Rantatunneli Alliance project

Project Plan

Alliance Executive Team 26.6.2013

RANTA-tunneli

Rantatunneli Alliance project

Project Plan

Tampere City
Finnish Transport Agency
Lemminkäinen Infra Oy
Saanio & Riekkola Oy
A-Insinöörit Suunnittelu Oy

Tampere 2013

The Design Process of the project plan and its content in brief

The Design Process

In the development phase, the task of the Alliance was to plan the implementation of the project and, define the target outcome costs as well as the key result areas. The development phase includes preparatory tasks regarding the building work which are necessary for drafting a project plan.

In the development phase, the following actions have been taken, inter alia, for the project plan:

1. supplementary additions to previously completed research, planning and cost estimates
2. preparatory work for procurements related to construction
3. cooperation with necessary stakeholders
4. initiation of the process for application for necessary permits and notices
5. initiation of environmental monitoring
6. preparation for the communications required for the project
7. preparation for insurance required for the implementation phase
8. agreement for the gainshare/painshare regime for the alliance during the implementation phase
9. organised workshops and other such processes to create the right Alliance culture and ethos, striving for maximum performance
10. reached agreement for tasks that are necessary to implement the project

Content and significance

The project plan describes the technical and financial goals of the project and its implementation. It also describes how the project will be planned, implemented, adopted and handed over, including the costs involved.

For the implementation phase, the project plan also contains a more detailed plan, describing the objectives and content of design, additional surveys needed and development goals, including a design schedule with intermediate milestones.

The project plan directs the practical activities of the Tampere Rantatunneli Alliance, giving guidance in the activities of the Alliance Project Manager, the Project Team and the Executive Team. This includes, inter alia, key result areas and the gainshare/painshare regime, the schedule, organisation and job descriptions, target outcome cost and an innovation and management system.

Summary

The Project

The project concerns relocating the Highway 12 in Tampere to a new alignment and a tunnel between Santalahti and Naistenlahti, according to the road plan of 2011. The necessary road and street arrangements, conduit and equipment transfers as well as the interchanges of Naistenlahti and Santalahti are also included in the project.

The Objectives

The objectives of the Rantatunneli project were defined in cooperation with the Alliance parties. The key result areas and indicators of the implementation phase are presented in the table below.

Key result area	Indicator
Schedule	The adoption of the tunnel in both directions takes place as planned and according to the issued schedule. Other traffic arrangements related to the scope of the project take place according to the issued schedule.
Safety	Significantly less than the industry average number of accidents are due to the project and their effect is minor, i.e., there are very few consequent absences from work.
Usability	The traffic capacity and flow remain at an appropriate level.
Public Image	The public image of the project is improved and the project gains demonstrable, general public approval.

The achievement of the objectives is monitored so that the Alliance organisation can manage and direct the project as well as develop its operations and the implementation. The objectives of the implementation phase are in line with the original operational and quality targets. The bonuses related to key result areas direct the Alliance activities towards achieving the original project key result areas and deliverables.

Organisation

The Alliance parties are Tampere City, Finnish Transport Agency, Lemminkäinen Infra Oy, Saanio & Riekkola Oy ja A-Insinöörit Suunnittelu Oy. The composition of the Alliance in the development phase will be kept unchanged as far as possible in the implementation phase, to ensure that the Alliance ethos, cooperation and approved practices created in the development phase are transferred to the implementation phase. The Alliance organisation will grow substantially during the implementation phase along with the construction organisation. The organisation chart is presented in *Picture 2.1* on page 9.

The technical scope of the project

The total length of the Rantatunneli is 2,327 meters. There will be two separate tunnels each direction, spaced 11-12 meters apart. Both tunnels will have two 3.5 meter lanes and a 3.25 meter hard shoulder (safety lane). The free height of the tunnel is 5 m (see the illustration on the right)

Gateways will be constructed between the separate tunnels every 150 m. The gateways are exits from one vehicle tunnel to another, partitioned for fire and smoke. The speed limit in the tunnel will be 60 km/h. Heavy vehicles will not be allowed to overtake while in the tunnel. Pedestrians, cyclists and slow vehicles will not be allowed in the tunnel, nor will transport of dangerous substances. The tunnels will be equipped with a fire detection and protection system.

Target outcome cost

In addition to the road plans material available, the target outcome cost is based on supplementing soil and bedrock studies, including a rock surface model, and methods and working times presented in the planning permission application in accordance with the Water Act, as well as the noise declaration, and the construction plans made during the development phase. The target outcome cost has been calculated using 5/2013 prices and is based on the assumption that the Alliance contract for the implementation phase will be finalised by 1st of October 2013 and that the work can be commenced without delay. The target outcome cost without VAT is 180,299,106 Euros. The development phase costs (6.5 million Euros with zero VAT) are included in the target outcome cost.

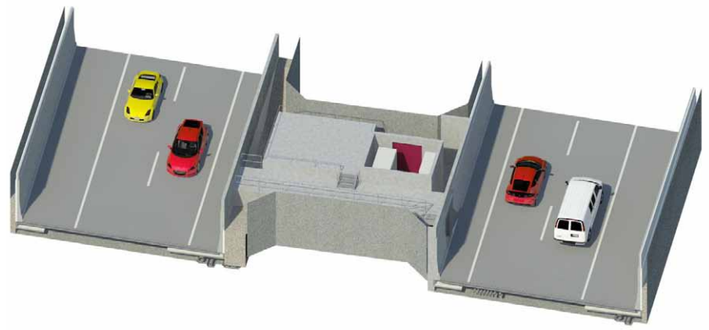
Risks and opportunities

The project risks include all factors which could jeopardise the implementation according to the key result areas. The Alliance will not take risks related to either personal, traffic or tunnel safety per se, but will instead use risk management to reduce or avoid these. Risk management will be a systematic and continuous activity to:

- identify the project risks
- assess their severity and management options for ensuring a successful project implementation
- implement a project risk management plan.

The Alliance has created a process in the development phase to vet ideas and innovations where all viable ideas were assessed and processed within the Alliance. The approved ideas have been included in the project implementation plans and target outcome costs.

The opportunities in the development phase consist of ideas and the risk management process still under development and the opportunities identified in establishing the target price. It is likely that new ideas and innovations will transpire in the implementation phase as they did in the development phase. The increase of personnel, more detailed work planning and finalising



the construction plans will no doubt bring new potential for creating and identifying new ideas.

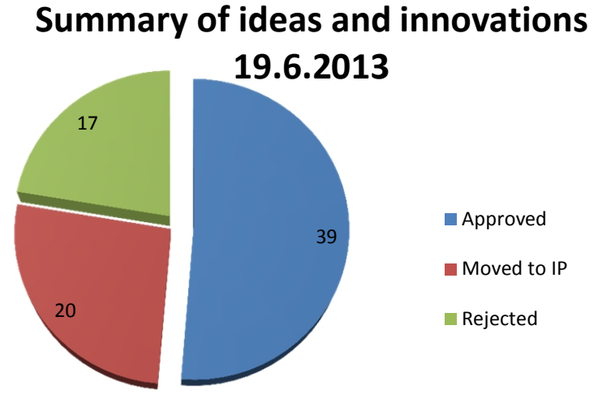
Gainshare/painshare regime and key result areas

The gainshare/painshare regime consists of bonuses and sanctions relating to

1. the target outcome cost,
2. key result areas and
3. major event modifiers.

The target outcome cost defined for the project is a unanimous decision by the Alliance. It includes direct costs, risk reserves and the fees by A-Insinöörit Suunnittelu Oy, Saanio & Riekkola Oy and Lemminkäinen Infra Oy.

The key result areas have been set by comparing the minimum required level with the general performance level of major infrastructure projects. Bonuses are paid for better than minimum level performance and sanctions are charged for lower performance. The bonus pool is 2% of the target outcome cost and will increase if a lower target price is achieved. Sanctions will reduce the consideration to the service providers.



Any major event modifier, which in the context of this project means a major disturbance in train traffic or other major accident will reduce the consideration paid to the service providers. In such a case, no moneys will be paid from the bonus pool even if a performance related bonus was due to the service provider.

Design program

The construction plans for the roads and streets and structures according to the project's technical scope are produced in the development phase. The starting points for the construction planning are the initial construction plans, approved road plans with planning details and the planning principles defined for the construction plan during the development phase.

Schedule

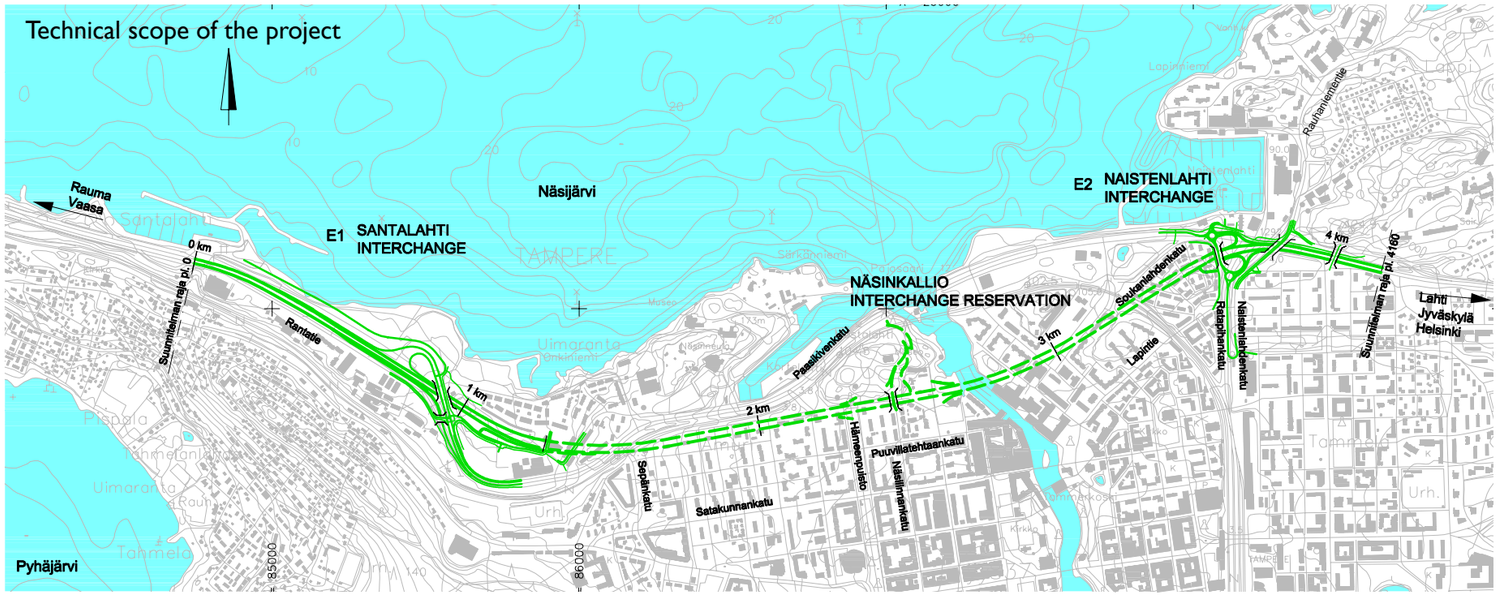
The schedule diagram shows the main activities of the implementation phase, both their duration and relation to the main project schedule. The work will begin on 1st October 2013, the tunnel will be opened for traffic on 15th May 2017 and the project will be finished on 30th November 2017. The environmental work to finish off the surroundings will be completed during the summer of 2018.

