RANTA-tunneli

Rantatunneli Alliance

Value for money report

Project development phase

Alliance Leadership Team 3 April 2014

Contents

1 INTRODUCTION

1.1 Value for money report

The Tampereen Rantatunneli project will be implemented according to the alliance model. After competitive tendering, the alliance will be formed by the City of Tampere and the Finnish Transport Agency as the owners, and Lemminkäinen Infra Oy, Saanio & Riekkola Oy and A-Insinöörit Suunnittelu Oy as the service providers.

This report describes the phases of the alliance model Tampereen Rantatunneli project from a value-for-money perspective. The report describes the key processes, solutions and decisions related to the project. Target-setting during the project development phase is also described.

In Finland, a similar value for money report has previously been drawn up for the Lielahti–Kokemäki railway project alliance. The purpose of this report is to demonstrate added value to the project's funders and key stakeholders. Reporting is also a management tool. The Alliance Leadership Team (ALT) exercising the highest authority in the alliance and the project team responsible for the operative management of the alliance regularly discuss the theme of value for money and the results achieved.

A representative of the owner side of the alliance, Project Manager Mauri Mäkiaho of the Finnish Transport Agency (Deputy Project Manager of the Rantatunneli Alliance), has been responsible for the writing and compilation of this report. An alliance expert, Lauri Merikallio of Vison Oy, has also worked on this report and will continue to update it in the future. Drawing up this report commenced during the project development phase (PDP, 9 July 2012 – 3 October 2013). The achievement of project targets will be evaluated in this value for money report once the project has been implemented. The project implementation phase (PI phase) began on 4 October 2013.

1.2 The concept of value for money

The Rantatunneli project seeks to achieve optimal value for the project's funders, the City of Tampere and the State of Finland. This will be realised through achieving the targets set for end-product quality, having the alliance team achieve its set targets during the PI phase, and equalling or undercutting the project's Target Outturn Cost (TOC). As a concept, value for money goes beyond the cheapest price. The concept has been defined in the following ways:

"*Value for money refers to the ratio of benefits (quality, requirements for the end product, social and environmental requirements) to the price and risks required to achieve them.*" Department of Treasure and Finance, Australia

"*VfM is defined as the optimum combination of whole-of-life costs and quality (or fitness for purpose) of the good or service to meet the user's requirement. VfM is not the choice of goods and services based on the lowest cost bid.*" HM Treasury, United Kingdom

In this project, value for money thinking has progressed as follows:

- The City of Tampere and Finnish Transport Agency have defined the project goals. These are based on the generation of value. The targets were presented in summarised form in the invitation for tenders for the alliance project, and they were discussed with all tendering consortia during the tendering process.
- Value for money thinking has been a key management theme during the project development phase of the Ratatunneli project. It has produced significant innovations during the project development phase and enabled a TOC below the funding framework, without changes to the project's scope or level of quality.
- The pricing of risks and benefits in the TOC was based on value-for-money thinking.
- Targets based on key result areas (KRAs) were derived for the alliance from the targets set by the owner, and the indicators and indicator values for the alliance targets were set according to the definition and idea of value for money.
- The business model of the alliance supports value for money thinking. If the service providers in the alliance receive a bonus for their actions, this means they will have produced verifiable added value to the project funders. If the alliance fails to achieve its targets, i.e. it is unable to produce the value for money specified in the targets, the service providers will return part of their fee to the funders in accordance with the business model.

Coaching on the idea of value for money has been extensively provided to participating personnel during the alliance project. This coaching seeks to encourage personnel to take part in brainstorming, innovation and efficient activity. All developed design and implementation solutions are always examined in relation to cost, risks, usability, safety, schedule, environmental impact and operating costs.

1.3 The alliance model

The Finnish Transport Agency has launched two projects in Finland implemented by the alliance model based on cooperation and transparency. The Finnish pilot alliance project was the Lielahti–Kokemäki railway project, the second being the alliance contract for Tampereen rantatunneli. An alliance is a form of contracting based on a common agreement for all parties, in which the parties are responsible for the planning and construction of the project under a single common organisation. In the alliance model, the parties share the positive and negative risks related to the project and observe the principles of transparency of information, seeking to achieve the closest possible form of cooperation. The Finnish Transport Agency has set the following targets for the alliance model:

- Improving the productivity of the construction industry
- Changing construction culture towards a more transparent operating method based on trust
- The development of innovations and competence
- Faster, better and more economical implementation of projects.

The cornerstones of an alliance are a common organisation and shared targets, as well as the division of risks and opportunities between the parties. The alliance model makes use of cooperation between the parties, promotes innovation and reduces needless waste and unnecessary work. The alliance model seeks to realise the project in a manner that, compared to more traditional forms of procurement, will deliver more benefits and value to society and the money it has invested in the project. Another target of the alliance model is the improvement of construction productivity.

Alliance contracts are divided into three main phases.

- **The selection phase** during which the owners select their alliance partners.
- **The project development phase**, during which the alliance develops and implements solutions in cooperation under a common organisation, while simultaneously steering the TOC towards an appropriate level acceptable to all parties. At the end of the project development phase, the TOC, other contract targets and implementation plans are approved.
- **The project implementation phase**, including construction and the warranty period.

The TOC must be tight, target-oriented, and approved by all parties. Setting the TOC is described in Chapter 5.1 of this report. The setting of other alliance targets is described in Chapter 5.3.

The alliance model features a three-stage compensation structure:

1. The owner always pays direct project costs to the service providers, according to realisation and based on the open book principle.
2. A fee paid to service providers, determined during the selection process. In the Rantatunneli project, the design company will be paid a percentage-based fee on top of direct costs. Lemminkäinen Infra Oy will be paid a fixed fee, divided into instalments in accordance with an ALT decision.
3. Service providers are paid a bonus or charged a penalty fee in accordance with the incentive system. The incentive system is described in Section 4.2.

The Alliance Agreement is drawn up in the first-person plural. In the agreement, "We" refers to all contract parties. The charter in Section 1.2 of the Alliance Agreement defines the commitment of parties to the basic principles of the alliance, i.e. transparency and the aspiration to make all decisions on the best-for-project principle.

2 RANTATUNNELI AS AN UNDERTAKING

2.1 Targets and phases before alliance formation

The development requirements of the Rantaväylä (the Santalahti–Naistenlahti stretch of VT12 in Tampere) have been recognised since the 1980s. The tunnel option has been on the table since the 1990s, when the road's traffic increased and the stretch of road administratively became a state highway. The road has been constantly developed in stages, until further development was deemed to require an entirely new road alignment. For reasons related to the development of the city centre of Tampere and land use, the new alignment is most appropriately implemented by the construction of a tunnel. At the same time, the decision to build the tunnel enables the traffic-oriented development of Rantaväylä.

After planning for the Ranta–Tampella area commenced in the 2000s, the possibility of constructing a long tunnel from Santalahti to Naistenlahti was raised during the preparation of a new partial traffic disposition plan for the city centre of Tampere. The partial traffic disposition plan entered into force in 2006, and the City of Tampere decided to begin traffic planning and the supporting zoning in 2007, in accordance with the preliminary plan completed in 2004. Road planning commenced in 2009, and the environmental impact assessment, general plan and road plan were completed in 2010–2011.

The City of Tampere, the Pirkanmaa Centre for Economic Development, Transport and the Environment, and the Finnish Transport Agency (previously the Road Administration) have drawn up several joint plans for improving the throughput of Rantaväylä and the development of the planning area since the late 1980s. The key plans include:

- General plan for the Santalahti–Näsinsilta stretch of Paasikiventie; City of Tampere, 1990
- Paasikiventie (VT12) at Onkiniemi and Mustalahti, connection to the Tampella tunnel, Idea plan; City of Tampere and the Finnish Road Administration, 2003
- Development report for Tampereen Rantaväylä (VT12 and KT65), Ylöjärvi–Tampere; the Finnish Road Administration, City of Tampere and the Council of Tampere Region, 2004
- The Rantaväylä tunnel, preliminary plan; City of Tampere and the Finnish Road Administration, 2004
- Development alternatives for Tampereen Rantaväylä, a compilation of prior reports:
    - The surface option
    - A short tunnel at Onkiniemi and an interchange at Mustalahti
    - Intersections at Tampella and Naistenlahti, (City of Tampere and the Finnish Road Administration, 2007, revised in 2008)
- VT 12 The improvement of preconditions for public transport, Road plan; City of Tampere and the Finnish Road Administration, 2009
- VT 12, Rantaväylä tunnel, Tampere, Road plan, preliminary draft, 16 December 2009; City of Tampere and the Finnish Road Administration, 2009
- General plan draft for Ratapihankatu; City of Tampere, 2010

In connection with approving the partial traffic disposition plan for the city centre in 2006, the City of Tampere decided to base further planning for the Rantaväylä development solution on the "long tunnel" alternative.

Work on the road plan commenced in 2008. Road planning was interrupted when the Administrative Court of Hämeenlinna ruled that the statutory environmental impact assessment (EIA) demanded by the Pirkanmaa Centre for the Environment was a prerequisite for the implementation of the undertaking.

The development alternatives deemed viable during earlier planning phases were reviewed during the EIA procedure carried out in 2009–2010. The EIA process concluded in the summer with the statement of the liaison authority. A general plan was drawn up after the completion of the EIA.

In 2011, the Finnish Transport Agency approved the general plan and the proposal to select the long tunnel alternative for further planning, after which the road plan was finalised. The Finnish Transport Agency approved the road plan on 21 October 2013.

The progress of the urban highway undertaking is integrally connected to regional plans and the land use plans and zoning of the City of Tampere. In addition to the city plan, the following plans apply to the planning area:

- The Pirkanmaa regional plan (Government, 29 March 2007).
- The partial disposition plan for the city centre of Tampere (City Council, 4 October 1995).
- Partial traffic disposition plan for the city centre (City Council, 18 January 2006, legally valid as of 2 March 2006).
- The partial disposition plan for Santalahti (City Council, 22 June 2006).

