 bridges, and 7 tunnels. Construction commenced in June 2006 and was completed August 2009. Several sections of the highway opened before the whole route was completed. The new road contributed to reducing travel time by 15 minutes, from 45 to 30 minutes.

The payment mechanism is availability based with potential bonuses for reductions in the number of accidents (safety bonus). All traffic (demand) risk is taken by the public sector. Parts of the availability payment are collected through road tolls but the public sector covers any differences between collected tolls and the agreed unitary payment to the special purpose vehicle ("SPV").

1.12.2 Packaging of the project

The procuring entity, the Norwegian National Roads Administration, signed a contract with a SPV Agder OPS Vegselskap AS for delivery of the road and its operation and maintenance for 25 years. Agder OPS Vegselskap AS has procured the different packages for the project as follows:

Agder OPS Vegselskap AS has contracted construction of the road with all structures, tunnels and other necessary add-ons to one main contractor - Construction Joint Venture E18 Grimstad - Kristiansand ANS (CJV E18) which is a joint venture of Bilfinger Berger AG and E. Pihl & Søn AS.

A substantial part of design has been subcontracted by CJV E18 to Rambøll who has been subject coordinator for construction, traffic, environment, geology, landscape, and lighting.

CJV E18 has furthermore subcontracted construction of tunnels to Leonard Nilsen og Sønner, electrical work to Otera and Concrete works to Ølen betong.

Maintenance of the road is contracted from Agder OPS Vegselskap AS to the construction company, NCC, on a 5 year contract (with an intention and possible renewal of 20 years).

Operation and maintenance of electrical and mechanical systems is subcontracted from Agder OPS Vegselskap AS to Otera on a 25 year contract.

1.12.3 Phasing of the project

The road was built in sections and Agder OPS Vegselskap AS started receiving availability payments as each section of the road was opened to the public.

Procurement commenced: 16 February 2005.
Financial close: 30 June 2006
Operation: 25 years from August 2009

1.12.4 Organisation

For organisation chart, see Exhibit 10 below.

The delivery entity/project sponsor, Agder OPS Vegselskap AS, is owned by Bilfinger Berger BOT (50%), E. Pihl & Søn AS (15%) and Sundt AS (35%).

The procuring entity was the Norwegian Roads Administration – an administrative public body reporting to MTC.

The procuring entity received advice from financial and legal advisers.