Alliance management system

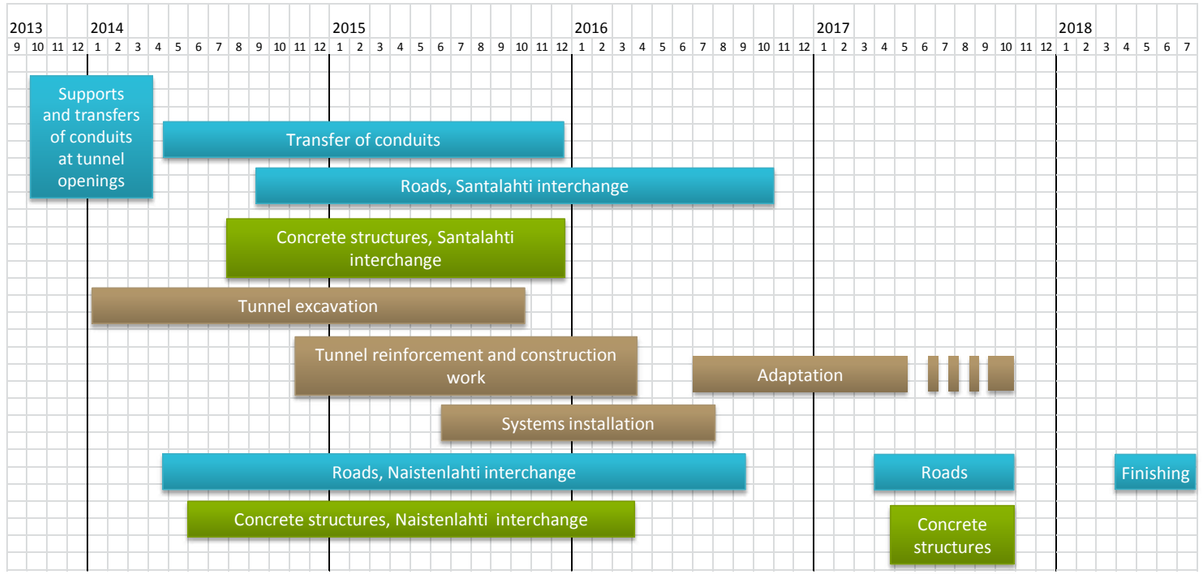
The Alliance management system describes the jointly agreed procedures and working methods for carrying out the implementation phase. It is in fact a plan of action, which deals with the following themes:

- Alliance procurements
- the management of the schedule, costs, quality, risks, environment, data and personnel
- management of planning and construction
- communications and cooperation with stakeholders
- training plan
- adoption of the tunnel to the public
- financing and payments
- safety
- permits and notices
- internal inspections
- reporting

The objective for following the processes as set by the management system is to achieve full utilisation of opportunities presented by the Alliance project and reach the agreed targets. The most important task in this respect is the management of both the schedule and the costs.



General Implementation Schedule



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1 PROJECT OBJECTIVES

1.1 Introduction

The objectives have been agreed by all Alliance parties and some of these are also key result areas included in the Alliance gainshare/painshare regime.

Meeting the project targets will be monitored so that the Alliance organisation can govern and manage the project effectively and develop its operations and the implementation. The objectives of the implementation phase (later also called IP) are in line with the original operational and quality objectives. The incentives related to the key result areas will direct the Alliance operations to achieve the original purpose and objectives of the project.

1.2 General objectives

The objectives for the development of Highway 12 (later Hw 12) (Tampere Rantaväylä) between Santalahti and Naistenlahti have been set by the planning project team together with Environmental Impact Assessment, general planning and road planning. They were derived from the objectives of Tampere City, Tampere city district and Pirkanmaa Regional Council and the road development objectives set by the national government.

Objectives

Traffic system objectives

- Promote equal travel opportunities in the city area. Access to Tampere city centre should remain at the current level at least, regardless of population increase in the city area.
- A clear traffic system which promotes easy travel and makes journey planning effortless.
- Direct the traffic bypassing Tampere away from the city centre street network as much as possible, with particular emphasis on public transport and light traffic.
- Reduce the probability of traffic accidents on Rantaväylä, with particular emphasis on reducing the risk of light traffic related accidents.
- Support public transport and light traffic operations and development opportunities and their appeal.
- Plan solutions which will not reduce the development opportunities of railway operations.

Land use objectives

- Create the conditions necessary to increase the use of land in the Tampere city area and enable the implementation of Ranta Tampella housing development for 3,600 inhabitants.
- Reduce the obstructions caused by Rantaväylä and improve pedestrian access from Tampere city centre to areas such as Onkiniemi, Särkänniemi and Lapinniemi.
- Improve connections between Tampere city centre and Näsijärvi coastal area.

Objectives for achieving a vibrant city centre

- Preserve Tampere city area as a competitive environment for living, working and commerce.
- Create a high quality, attractive and pleasant general environment and a main light traffic connection to the Näsijärvi costal area between Santalahti and Naistenlahti docklands.
- Ensure the status of Särkänniemi as one of Finland's key travel destinations and that its operating conditions and development opportunities are maintained.
- Support the preservation and development of Mustalahti dockland area's cultural history.

Environmental objectives

- Prevention and reduction of factors which lower the attractiveness of the area for living and visiting and pose a health risk, such as traffic noise and emissions.
- Enable the implementation of activities which increase the Näsijärvi coastal area's attractiveness and accessibility.
- Prevent harmful ground water effects.
- Be prepared to prevent risks related to unusual environmental conditions.
- Planning solutions that reduce greenhouse gas emissions.
- Preserve the cultural environment and natural heritage values of national importance.

Highway objectives

- Preserve Rantaväylä as a national, long-distance travel connection.
- Preserve the continuing good traffic capacity and development opportunities of this nationally important road joining the ring road (Hw 3, Hw 9) so that Rantaväylä is not congested even in peak hours.
- Develop Rantaväylä as a city route.

1.3 Objectives and operations

The owner partner of the Alliance sets the key objectives in the development phase, based on general objectives for the project, to be further refined to final key result areas for the implementation phase (later IP) *(Table 1.1)*

The objectives of the implementation phase are in line with the original objectives. The primary objective is to plan and build Rantatunneli according to the project plan and meet or exceed the set targets. The key result areas with indicators are presented in *Table 1.2.*

Meeting the key result areas requires the Alliance to adopt a working style which encourages innovation, cooperation, continuous improvement, efficiency and effectiveness. This will support all the Alliance partners to achieve the best and required end result.

Table 1.1. The key objectives set by the subscriber in the procurement phase.

Key objectives	Description
Cost effectiveness	The project is implemented cost effectively using innovative solutions and operational and work methods. The Alliance will produce value for money for the subscriber.
Schedule	The project is deployed successfully according to the schedule where the tender phase duration is optimised.
Environment	The environmental impact of the project's end product and construction phase is minor.
Quality	The quality of planning and construction is excellent.
Safety	The project is managed in an excellent fashion in terms of safety.
Traffic	Traffic during the construction must be as unhindered as possible and the tunnel must remain in constant use after opening.
Public image	The public image of the project must be positive.

Table 1.2. Key result areas and indicators of the Alliance in the implementation phase. The gainshare/painshare regime is described in detail in Chapter 6.

Key result area	Indicator
Schedule	The deployment of the tunnel in both directions takes place as planned according to the set schedules. Opening and deployment of other traffic systems takes place according the set schedules.
Safety	Accidents caused by the project are of minor magnitude and effect, e.g., absences from work due to accidents are few.
Usability	Traffic capacity and flow remain at an appropriate level.
Public image	The public image of the project improves and the acceptance of the project can be clearly ascertained.

2 ALLIANCE ORGANISATION IN THE IMPLEMENTATION PHASE

2.1 General

The Alliance parties are Tampere City, Finnish Transport Agency, Lemminkäinen Infra Oy, Saanio & Riekkola Oy ja A-Insinöörit Suunnittelu Oy. The composition of the Alliance organisation in the development phase will remain as close as possible in the implementation phase. This will ensure that the Alliance ethos, cooperation and best practices are applied in the implementation phase. The Alliance organisation will increase in number significantly along with the construction organisation.

A Project Manager is responsible for instructions and the composition of the organisation. Continuous investment is afforded to orientation and Alliance training because the organisation changes and grows as the project advances. The function of the organisation is described in the project plan Chapter 9, Alliance Management System.

2.2 Alliance Executive Team (AET)

The Executive Team is the highest decision maker of the Alliance and is responsible for Alliance management. The Executive Team members are: Pekka Petäjäniemi, Magnus Nygård, Risto Laaksonen, Milko Tietäväinen, Jaakko Kivi, Risto Kupila, Reijo Riekkola and Jarmo Kuivanen. In addition to voting members, the meetings will be attended by Juha Sammallahti (Pirkanmaa Centre for Economic Development, Transport and the Environment (ELY), Director of Traffic and infrastructure), the Project Manager and the Deputy Project Manager (right to speak and attendance authority).

The Executive Team minutes are distributed to the Executive Team members, the financial expert and the cost expert. The Project Manager will inform the project team and other Alliance organisations about decisions taken by the Executive Team on a need to know basis.

2.3 Alliance Project Manager

The Alliance Project Manager Esko Mulari is the chairman and a member of the project team. He is responsible to the Executive Team for the Alliance operations and for project implementation. The Project Manager's tasks have been defined in the Alliance Management System, and the most important ones are as follows:

- Take decisions about issues within his authority and manage the daily activities of the Alliance with the help of the project team
- Attend the Executive Team meetings, report on daily status, anticipate future performance and, request instructions and support as needed
- Carry out the Executive Team's instructions and act on their decisions
- Maintain the high performance level of the Alliance.

The Alliance Project Manager will work within authorities (financial and other) described in the Management System approved by the AET.

2.4 Alliance Project Team (APT)

The task of the project team is to manage and coordinate the daily activities of the Alliance. The project team is resourced with the necessary skills and expertise and is capable of quick and flexible decision making. The working method of the team is based on openness, mutual trust and respect. The project team has clear responsibilities and agreed deputy arrangements. The project is responsible for meeting the objectives and targets set to the Alliance.

The members of the project team are: Esko Mulari, Mauri Mäkiaho, Hannu Kivelä, Matti Kalliomäki, Esa Virtanen, Jari Humalajoki, Harri Vehola, Matti Heikkinen, Matti Aitomaa, Sami Järvelä, Merja Tyynismaa, Tapani Toivanen and Ari Lyytikäinen.

Everybody working in the Alliance will be informed of major decisions by the project team in a weekly newsletter. The project team members also carry the responsibility to inform their own technical discipline about the decisions.

2.5 Planning Steering Group (PSG)

The Planning Steering Group is responsible for directing the planning. The group includes the Project Manager and his deputy, design manager, the principal tunnel designer and the planning supervisors and construction heads of different technical disciplines. The task of the Steering Group include management of planning activities, integration of plans from different technical disciplines, integration of planning and construction and management of planning risks and quality assurance.

The Steering Group has a significant role in the beginning of the implementation phase to integrate the plans. As the project progresses and the plans are prepared, the importance of the role will reduce slowly.

The members of the Steering Group are: Esko Mulari, Mauri Mäkiaho, Hannu Kivelä, Matti Kalliomäki, Esa Virtanen, Jari Humalajoki, Harri Vehola, Matti Heikkinen, Jukka Levä, Kari Niemi, Paula Pohjanperä and Tapani Toivanen.

2.6 Communications Team (CT)

The task of the Communications Team is to direct, plan and coordinate the communications of the Alliance and its stakeholders so that the project communications objectives defined in the development phase are met as well as possible. The CT updates the communications plan devised in the DP phase as well as adding more detailed instructions (disturbances and other communications). The objectives of project communications and dialogue are:

- To offer key stakeholders (inhabitants, decision makers, authorities, housing associations etc.) sufficient and timely information about project, its progress and effects
- Improve the public image of the project so that Rantatunneli is a good example of an Alliance contract
- Support the progress of the project through communications
- Be prepared for communications regarding disturbances
- Gather and disseminate information regarding the environmental changes (effects on people and landscape) and involve people.

The members of the Communication Team are: Mauri Mäkiaho, Esko Mulari, Pekka Petäjäniemi, Inka Koskenvuo, Anna-Maria Maunu, Päivi Korpela and Merja Tyynismaa. The issues to be discussed in the Communications Team will be prepared, presented and actioned by Merja Tyynismaa. The Communication Team will meet ca. every 2 months or more frequently if required, as in the beginning of the IP phase.

2.7 Technical Disciplines

The division of work between the technical disciplines is the same as it was in the DP phase. The work content of technical disciplines is described in the table below. Planning, management and monitoring of construction work is done per technical discipline. The technical disciplines report to the project team according to Reporting in 9.15 (Chapter 9).

The Head of a Construction will manage the activities within a technical discipline. The head has a central role in the innovation of technical solutions, in cost comparison and construction feasibility analysis. He will also have the primary decision making power regarding the sequence of required plans. Additionally, he is responsible for schedule, quality and costs in his own technical discipline.

The task of the Design Supervisor is to coordinate and manage his consultants' and subcontractors' planning for his own technical discipline. The coordination and integration between technical disciplines will be done by the Planning Steering Group.

Technical experts work in their technical discipline. E.g., issues related to telematics, traffic control and the traffic centre means that the subscriber's experts in this field work under the Design Supervisor of this technical discipline.

The number of site managers and project engineers under Heads of Construction varies between technical disciplines. The size and exact structure of the construction organisation will be clearer at the end of the development phase based on technical solutions and the scope of subcontracts.