The development solutions for Rantaväylä have been discussed in the city centre's partial disposition plan and partial traffic disposition plan for the centre. Road planning for the long tunnel commenced in 2008 in accordance with the guidelines of the partial traffic disposition plan.

Simultaneously with road planning, the City of Tampere began reviewing the city plans and drawing up an underground city plan. The City Council of Tampere approved the underground city plan for the tunnel and the changes to city plans for the tunnel heads in 2011. These plans carry legal force.

The City of Tampere and the Finnish Transport Agency (previously the Finnish Road Administration) signed an agreement on the implementation of the undertaking in 2008. In the 2012 state budget, Parliament gave the Finnish Transport Agency the right to sign agreements worth a maximum of EUR 185 million for the VT 12 Tampereen Rantaväylä undertaking.

The objective of the undertaking is to implement the solutions specified in the 2011 road plan in an innovative manner that delivers value for the money invested by society. With regard to the whole, it is crucial to create the best conditions possible for cooperation between the various parties and stakeholders in the undertaking, in order to achieve targets in an efficient manner.

The undertaking will be funded from public funds. In their agreement on the implementation of the undertaking, the City of Tampere and the Finnish Transport Agency have specified a division of costs, with the City of Tampere responsible for 67% and Finnish Transport Agency for 33% of the expenses.

The interest of the City of Tampere in the undertaking is related to land use and the development of the city centre and urban region. The undertaking is linked to other projects such as:

- The implementation of the Ranta–Tampella city plan
- The traffic systems required by the development of Niemenranta, Lielahti, and the whole of western Tampere, as well as Ylöjärvi on a larger scale
- The implementation of the Ratapihankatu section of the ring road around the city centre, in accordance with the partial traffic disposition plan
- The development of Särkänniemi and Mustalahti harbours
- The conversion of Hämeenkatu into a public transport street and the construction of a tram route

The interest of the Finnish Transport Agency in the undertaking is related to highway development. The implementation of the undertaking will improve the smoothness and safety of traffic and reduce the number of people exposed to traffic emissions and noise. The undertaking is socially significant and has a profitable cost-benefit ratio.

2.2 Rantatunneli as a project

The aim of the project is to implement the planned traffic route undertaking in a manner that enables its targets and impact to be achieved economically and efficiently from the perspective of society as a whole. The project's owner is the City of Tampere, which will own the project routes during the construction phase. The City of Tampere has authorised the Finnish Transport Agency to take care of project management, the preparations for the contract, and monitoring. The project will be implemented as an alliance contract that will be received by the City of Tampere when complete. Once the contract has been completed, the Finnish Transport Agency will use a central government transfer to redeem the stretch to be transferred to its ownership.

2.3 Scope of the project

The implementation of the project includes moving highway 12 into a tunnel for a length of 2.3 km on the Santalahti–Naistenlahti stretch in Tampere. The required road and street arrangements, moving of lines and equipment, and interchange arrangements in Naistenlahti and Santalahti are also included in the project. As a whole, the changes will apply to a 4.2 km stretch of highway (Vt 12 Tampereen Rantaväylä). In the west, the planning area will begin from Paasikiventie at Santalahti marina and end at Kekkosentie, on the western side of the slip road junctions on Kalevan puistotie.

The project also includes a provision for the construction of an interchange at Näsinkallio near the midpoint of the tunnel. The provision will be implemented to an extent that will allow the construction of the interchange at a later date without suspending traffic through the tunnel. The City of Tampere will decide on the implementation of and design solution for the middle interchange when the required reports and plans related to the city centre's development are complete. This stretch of road is an integral part of the internal traffic network of Tampere, and is located completely within the street plan area of the City of Tampere.

The project's technical scope includes a level of implementation that will attain the quality level as well as other objectives and impacts specified in the road plan (Valtatie 12 (Tampereen Rantaväylä) for the Santalahti–Naistenlahti stretch). The integration of technical and functional systems related to other urban infrastructure and traffic management is included in the project's scope, insofar as the change requirements are caused by the project.

The concepts related to the project's scope were specified in greater detail during the development phase, as the implementation solutions and division of risks were defined. These specifications have been documented for the purpose of determining the TOC.

With regard to the scope of the project, the starting point of the implementation phase was specified during the project development phase (PDP) of the alliance and is described in part 3, SCOPE OF THE PROJECT, of the project plan for the Rantatunneli Alliance contract (dated 26 June 2013).

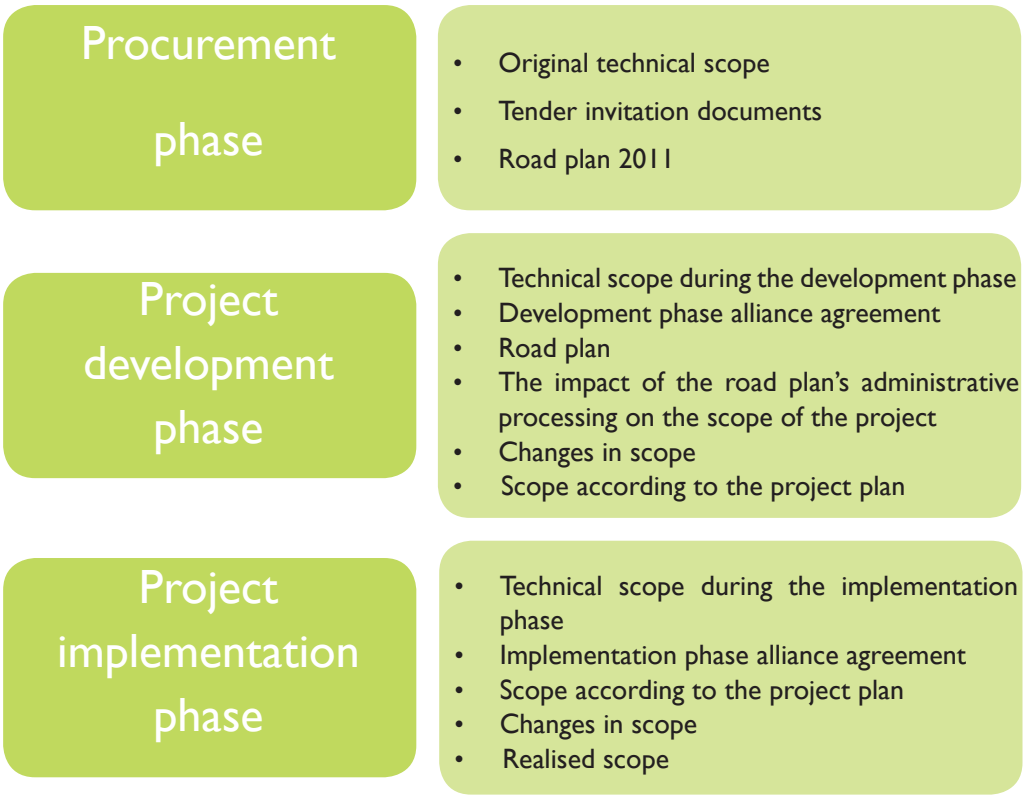

Figure 1. The technical scope of the project by phase.

2.4 Challenges involved in the project

The possibility of moving into the implementation phase even if all development phase targets were met remained uncertain during the project development phase. This hindered the securing and efficient use of the required resources and reduced the interest of subcontractors in the project. In addition, certain technical challenges were involved in the project's implementation.

Key factors of uncertainty

- The administrative completion of city plans, the general plan and the road plan (appeals and their processing times)
- The processing schedule of water permits
- The impact of the publicity received by the project

- The City of Tampere's final decision on moving to the implementation phase
- Challenges related to the alliance model (ability to adopt the model and demonstrate whether value for money has been achieved)

Key technical challenges

- Risk management and agreeing on the division of risks regarding the restoration of the contaminated soil in Santalahti (the extent of the contamination is impossible to determine in a completely reliable manner)
- Traffic arrangements around the principal construction sites and interchange areas during work, particularly in Naistenlahti
- The management of the impact and scope of the final planning of line transfers as plans and implementation solutions are defined in more detail
- Rock quality
- Groundwater management at the tunnel heads, and the related trough structures
- Air quality management at the tunnel heads
- The tunnel's inception into use (the success of technical system trials and testing)

3 PROCUREMENT PHASE

The negotiation method was applied to the procurement. The objective was to select the best tendering consortium as the owner's partner in implementing the Rantatunneli project. The contract was awarded to the tendering consortium that submitted the best tender in terms of overall economy, consisting of Lemminkäinen Infra Oy, A-Insinöörit Suunnittelu Oy and Saanio & Riekkola Oy.

3.1 Background

The Finnish Transport Agency was authorised by the City of Tampere to arrange a tendering competition for the Vt12 Tampereen Tunneli Alliance Project. Based on the tendering competition, the contract was awarded to the tendering consortium with the best tender in terms of overall economy and the best prerequisites (resources, expertise and experience), as defined in the contract award criteria, to implement the undertaking in cooperation with the City of Tampere and the Finnish Transport Agency. The procurement procedure was identical to that followed in the pilot project for the alliance contract (the Lielahti–Kokemäki railway undertaking).

Both alliance contracts are public procurements and have been subjected to competitive tendering in accordance with the Act on Public Contracts, using the phased negotiation procedure provided for in the Act. On 16 September 2013, the European Commission approved Finland's report on EU Pilot matter 4914/13/MARK; public contracts - infrastructure procurement - Finnish Transport Agency.

The competitive tendering process was launched by contract notices published in the national HILMA system and the Official Journal of the European Union in December 2011. The development phase alliance contract agreement was signed between the winning alliance contractor and the owners in July 2012.