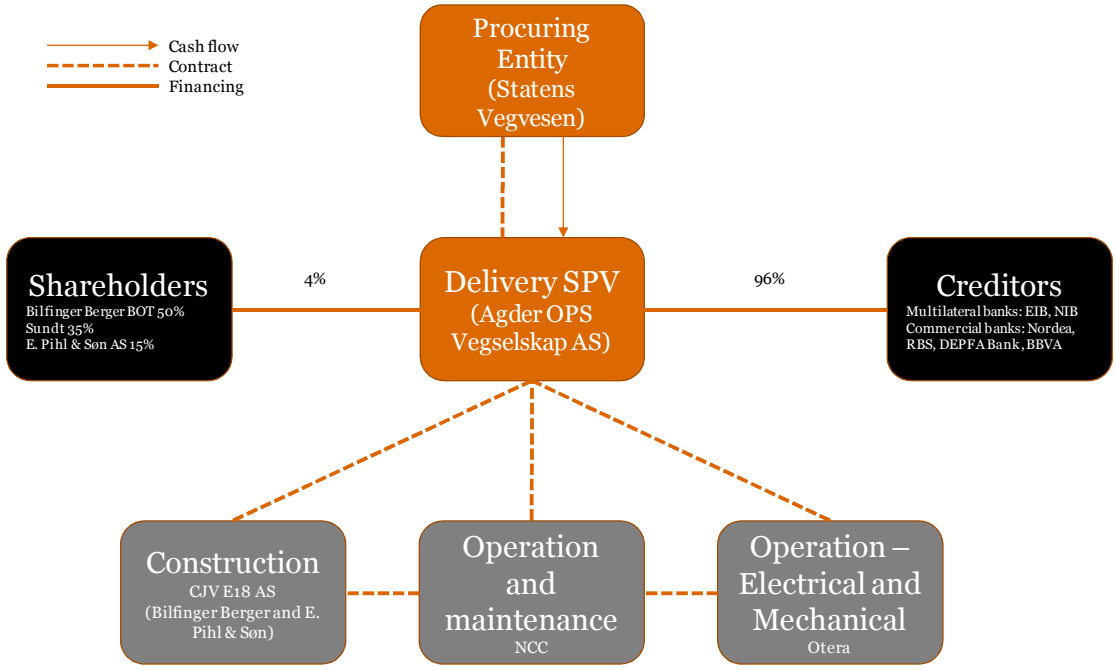


Exhibit 9 - Organisation of PPP E18

1.12.5 Key challenges

- The delivery entity has faced a number of challenges. The financial loss for Agder OPS Vegselskap AS has been estimated at €90 million and the main contractor has cancelled its contract with one of the subcontractors during the project.
- Unforeseen challenges with the ground conditions (geology and topography) – the terrain in which the road is constructed has proved difficult regarding getting building material and machines in place.
- There have been accidents in connection with the construction works and these have also lead to negative media attention.

1.12.6 Key stakeholders

1. Owners
2. Financiers
3. Contractors
4. procuring entity (States Vegvesen)
5. Local municipalities

6. The Norwegian Labour Inspection Authority (Arbeidstilsynet)

1.12.7 Funding and financing

Financing:
The project was 100% privately financed. The project is financed through of €18 million of equity in the SPV Agder OPS Vegselskap AS and €442 million of loans.

The equity is provided by
- Bilfinger Berger Project Investments (€9 million /50%),
- E. Pihl & Søn AS (€2.7 million /15%), and
- Sundt AS (€6.3 million /35%).

Bilfinger Berger and E. Pihl. & Søn are construction contractors who formed the construction joint venture CJV E18. CJV E18 did the construction work in the project.

The debt of €442 million was wrapped by XL Capital and provided by a number of commercial and multilateral banks. Senior bank debt with 26 years tenor was provided by:
- The European Investment Bank (EIB) (€197.63 million),
- The Nordic Investment Bank (NIB) (€0.095bn).

Commercial debt (€0.1bn) with 28 years tenor was provided by:
- Nordea,
- RBS,
- DEPFA Bank, and
- BBVA.

Funding
The availability payment will be paid through tolls for use of the road. Tolls will be collected by the Norwegian Roads Administration which pays the availability payment to Agder OPS Vegselskap AS. To the extent the tolls from traffic on the road are not sufficient to meet payment obligations to the delivery entity, the Norwegian Roads Administration has guaranteed to pay the difference.

1.12.8 Cost and budget

Total cost of the project, including maintenance for 25 years, is approximately €0,42bn (discounted over the contract period of 25 years from end of construction).

The project was delivered on time but suffered cost overruns of about €90million. These overruns were covered by the delivering entity.

Final delivery of the project was slightly behind schedule due to delays with the technical instrumentation for monitoring the road. Parts of the road were however opened considerably earlier than the final end date allowing the public to use these parts up to a year before final completion. This was done at no extra cost to the Procuring Entity except for availability payments for the sections that were opened.

1.12.9 Key contractual features

Agder OPS Vegselskap AS is responsible for the maintenance and availability of the road for 25 years from end of construction until 2034. During this time the company is obliged to make the road available to an agreed minimum standard and quality and receives for this an annual payment from the National Roads Administration.

Agder OPS Vegselskap AS did not receive any payment during construction of the road. There was provision for opening part of the road before the final completion date and Agder OPS Vegselskap AS received in such case availability payments proportionate to how much of the

road was open and available.