2.8 Site safety

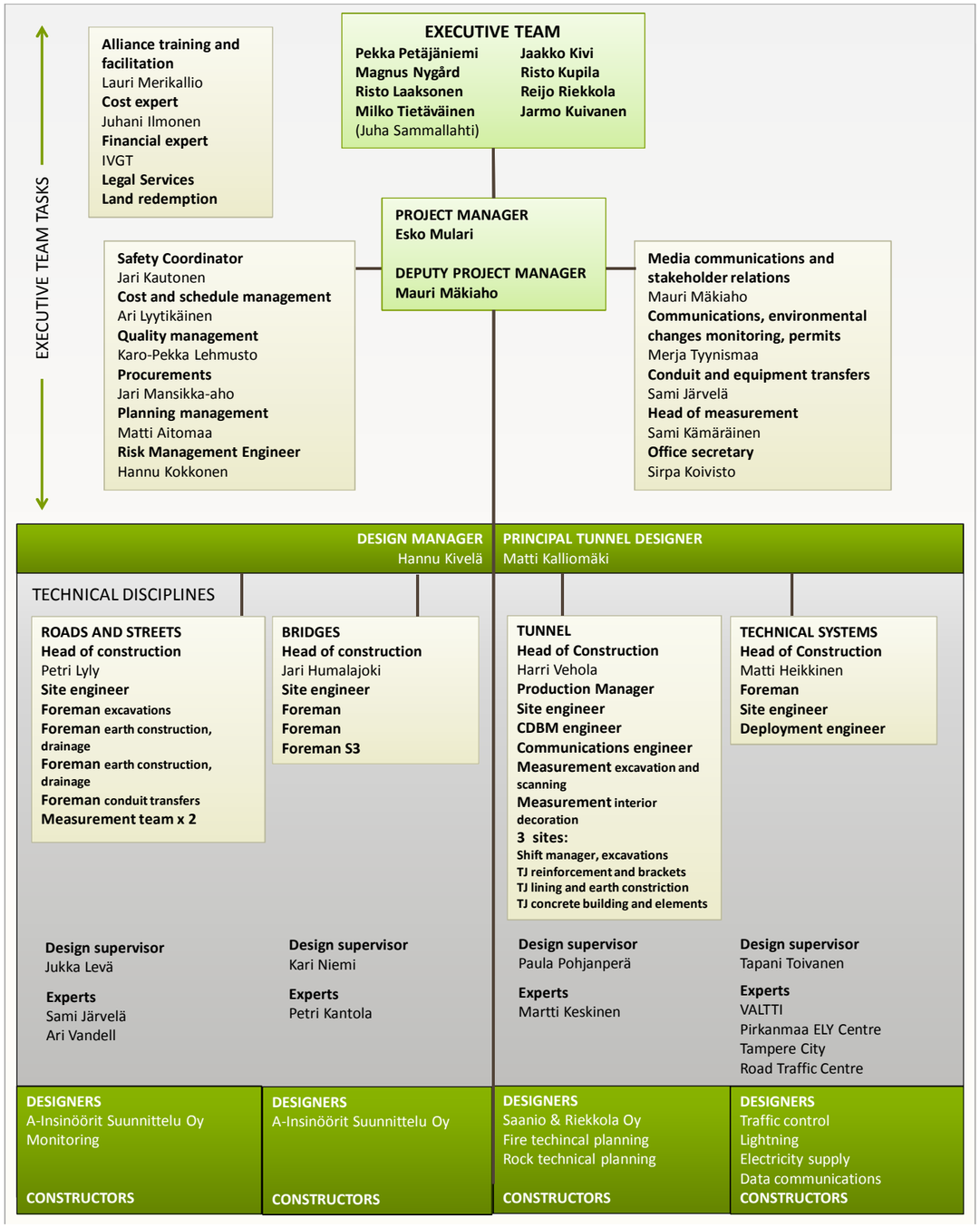
Jari Kautonen will function as the project's Safety Controller. He will make sure that the obligations set to the constructor are fulfilled. The Alliance will ensure that the Safety Controller undertakes these tasks.

Harri Vehola will be responsible for the Alliance's safety matters. Additionally, every employer working on the site has to appoint a capable and responsible person to supervise and control the work assigned.

Table 2.1. Technical disciplines according to the division in the table of contents

Construction design task		Technical discipline
R3-5	Road design	Roads ans streets
R7	Structures not belonging to the Traffic Authorities; streets and conduit transfers	Roads ans streets
R8	Drainage design	Roads ans streets
R9	Environmental design	Roads ans streets
R11	Lighting design	Technical systems
R12	Traffic control (variable and fixed traffic control)	Technical systems
R13	Geotechnical engineering	Roads ans streets + bridge + tunnel
R14	Measurement design	Roads ans streets
R15	Bridge design	Bridges
R16	Special structures	Bridges
R17	Tunnel design (excavation + other structures)	Tunnel
R18	Tunnel technical systems (HVACE)	Technical systems
R19	Electrical, data- and telecommunications and information and safety systems	Technical systems

2.9 Organisation Chart



Picture 2.1. Organisation Chart.

3 TECHNICAL SCOPE OF THE PROJECT

3.1 General

The project's purpose is to improve Highway 12 (Hw 12) between Santalahti and Naistenlahti, a stretch of 4.2 km, according to the road plans devised in 2011. The planning starts in the west on Paasikiventie at Santalahti marina and ends on Kekkosentie, west of Kalevan Puistotie slip road junctions. The highway stretch is in Tampere City and part of its internal traffic network.

Hw 12 is moved to a new alignment between Santalahti and Naistenlahti. The stretch of the road in the tunnel is about 2.3 km long. The Santalahti and Naistenlahti interchanges are in scope.

In addition to the road plan, the starting for the work includes the claims and statements given during the road planning, the presentation for road plan approval and the qualifications made to the initial construction plan.

3.2 Starting point of the design

The road plan was designed using Tampere City's own elevation and coordinate system. The construction plan will be prepared using GK24 coordinate and N2000 elevation systems.

Design speed
- The design speed for Hw 12 is 70 km/h and the speed limit is 60-70 km/h.
- The design speed for the streets and the speed limits vary between 30-60 km/h.

Interchange and area specific speed limits
- The design speed for the ramps for regional traffic in Santalahti interchanges is 35 km/h in accordance with the design speed planning instructions. For the ramps in Naistenlahti interchange, a design speed of below 35 km/h is allowed by exception.

Standard classes
- Hw 12 is designed as a highway, using the standard of residential main route. The highway's interchanges will be designed as land use interchanges.

Cross-section
- Hw 12 is a dual carriageway. The carriageways are separated from each other.

Mainline track reservations have been noted in the design. The planned stretch of Ratapihankatu in the Naistenlahti area is in the current track area which has been partly withdrawn from use. A track plan will be prepared for dismantling the track. The tram reservation which is being planned for the city area is noted in the planning.

3.3 Tunnel

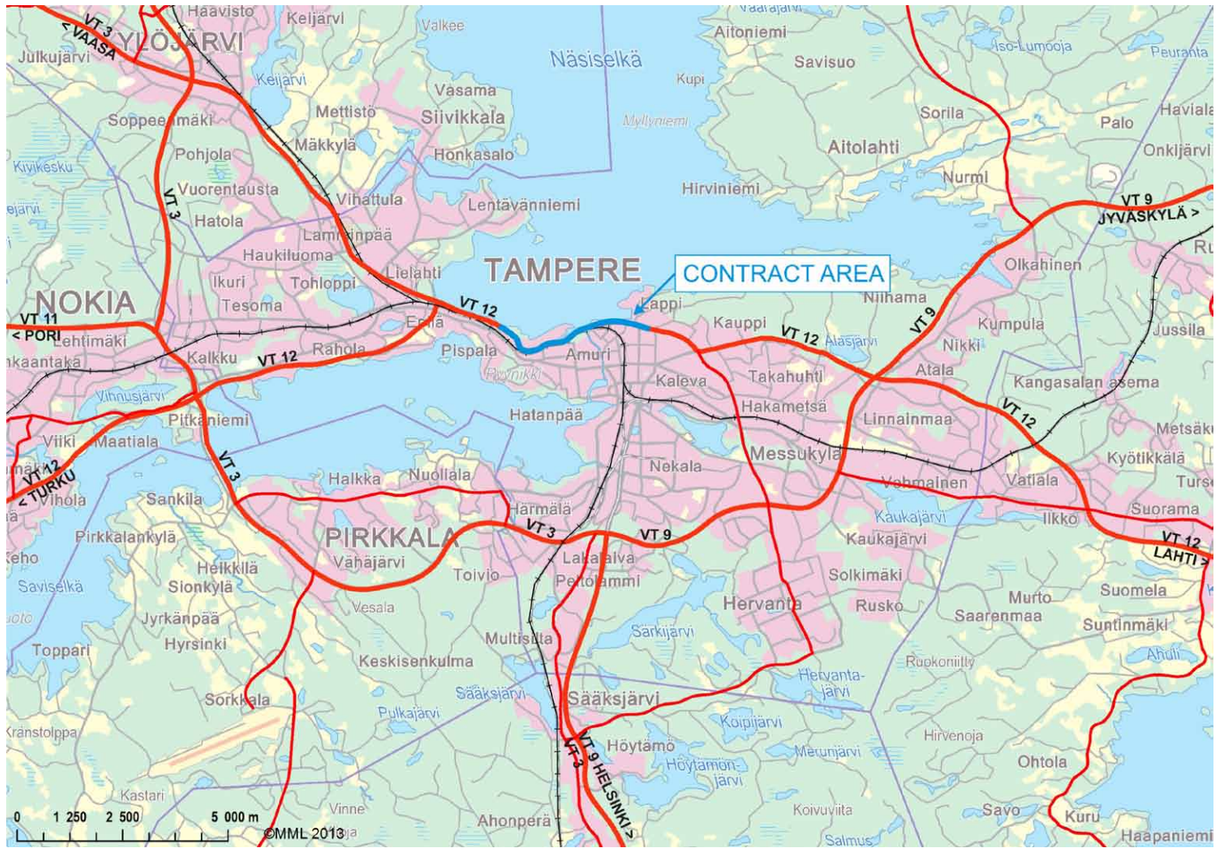
The total length of the Rantaväylä tunnel is 2,327 m, of which the rock tunnel is 2,230 m long and the rest is a concrete tunnel.

There will be two separate vehicle tunnels in each direction, spaced 11-12 m apart. Both tunnels will have two 3.5 meter wide lanes and a 3.25 m wide hard shoulder (safety lane) which is on the same level as the other lanes. The width of the inner shoulder is 1.75 m. This will be separated from the carriageway with an edge line. The free height of the tunnel is 5 m.

Gateways will be constructed between the separate tunnels every 150 m. The gateways are exits from one vehicle tunnel to the other and partitioned for fire and smoke. In addition to the gateways, there will also be a vehicle gateway in the tunnel, which will be located near its lowest point of ca. pole 2500.

The traffic in the vehicle tunnels is one way only and the speed limit will be 60 km/h. Heavy vehicles will not be allowed to overtake while in the tunnel. Pedestrians, cyclists and slow vehicles will not be allowed to use the tunnel, nor will transport of dangerous substances.

The tunnel tubes will have mechanical longitudinal ventilation. The air quality of the tunnel will be kept at an acceptable level with impulse fans which are controlled by continuous content measurement. These fans will also be used for smoke extraction in the event of a fire. The exhaust air is directed out through the tunnel entrances and through using exhaust air ducts.



Picture3.1. Project location.

3.4 Technical systems

Control of traffic and disturbances

There will be a fixed signage system on the highway as well as variable, lane specific signposts. There will be traffic lights on the Santalahti interchange ramp junction.

Rantatunneli will be equipped with a variable traffic control system. The road control centre will monitor the tunnel operation 24 h a day. The monitoring will be based on the tunnel's traffic control system and impulses and alarms from other technical systems. The traffic centre duty officer will intervene and take action using the user interface of the traffic control system when required.

The tunnel tubes will be equipped with an automated disturbance detection system and the exit areas of the tunnel will be equipped with a congestion identification system. These systems will identify a disturbance, its type and location, and raise an alarm. An alarm will activate appropriate traffic control responses automatically to reduce the danger, such as warnings and speed limit reduction or lane or tunnel tube closures if appropriate. The tunnels will be equipped with smoke detectors and an extinction system.

Lighting

Hw 12 and the connecting roads, streets and the tunnel section will be lit to the extent presented in the road plan. Exit road lighting will be installed in the tunnel's technical corridor. The ramp reservations of the Näsinkallio interchange will not have lighting.

3.5 Road technical solutions

Drainage

The water from the Santalahti area will be extracted through storm drains and the water from Naistenlahti area will be extracted to Näsijärvi through a new storm water network planned.