Based on the agreement, the Rantatunneli Alliance began preparing and planning for the project's implementation, while the City of Tampere, Pirkanmaa Centre for Economic Development, Transport and the Environment, and the Finnish Transport Agency managed the required administrative matters.

3.2 Selection of procurement modul

The project owners made a joint decision to use the alliance model. The Finnish Transport Agency opted for the alliance model for the Rantatunneli project after discussing the matter with international alliance experts at the 2010 Lean in Public Sector seminar. After the seminar, the Agency enquired about the City of Tampere's opinion on the matter. On 19 January 2012, the City of Tampere announced that it will participate in the project's preparation according to the alliance model.

The owners decided on the alliance model for the Rantatunneli project for the following reasons in particular:

- The undertaking is significant in scope and entails risks that can be managed better in cooperation
- The owner expects the alliance model to provide certainty in cost management and acceptability
- The undertaking involves costs related to duration, so achieving an optimal lead-

time is vital
- The undertaking requires the challenging integration of various technologies and is located in a residential area with busy traffic
- Significant results can be achieved in the project through close cooperation between the parties
- The undertaking includes sufficient opportunities for finding new technical solutions and more efficient implementation methods

3.3 Use of experiences gained from the pilot project

Based on experiences gained from the Lielahti–Kokemäki railway project, the decision was made to concentrate on the measurement of the cost-effectiveness of service providers as early as during the tendering phase of the Rantatunneli alliance contract. The tenderers' assessments of the risks and opportunities involved in the cost estimate set by the owner were used as one evaluation criterion. The remuneration structure was also altered. In the Lielahti–Kokemäki railway project, all service providers offered a percentage-based fee. A fixed fee was selected for the Rantatunneli alliance contract, since this was deemed to encourage contractors to concentrate more effectively on minimising the TOC during the development phase and undercutting it during the implementation phase.

3.4 The procurement process and evaluation criteria

Procurement process

The Finnish Transport Agency was authorised by the City of Tampere to act as the contracting authority for the public procurement. Since the value of the contract exceeds the EU threshold, the contract notice was published in the EU's TED database in addition to the HILMA system.

During the first phase, the number of tenderers was narrowed down to five on the basis of participation applications. The best two tenderers were then selected over consecutive phases before the final contract award decision. The Finnish Transport Agency and City of Tampere participated in the procurement process as project owners. A procurement consultant, financial expert, cost expert, neutral observer, management expert and alliance facilitator took part as experts commissioned by the owners.

The alliance facilitator, who also served as an alliance expert, coached the owners' personnel and participated in the preparation of events related to the procurement. The management expert served the owners as a consultant and functioned as an expert observer during the evaluation of the alliance leadership and project team's management abilities in the tendering phase. The role of the neutral observer was to ensure the fairness of the procurement phase. The cost expert served as an expert on cost information and ensured that the cost-calculation systems of the best two tenderers were able to produce a realistic TOC based on actual costs. During the procurement phase, the financial expert conducted a detailed audit of the companies' internal and external accounting systems and their ability to produce a sufficient amount of information, in order to ensure that service providers would be paid in accordance with agreements. The owners' proposals for a cost expert and neutral observer were subjected to approval by the tenderers.

The alliance's procurement phase lasted approximately six months. At the end of the procurement phase, feedback on the procurement was requested from the tenderers. The

neutral observer issued a statement on the tendering competition and the cost expert on the audits of the tenderers' cost-calculation systems.

Table 1. Procurement phases, duration and key contents.

Phase - content	Schedule	Key content
Phase 1 - Tendering period	27 January – 26 March 2012	• Contract notice • Inspection of participation applications • Decision on the selection of candidate tenderers
Phase 2 - Selection of the two best tenderers over several stages (including phases 2a and 2b)	27 March - 27 April 2012	2a) • Preliminary invitation to tender • Beginning of tendering period • Opening and inspection of tenders • Beginning of the evaluation of tenders 2b) • Dialogue with tenderers • Supplementation of tenders • Decision during the procurement process => 2 best tenderers selected to continue • Tender evaluation continues
Phase 3 - Selection of best tenderer	28 April - 15 June 2012	• Development workshops and their evaluation • Financial negotiations • Final invitation to tender • Completion of qualitative tender evaluation • Fee offer • Selection of best tenderer • Contract award decision • Agreement review
Phase 4 - Signing of the development phase alliance agreement	9 July 2012	• Signing of the development phase alliance agreement • Alliance formation • Beginning of project development phase

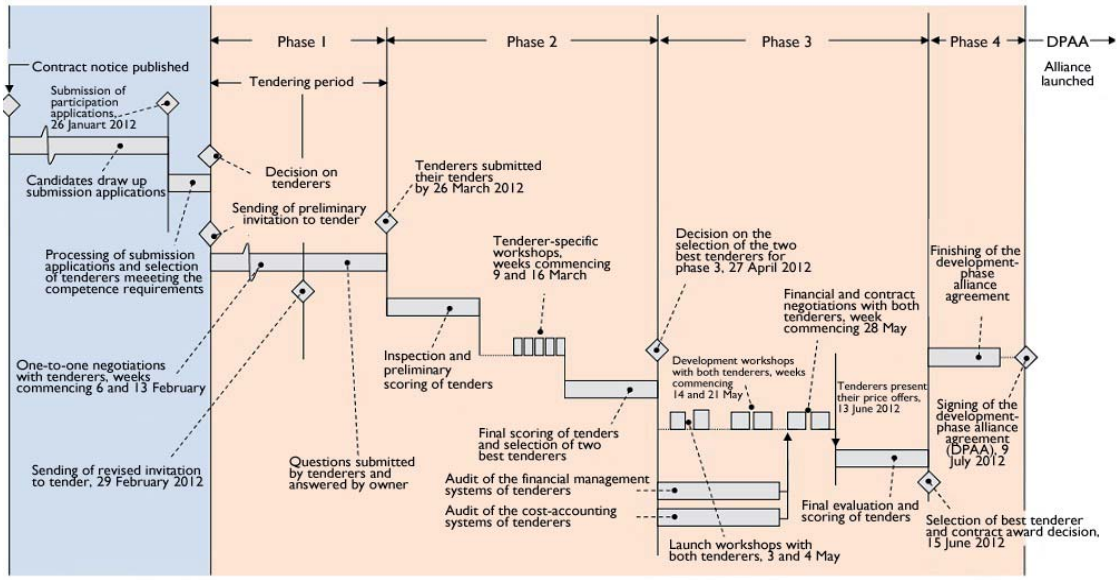

Figure 2. Phased negotiation procedure.

Tenderer selection and evaluation criteria

With regard to the organisation and the implementation plan for the project, the following were evaluated:

- The ability to carry out key tasks related to the project
- The method of ensuring the availability of the competence and resources required by design and construction
- Organisational structure and resourcing
- How well the tenderer has understood the contract form and project, and the requirements set by their various phases for the organisation and the tasks and roles of employees

With regard to proof of profitable operations, the following were evaluated:

- The results achieved by personnel with regard to the stated key issues
- The amount and significance of results achieved
- In particular, results achieved in traffic tunnel projects implemented in cooperation between design and construction as well as with different companies (design-build and life span models)

With regard to learning from mistakes, the following were evaluated:

- The readiness to report failures
- The analysis of failures and identification of their causes
- The ability to learn from failures
- Proof of development of operations

With regard to the setting of the TOC, the following were evaluated:

- The definition of the parties' roles, tasks and responsibilities
- How risks and opportunities are identified and managed
- Task schedules, phasing and the definition of inspection points
- Demonstration of the target-oriented nature of the TOC
- Cost steering of design solutions
- The processing of ideas and innovations

With regard to the review of the owner's cost estimate, the following were evaluated:

- The evaluation of the accuracy of costs and its grounds
- The risks and opportunities stated
- The definition of measures required for setting the TOC

With regard to alliance capability and management, the following were evaluated:

- The leadership ability of the alliance leadership and project team proposed by the tenderer and, in particular
    - Organising ability
    - Decision-making and problem-solving ability
    - The ability to develop and reinforce mutual trust
    - The ability for self-reflection
- Commitment and the ability to operate according to the principles and targets of the alliance

With regard to quality, the capability of implementing the project was evaluated. For evaluation purposes, the tenderers were required to present proof of profitable operations that have prepared them for this project. Plans for setting the TOC were also requested from tenderers. Implementation plans for the project and proposed organisations for the project development and implementation phases (hereinafter the PDP and PIP). The weighting of ability in the selection process was 75%.

The fee offer was evaluated as the tender price. The fee compensates the service provider for:

- Direct and indirect costs related to the performance of PDP duties and the fulfilment of obligations set by the PDP agreement, which do not constitute otherwise compensable costs
- Overhead expenses insofar as they do not constitute compensable expenses
- The company's profit

In order to ensure the commensurability of tenders, the owner specified the sum of directly compensable costs, EUR 150 million, as the calculation basis for the fee offer. The weighting of the fee offer in the selection process was 25%.

Table 2. Evaluation criteria and their weighting.

75 %	• The implementation plan and organisation for the project • Proof of profitable operations • Setting of the TOC • The leadership ability and alliance capabilities of the alliance leadership and project team
25 %	• Fee offer

3.5 Evaluation of tender contents

In phase 2, the Finnish Transport Agency conducted a preliminary evaluation and scoring of the tenders and held one-to-one workshops with the tendering consortia in the weeks commencing 9 and 16 April 2012. After this, the owner carried out the final evaluations and scoring for phase 2. Both the written tenders and the results of the workshops had an impact on the final evaluations. The owner selected the best two tendering consortia on 27 April 2012.