The annual payment to Agder OPS Vegselskap AS is not dependent on how much traffic there uses the road. The payment can be reduced if the road is not available to the public or if it does not meet the agreed levels of quality. The payment can also be increased if the number of accidents on the roads is very low.

The providers of debt to Agder OPS Vegselskap AS have step in rights.

1.12.10 Procurement strategy

The project was undertaken using a DBFO model. Responsibility for Design, Build, Financing, and Operation of the road lies with the project delivery entity and the project has been delivered to a fixed price.

1.12.11 Risks

1. Ground condition
2. Cost overruns

1.12.12 Lessons learned

The PPP structure supports an efficient allocation of risk – the project was delivered on time even though there were considerable challenges during the construction phase. Furthermore, the delivering entity suffered considerable cost overruns without this affecting the final cost for the procuring entity. Although this was beneficial to the public side on this occasion, it is of importance for the market in general that such projects provide benefits to all parties.

Efficient project management in the procurement phase gives the market confidence in the project, which in turn makes the project attractive to bidders and potential financiers.

1.12.13 Sources

- http://www.ncc.no/no/Materialer-og-tjenester/Veiservice/Kontraktsomrader/
- http://www.agderops.no/hovedsiden.asp?aid=18887&gid=8790
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- http://www.bygg.no/id/46359.0
- http://www.fvn.no/lokalt/lillesand/article675889.ece
- PwC staff based in Oslo

1.13 Offshore – The Gjøa installation

1.13.1 Project outline

Gjøa is an oil and gas field in the northern part of the North Sea, developed by Statoil and Gas de France Suez. The field comprises a production facility with a total volume of 82 million barrels of oil and condensate and 40bn m^3 of gas. In addition, the production installation at Gjøa will process condensate and gas from the neighbouring Vega-field, with a total volume of 26 million barrels of condensate and 18bn m^3 of gas.

Gjøa is built as a semi-submersible production platform with a subsea production system consisting of five templates on the sea bottom.

Development of the neighbouring Vega-field started out as a separate project from Gjøa although the two were progressively integrated during the installation phase. The following description relates to the Gjøa-project.

1.13.2 Packaging of the project

Please see the overview of deliverables and organization of the project in Exhibit 11 below.

The project was procured in 15 different main deliverables from 13 different subcontractors during the construction phase. In addition there were a number of contracts directly with the Procuring Entity, and a range of subcontracts.

Types of contracts include EPCI (engineering, procurement, construction and installation) engineering contracts, construction and fabrication contracts (in which the main part of the engineering could be done by another contractor), service contracts e.g. for transport and installation, contracts for labour, contracts for advisory services such as third party evaluations etc.

Packaging decisions were based on technical assessments of which components are logically manufactured together and how the timing of different deliverables e.g. the build of the hull of the platform, one of the larger procurements, was contracted to Samsung in South Korea whereas the engineering contract for the hull was signed with Aker Solutions.

Packaging was also determined by the resources available within the procuring entity and the contractors. The larger contractors in the Gjøa-project such as Aker Solutions and FMC were awarded relatively more responsibility for management and coordination of the project based on their competence and available resources.

There was a limited market of suppliers for the Gjøa-project, in particular for the subsea elements of the project. This forced the use of more separate contracts than normal. These, in turn, required more attention and work from Statoil (the procuring entity) to manage the contracts and address interface risks.

Interfaces between the different contracts were managed by the procuring entity through a very detailed and specific interface schedule that clearly stated the responsibilities of the different contractors regarding what should be delivered, to what quality and at what time. The schedule took into account the interdependencies between the different deliverables and detailed planning was essential to manage this properly. Incentives were primarily linked to on time delivery. In addition, guarantees for the quality of the work and the deliveries were required.

The contract for the 100.5km power cable was procured using an EPCI contract. This deliverable was a very specialized item – a very long power cable from shore to a floating platform, required to withstand very harsh weather conditions.