The vehicle tunnels have independent drainage systems which contain the following:

- A drainage subsurface draining system with sewers and pumping stations, extraction to the rain water system
- A closed loop collection system for washing, fire extinguishing and accident water which uses inflammable materials (concrete, steel or inflammable plastic). Collection by a tanker.

Ground water control

The planning target is not located in the groundwater catchment area. The whole area in question is within the water and sewage network. The water impermeability of the tunnel will be secured by injecting the rock to be sufficiently water proof. Water flow from the Lake Näsijärvi direction will be prevented during the construction work.

Noise abatement

Noise barriers will be used in areas requiring noise abatement.

Traffic arrangements during construction work

The Highway and those street sections which have 2+2 lanes will remain so during construction. Traffic arrangements and traffic lights during construction will be planned case by case. The most significant arrangements will be those for the Naistenlahti interchange area.

3.6 Conduit and equipment transfers prerequisite for the project

Conduit and equipment transfers are done in cooperation with the owners of the equipment. The most significant conduit and equipment transfers will be in the Santalahti and Naistenlahti interchange areas:

- Gasum Oy: pipe transfers of natural gas pipeline valve and scraper stations
- Tampereen Kaukolämpö Oy: district heating pipe transfers
- Tampereen Sähköverkko Oy: transfer of 110kV overhead line pylons, 110kV and 20kV earth cables and low voltage cables
- Tampereen Vesi: transfer of water pipes, sewage and storm water sewage systems and a waste water pumping station
- Cable transfers of telecommunications and telephone operators: Elisa Oy, TeliaSonera Finland Oy, TDC Oy, Tampereen Puhelin Oy, Tampere City, Hallintopalvelukeskus

Picture 3.2. Illustration of the tunnel cross-section at the gateway.

3.7 Roads, streets, bridges and other structures to be built

3.7.1 List of roads, streets, bridges and noise barriers

Table 3.1. List of routes.

Route	Administrative class./ functional class..	Pole interval / Length	Cross-section	NB!	Load class. / Street class.	Requirement class.
Hw 12						
	road / highway	0 – 1230 / 1230 m	2x 9/7	AADT west of Santalahti interchange	25,0 AB	R2
	road / highway	1230 – 3610 / 2380 m	2x12.5/9	Tunnel section	25,0 AB	R2
	road / highway	3610 – 4200 / 590 m	2x 9/7	AADT east of Naistenlahti Interchange	25,0 AB	R2
E1 Santalahti interchange						
R1	road	340 – 593 / 253 m	8/7	10,0 AB	R2	R2
R2	road	5 – 140 / 140 m	6.5/4.5	0,8 AB	R2	R2
R3	road	128 – 305 / 177 m	6.5/4.5	0,8 AB	R2	R2
R4	road	300 – 555 / 255 m	10/7	10,0 AB	R2	R2
E2 Naistenlahti interchange						
R1	road		5.5/4.0	6,0 AB	R2	R2
R2	road		5.5/4.0	6,0 AB	R2	R2
R3	road		5.5/4.0	6,0 AB	R2	R2
R4	road		5.5/4.0	6,0 AB	R2	R2
Streets						
K1	street	0 – 245 / 245 m	7.5/6.5	Rantatie	3	R2
K2	street	555 – 1057 / 502 m	2x8/7	Paasikivenkatu	2	R2
K3	street	15 – 578 / 563 m	6.5/6	Sahansaarenkatu	4	R2
K4	street	7 – 413 / 406 m	6.5/6	Haarlankatu	3	R2
K5	street	0 -135 / 135 m	6.5/6	Onkiniemenkatu	5	R2
K6	street	525 – 867 / 342 m	7.0	Ratapihankatu	3	R2
K6	street	905 – 1014 / 109 m roundabouts x 2	8.0	Ratapihankatu, section between the roundabouts	3	R2
K7	street	17 – 290 / 273 m	7.0	Kekkosenkatu	3	R2
K8	street	17 – 144 / 127 m	5.0	”Voimalaitoskatu”	4	R2
K9	street	3 – 24 / 21 m	7.0	”Pursikatu”	5	R2
K10	Street		8.0	Rauhaniementie	3	R2
K11	Street	4 – 90/90 m	7.0	Parantolankatu	3	R2
K12	Street	4 – 30 / 26 m	7.0	Tunturikatu	4	R2
K13	Street	40 – 290 / 250 m	7.0	Soukanlahdenkatu	4	R2
K14	Street	0 – 58 / 58 m	7.0	Ainonkatu	4	
KIJ	Pedestrians & cyclists	7 – 194 / 187 m	3.5/3.0	Simppoo		
K2J	Pedestrians & cyclists	0 – 503 / 503 m	3.5/3.0	Alongside K1, K2		
K4J	Pedestrians & cyclists	0 – 413 / 413 m	4.5/5.0	Alongside K1, K2		
K5J	Pedestrians & cyclists	2 – 68 / 66	3.5/3.0	Haarla area		
K6J	Pedestrians & cyclists	2 – 23 / 21 m	3.5/3.0	Onkiniemi		
K7J	Pedestrians & cyclists	8 – 18 / 10 m	3.5/3.0	To the port		
K8J	Pedestrians & cyclists	2 – 160 / 158 m	3.5/3.0	Along J5, K10		
K9J	Pedestrians & cyclists	20 – 110 / 90 m	3.5/3.0	Marjatta overpass		
K10J	Pedestrians & cyclists	2 – 130 / 128 m	3.5/3.0	Partly along K13		
K11J	Pedestrians & cyclists	0 – 160 / 160 m	3.5/3.0	Along K7		
The light traffic routes belonging to highway 12						
J5	Pedestrians & cyclists	178 – 680 / 502 m	4.0	Pavement		

Table 3.2. List of bridges

Bridge identifier and name	Location	Type	Effective width	Underbridge clearance
Highway 12				
S1 Paasikiventie flyover	K2 / Hw12	Concrete continuous span girder bridge	19,42-22,49	4,80
S2 Rantatie flyover	K1 / E1R1	Reinforced concrete slab frame bridge	14,25-19,10	4,80
S3 Onkiniemi concrete tunnel and trough	K4 / Hw12	Reinforced concrete trough / reinforced concrete tunnel	83,2 / 94,2	5,00
S4 Näsinkallio flyover	Junction res. / Hw12	Reinforced slab bridge	10,5	5,50
S5 Armonkallio flyover	K6 / Hw12	Two separate reinforced concrete slabs	8,0	4,80
S6 Rauhaniementie flyover	K10 / Hw12 ja J5	Continuous concrete span girder bridge	11,5	≥4,80 (Vt12), ≥3,20 (J5)
S7 Marjatta overpass	K9J / Hw12, J5 and K11	Continuous concrete span girder bridge	4,0	≥4,80 (Vt12, K11), ≥3,20 (J5)
S8 Eastern fan hall bridge	K6	Steel tubular bridge	3 x 2,5	
S9 Naistenlahti trough	E2R4 pl 70 – Hw12 pl 3260	Reinforced concrete trough		
S12 Santalahti overpass (separate)	Hw12 pl 385	Steel tube framework	4,0	> 5 m
The identifier and the name of the bridge to be dismantled	Location (over/ under)	Type	Year of manif.	Cover footage [m2]
H-1853 Santalahti subway	Hw 12 / light traffic	Reinforced slab bridge	1982	103,41
418461 Naistenlahti northern overpass	Hw 12 / street, railway	Reinforced slab bridge	1977	1972,00
418462 Naistenlahti southern overpass	Hw 12 / street, railway	Reinforced slab bridge	1997	ca. 1890
H-1845 Rauhaniemi flyover	street / Hw 12	Reinforced slab bridge	1978	935,57
H-1937 Marjatta overpass	Light traffic / Hw 12	Concrete continuous span girder bridge	1990	315,73

Table 3.3. List of noise barriers

Identifier	Action	Location	Left/right	Length	Height above road surface
Highway 12					
Me1	Noise barrier (bank)	380-710	left	330 m	4,0m
Me4	Noise barrier (wall)	950-1070	left	120 m	3,5m
Me5	Noise barrier (wall)	1052-1240	left	188 m	carport + 2,1m
Me6	Noise barrier (wall)	1240-1250	left	10 m	5,1m
Me7	Noise barrier (wall)	1250-1300	left	50 m	carport + 2,1m
Me10	Noise barrier (wall)	3792-3836	right	44 m	13,0-15,0m
Me11	Noise barrier (bank + wall)	3836-3990	right	154 m	7,0-14,0m
E1 R4					
Me2	Noise barrier (balustrade)	705-865	left	160 m	ramp E1R4 +1,2 m elevation
K2 Paasikivenkatu					
Me3	Noise barrier (balustrade)	890-980	right	90 m	Paasikivenkatu + 1,2 m elevation
K10 Rauhaniementie					
Me9	Noise barrier (wall)	3750-3792	right	42 m	Rauhaniementie + 3,0 m elevation
K13 Soukanlahdenkatu					
Me8	Noise barrier (wall)	3600	right		Soukanlahdenkatu + 2,5 m elevation

3.7.2 Näsinkallio interchange reservation

Ramp reservations and the flyover from the Näsinkallio interchange will be implemented so that the necessary extensions related to the deployment of the interchange can be built without any tunnel traffic stoppages. The rock spaces of the interchange will be excavated and reinforced. A work tunnel will be built from the pole 2500 of the northern tunnel to the site of the eastern Nääshalli entrance. The work tunnel will also function as a maintenance tunnel.

The potential extension of the Näsinkallio interchange according to the needs of the city centre development plans has been taken into account. The construction of the interchange as a rhombic juncture is also possible in terms of the current implementation of the ramp arrangements and technical systems.

3.7.3 Retaining walls

Retaining walls will be implemented in the interchanges of Santalahti and Naistenlahti. The targets have been specified below. The retaining walls will be designed in more detail in connection with the construction planning.

In the Santalahti interchange:

- Hw12 pole interval of 1070–1230 (left), h = 1,0–4,0 m
- E1R2 pole interval of 20–115 (left), h = 1,0–3,0 m
- K4 pole interval of 300-340 (right), h = 1,0-2,0 m

In the Naistenlahti interchange:

- E2R4 pole interval of 170-210 (right), h = 1,0-3,0 m
- J5 pole interval of 240-400 (right/left), h = 2,0-4,0 m, partly founded on the embankment slabs
- K8J pole interval of 2-68 (left), h = 3,0

3.7.4 Technical facilities and equipment

The technical facilities of the tunnel and the control room will be built in Santalahti by Onkiniemenkatu on top of the concrete tunnel. The reserve power unit of the electric system will be placed in the technical facilities There is a stair connection from the technical facilities to the ventilation fan hall situated in the middle lane of the concrete tunnel.

The tunnel's ventilation and smoke extraction system includes the fans in the tunnel, separate exhaust air fans and related exhaust channels and pipes, and Näsinkallio air extraction grille. The ventilation machine rooms are under ground.

The facilities required by the tunnel's technical systems are situated in the connecting corridors. The electrical transformer substations are also in the same location.

The equipment and data transfer connections for traffic control and other technical systems will be implemented according to the scope of the tunnel and its adjacent roads.

Picture 3.3. The three buildings in the middle of the picture in Onkiniemi will be pulled down due to traffic arrangements. Source: Rantatunneli Alliance

3.7.5 Structures to be pulled down

Due to road arrangements, three buildings will be pulled down in addition to the previously mentioned bridges in the Onkiniemi. A current, disused section of track will be dismantled in the Naistenlahti area.

3.7.6 Plan updates

The road plan solutions have been further defined as the ground and rock surveys and other initial data has been qualified. The qualifications focused on tunnel levelling, tunnel cross-section and the tunnel's technical systems.

Routes

- Lowering of the road levelling pole interval of 900-2700. This change meant that the tunnel was in a much better quality rock environment. Due to the levelling, the longitudinal gradient has changed from 3,0 % to 3,5 %.
- A separating barrier was removed from ramp R1 exit lane in the Naistenlahti interchange. This narrowed the tunnel cross-section by ca. 2 m.
- The renewal of K11 Parantolankatu surfacing due to the transfers of pipelines and excavation works between poles 90 – 220 / 130 m
- K2j alignment was changed due to the transfer of a natural gas pumping station, KJ2 was connected to the light traffic network at the same time and the length increased to 503 – 562 / 59 m
- K10J alignment was changed to achieve better control of pedestrian crossings and light traffic, the new measurement are 11 – 50 / 39 m (old measurement was 2 – 130 / 128 m
- Separate target : Continuation of K3 Sahansaarenkatu to the marina, poles 563 – 810 / 247 m

Bridges

- S8 fan hall bridge, changed to a lighter tubular bridge
- S9 Naistenlahti trough has been lengthened.