Phase 3 was reached by the Peitsi tendering consortium: YIT Rakennus Oy, YIT Kiinteistötekniikka Oy, Pöyry Finland Oy and Sito Oy; as well as the Lemminkäinen tendering consortium: Lemminkäinen Infra Oy, A-Insinöörit Suunnittelu Oy and Saanio & Riekkola Oy.

Launch workshops were held with both consortia in this phase, the financial expert audited the accounting systems of the companies named in the tendering consortia, and the cost expert audited the cost-calculation systems of said companies. Finally, development workshops and financial negotiations were held with both tendering consortia.

On 6 June 2012, the owner posted additional letter no. 5, containing instructions on the submission of price offers, among other things. The contents of the additional letter were specified further on 7 June 2012. Evaluation items A1.1, A3.1 and A3.2 were evaluated and scored on the basis of the tenders and development workshop results. Evaluation item A4.1 was evaluated and scored on the basis of development workshop work. After the completion of the qualitative evaluation, the owner opened the price offer letters and evaluated the price offers.

In the invitation to tender, the basis for the calculation of the fee portion of design work in the fee offer had been specified as 7% of all compensable costs (the EUR 150 million specified by the owner). The fee offers for consultancy work amounted to Peitsi 58%/Lemminkäinen 32.9%. The basis for calculating the fee portion of construction work had been specified as 93% of all compensable costs. The fee offers for construction work were EUR 17,100,000 by Peitsi and EUR 12,541,000 by Lemminkäinen.

The reference figures for the fee offers were

Tendering consortium Peitsi

- Construction work 12.8668%
- Design work 58%

Tendering consortium Lemminkäinen

- Construction work 9.1234%
- Design work 32.9%

Table 3. Evaluation of tender contents by phase.

Subject of evaluation		Weighting			
		Phase 2		Phase 3	
		Total	**Part**	**Total**	**Part**
A.	**Ability**	**100,00%**		**75,00%**	
A1.	**Project implementation plan and organisation**	**25,00%**		**10,00%**	
	A1.1 Project implementation plan and organisation		25,00%		10,00%
A2.	**Proof of profitable operations**	**35,00%**		**10,00%**	
	A2.1 Proof of profitable operations in the KRAs		25,00%		10,00%
	A2.2 Learning from mistakes		10,00%		Not evaluated
A3.	**Value for money**	**40,00%**		**30,00%**	
	A3.1 Setting of the project TOC		25,00%		15,00%
	A3.2 Examination of the owner's cost estimate		15,00%		15,00%
A4.	**Alliance cabability and management**	**0,00%**		**25,00%**	
	A4.1 The leadership ability of the alliance leaders and the project team, and alliance capability of the tenderer		Not evaluated		
B.	**Price**			**25,00%**	
B1.	**Price**		Not evaluated		**25,00%**
	A + B in total	**100,00%**		**100,00%**	

Table 4. Final evaluation of tender merit.

Subject of evaluation	Weighting	Score multiplied by weighting coefficient	
		(Peitsi)	(Lemminkäinen)
A1.1	10 %	9,08	10,00
A2.1	10 %	10,00	9,41
A3.1	15 %	15,00	14,35
A3.2	15 %	15,00	13,60
A4.1	25 %	25,00	22,08
Total		74,08	69,44

Table 5. Final evaluation after the opening of the fee offers.

Subject of evaluation	Weighting	Score multiplied by weighting coefficient	
		(Peitsi)	(Lemminkäinen)
A1.1	10 %	9,08	10,00
A2.1	10 %	10,00	9,41
A3.1	15 %	15,00	14,35
A3.2	15 %	15,00	13,60
A4.1	25 %	25,00	22,08
B (price)	25 %	13,76	25,00
Total		88	94

3.6 Statements on the procurement process

The neutral observer for the tendering phase of the Tampereen Rantatunneli project was rakennusneuvos Toimi Tarkiainen. Aulis Nironen substituted for Toimi Tarkiainen at two events. The neutral observer was involved in the process from the beginning of procurement until the contract award decision. The neutral observer or his substitute did not make any remarks regarding the procurement process.

Juhani Ilmonen (UJI Konsultointi Oy) served as cost expert in the process. In his statement, the cost expert stated that the project's TOC and realisation can be predicted in accordance with the alliance's principles, taking the software and systems used by the audited companies and the experience of accounting personnel into consideration.

The Synergos Research and Education Centre at the University of Tampere's School of Management served as the management expert. The management expert issued statements on the participation of the two best tenderers, the Lemminkäinen and Peitsi consortia, in the tendering phase workshop that tested leadership ability. The statements of the management expert were used in the evaluation of the tendering consortia.

Idman Vilén Grand Thornton Oy served as the financial expert. The financial expert issued statements on the audits of the accounting practices of the two best tendering consortia. The financial expert's audit reports stated that the invoicing practices of all audited companies were appropriate and could produce the information required in financial negotiations during the procurement phase.

The procurement process was additionally monitored by Counsel Päivi Hillner of the Finnish Transport Agency, Counsel Tanja Welin of the City of Tampere, and Counsel Juha Virolainen of Sweco PM Oy.

3.7 Recources required in the procurement phase

In addition to officials of the City of Tampere and the Finnish Transport Agency, the owner employed outside experts during the procurement phase. From the City of Tampere, the Procurement Director and Construction Director, as well as one to two lawyers participated in the procurement phase ex officio. From the Finnish Transport Agency, the Director of the Construction Department's New Construction Unit, as well as a project manager and lawyer from the unit, participated in the procurement phase ex officio.

In addition, 10–15 experts from both owner organisations took part in the procurement phase. The procurement phase required approximately 1.82 person years from the City of Tampere and the Finnish Transport Agency. The work contribution of outside experts amounted to roughly 0.90 person years. The total costs of consultancy work by outside experts was EUR 290,000. Venue costs amounted to EUR 30,000, and EUR 160,000 of tender fees were paid.

Table 6. Resources used by owner (official work).

City of Tampere	Use of time in PY (person years/1834, rounded to the nearest 2 decimals) 1/2012-6/2012
Procurement Director, approx. 40% of working hours	367/1834 = 0.20
Construction Director, approx. 40% of working hours	367/1834 = 0.20
Lawyer, 20% of working hours (1-2 persons with 1.25 coefficient)	229/1834 = 0.13
Experts, 5% of working hours (12.5 persons)	573/1834 = 0.31
Finnish Transport Agency	
Director of Investments Unit, 40% of working hours	367/1834 = 0.20
Project manager from Investments Unit, 75% of working hours	687/1834 = 0.38
Lawyer, 20% of working hours	183/1834 = 0.10
Experts, 5% of working hours (12.5 persons)	573/1834 = 0.31

Table 7. External resources used by owner.

Outside experts	Use of time in PY (person years/1935, rounded to the nearest 2 decimals) 1/2012–6/2012
Procurement service consultancy	960/1935=0.50
Alliance consultancy	33/1935=0.02
Neutral observer	300/1935=0.16
Cost expert	160/1935=0.08
Financial expert	271/1935=0.14
Management expert	11/1935=0.01

The winning tenderer spent approximately 2.04 person years on the tendering process. The workloads of each of the two tenderers that submitted price offers were approximately in the same order of magnitude as that of the owner. The individual workloads of the tenderers eliminated in earlier phases were smaller. No comparison to the resources used in the alliance's pilot project was made.

Compared to traditional forms of implementation (design-build (DB)/integrated project delivery (IPD) contracts or project-management contracts), an alliance requires more resources from the owner. The tendering costs of service providers are correspondingly 20–40% smaller compared to traditional implementation methods. For tendering consortia, the tendering costs of design offices may nevertheless be significantly higher than in models such as DB/IPD or project-management contracts if each party in the tendering consortium is liable for its own costs.

4 ALLIANCE TARGETS AND INCENTIVE SYSTEM

4.1 General and project-specific targets for the alliance model

The goal of the alliance is the cost-effective and high-quality implementation of the project. Operations are steered towards this goal by an incentive system. In the project development phase, the alliance specified shared key targets and an incentive system for the implementation phase, based on the original targets for the project.

Table 8. Original targets set for the project.

Key Result Area	**Target**
Cost-effectiveness	The project will be implemented in a cost-effective manner through innovative solutions, operating methods and ways of working. The alliance will produce value for money for the owner. The realised costs will be equal to or less than the TOC.
Lead-time	The project will be successfully implemented within the agreed schedule or sooner. The duration of the implementation phase is optimised.
Safety	The project is handled impeccably with regard to safety.
Usability	Disruptions to traffic shall be minimised during work, and the tunnel shall be continuously open for use after its inception into use.
Environment	The project's end product and construction do not cause significant damage to the environment.
Quality	The quality of design and construction is excellent.
Public image	The project has a positive public image.
Social responsibility	Disruptions to the railway network, users of VT 12 and residents within the project's area of impact will be minimised. A zero-tolerance policy will be observed with regard to the grey economy.
Lifespan costs	The minimisation of lifespan costs.

4.2 Incentive system

The incentive system consists of a cost incentive targeted at the TOC, performance incentives targeted at the KRAs, negative and positive modifiers, and major event modifiers.

The TOC: during the development phase, the alliance defined a TOC, which is a unanimous decision on how much the project's implementation may cost. The TOC includes directly compensable costs, risk provisions, and the fees of A-Insinöörit Suunnittelu Oy, Saanio & Riekkola Oy and Lemminkäinen Infra Oy. The difference between the realised cost and TOC will be divided among the parties to the alliance.

Key performance indicators (KPI) for the KRAs: Targets have been set for schedule, safety, usability and public image. The targets were set by comparing the minimum requirement (zero level) with the general performance of major investment projects in the infrastructure industry. A bonus will be paid for performance that exceeds the minimum requirement, while a sanction will be charged for performance falling short of it.