There were three main elements to this deliverable: the systems design; construction/production of the cable itself; and installation of the cable, which was done in one operation with a vessel that was constructed for the purpose. It was deemed important for the contractor to be in control of all aspects of this deliverable and therefore an EPCI contract was preferred.

1.13.3 Phasing of the project

The construction consisted of four main parts – the hull, the superstructure (living quarters and production facilities), the subsea system and the power supply cable from shore. The hull was constructed in South-Korea and towed to Norway. In Norway the superstructure was mounted on the hull and the platform was towed off shore. Finally the platform, the subsea system and the power supply cable were installed and integrated off shore before production commenced.

The planning of the Gjøa-project started in 2005 and production on the Gjøa field commenced 7th November 2010.

1.13.4 Organisation

Statoil managed the construction of the platform, whereas GDF Suez has taken over operations at the start of production.

The procuring entity is jointly owned by the licensees of the oil field in proportion to their ownership of the licenses. During construction Statoil managed the procurement on behalf of the other owners (it was the procuring entity) and was compensated for the cost of doing this. The project organisation consists of both resources from Statoil and from the most important suppliers, working in an integrated manner.
An outline of the organization structure for the construction phase is shown below.

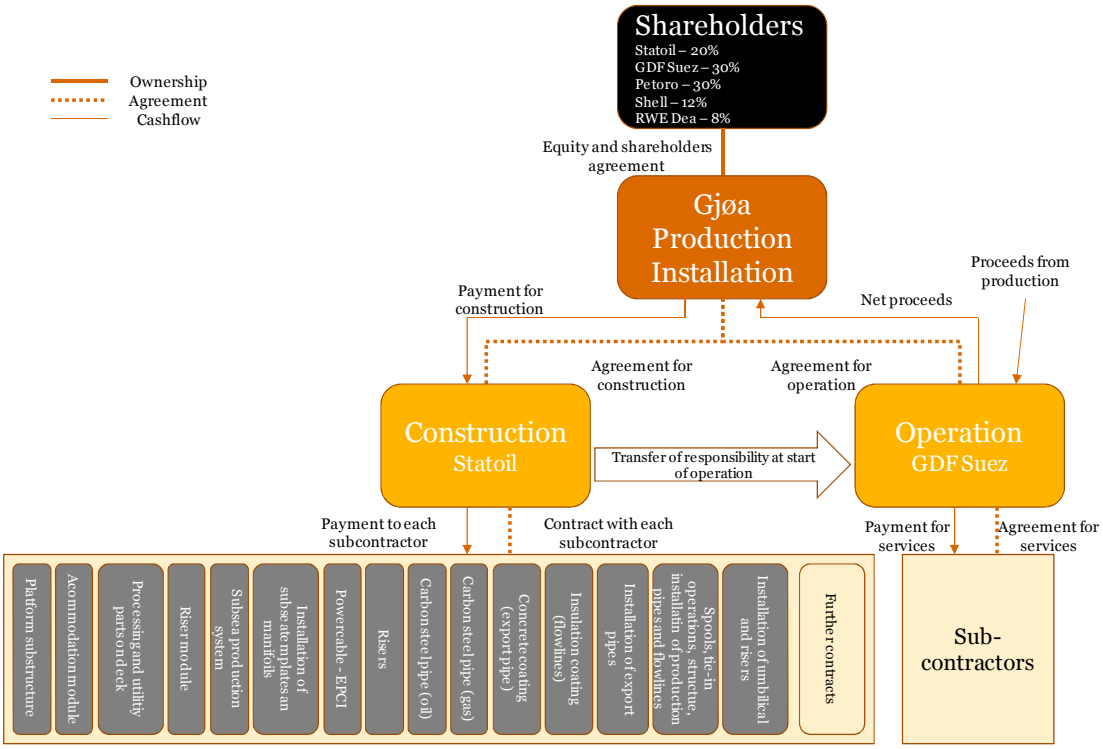

Exhibit 10 - Organisation of the Gjøa Project

1.13.5 Key challenges

1. There was high demand for off-shore facilities at the time of procurement, which resulted in:
   a. prices increasing
   b. tailoring of contracts
   c. concerns over quality
2. The subsea system required extra attention because of a contract structure with many small contracts (also due to limited capacity amongst suppliers at the time of procurement)
3. Political issues regarding on-shore electrification – while on-shore electrification is considered environmentally sound, in this case it conflicted with local communities' interests in reducing the pressure on the power supply in the area and there was significant political resistance to the solution that was applied

1.13.6 Key stakeholders

Internal:

1. Owners
2. Worker unions
3. Management

External:

1. Authorities – the political authorities as well as the bureaucratic system related to oil exploration and production on Norwegian area
2. Suppliers in the project
3. Suppliers that were not awarded contracts in the project.
4. Non Governmental Organisations

1.13.7 Funding and financing

Ownership:

- Statoil – 20%, resp. for development
- GDF Suez Norway - 30% - resp. for production
- Petoro – 30%
- Shell – 12%
- RWE Dea – 8%

The construction costs were funded by the licensees of the oil field from revenues generated from operations. There was no funding by the public sector.

Financing:

The Government is involved both through ownership in Statoil (which is a public limited company) and through Petoro but apart from this there has been no direct public financing.