Tunnel

- The tunnel cross-section has been changed by narrowing the width of the hard shoulder from 3.75 m to 3.25 m
- A technical corridor has been added to the southern tunnel tube for cables and the southern tunnel alignment has been moved 1 m to the south at the same time
- The relative distance of the gateways has been reduced to 150 meters and the number of gateways has increased by 2 to 15. The vehicle gateway has been moved to pole 2500.
- No kerbstones will be used on the exit ramp edge in the tunnel cross-section.

Technical systems

- A principle change in electricity supply: the other electricity connection has been omitted and an auxiliary power unit has been added in stead
- Data communications connection from Rantatunneli to the new premises of the Traffic Centre (lacking from the road plan's cost estimates)
- The user interface to the Traffic Control system will only be installed in Tampere road traffic centre (local control station as reserve)

3.8 Simultaneous arrangements with the project

3.8.1 Santalahti light traffic bridge and bus stops

Based on the new Santalahti city plan, Tampere City will implement an overpass at pole 285 as an independent project. The overpass will be attached to the highway's northern noise barriers.

3.8.2 Traffic control changes on Paasikiventie

The traffic volume on Paasikiventie will change substantially as the bypassing traffic moves to the tunnel. The programming and design of Paasikiventie's current traffic light interchanges on Sepänkatu, Sahanteränkatu, Laiturikatu and Näsijärvenkatu will be changed. The alterations will be implemented according to separately drawn up street plans. These tasks and other potential traffic control expansion requirements outside the planning area are out of scope of the Alliance.

3.8.3 Changes in lighting on Paasikiventie between Santalahti and Mustalahti

The current Paasikiventie will be changed from a highway to a street. The responsibility for lighting on Paasikivenkatu will be transferred to the city. The technical lighting solution will be changed as the street is improved. The administrational boundaries and cost responsibilities have been defined in the road plan.

3.9 Uncertainties related to the soil and bedrock

Further research done in the development phase has given a lot of new information especially on the contaminated soil in the Santalahti area. However, the size of the contaminated area, mass quantities, degree of contamination and the degree of purification required is still not completely known. The final size of the area and the quantities involved will first become clear with the excavation work.

Based on the surveys and research undertaken in the area, and empirical data, it is likely that there is montmorillonite in the bedrock. The exact quantity of this cannot be predetermined by drilling or other ground level activities. The cost effect of this is 2 M€ in the target outcome cost.

According to the analysis done, the content of arsenic in the rock is within accepted parameters. If this is exceeded this may limit the use of rock waste.

The condition of the track embankment at Mustalahti requires monitoring during the construction.

3.10 Data communications network

Tampere Traffic Centre is going to move to new premises during the spring and the planning of the transfer links is not yet completed. Tampere City's current network connections will be used in establishing the connection.

3.11 Conduit transfers

The project costs related to transfer of conduits have been determined. These do not include:

- Changes of pipe sizes due to the larger design of the network
- Improving standards
- Transfers of equipment and conduits outside the project area.
- Renewal of old conduits.

3.12 Dumping areas

Water permit applications are pending on the use of the reserved dumping areas of Santalahti and Ranta-Tampella. The dumping will conform to the decisions and permit conditions issued by the permit authorities.

3.13 Care and maintenance

The care and maintenance costs for the tunnel, technical systems and routes will transfer to the road and street authorities when the tunnel is taken into use.

Picture 3.4. Santalahdenpuisto, shown in the picture, will be expanded as a result of the watercourse fill-in. Source Rantatunneli Alliance

Picture 3.5 A new park area will be created by the breakwater as a result of Ranta-Tampella watercourse fill-in. Source: Rantatunneli Alliance

4 TARGET OUTCOME COST

4.1 General

In addition to road planning materials, the target outcome cost is based on complementing ground and bedrock studies, rock surface model, methods and working times presented in the application according to the Water Act (LSSAVI/100/0409/2011) and noise notification (2013-56-IPM), and the planning materials for target outcome cost saved in the project bank. The project scope is described in Chapter 3.

The project has been costed on a resource basis using Lemminkäinen's Hakku software and INFRA-RYL nomenclature. The costing is based on received subcontractor bids, the contractor's own buying-in prices and required quantities, and drafted implementation plans and schedules (Chapter 8). The target outcome cost is calculated at 5/2013 price level and is based on the assumption that the Alliance contract for the implementation phase will be signed by 1.10.2013 and that the project can be started immediately afterwards.

The structure of the target outcome costs follows the main group divisions by technical discipline: routes, bridges, the tunnel, technical systems and project activities. The transfer of conduits and arrangements for general traffic has been costed under the route main heading.

The project costs have been further divided into site operating costs and joint costs, planning costs and construction and owner activities. The costing is based on the drawn up implementation schedule, the design programme and the resource plans drafted accordingly.

The pricing of the risks and opportunities is based on the risk/opportunity matrix drawn up along the planning work and pricing.

Ideas and innovations have been included according to the *Table 5.2A* in the Appendix.

The target outcome cost is tied to the land construction industry's M, S and K indices published in May 2013 by Statistics Finland and the construction industry labour cost index. The target outcome cost breakdown is presented in *Table 4.1*.

APPENDIX 4.1A List of drawings, initial construction plans of the development phase (28.6.2013)

Picture 4.1. Drilling to determine the rock surface in January 2013. Source: Rantatunneli Alliance

4.2 Clarifications and costing principles by technical disciplines

4.2.1 Routes

Quantity surveying has been done per routes and layer structures have been calculated according to the inspected superstructure tables. Performance quantities per routes have been recorded in the project bank. The cost estimate on landscaping is based on the road environment plans from the road planning phase.

In terms of contaminated soil, the cost estimate is based on the general plan devised on soil remediation.

The earth and rock materials originating from the Rantatunneli project will be used firstly to serve the project needs and secondly, in Ranta-Tampella and Santalahti water system dumping areas. The waste earth or rock materials not used for the project needs or the above mentioned water system fill, will be transported to the location given by Tampere City. In this case, Tampere City will be responsible for the transport costs exceeding 2 km (upload charge), measured from the tunnel entrance (pl 1400, pl 2500 and pl 3600) and for potential receipt costs etc. (Alliance Executive Team meeting 25.4.2013). This applies to all earth and rock masses related to the project.

Three AB layers required for loadbearing capacity will be implemented on the Highway. The topmost surface layer will be built after 5-7 years in accordance with the phased construction.

The target outcome cost does not include the dredging sheets for Ranta-Tampella water system filling or the reception of earth and rock masses for the fill-in nor any other related tasks. The target outcome cost does include the delivery of filling material which is dislodged by the project to the designated target area.

The city or a party assigned by the city will be responsible for other costs related to embankment work (Alliance Executive Team meeting 25.4.2013). Santalahti water system filling is included in the target outcome cost apart from green and technical municipal structures.

30% of the purchase value for the sheet pile and steel girder materials for support during the construction has been amortized, 70% will remain as stock value.

4.2.2 Conduit transfers

Transferring district heating has been costed based on the plans devised in the development phase; the earth work on resource/performance basis and piping work according to the average unit prices of implemented targets received from Tampereen Kaukolämpö Oy. Age allowances of 750,000 € have

been included in the target outcome cost according to the contract between Tampere City and Tampereen Kaukolämpö Oy.

The cost of transferring the natural gas pipes for Santalahti are based on the alignments made in the development phase and the mass quantities calculated on that basis. The land construction work has been costed by the Alliance and the piping work by the cost estimate provided by Neste Jacobs. The planning costs are included in the Neste Jacobs cost estimate.

Moving the natural gas pipe in Naistenlahti is part of the transfer of a gas pipe related to Ranta-Tampella implementation, which Tampere City has decided to implement between Santalahti and Naistenlahti according to the water system alternative. Gasum/Neste Jacobs Oy is responsible for the cost estimate in this respect and 20% of the cost has been included in the Rantatunneli target outcome cost. Cost-sharing (20 % Alliance, 80 % Tampere City) is agreed in an internal meeting of the city on 13.6.2013.

4.2.3 Bridges and special structures

The costs of the trough structure in the Naistenlahti interchange (E2) are based on the permanent reduction of groundwater level at that point. The surface structures of bridge S4 are not included in the target outcome cost as ventilating chambers will be built on top of the bridge and it will not be used for vehicle traffic.

Some clarifications have been made to the road plan's solutions:

- The bridge S5 type has been changed from two frame bridges to one post-tensioned slab bridge
- The bridge S8 (eastern fan hall earth bridge) has been changed to a tubular bridge. The fans will be placed inside the rock.

4.2.4 The tunnel

The waterproofing of the tunnel is according to the content of the water permit application and the working time restrictions as per the noise notification will be observed.

The ramp tunnels of the Näsinkallio interchange have been costed so that the ramp tunnels presented in the road plan are included to the extent presented in the development phase plans.

The cladding structure has been calculated all through the tunnel. The roof section is insulated with 100 mm PE insulation from the eastern end to the first fire stop and 50 mm elsewhere. The backing of the heat insulation is heated by circulated air conducted from the transformers.

The excavation of the middle part will be speeded up by excavating a work tunnel from the eastern Nääshalli vehicle tunnel.

Anfo will be used as explosive, apart from the entrances and areas which have stringent requirements for cleavages.

APPENDIX 4.2A Extracts from the construction plan drawings of the DP phase

Table 4.1. Cost specification of the project.

Main target	Title	Total
	1 ROUTES	**36 226 054**
	Existing structures and building blocks	
	Contaminated soil	
	Foundation structures	
	Base structures	
	Rock sealing and reinforcement structures	
	Earth cuts and excavation	
	Open cuts	
	Embankments, weirs and fillings	
	Components of surface structure	
	Edge supports, gutters, steps and walls	
	Vegetation structures	
	Water supply systems	
	Safety and guidance systems	
	Electrical, telecommunications and mechanical systems	
	Environmental structures	
	CONDUIT TRANSFERS	
	110 kV overhead cable, Santalahti	
	Electrical cables	
	District heating	
	Natural gas	
	Water pipes	
	Telecommunications cables	
	TRAFFIC ARRANGEMENTS DURING CONSTRUCTION	
	Santalahti	
	Naistenlahti	
	Rauhaniementie connection replacement	
	2 BRIDGES	**23 663 965**
	Onkiniemi trough	
	Onkiniemi concrete tunnel and S3	
	Naistenlahti trough (S9)	
	S1 Paasikivenkatu jb	
	S2 Rantatie jb	
	S4 Näsinkallio jb	
	S5 Armonkallio jb	
	S6 Rauhaniemi rs (old land supports)	
	S7 Marjatta overpass	
	S8 Eastern fan hall land bridge	
	Concrete retaining walls	
	Noise barriers	
	Santalahti technical area and control room building	
	Näsinkallio grid building	
	3 THE TUNNEL	**79 188 220**
	Reinforcement and compaction work of the tunnel entrances	
	Tunnel excavations	
	Channels and hollows in the tunnel	
	Injections	
	Boltings	
	Shotcreting	
	Collision barrier structure	
	Lining structure	
	Technical construction work	
	HVAC auxiliary works (pipe work etc.)	
	4 TECHNICAL SYSTEMS	**27 830 564**
	Electricity supply	
	Lighting	
	Electricity and data communications systems	
	Telecommunications and safety systems	
	HVAC systems	
	Traffic management and control systems	
	Automated fire extinguishing system	
	PLANNING COSTS (inc. Ground and rock research and environmental monitoring)	**13 182 803**
	WARRANTY WORK RESERVE	**360 000**
	RISKS	**3 647 500**
	OPPORTUNITIES	**-3 800 000**
	TARGET COST	**180 299 106**

5 RISKS AND OPPORTUNITIES

5.1 Risks

5.1.1 Starting points and principles of risk management

Starting points

During the Alliance's development phase, the Alliance parties determined the cost and key result areas for the project together. Risks and opportunities will be distributed amongst all Alliance parties in accordance with the Alliance contract (set out in further detail in section *5.1.4 Bases of risk distribution and the pricing of risks in the target outcome cost).*

Principles

The Alliance will not take risks related to either personal, traffic or tunnel safety per se, but will instead use risk management to reduce or avoid these. The project risks include all factors which could jeopardise the implementation according to the key result areas. Risk management will be a systematic and continuous activity which will help to

- identify project risks
- assess their impact with regard to the successful completion of the project
- effectively manage risks.