Each KPI value (points between -100 and +100) in the KRAs will be determined as follows:

- A result of +100 in a KRA corresponds to excellent or breakthrough performance for the alliance, in accordance with the chosen criteria
- A result of -100 in a KRA corresponds to the complete failure of the alliance, resulting in a failure to achieve the minimum requirements
- A result of 0 in a KRA signifies performance corresponding to the minimum requirement

Positive and negative modifiers reward or punish key results with regard to the alliance's success, for which indicators and indicator values nevertheless cannot be specified, or it would not be sensible to do so. Positive modifiers can increase the performance points by a maximum of 20, and negative modifiers can correspondingly reduce them by up to 10.

The overall performance score (OPS) for the KRAs is obtained by adding up the weighted points obtained from the KPIs and the points from positive modifiers and deducting the points for negative modifiers.

Tragic event will reduce the fee paid to service providers. In the event of a major event modifier, the owners will not pay any rewards from the bonus pool, even if the service providers would have earned such rewards for their performance.

As part of the alliance's financial model, the project's performance targets will be presented using the KRAs. The KPIs set for the KRAs enable the payment of a financial bonus for good performance and the imposing of sanctions for a performance that falls short of targets. The OPS therefore provides a realistic picture of the alliance's success. The incentive system was defined during the project development phase (PDP) of the alliance and is described in part 6, *Incentive system and key result areas,* of the project plan for the Rantatunneli Alliance contract (dated 26 June 2013).

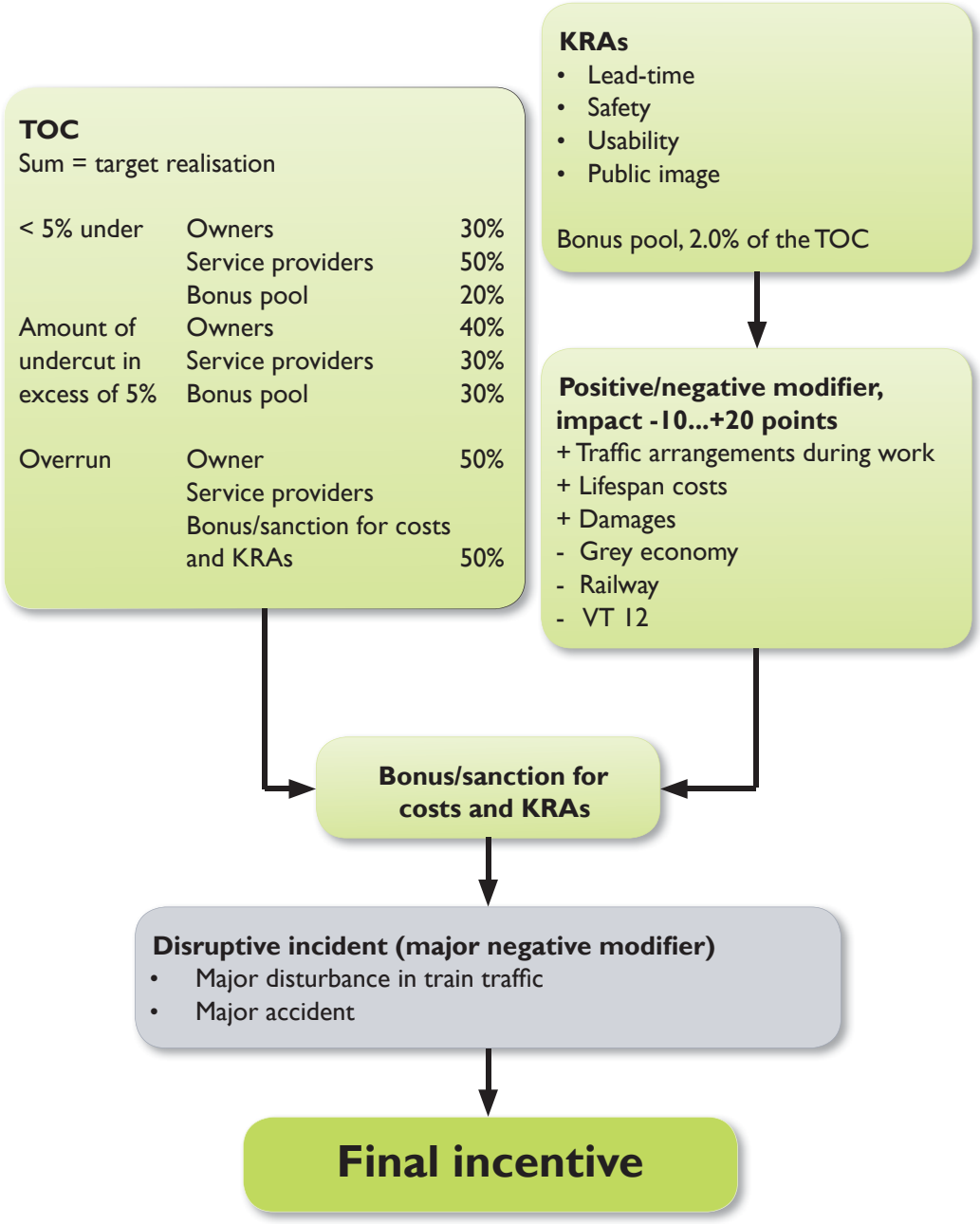

Figure 3. *Incentive system.*

Table 9. KPI value and description of the required level of performance

Description of the required level of performance	Definition
Breakthrough 70–100 points	• A target never before achieved in tunnel projects in Finland. • It cannot be achieved through existing methods – requires new ways of thinking. • The alliance does not know how this target could be met, but believes it to be possible and is 100 per cent committed to meeting it.
Stretch 10–70 points	• Has been achieved before, but not often. • The alliance knows how it can be done and can make use of existing methods to achieve it, but meeting the target still requires stretching resources/an exceptional performance by personnel to achieve this result.
Minimum requirement 0–10 points	• Considerably better than the normal performance of individual parties in other projects. • A level of performance achieved in cooperation by the best operators in the industry.
Failure - 50 - 0 points	• A level of performance below the minimum requirements set by the owner parties.
Complete failure -100 – -50 points	• An extremely poor performance.

5 RANTATUNNELI ALLIANCE DEVELOPMENT PHASE

The alliance drew up a development phase project plan and began implementing it. A target schedule and budget (EUR 6.5 million) were drawn up for the development phase. The target schedule was met and the cost remained slightly below budget. The costs of the development phase (EUR 6.2 million) are included in the alliance's TOC. The development phase focused heavily on brainstorming, innovation and the examination of alternatives, instead of traditional construction design.

The TOC set by the Rantatunneli Alliance is EUR 180,299,106.00, including design, implementation and the warranty period.

5.1 Setting the TOC

In traditional forms of contracting, the service providers offer a total price or a target price that the tenderer commits to for the whole duration of the project. The price changes only if the scope of the project changes. In such forms of contracting, the service provider frequently bears sole responsibility for the risks entailed by the project.

In an alliance contract, the service providers offer a fee, but not a total price. For this reason, it was important to set a transparent, tight TOC that will provide value for money for the owning parties. Cost expert Juhani Ilmonen had access to all cost-calculation materials for the entire duration of the development phase. At the end of the development phase, the cost expert issued his own written statement on the TOC-setting process and the tightness of the TOC. The statement was discussed by the alliance leadership team before the TOC was approved.

The process of setting the TOC was implemented in accordance with Chapter 6, The process of setting the project's TOC, of the development phase project plan.

The setting of the TOC included the following phases:

- Before the beginning of construction and implementation design, the level of accuracy required for setting the TOC was specified with regard to reliable volume calculation in tender price enquiries, the scope of procurement, and timing. The interfaces between different types of technologies were also taken into consideration in the accuracy requirements.
- At the beginning of the development phase, in August 2012, a comparative cost estimate (TOC estimate I) was calculated on the basis of the road plan, amounting to EUR 221 million. This cost estimate still included many uncertain factors. After this, a study was carried out of design solutions that the alliance could influence and find more efficient solutions for.
- Optimal solutions were sought in the development phase through iteration in cooperation with the designers' and developers' cost accountants . The daily cost steering of design took place within individual fields of engineering, directed by area managers and, at the level of the entire project, by the project manager. Design steering was carried out informally through daily interaction, and formally at meetings and workshops.
- Risk provisions that could be managed through further study and design were eliminated by identifying and assessing risks. The design focused on examining alternatives for major questions of principle, and on dialogue with authorities, selection of alternatives and innovation.

- In October 2012, a target of EUR 180 million was set for the TOC, and this was parcelled out to the engineering teams to steer fieldspecific design and the costs of design solutions.
- The next target TOC II (EUR 196 million), based on the alliance's own volume calculations and partly on the volumes specified in the road plan, was completed at the end of January 2013. Based on this figure, the leadership team decided on 7 February 2013 that there was no need to alter the scope of the project, and that the search for more efficient solutions and focusing on the assessment and management of risks would continue in order to lower the TOC.
- Based on the plans and quantity lists drawn up during the development phase, the project was priced by resources, using Lemminkäinen's Hakku software in compliance with the INFRA – RYL nomenclature. The alliance sought to obtain binding prices for subcontracts and materials, which would remain fixed for the duration of the whole project or whose annual increases were clearly indicated. Insofar as this was not achieved, the estimated increases in costs were priced by the alliance. Increases in costs were priced as a separate entity in order to avoid mixing accurate price information and cost-increase provisions based on guesswork in the actual cost calculation. The cost estimate and related cash flow estimate were completed in May 2013.
- The pricing of risks and opportunities was based on a charting of risks and opportunities carried out alongside the design work and pricing. The identified risks were minimised through design solutions, and those that could not be mitigated were priced together with the opportunities. A risk provision of EUR 3.3 million (ALT, 6 June 2013) was included in the TOC.
- TOC estimate III (EUR 185.4 million) was completed on 31 May 2013. At the leadership team meeting of 6 June 2013, it was decided to specify the TOC further in the weeks commencing 3 and 10 June, at least with regard to technical systems, risk and opportunities, and the provisions for cost increases. It was further decided not to alter the scope of the project.
- The final estimated TOC, EUR 180,299,106, was arrived at on 25 June 2013. Instead of using a cost-increase provision, the TOC is tied to the cost level of May 2013. The cost expert's report of 25 June 2013 states that the TOC was, as a rule, drawn up in accordance with the alliance agreement and was sufficiently tight. On 26 June 2013, the ALT unanimously decided to approve the TOC. At the same time, the ALT decided to approve the key targets guiding the implementation phase, and stated that a solution meeting the technical and financial targets had been achieved during the development phase.