1.13.8 Cost and budget

The total cost of the Gjøa installation was just over €3,8bn.

There was a cost overrun of slightly less than 5% compared to original budget and the project was delivered one week later than planned.

The cost overrun was due to some changes to the design and slightly higher inflation than budgeted and was covered by the procuring entity. The delay was due to a winch that was broken just before completion.

1.13.9 Key contractual features

Ref. Exhibit 11 above.

The suppliers were payed on milestone basis or on completion depending on the type of contract they were on (typically the procuring entity financed the construction).

1.13.10 Procurement strategy

Ref. Section 1.13.2 above. The procurement strategy reflects that the different deliverables have different characteristics, and the types of contract vary according to this.

The total delivery was managed by the procuring entity through a properly resourced project organization. Some contracts at different levels of the project were awarded on turnkey terms (EPCI).

1.13.11 Risks

1. Market – borne by the procuring entity
2. Technological – allocated to contractors when appropriate
3. Political – borne by the procuring entity

1.13.12 Lessons learned

The Gjøa and Vega projects started out as two separate projects and were successively more integrated towards completion. If the two projects had been more closely integrated from the start more synergies related to planning, design and economies of scale could potentially have been captured.

A learning point from using EPCI contracts is that this contractual strategy requires that the contractor retains full responsibility for the delivery and that the procuring entity does not interfere with the delivery before it has been completed. Interference from the procuring entity during delivery increases the likelihood of cost and time overruns. It also tends to blur the allocation of responsibility to the contractor and increase the probability of conflict.

To the extent there were any interface issues or problems these were related to the different contractors being at different levels of maturity – some were very experienced and had been doing the same kind work for a long time whereas some of the contractors were fairly inexperienced and had undertaken similar work only a few times before.

1.13.13 Sources

- Statoil homepage, interview with Project Manager Kjetil Digre,
- http://www.npf.no/course.php?id=552&time=202&c=&a=program),
- http://www.aftenbladet.no/energi/olje/1155661/Gjoea-plattformen_ferdig_etter_18_mill_arbeidstimer.html,
- http://www.statoil.com/no/OurOperations/ExplorationProd/ncs/Gjoea/GjoaProjectSite/Pages/default.aspx
- PwC staff in Norway

1.14 Aviation – Heathrow Terminal 5

1.14.1 Project outline

In addition to the construction of a new terminal building on the 260 hectare site, the project included a new air traffic control tower, railway station, tunnels for the extension of both the Heathrow Express (HexEx) and the Piccadilly Line railways and a motorway spur road from the M25. The project also included 62 aircraft stands, a 4000 vehicle capacity car park, a hotel and the diversion of two rivers.