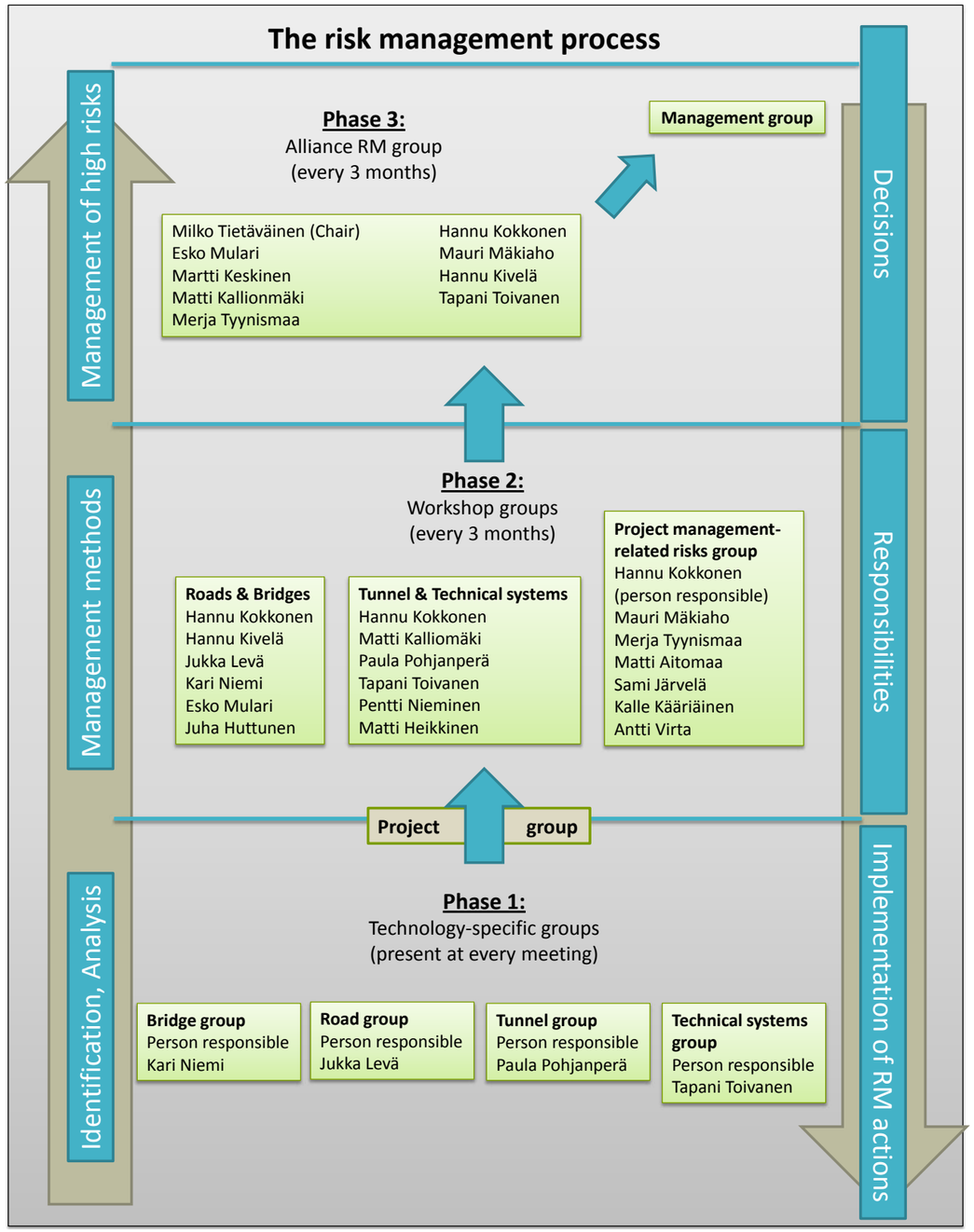
Risks can be related to a sector of any activity, to internal project matters or to external factors. The road plan risk assessment will be used as the initial information for risk management. Central risk management areas include:Riskinsietokyvyn määrittäminen

- Definition of risk tolerance
- Risk assessment: identification of risks and probability of occurrence; evaluation of risk impact
- Preparing for risks: planning, execution and monitoring of management methods
- Distribution of risk management information
- Training of the entire project organisation and promotion of risk management

5.1.2 The risk management process during the development phase

The risk management policy drawn up by the Alliance describes the risk management principles and the risk management process for the development phase.The development phase risk management was carried out in accordance with the policy.The main phases of the risk management process are set out in *Picture 5.1*.

The road plan risk assessment was updated at the start of the development phase risk management process to correspond to the situation at that time. The risks that were recognised during the road plan phase were distributed and categorised by technical discipline.



Picture 5.1. The risk management process during the development phase

Identification and analysis

During the first phase of the risk management process, the technical discipline groups dealt with the risks recognised in the road plan which affected their own discipline of technology. After this, the technical discipline groups mapped new risks concerning their own discipline of technology.

The severity of identified risks was evaluated based on the probability of the risk occurring and on its impact.

Management methods and assignment of responsibility

During the second phase, management methods and persons responsible were assigned to risks. In addition, the severity of risks was also re-assessed from the perspectives of several disciplines of technology.

Dealing with risks

During the third phase, the technical discipline groups determined the direct cost impact the occurrence of a risk would entail. These were later further clarified into minimum and maximum effects on cost.

The most significant risks were dealt with both by the Alliance project team and the risk management specialist group, which monitored and guided the risk management process.

Classification of risks

In the risk management process for Rantatunneli, risks were grouped according to which specialist group and project phase (DP, IP) the risks were recognised and risk management methods were planned and executed:

- Risks by discipline of technology (roads, bridges, tunnel and technical systems)
- Project management risks: a) Administrative risks b) Production-related risks

Separate workshops were organised for dealing with administrative risks and risks relating to various disciplines of technology.

In addition to what is mentioned above, risks were also distributed according to

- what the primary impact of the risk would focus on, should the risk occur: costs, schedule, the environment, quality, safety, traffic or public image.
- Whether the Alliance can manage the risks and whether they have an impact on cost.

5.1.3 Bases for distribution of risks and costing of risks in the target outcome cost

Risk distribution

The main principle is that the Alliance is responsible for technical risks. With regard to certain risks, the risk is borne partially by the Alliance and partially by the client. The primary basis for distribution is whether the Alliance or an individual part thereof has the opportunity to manage the risk.

Risk pricing

Principles for costing risks:

- Changes in circumstances are dealt with as risks.
- Planning was carried out following requirements set in accordance with current, valid regulations, whereby any possible changes to guidelines during the implementation phase are to be dealt with as changes to scope, not risks.
- Planning was carried out following conditions set out in permit applications.
- Concerning pending permit applications, the tightening of conditions for permit decisions will be dealt with as risks to be borne by the client.
- Work costs will be priced as non-risk according to the 5/2012 price level.
- Risks related to an increase in costs will be dealt with as provisions for an increase in costs.
- Life-cycle risks will not be priced in the target outcome cost.
- Protection against excavation damages is to be obtained through insurance.

Opportunities will not be examined in connection with the effects of risks on cost, but will instead be dealt with in the Ideas and innovations process.

Individual risks will be costed in the target outcome cost using the formula:

*Risk provision = probability (%) * direct cost impact, should the risk occur.*

Examples of risk distribution

An example of a risk carried by the Alliance and its costing in the target outcome cost:

Bridge group risk No. 11. The quality and/or location of the rock deviates from what was planned at the site where the concrete tunnel and rock tunnel meet. There is an increase in concrete and reinforcement structures.

Estimated impact on cost: EUR 250,000
Estimated probability: e.g., 50%
Costing of risk on target outcome cost:
*50% * EUR 250,000 = EUR 125,000*

An example of a risk carried by the client:

Technical systems risk No. 11. Technical systems become outdated due to a change in authority regulations.

Technical systems are planned to adhere to current requirements and directives. Technical systems are costed on the target outcome cost using the solutions set out in completed plans. Should the systems have to be changed during the implementation phase due to a change in authority regulations of which there was no knowledge during the development phase, the client is liable for any costs which arise as a result.

An example of a distributed risk:

Route group risk No. 1 Contaminated soil

The target outcome cost includes a calculation of the amount of contaminated soil materials arising from the excavation required for construction and which needs to be processed, in accordance with the qualitative and quantitative scope set out in advance investigations. The excavation necessary for construction is to be carried out to the extent required for structures and the principle is that any potential contaminated soil materials occurring underneath and outside of the shear surface can, using the risk reassessment process, be left in place in such a way that the chain of exposure is broken. With regard to contaminated soil masses outside the road project excavation area, the risk reassessment is based on the area's use, the properties of hazardous substances and how easily they might spread (Pilaantuneen maa-alueen kunnostuksen yleissuunnitelmaluonnos, 3.6.2013, Draft of a general plan for renovation of contaminated soil)

The unit costs of contaminated soil are calculated using the quoted transportation prices and collection fees. A qualitative increase in the amount of contaminated soil, or a deterioration in quality during the excavation required for construction, will be dealt with as risks.

A separate calculation has been drawn up for the costs and risk distribution pertaining to contaminated soil, and is based on the general plan for the renovation of contaminated soil areas, a mass calculation carried out in accordance with the renovation plan and the risk evaluation drawn up by the designer for the renovation plan. The risk distribution for the share of contaminated soil exceeding the target value has been agreed as follows:

- *Lightly contaminated soil materials: Alliance 25% / Client 75%*
- *Heavily contaminated soil materials: Alliance 10% / Client 90%*

5.1.4 Risk management during the implementation phase

Principles and use of risk management plan

The Alliance's risk management plan includes all recognised risks and their associated management procedures. The risk management plan is saved in the project bank and is distributed according to the same principle as in the development phase.

The risk management plan deals with each identified risk by defining the following for each risk:

- An identifier
- A description
- The type of risk
- Severity (effect * probability)
- Direct impact on cost (min and max)
- Management procedure
- Person in charge

Central risk management principles:
- Newly identified risks are to be entered into the table immediately. A brief description, identifier and person who identified the risk are to be recorded for an identified risk.
- The risk will be assigned an identifier.
- Identified risks are not to be removed from the table, nor may their identifiers be changed. Former risks will be crossed out.
- The individual assigned as responsible for a risk is responsible for ensuring that the management procedures determined for a risk are carried out according to the set schedule.

Responsibility

Executive team
- makes decisions on risk distribution
- determines risk tolerance
- makes decisions on management procedures for the most significant risks.

Project team
- recognises and analyses project management-related risks
- is responsible for determining risk management methods and for assigning responsibility
- is responsible for procedures after risks occur
- monitors the execution of risk management work
- is responsible for practical risk management procedures.

Technical discipline groups
- recognise and analyse risks
- determine the effects that risk management procedures have on costs
- deploy risk management procedures.

Project Manager
- makes decisions on risk management procedures and the allocation of resources (people, procedures, costs)
- is responsible for reporting on risk management to the Alliance management group.

Risk management engineer
- is responsible for the maintenance of the risk management plan
- prepares the processing of acute risks in the project team
- monitors and reports on executed management procedures
- monitors the status of project management-related risks and prepares their processing in the project team
- is responsible for reporting to the Alliance's Project Manager and to the risk management specialist group.

Risk management expert group
- deals with the Alliance's risk status once per quarter, focusing on the central risks and associated management procedures in the upcoming quarter
- monitors the status of risk provisions.

Site supervisor
- is responsible for issuing instructions to employees and subcontractors
- plans and initiates site risk management procedures
- analyses contract risks
- is responsible for implementing the risk procedures after a risk occurs

Employees
- are responsible for adhering to given rules and notify supervision of any identified risks.

5.2 Opportunities

5.2.1 Processing opportunities

The Alliance has created a process to sieve through ideas and innovations. Ideas eligible for development will be collected, investigated and processed within the Alliance. Approved ideas are included in the project implementation plans and taken into account in the target outcome cost.

Towards the end of the DP phase, some ideas will be incomplete or even still not assessed. Some of them will be opportunities which may have the potential to generate savings.

The Alliance has decided to deal with opportunities highlighted by the risk management process, or "positive risks", separately from risks. They are dealt with the target pricing together with opportunities which have been taken into account.

5.2.2 The process during the development phase (Ideas and innovations)

During the DP phase, the Alliance encouraged the parties involved to propose ideas which could be developed into significant innovations. Written instructions on procedures were drawn up for dealing with ideas and innovations. The threshold for proposing ideas was lowered by e.g., "allowing" ideas to be expressed orally.

Ideas have cropped up both as individual inventions and as results of technical discipline group meetings and workshops. Working together has been particularly fruitful; workshops have produced good planning solutions and good ideas have emerged either immediately or shortly after a workshop. Often an idea has more than just one originator. Proposed ideas are often derivations from earlier ideas. The original idea may have been further developed through discussion and analysis and lead to a new idea which is accepted even though the original idea may have been discarded.