The main tasks of setting the TOC included:

PREPARATION

- The identification of the largest cost items and an assessment of how they could be influenced
- The critical review of design principles
- The precise definition of interfaces between fields of engineering and a review of the definition principles
- Launching the innovation process and defining its systematics
- "Broad framework innovation days"
- Discussions with authorities on questions of alignment
- The specification of the level of accuracy for plans and volume calculations
- Definition of interim design targets
- Guidelines on the recording and handling of risks for future pricing

DESIGN

- The programming of base studies and the launch of site investigations
- The start and steering of design and the definition of interim targets
- Cost comparisons for alternative solutions and a review of work methods
- Drawing up the work plan and schedule
- Constant updating of the risk list

PRICING

- Competitive tendering of material deliveries and subcontracting
- The checking of volume calculations, with particular attention paid to interfaces
- Entering the quantities into the tender-calculation software
- Entering resource-specific consumption amounts and input prices into the tender-calculation software
- Agreeing on the principles for pricing increases in costs
- The probability of realisation and costs were estimated for risks. A share of the costs of potential realisation corresponding to the probability percentage of individual risks was priced as risk costs in the TOC.

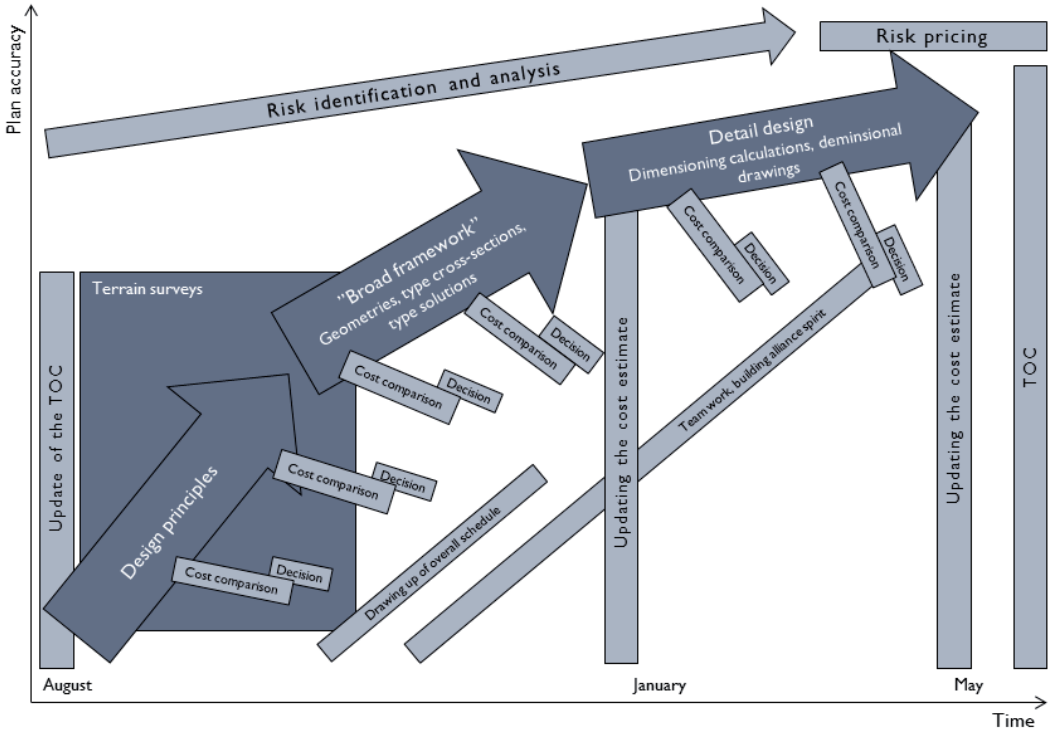

Figure 4. TOC-setting process.

Lemminkäinen Group PHASES AND SCHEDULE OF TOC SETTING

Head: Designer: JUK

Hierarchy	Description	Duration	Start
1	**ORGANISATION**	45 days	9.7.2012
1.1	PDP project plan	45 days	22.3.2012
2	**PREPARATION**	95 days	
2.1	Identification of largest cost items	10 days	13.8.2012
2.2	Critical review of design principles	25 days	20.8.2012
+2.3	"Broad framework innovation days"	22 days	27.8.2012
2.4	Discussions with authorities on questions of alignment	80 days	3.9.2012
2.5	Precise definition of interfaces between fields of engineering	15 days	27.8.2012
2.6	Definition of the level of accuracy of design and volume calculation	10 days	3.9.2012
2.7	Review of quantity-measurement principles	5 days	10.9.2012
2.8	Specification of "HOLD" points for design	10 days	17.9.2012
2.9	Guidelines on the recording of risks for future pricing	5 days	3.9.2012
3	**DESIGN**	187 days	
3.1	Ground survey programming	20 days	6.8.2012
3.2	Terrain surveys	80 days	3.9.2012
3.3	Drawing up of individual plans for fields of engineering	150 days	27.8.2012
3.4	Drawing up the work plan and schedule	153 days	17.9.2012
3.5	Engineering field-specific quantity lists completed	1 days	2.4.2013
3.6	Finishing the drawings	20 days	4.4.2013
4	**PRICING**	163 days	
4.1	Preliminary invitations to tender	111 days	1.11.2012
4.2	Drawing up a pricing template for the HAKKU program	40 days	1.10.2012
4.3	Pricing in HAKKU	106 days	26.11.2012
4.4	Quantity inspections of alliance plans	20 days	3.4.2013
4.5	Input of quantities into pricing program	15 days	10.4.2013
4.6	Pricing of project tasks	10 days	26.4.2013
4.7	Risk pricing	30 days	27.3.2013
4.8	Monte Carlo risk analysis	10 days	14.5.2013
5	**OTHER**	226 days	
5.1	Risk identification	215 days	9.7.2012
5.2	Compilation of project plan files	10 days	17.5.2013

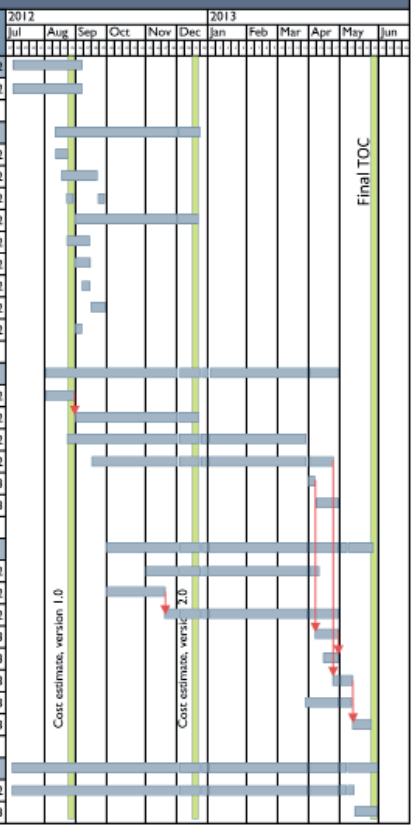

Figure 5. TOC-setting schedule.

5.2 Factors influencing the TOC

By a rough estimate, the design principles determined 80% of the costs that could still be influenced during the development phase. For this reason, particular attention was paid to the detailed specification of the design principles and the related negotiations with third parties at the beginning of the development phase. Immediately at the start of the development phase, the alliance reviewed the Finnish Transport Agency's guidelines and regulations under the leadership of the design manager, and agreed with the owner on which design principles and rules were binding and to what extent the alliance could influence the contents of plans and requirements set by them. In particular, aspects that could create added value through better quality or cost savings or in another specified manner were evaluated during the review of design principles.

The definition of the project's technical scope, risk management, consideration of opportunities, cost accounting, and innovations all affected the TOC. The most significant innovations, risk provisions and opportunities, and their value-for-money impacts are presented in the table below.

Table 10. The most significant innovations.