1.14.2 Packaging of the project

BAA, the airport operator, divided the programme into 18 main projects ranging in size from €11,9 million to €237,7 million. These were split further into 150 sub-projects and further still into around 1,000 work packages. Suppliers were engaged on work packages where their capability was required.

The Principle Contractors for T5 were:

- Laing O'Rourke (Civil & Concrete)
- Mace (Project Management &Fit out)
- Balfour Beatty (Rail and station fit out)
- Spie Matthew Hall (AMEC) (Mechanical & Electrical plus aircraft pavements)
- Severfield-Rowan (Structural Steelwork).
- In addition there were another 60 top tier contractors.

1.14.3 Phasing of the project

The project was constructed in two phases:

- The first phase and the focus of this case study was the delivery of a fully operational new terminal.
- The second phase was for additional satellite buildings to allow greater passenger capacity as a result, in part, of the increased capacity and use of the Airbus A380.

The Terminal 5 ("T5") project was given the go ahead on 20 November 2001 after a 46 month enquiry. Construction started in September 2002. T5 opened on 27 March 2008.

1.14.4 Organisation

BAA is owned by ADI Limited, a consortium led by Grupo Ferrovial. The consortium also includes Caisse de depot et placement du Quebec and GIC Special Investments.

The prices that BAA charges for the use of its airports are regulated by the Civil Aviation Authority (CAA) and the Competition Commission. The Government and the CAA also regulate on all aspects of safety and security.

For the T5 project, BAA appointed a T5 Managing Director (MD) who was responsible for the safe delivery of T5 to time, quality and budget. Under the MD were three further directors who were responsible for managing the BAA stakeholders, the build and T5 going live. The MD was also required to keep in close communication and coordination with the Heathrow Airport Limited (HAL) integration director. HAL is a subsidiary of BAA. (See organisation chart below).

Each of the major projects within the building of T5 shared four project functions across them:

- Assurance, which included quality, time, safety and risk.
- Programme office to co-ordinate time and cost tradeoffs to ensure timely delivery.
- Organisational effectiveness to help develop the T5 organisation.
- Public relations to ensure a good public portrayal of the project.