The recording and processing of ideas and innovations in the Alliance:

- A person is nominated for recording ideas.
- An "Ideas and innovations" list will be maintained in the project bank and updated regularly (every 1-2 weeks).
- Any possible background material relating to ideas (reports, principle drawings, calculations) will also be saved in the project bank's "Innovations" folder.
- New ideas will be dealt with in the Planning Steering Group, which will nominate person to be responsible for the idea.
- The nominee will then prepare the idea with the help of a technical discipline group and determine inter alia, the idea's impact on cost (together with the person in charge for construction technology) for decision making.
- A decision on the approval of an idea will be made by the project team based on a decision proposal compiled by the person in charge. The project team will also decide which ideas are to be sent to the Executive Management Team for further processing.
- The project team will monitor the development of ideas and set out a schedule framework for further preparation if necessary.
- The Ideas and innovations list is also to be regularly submitted to the Alliance Executive Team for reference and processing.

An entry should be recorded as to whether an approved idea has been taken into account in the final target outcome cost. The table at the end of the DP phase shows which ideas have been taken into account in the target outcome cost.

5.2.3 Distribution

During the development phase, ideas were distributed into main classes when they were recorded as follows:
- roads and streets
- bridge
- tunnel
- technical systems
- geotechnics
- other ideas and innovations

The Ideas and innovations list also takes into account the value for money perspective. Ideas have been classified according to this perspective in *Table 5.1*. Impacts on cost were not systematically recorded on the Ideas and innovations list because they are presented in the value for money report.

Table 5.1. Value for money classification

SR DP	planning solutions, value for money ideas and innovations during the DP phase
TR DP	implementation solutions, value for money ideas and innovations during the DP phase
MK DP	ideas for developing procedures, value for money ideas and innovations during the DP phase
ATT DP	ideas and innovations which have an influence on key result areas for better success, during the DP phase
OTHER DP	other value for money ideas (not innovations) during the DP phase
MP DP	significant decisions which have had a monetary added value effect on

The processing phase of each idea was also noted in the table as the ideas were processed. The classification depicting the process phase in use during the DP phase was as follows:

- processed and approved
- rejected / not to be investigated
- incomplete
- not processed currently ("frozen")
- returned for re-investigation

At the end of the DP phase, the classification "Move to IP phase" was added to the processing phases. All new and existing incomplete or "on hold" ideas were examined. They were either rejected or moved for investigation during the IP phase

At the end of the DP phase, all ideas were divided into three categories:

- processed and approved (taken into account in the target outcome cost)
- rejected
- moved to the IP phase (includes opportunities)

Ideas moved to the IP phase contain identified opportunities which could not be utilised during the DP phase. New ideas were still cropping up during May and June 2013, and the opportunities contained within are naturally still partially or entirely unassessed. At the end of June the number of ideas to be moved to the IP phase totalled 20 *(Pictures 5.2 and 5.3)*. The Ideas and Innovations table is set out in its entirety in *appendix No. 5.2A.*

5.2.4 Most notable innovations

Some of the most notable, approved ideas from the DP phase are set out in *Table 5.2.* In addition to cost, the value for money perspective was also used as an evaluation criterion. A more detailed description of all significant, approved ideas/innovations is set out in the Value for money report.

5.2.5 Opportunities in the development phase

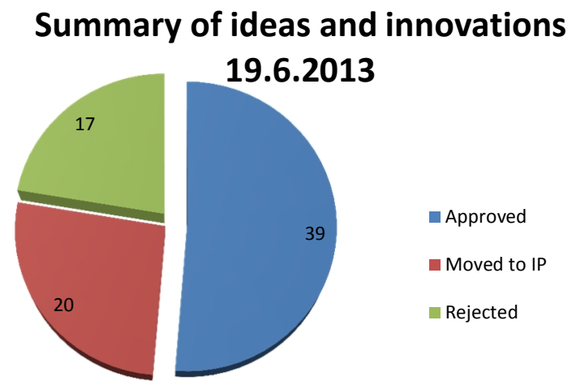
The opportunities in the implementation phase consist of the above mentioned, still to be assessed ideas and the opportunities identified by the risk management process and target outcome cost process. The cost impact related to these opportunities has already partly taken into account in the target outcome costs.

The ideas and innovations process drawn up in the development phase will continue to be used in the implementation phase. Based on experience so far, it is highly likely that new ideas and innovations are borne in the implementation phase as well.

During the implementation phase, a more detailed work planning and finishing of the construction plans in cooperation with designers and construction professionals will bring new food for ideas. Full utilisation of this potential requires that all parties' key personnel work in the same facilities. Daily interaction will lower the threshold for proposing new ideas and their further refinement. Hence, new ideas have a better chance to develop into mature ideas and innovations. During the IP phase, more emphasis is therefore placed on working together in shared facilities and on improving the environment for cooperation.

The number of operatives working in the Alliance will increase significantly as construction professionals are recruited. Orientation on Alliance working methods is essential for ensuring a fruitful cooperation between the old hands and new entrants.

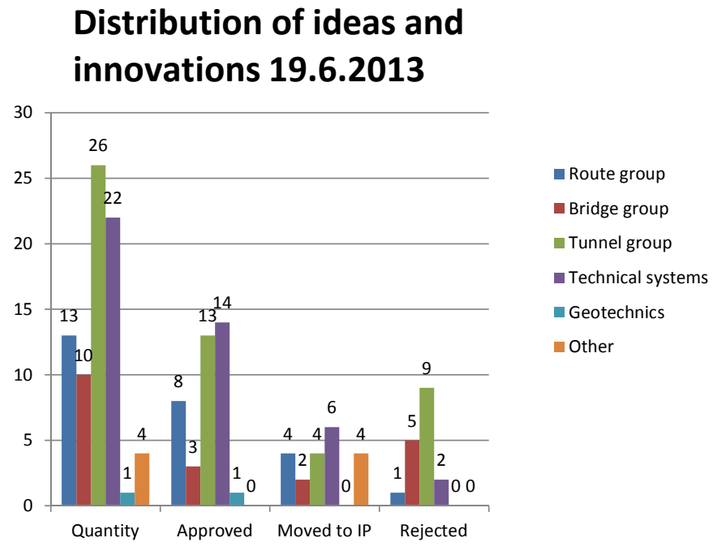
The Alliance operating model enables fast and flexible decision-making. It facilitates the management of inevitable changes to the project and unexpected situations, as well as reducing any resulting delays and additional costs.



Picture 5.2. Status of idea processing, June 2013.

Table 5.2: Some of the most significant ideas approved during the DP phase

Identifier	Description of the idea	Impact
T11	Vehicle tunnel from Nääshalli	• Shorter implementation time by 4 months • No traffic (re)arrangements for current Rantaväylä road • Reduces the risk of damage to existing structures • Removal of lattice building further away from the playground
T8	Vehicle tunnel and ventilation fans to the eastern ventilation channel	• Tunnel excavation can begin sooner. • The Bridge's S8 type has been changed to a lighter weight tubular bridge. • Significant cost savings
T3	Technology corridor	• Easier work integration • Rationalisation of work order • Working time will be shortened.
V5 and V12	Lowering of tunnel levelling	• With fairly minor adjustments to the longitudinal gradient , the thickness of the rock ceiling could be increased and therefore reduce the need for reinforcements.
T10	Extension of the rock tunnel by ca, 5 m at the western end	• There is no need to close Onkiniemenkatu to traffic during the construction. • Disturbance to inhabitants will be considerably less.



Picture 5.3 Distribution of ideas, June 2013.

Ideas and opportunities transferred from the development phase

Idea J11 presents the selection of new technology during the implementation of the tunnels disturbance detection system. The DDS system will be based on radar technology and is deemed to be fit for purpose, with sufficient operating features, and to have better reliability and lower operating costs than a traditional system relying on the interpretation of photographic images.

Based on a preliminary cost comparison, the procurement price of the radar DDS is up to EUR 550,000 more affordable than the DDS which relies on camera technology. The cost estimate does, however, include much uncertainty with regard to both the technical solution and the level of cost. Taking into account the uncertainty, the potential for cost savings is estimated between EUR 200,000 - 300,000.

The technical systems group considers the implementation of a radar DDS pilot in the Mestarintunneli tunnel, as planned by The Finnish Transport Agency, to be a requirement for the implementation of a radar DDS for this project. There is already a camera technology based DDS system in use in the Mestarintunneli tunnel, whereby it will be possible to compare the two systems. The pilot would generate information on the suitability of the radar DDS for the Rantatunneli tunnel as well as technical dimensioning values for, inter alia, the number of radars and the determination of the distances between them. The probability of the implementation of the idea is however estimated to be comparatively small when the aforementioned uncertainties are taken into account.

Of other ideas transferred to the IP phase, the utilisation of fire-detection fibre optics properties is estimated to have greater potential (idea J15). The advantages cannot probably be measured in monetary terms, but from a value for money perspective, it is worth investigating this idea further.

The idea "T19 Modular construction" contains opportunities yet to be utilised which relate to speeding up technical systems testing and thereby ensuring that the overall schedule is adhered to. Any benefits arising from modular construction are absolutely worth researching further in the implementation phase.

A summary of potential ideas to be moved to the IP phase is set out in *table 5.3*.

All identified ideas moved to the IP phase can be found in the ideas and innovations table in *appendix 5.2A*.

Opportunities recognised in the risk management process

Opportunities identified in the risk management process relate primarily to the assumption that overly robust solutions might have been chosen in the planning as a result of incomplete initial data.

Deficiencies in initial data have been removed as far as possible and clarified in the planning as a result of additional research carried out as a risk management procedure. The designer and the construction contractor have together ensured that for example, no over-dimensioning of reinforcement planning has taken place. As such, an opportunity relating to overly robust solutions was already harnessed during the DP phase.

Opportunities identified during the target price determination process

The target outcome cost includes identified opportunities to a value of EUR 3.8 million. They are related to the following subjects:

- The Alliance's operating model
- Procurement premise
- Steering and instruction of design

Table 5.3: Ideas with the most potential to be transferred to the IP phase

Identifier	Description of the idea	Potential
J11	Radar DDS	A disturbance detection system based on a DDS radar system with sufficient operating features, reliability and affordability
T19	Modular construction	For speeding up testing and adherence to the overall schedule
J15	Utilisation of fire detection fibre optics	Improvement of the functional reliability of fibre optic detectors; utilisation of temperature measurement data in condition assessment after a fire; utilisation of winter temperature data in the assessment of the tunnel's sub-zero temperatures and insulation structure weather.

Process for dealing with ideas during the IP phase

The same process for dealing with ideas in the development phase will also be used during the implementation phase. The process should, however, be clarified and the instructions should be further specified throughout. At the start of the IP phase, the project team will to nominate a person responsible for logging ideas, and the nominee's first task shall be to update the written instructions on procedures. When updating the instructions, particular attention should be paid to the following:

- A small work group (2-3 individuals) should be nominated for each potential idea transferred from the DP phase and the project team is to set a target schedule for the group.
- Other ideas transferred from the DP phase, as well as new ideas, will still be processed in the technical discipline groups.
- The Planning Steering Group will nominate a person to be responsible for new ideas; for ideas evaluated as significant, a small group will be assigned and a target schedule will be set for the research/development of the idea.
- A separate column in the ideas and innovations table will be reserved for the schedule.
- A small working group will be nominated for the "Other ideas and innovations" group.
- The threshold for the identification of new ideas and passing on related information will be lowered using various incentives.
- The orientation package for new employees will contain "Tell us about an idea" information and a description of some of the most significant approved ideas.

Cooperation and workshops in particular, have proved to be productive in generating a number of ideas. In the IP phase, the Alliance will place emphasis on free-form small group work in addition to or instead of normal meeting work. Group work will be made more effective through the organisation of facilitation training within each discipline of technology.