Subject	Idea / Innovation	Sum €
Ventilation duct	The ventilation duct at the tunnel's eastern end will be widened so it can be used as a work tunnel; the eastern exhaust air fans will be placed in the widened ventilation duct. Ventilation fan room S8 thus became unnecessary and could be dropped. Excavating the space required by the technology into rock is cheaper than constructing a separate building.	2,950,000.00
Tunnel cross-section	The dimensioning principle for the tunnel's cross-section was specified as a safety lane running the length of the tunnel. This enables the tunnel to be narrowed at the right-hand side of the cross-section. Correspondingly for the left-hand side, see item "Cable routes behind the impact railing = engineering corridor".	2,500,000.00
Bridges S8 and S9	Lowering the groundwater level in the region of Naistenlahti enables more modest buoyancy-resistance structures. The earlier innovation of moving the technical facilities within the bedrock eliminates the massive space requirement for bridge S8, which can now be replaced by more affordable steel pipe bridges or a slab bridge. The number of structures will be significantly reduced when the technical facilities do not require the construction of above-ground concrete structures. At the same time, these structures can be made lighter and cheaper than estimated, since the more specific research results for the rock surface and the consequently reduced buoyancy effect have decreased the size of the constructed area.	1,550,000.00
Access tunnel from Nääshalli	The construction of an access tunnel from Nääshalli onwards. The lead-time will be approximately 4 months shorter than in the base alternative. At the same time, the ventilating grate structure of the ventilation duct has been moved slightly to the north-east on Rantatie.	1,200,000.00
Cable routes behind the impact railing = engineering corridor	To the left-hand side, the tunnel will be excavated to a width that allows the placement of an engineering corridor behind the impact railing, into which the cables and pipes can be moved from under the driveway. The cable manholes intended for the driveway can be dropped.	1,000,000.00
Vt12	Avoiding the zone of fractured rock at Mustalahti will facilitate construction.	700,000.00
Wall cladding based on prefabricated units	Using prefabricated (light-coloured) concrete units for the entire height of the wall will expedite construction and the light surface will improve lighting in the tunnel.	550,000.00

E3R3 extent	For slip road R3 in the Näsinkallio interchange, the road plan proposes a provision for the excavation of a ventilation duct running from the grate building all the way to the traffic tunnel. Ventilation will instead be designed to run through bridge S4, obviating the need to reserve the beginning of R3 for ventilation. The provision for R3 can be excavated only to the extent required by ventilation.	500,000.00
VT12 tunnel, east end	Avoiding the zone of crushed rock at Tampella at the tunnel's east end by altering the grading will facilitate construction.	400,000.00
VT12 & E2R1	The railing described in type image 4T-2 has been dropped between the Naistenlahti interchange and VT12, vt12 spacing 3560-3610, for reasons of traffic safety. This construction element was deemed unnecessary and will not be included.	400,000.00
Concrete trough on the side of Santalahti	The ventilation canal will be lifted to the level of the trough bottoms. The concrete pipes running in the canal will be replaced with steel ones. The troughs will rest directly on the ground, with the exception of the ventilation pipe that will rest on piles. The walls of the trough will be constructed in the shape required by the impact railing, obviating the need construct separate concrete railings. Diverging from the road plan, the trough, with the exception of the ventilation pipe, will rest directly on the ground.	400,000.00
Basins	The waste and drainage water basins will be structurally combined: The basins will be placed side by side, creating a single pair of waste and drainage water basins serving both tunnels.	330,000.00
Welding the back-grouted expansion-shell anchor bolt by grouting	Back-grouted expansions-shell anchor bolts will be used for leaking holes. The welding will be done by grouting the bolt with a grout that fulfils the requirements (service life, stress categories, hardness) set for the bolt's grouting mortar.	290,000.00
Heating of the space between the cladding structure and rock	The intermediate space will be heated with recirculated air using waste heat from transformers, in the engineering corridor, for example. In connecting corridors, the air will be directed into the intermediate space and distributed throughout its length using pipes.	260,000.00
20 kV cables without cable manholes	The 20 kV cables will be installed without cable manholes, which facilitates the coordination of work within the tunnel. This will also eliminate unnecessary construction elements.	220,000.00
Santalahti work tunnel	A work tunnel constructed in Santalahti, outside the mouth of the excavation, will expedite work.	200,000.00
K10	The grading of street K10 Rauhaniementie will remain un-changed. Serviceable street and supporting wall structures will not need to be dismantled and reconstructed.	180,000.00

Vt12 spacing 1200 - 1380	The middle of the highway will be narrowed at the ventilation machine room. This will narrow the highway's cross-section and reduce cutting mass and the area of the fan room's ground slab.	150,000.00
Access tunnel from Nääshalli; follow-up idea	For the duration of work, a connection will be built from the back part of the basin room (interim rock waste storage) to the slip road tunnel, and the access tunnel will be built as straight as possible. This solution will eliminate the need for structural solutions necessitated by height differences, while minimising access tunnel length. The solution also creates an easy haulage route to the ventilation machine rooms at Näsinkallio without interruption to traffic.	145,000.00
Lengthening the rock tunnel by approximately 5 m at its western end	Lengthening the rock tunnel by approximately 5 m at its western end. This will reduce the disruption to Onkiniemenkatu (it will not be necessary to dismantle the street completely) and disturbance caused by construction to the residents of the tower blocks on top of the tunnel entrance. This will lower the cost of the concrete tunnel section included in the rock tunnel.	120,000.00
S6 Rauhaniemi bridge	Keeping the current grading and supporting wall structures will enable the use of the existing bridge structures when renovating Rauhaniemi bridge.	100,000.00
Sprinkler body pipe	Plastic pipes, which are cheaper than steel, will be used for sprinkler body pipes when these are located inside backfill.	100,000.00
Drainage water basins	The drainage water basin will be drained from the top, and the water will be directed into the rainwater sewer. This will simplify the piping and its dimensions and reduce the amount of pipes needed.	90,000.00
Fire water body pipe	Plastic pipes, which are cheaper than steel, will be used for the fire brigade's fire-fighting water pipes when these are located inside backfill.	70,000.00
Locations of the fire-fighting water basin and pumping station	The fire-fighting water basin and sprinkler pumps will be located at the bottom end of the access tunnel, next to the drainage and waste water basins, since this is sensible from an operational perspective, and excavating the required space into rock creates cost savings.	40,000.00
K5J	Change to the alignment of route K5J. Changing the alignment allows the use of slope ramps instead of supporting walls in the cross-section.	35,000.00
Moving the vehicle access tunnel to the west	Vehicle access tunnel pl 2800 => 2500 will be moved to the west, as this will expedite multi-face excavation.	25,000.00
Middle support for bridge S4	Moving the loads created by bridge S4 away from the rock shelf between the tunnels. This will eliminate the need to reinforce the rock shelf.	20,000.00
	Total	14,525,000.00

Through the solutions listed above and by making use of opportunities to build in areas of better-quality rock, savings will be created by bringing the schedule forward.	2,500,000.00
In total	17,025,000.00

Table 11. The most significant risk provisions.

Subject	Description	Provision €
The increase in work required for the tunnel and technical systems	Inaccuracy of volume calculations in the construction plan when the production drawings remain unfinished.	535,000.00
Contaminated soil	The treatment requirement of contaminated soil will exceed the amounts specified in preliminary studies.	312,000.00
Pricing of the tunnel's technical systems	The risk involved in the accuracy of the resource-based input price calculation. The accuracy of calculations based on subcontracting enquiries. The reliability of tenders entails a risk.	365,000.00
The information on the elevation of the rock face and rock quality does not correspond to reality.	The estimated reinforcement amounts are based on the results of local studies, and rock quality will be determined in further detail during the probing performed in connection with excavation. Costs may be incurred from phased excavation and immediate reinforcement needs.	200,000.00
The operating principles and adjustment of the smoke-venting and ventilation systems.	Adjusting the smoke-venting and ventilation systems may prove to be more difficult than anticipated and require wider testing and calibration.	160,000.00
Disturbances caused by blasting	The noise, vibration and/or pressure shock from blasting creates such a disturbance that working hours will need to be adjusted.	160,000.00
Timing of excavation work or more cautious excavation methods than anticipated	The timing of excavation work or the need to employ more cautious excavation methods will create additional costs. E.g. issues related to noise or vibration/sensitive properties, hospitals, etc.	160,000.00
Operating principle of the fire extinguishing system	Fire extinguishing systems have not been implemented in Finnish traffic tunnels before. Unanticipated changes may arise in the operating principles, influencing the system's scope and dimensions.	150,000.00
Functionality of the Santalahti excavation	A more extensive than anticipated need to reinforce the bases of supporting walls due to groundwater management.	150,000.00

The area of absorbent clay will double	A significant change in the amount of absorbent clay, estimated on the basis of study results (the TOC includes a reinforcement need for 200 metres of tunnel).	142,500.00
Movement of municipal engineering systems.	The moving of lines and equipment proves to be more expensive than anticipated or requires more planning, integration and resources.	125,000.00
Joining the concrete tunnel to the rock tunnel	The concrete and reinforcement structures entail a cost risk, if rock quality and location diverge from those predicted on the basis of the base data.	125,000.00
Increased amount of work required for the routes	Risks involved in existing structures, supports and drainage during work.	120,000.00
Traffic arrangements during work	Traffic arrangements during work prove inadequate; traffic will be significantly congested and will be directed into the street network. The traffic arrangements have to be changed radically.	90,000.00
The lowering of the groundwater level for the duration of work will not succeed as planned	Isolating the area in which groundwater will be lowered proves more difficult than anticipated, and additional costs are incurred from structures that prevent hydraulic conductivity (supporting walls and additional waterproofing).	75,000.00
Route pricing	Calculation accuracy. The calculations have been made based on resources, using input prices.	75,000.00
Increased need for supporting walls	Variations in the rock face at the locations of supporting walls increases the wall area required on top of the rock. Provision +10%.	70,000.00
The tunnel's inception into use is delayed due to the testing and integration of technical systems	The testing of technical devices, integration of control and data systems, training the traffic control centre, testing related to tunnel safety, and rescue drills take more time than anticipated.	64,000.00
Increased amount of work required for the bridges	Inaccuracies in the volume calculations included in the construction plan. The most significant risk is related to the required amount of concrete reinforcement.	60,000.00
Pumping station capacity in Naistenlahti	The capacity of pumping stations proves inadequate and has to be increased.	50,000.00
Relocation of the rock face at the tunnel's western end	Onkiniemenkatu will have to be cut, drainage and traffic arrangements during work will be difficult.	50,000.00
Sealing the tunnel during work	Back-grouting requirements arise after the initial grouting (walls, ceiling and bottom).	50,000.00

Erroneous space provisions	Requirements for additional space arising after excavation. The cost effect will be caused by delays in the schedule and the dismantling of existing reinforcement structures.	50,000.00
Hydraulic conductivity of the rock in Naistelahti	Water will be directed through the rock into the excavation at the area of the mouth, increasing the grouting area.	45,000.00
Inoperability of an individual technical system	The tunnel's interoperability testing is delayed and installation and testing resources have to be increased in order to enable the tunnel's inception into use.	32,000.00
Pricing, bridges	Calculation accuracy. The calculations have been made based on resources, using input prices.	30,000.00
Excavation delays caused by train traffic	Agreed interruptions will not be realised, for example due to trains being late. Interruptions at inopportune moments. Only affects the three railway underpass sections.	30,000.00
Other risks	Geotechnical solutions, grouting spread, degradation of water quality, traffic arrangements during work	172,000.00
	Total:	3,647,500.00

Table 12. Opportunities.