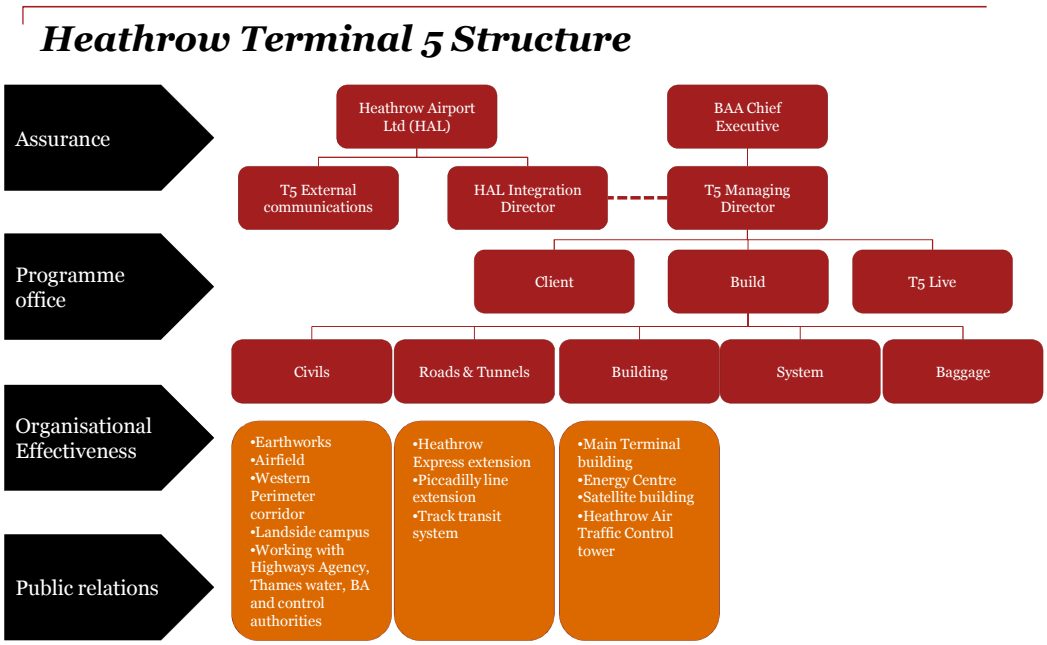

Exhibit 11 - Organisation of the Terminal 5 project

1.14.5 Key challenges

1. On time delivery
2. Different trades unaware of each other
3. Logistics
4. Tunnelling works underneath an operational airport

1.14.6 Key stakeholders

Internal:

1. BAA
2. CAA
3. BA – the airline that has exclusive use of T5

External:

1. Laing O'Rouke
2. Spie Matthew Hall
3. Severfield and Rowens

1.14.7 Funding and financing

BAA self funded

T5 was funded by debt raised by BAA and retained earnings. In 2003 it was estimated that the cost of T5 could be repaid from earnings of the next five years.

Financing:
100% Private

1.14.8 Cost and budget

The budget for the project was €5,1bn.
The total actual cost was €5,1bn.

1.14.9 Key contractual features

The T5 Agreement is a legally binding contract between BAA and its key suppliers. Key features of the BAA T5 Agreement were:

- Framework agreement to encourage long term relationship behaviours amongst suppliers
- BAA carried all of the risk for the construction project allowing the contractors/suppliers to concentrate on the project and solving problems rather than avoiding possible litigation/disputes in relation to contractual liabilities;
- BAA also arranged professional indemnity and insurance policies for the entire project. Under the unique insurance policy BAA underpinned all financial risks which meant the suppliers would not be held financially accountable for insurable problems;
- Contractors worked to pre-determined fixed profit levels; and
- Contractors were expected to work in partnership. For example, the agreement encourages contractors to pool resources to buy materials at discount.

1.14.10 Procurement strategy

The T5 agreement was a framework agreement in which suppliers were engaged to carry out work on a call off basis. Payment was made on a costs reimbursement basis; BAA paid actual prime cost plus an agreed overhead cost with the supplier and then negotiated a profit margin on top.

1.14.11 Risks

All risks carried by BA. See contractual features.

1.14.12 Lessons learned

- Contractors at the first tier level were very receptive to the ideas, but were not entirely certain how to translate them down their own supply chains.
- Allowing the supply chain to create their own products against BAA's functional brief rather than trying to impose technical solutions on the supply chain worked well.
- BAA felt that it should have increased the size and capability of its project team ahead of project needs rather than once they occurred.
- Getting people who had worked in an adversarial environment for 10–15 years to collaborate was not always easy.
- BAA put a lot of effort into comprehensive controls and reporting procedures and some suppliers at times found them frustrating. In hindsight BAA has indicated that it would now seek to achieve the same outcomes without being so prescriptive.

The management of interfaces and integration of systems undertaken by BAA was handled very well during the construction. However, despite trials and testing carried out at T5 before the terminal was handed over to British Airways, the actual handover was not so successful. This was because although the equipment was functional, the system as a whole, complete with operational staff and customers, had not been adequately trialled. BAA's project director explained that "With the benefit of hindsight it would have seemed more obvious to have done [the move into T5] in more incremental steps."

1.14.13 Sources

- Capital Structure and The Cost of Capital CAA/355 written by BAA in Feb 2003)
- Doherty Sharon, Heathrow's T5 – History in the making, John Wiley & Sons Ltd, 2008
- T5 Case study, MPA Report of seminar 136 held on 23rd October 2007 at the Cavendish Conference Centre, London