Procurement supposition, all fields of engineering in total €	2,675,000.00
Design €	550,000.00
Tunnel-cladding structures €	400,000.00
Mass relocations €	175,000.00
Yhteensä:	3,800,000.00

5.3 Setting the KPIs for monitoring the KRAs

The KPI values for the KRAs, positive and negative modifiers and major event modifiers were discussed twice by the alliance leadership team. All KPI values were prepared in small groups, including members of the ALT.

The key principle of the alliance is commitment to high performance and the achievement of value for money. With regard to the KPIs, this means that a zero-level KPI value has to signify better performance than the average in the construction industry. The monetary bonus paid for performance exceeding the zero level must also correspond to demonstrable benefits to society. The sanctions imposed for falling short of the zero level will likewise correspond to the benefits lost by society.

The values for each KPI value of zero have been justified and their monetary effects simulated. For each KPI, a perfect performance of +100 points requires the achievement of a breakthrough, while a performance of -100 points equals complete failure.

Table13. Key result targets and indicators and their zero level.

Key Result Area	KPI/weighting	Value corresponding to zero level	Justification for zero level
Schedule	Keeping on schedule KPI weighting: 30%	15-0 days late	A delay in the tunnel's inception into use will incur additional costs and loss of public image. The target schedule (15 May 2017) is challenging.
Safety	Accident frequency KPI weighting: 10%	16–14 accidents/million hours	The construction industry average is 70/million working hours. The average of rock construction by Lemminkäinen Infra Oy is 32.4/million working hours and 34.3 in earth-moving and route construction. The zero-level KPI is challenging.
	Absences resulting from accidents KPI weighting: 10%	200–160 days/year	The average absence duration of Lemminkäinen Infra Oy and the target accident frequency set for this project have been used to set this target.
Usability	Disruptions to traffic after the end of the construction phase KPI weighting: 10%	This target will be set three months before the end of the construction phase.	
Public image	The tone of publicity is neutral or positive KPI weighting: 20%	85-90	The Finnish Transport Agency began monitoring the project on 30 August 2012. In the publicity analysis for 2012, 74% of the publicity received by the project was neutral or positive in tone. This result was the lowest of all monitored projects and fell short of the average for Finnish Transport Agency projects (90%).

Table 14. Positive modifiers with their indicators.

Positive modifier	KPI	Justification
Traffic arrangements during work	Average traffic volume unchanged from the start of the project = +10 points Average traffic volume reduced by no more than 7% = +5 points	Poor traffic arrangements will direct traffic into the street network in an uncontrolled manner.
Damages	Damages equal a maximum of 0.075 per cent of the TOC = +5 points	The average amount of damages in construction in dense urban areas is 0–0.5%. The target of 0.075% is challenging for this project's environment
Major commendation	The project receives a major commendation.	A commendation is a recognition of high quality provided by a third party.
Lifespan cost	Decreasing the lifespan cost by more than EUR 100,000/year = +5 points	The reduction in operating costs must be signficant and greater than the bonus paid for it

Table 15. Negative modifiers with their indicators.

Negative modifier	KPI	Justification
Disruptions to traffic on VT 12	Traffic suspended for 12–24 hrs: -2 points Traffic suspended for more than 24 hrs: -5 points	Disruptions to traffic on VT 12 will also cause disturbances and traffic safety problems in nearby areas
Disruptions to train traffic	Traffic cut for 6–24 hrs: -3 points Traffic cut for 24-48 hrs: -6 points	Disruptions to train traffic will hinder the transport of passengers and goods
Grey economy	Detected once: -2 points Detected twice: -5 points	The alliance is committed to zero tolerance with regard to the grey economy

Table 16. Major event modifiers with their indicators.

Major event modifier	KPI	
Disruptions to train traffic	Train traffic cut for more than 48 hrs:	The Ostrobothnia railway is a major artery for passenger and freight traffic. An interruption of more than 48 hours will cause considerable detriment to the supply and material flows of communities and businesses in the area, as well as to passenger traffic. These detriments may have severe economic impacts.
Major accident	The report of the Safety Investigation Authority finds the alliance responsible for the accident	A major accident is one that results in particularly large financial losses, injuries or casualties.

5.4 Management and operating methods during the development phase

Roles and responsibilities of the parties in setting the TOC.

The key tasks of the parties with regard to setting the TOC were divided as follows.

Table 17. Tasks of different parties in setting the TOC.

Owner parties	Implementing parties	Stakeholders (ELY, AVI, building supervision, rescue services)
• Approval of design principles, functionality requirements and the level of quality • Approval of safety solutions for the tunnel • Maintenance and specification of lifespan issues • Approval of the project plan	• Design • Design solution optimisation, innovations and new ideas • Implementation cost optimisation (schedules, organisation, procurement, design, construction and others) • Pricing	• Permit terms • Permitted working hours • Approval of safety solutions for the tunnel • Requirements of environmental monitoring

Decision-making

Decisions are made together and unanimously in the alliance. The owner party is entitled to make a unilateral decision on moving from the development to the implementation phase after the alliance leadership team has unanimously approved the TOC, KRAs, project plan, specifications to the commercial model, and the alliance agreement for the implementation phase. The project plan will be followed during the implementation phase. The alliance agreement for the implementation phase states that the owner will unilaterally make the decisions regarding the project's functional requirements, scope, design principles, and the road plan. The TOC and key result targets were defined on the basis of these. The alliance's management system is described in the alliance agreements for the development and implementation phases.

The alliance leadership team is the highest decision-making authority in the alliance. All parties to the alliance are represented in the ALT. The ALT convened roughly once per month. The minutes of its meetings were distributed to ALT members and to the alliance's financial and cost experts.

The alliance project team was responsible for the operative management of the project. The Alliance Project Manager served as the head of the project team. The project team included the heads of all areas of responsibility and the required experts. Rapid decision-making ability was expected of the project team. The team convened every three weeks on average, and key decisions were communicated to all alliance personnel via supervisors and through a weekly bulletin.

The design steering team was responsible for design steering. The team directed design and was responsible for the integration of plans from different fields of engineering, and participated in the coordination of design and construction as well as the risk and quality management of design. The Alliance Design Manager headed the design steering team. The team met approximately every three weeks.

The project organisation included four engineering teams. Tunnel design, route design, bridge and geotechnical design, and technical systems. Each engineering team was responsible for the cost management and steering of design solutions, as well as for design schedule and resource management. The engineering teams were also responsible for the processing of plans, changes to plans and innovations, as well as the management of design costs, design subcontracting and quality management in design. The engineering teams met approximately every other week.

Operating methods

During the development phase, all parties to the Rantatunneli Alliance worked in a single space, the "Big Room". For practical reasons, the Big Room was divided between Tampere and Helsinki and outfitted with video conference equipment for communication. As a rule, the personnel of the City of Tampere, Finnish Transport Agency, Lemminkäinen Infra Oy and A-Insinöörit worked in Tampere. The personnel of Saanio & Riekkola Oy worked in Helsinki. The objectives of the Big Room solution were fast information flow, transparency and openness of operations, and good conditions for innovative operations. Big Room work indeed proved to be a significant facilitator of innovations. From the perspective of information flow, concentrating operations in a single Big Room would have been more efficient. On the other hand, the opportunity for Big Room work in two locations increased flexibility and reduced travel requirements.

To a considerable extent, the alliance used workshops in place of meetings. Workshop work promoted the teams' capacity to brainstorm, innovate and work more efficiently, and facilitated commitment to common targets. Workshop work was also applied to stakeholder cooperation, such as in connection with line relocations, tunnel safety, maintenance and traffic control.

Figure 6. Development phase workshop.

The alliance created a handling process for ideas and innovations in order to sift out opportunities. Viable ideas were collected, studied and processed within the alliance. Approved ideas were included in the project's implementation plans and taken into account in the TOC. During the development phase, the alliance encouraged its parties to report all ideas, and the best of these resulted in major innovations.

A financial expert and cost expert served as experts for the owning party during the development phase. In cooperation with the cost expert, the financial expert ensured that the compensable costs and fee were based on verifiable information and were in compliance with the financial model. The financial expert also carried out regular audits in order to ensure that invoices and payments were compliant with the alliance agreement and included the agreed-upon notes. The cost expert participated in meetings and workshops related to setting the TOC, checked cost estimates and prices, and cooperated with the financial expert.

The alliance consultant Sweco PM Oy, commissioned by the owning party during the development phase, took part in project team work, engineering teams, safety and risk-management duties, and the preparation of the project implementation phase agreement.

The alliance facilitator commissioned by the owning party in the development phase (Lauri Merikallio, Vison Oy) advised the leadership and project teams on matters related to the alliance's operating method during the development phase. He was tasked with assisting the project team and its members in coaching new employees for the alliance, evaluating the alliance's operations and making proposals for development measures to the project and leadership teams. The alliance facilitator also participated in value-for-money reporting and the definition of KRAs and their indicators, and served as a mentor on Lean Construction.

During the development phase, the project and leadership team evaluated their own activities in order to identify and implement development measures.

Lemminkäinen