Reporting during the IP phase

The Ideas and innovations table will be maintained throughout the entire IP phase. At the end, a short summary report will be compiled and the table will be appended to this. The table will contain all collected ideas grouped into approved and rejected ideas. In addition, all approved ideas will also be set out in the IP phase *Value for money report.*

APPENDIX 5.2A Ideas and innovations table

6 GAINSHARE/PAINSHARE REGIME AND KEY RESULT AREAS

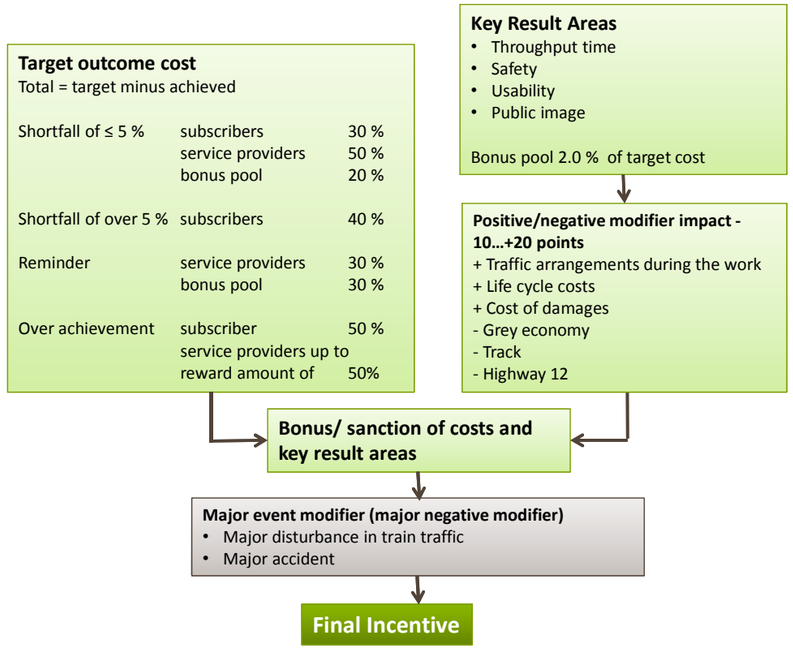
6.1 Gainshare/painshare regime

The gainshare/painshare regime is based on a bonus incentive(s) on target outcome costs and key result areas, negative and positive modifiers and major event modifiers *(Picture 6.1)*. The details about the gainshare/painshare regime have been described in the commercial model of the implementation phase.

The project's performance targets are presented using key result areas as part of the Alliance commercial model. The measurements set for the key result areas make it possible to advance a financial bonus on good performance and issue a sanction on a poorer performance. The final points accumulated will therefore give a realistic picture on how well the Alliance is doing.

6.2 Target outcome cost

The Rantatunneli Alliance has set a target outcome cost based on a unanimous decision on allowable project costs. The target outcome cost includes direct costs, risk reserves and the fees charged by A-Insinöörit Oy, Saanio & Riekkola Oy and Lemminkäinen Infra Oy.



Picture 6.1. Overall picture of the Gainshare/painshare regime.

6.3 Key result areas and performance indicators

Targets are set for the schedule, for safety, usability and public image. They are set so that the minimum performance target (0 level) is compared to large completed projects in the infrastructure industry in general. A bonus is paid for performance exceeding the minimum level and a sanction is charged for a performance below the minimum level.

Every measurement value of the key result area (points between -100 and +100) is defined as follows:

- A performance of +100 is regarded as an excellent or breakthrough performance according to the chosen criteria,
- A performance of -100 is regarded as a complete failure to meet the minimum requirements of the Alliance,
- A performance of 0 is regarded as meeting the Alliance minimum requirements.

The measurements are detailed in *Table 6.1*. Key result areas and the performance indicators are shown in *Table 6.2*.

Table 6.1. Description of key performance indicator values.

Performance level	Features
Break through 70-100 points	• A target which has not been achieved in tunnel projects Finland before • Cannot be achieved using previous methods – requires new ways of thinking • The Alliance does not know how it will achieve the target it has set but believes it to be possible and is 100% committed to achieve it.
Exceed 10-70 points	• Has been done before but rarely • The Alliance knows how to achieve the target and is able to use known methods to achieve it but it still requires excellence from the resources/ personnel involved.
Minimum requirement 0-10 points	• Significantly better performance than that of other individual parties in other projects • A performance level reached by the the best operators working together
Partial failure -50-0 points	• A performance level which does not reach the subscriber's minimum performance level
Complete failure -100 -50 points	• The achievement is of an extremely poor performance level

Table 6.2. Key result areas, performance indicators and values.

Key result area	Key performance indicator (KPI)	KPI values		
		-100 points	0 points	+100 points
Schedule	On schedule	240 days late	15...0 days late	120 days early
Safety	No. of accidents	100	16-14	0
	No. of days of absence due accidents	1000	200-160	0
Usability	Traffic disturbances caused after the construction phase completion	Set at 3 months before the construction phase completion	Pls. See the measurement description	0
Public image	Tone of public image	40	85-90	100

Positive and negative modifiers of the key result areas

The gainshare/painshare regime contains positive and negative modifiers which either reward or penalize major factors which are important to the Alliance but which cannot be measured by a performance measurement mechanism. Positive modifiers may increase performance points by a maximum of 20 points and negative modifiers can reduce them by 10 points. *(Tables 6.3 and 6.4)*.

Key result area performance points

The key result area performance points (KTA) are calculated by adding up the weighted points gained by the performance measurements values, adding any points gained from positive modifiers and deducting any negative points.

Tragic Events

The Executive Team of the Rantatunneli Alliance has defined the tragic events, i.e. major negative modifiers *(Table 6.5)*. A tragic event reduces the reward paid to the service providers. In the case of such an event the subscriber will not pay any monetary reward from the bonus pool even if the service providers had earned it according to their performance otherwise.

Table 6.3. Positive modifiers

Positive modifier	Indicator	Indicator values	Points
Traffic disturbances during construction	Amount of traffic during construction	KVL same as before the project KVL less than a maximum of 7 % compared to before the project	+ 10 points + 5 points
Damages	Amount of damages	Total damages below 0.75 ‰ of the target outcome cost, 180 million euros	+ 5 points
Significant accolade	Reward for accolade	See description of the measurement	+ 5 points
Life cycle cost	Reduction in operation costs	100,000 euros / year	+ 5 points

Table 6.4. Negative modifiers

Negative modifier	Indicator	Indicator value	Points
Highway 12 traffic disturbances	Hours	Traffic stopped for 12-24 h Traffic stopped for 24 h	-2 points -5 points
Train traffic disturbances	Hours	Traffic stopped for 6-24 h Traffic stopped for 24-48 h	-3 points -6 points
Grey economy	Observations	Observed once Observed twice	-2 points -5 points

Table 6.5. Major event modifiers (major negative factors).

Major event modifier	Indicator	Indicator values	Points
Train traffic disturbance	Hours	Train traffic stopped for > 48 h	-50 points
Major accident	Observation	Alliance activities found to have caused the accident according to the Accident Research Board	-50 points

Table 6.6. Description of key performance indicators (KPI), indicators of positive and negative modifiers and major event modifiers.

Measurement/ indicator	Definition
Staying on schedule	The tunnel is opened to traffic at time specified in the implementation schedule. AET will decide the date when the implementation phase can be started. Minimum level, i.e. zero points: fluctuation range = settled date – 15 days.
Accident frequency	Number of accidents per million man hours
Absences due to accidents	Absences due to accidents per year. An absence from work is defined by the length of sick leave, i.e. elapsed time (not only working days). If the timing of the absence falls into two years, i.e. December to January, then the days of absence will be recorded against the year where they occurred, irrespective of when the accident happened. In calculating the days of absence, only those absences which amount to at least one day are taken into account. The day of the accident itself is not included. Minimum level, i.e. zero points: fluctuation range = 160 – 200 days of absence per year. The measurement value is calculated as a weighted average for the years 2013-2015.
Traffic disturbances caused after construction phase	One or more lane closed after the construction phase is over (project hand-over has been done and the guarantee period has commenced). Maximum value is 100 points = 0 disturbances, from which points are deducted as follows: • Major disturbance = deduction of 20 points, if the total points are over zero points and 10 points, if the total points are below zero points. • Minor disturbance = deduction of 5 points, if the total points over zero points and 2.5 points, if the total points are below zero points. Major disturbance = one or more lanes closed during working days between 7.15 am and 9.15 am or, 3.15 pm and 5.15 pm. Minor disturbance = working days between 9.15 am and 5.15 pm, 7.00 pm, Saturdays 8.30 am and 4 pm, Sundays 12.00 pm and 7 pm Public holidays = Sunday • If there are one or more lanes closed in the tunnel for24 hrs = deduction of 25 points *1) Minor disturbance definition is affected by assessment of queuing and/or reduction in driving speed. The assessment method will be defined in the TAS phase 3 months before the end of the construction phase. The measurement needs to take the flow of traffic into account.*

Tone of publicity	Highway 12 Rantatunneli publicity in the Finnish media is measured in a publicity survey, categorised by Liikennevirasto's media list: • national newspapers • provincial newspapers • local newspapers • free publications • local papers • professional publications and magazines • news and current issues programmes on main stream radio and TV The publicity analysis will take into account the: • progress of publicity (number of hits) • relative share of project publicity from total publicity • project publicity per media type • publicity per type (traffic arrangements/safety, other subjects, finance/costs, construction, plans/project purpose, tenders/employment) • tone of publicity (negative, slightly negative, neutral, slightly positive, positive) • share of negative publicity from total publicity Terms and definitions: Hits are usually defined as individual newspaper articles (news, columns, comments from the public) and radio/TV programmes. A hit will demonstrate the views that different parties (e.g. a person, a company, an organisation or other party) have of the subject reviewed, either through direct or indirect quotations. The party/parties involved will be taken into account in the assessment of the publicity in question. There may be several hits based on a single article (e.g. if the article deals with two projects). The tone of the publicity will be assessed by a five-step scale (negative, slightly negative, neutral, slightly positive, positive). The period of measurement is the construction period plus the first year of the guarantee period. The measurement value is calculated as an average of the publicity measurements performed during the measurement period.

Traffic volume during construction	The initial comparison value is the amount of traffic before the construction phase on Rantaväylä between Santalahti and Naistenlahti. This will be decided by AET. The amount of traffic is measured all through the construction phase. If the amount of traffic during the construction phase is greater than the initial value, 10 points are given. If the amount of traffic during the construction phase is between -7 % and 0 % compared to the initial value, 5 points are given. The traffic data is forwarded to the Alliance by Pirkanmaa ELY Centre.
Amount of damages	If the damages caused by Alliance activities are less than 0.75 ‰ of the target outcome cost in euros, 5 points are given. The total amount of damages includes all damages, regardless of who is paying the compensation.
Award for accolades	If the Rantatunneli Alliance or an individual working in the Alliance is awarded a national or international award for excellence, 5 points are given. An individual award must be related to the Rantatunneli project. The decision on the application of this positive modifier is made by AET.
Reduced operating costs/life cycle costs	The Alliance proves that the saving is due to its activities during the construction phase. Pirkanmaa ELY Centre confirms that the operating costs have been reduced by at least 100,000 €/year, by using approved methods, and that the saving is due to Alliance activities. The value of the bonus is +5 points (a total of 180,000 euros).
Hours/Hw 12 traffic stopped	If the Highway 12 traffic is stopped due to Alliance activities for 12-24 hours, -2 points are given, if for over 24 hours, -5 points are given.
Hours/ train traffic stopped	If the train traffic is stopped due to Alliance activities for 6-24 hours, -3 points are given, for 24-48 hours, -6 points are given and if for over 48 hours, this is regarded as a major event modifier and -50 points are given.
Observation of grey economy	If any systematic use of grey economy is found either in external or internal inspections, whether this is found in a subcontractor's company registration, pensions insurance, tax payments or applied employment contracts. First finding = -2 points, second finding = -5 points. The decision on whether this has been systematic is made by AET based on the reports received.
Major accident	A major accident with human fatalities/ injuries or substantial material damages is caused by Alliance activities. The incident will be investigated by the Accident Investigation Board. The decision on a major incident is made by AET based on the reports received.

7 PLANNING PROGRAMME

7.1 General

The starting point for the planning is the completion of the construction plan for the roads and structures, as presented in Chapter 4, Project technical scope. The initial construction plans by technical discipline were made in the development phase for the implementation phase cost estimates. This design programme describes IP phase construction planning where the construction plan is finalised for implementation together with the contractors.

Starting point for the planning

The starting point for the construction plan comprise of the initial DP phase construction plans, the road plan with its planning materials, the planning permission and the planning principles for the construction plan formulated during the planning process. The planning principles are based on those presented in the road plan.

The planning instructions to be used have been collected and recorded in the project bank as lists (title and date of the instruction) and partly also as help texts. There are changes in the instructions and rules in the IP phase, which are discussed in the project and executive teams as these must be taken into account in the implementation and as these may have a considerable cost effect. Planning laws and statutes and other regulations are also observed in the construction plan. Planning tasks include, inter alia, the selection of CE marked construction products which are best suited to the site and fulfil national construction regulations.

Management of the planning process

The supporting processes for drafting the construction plan direct the planning work and ensure a good outcome.

Construction planning is done in parallel with the costing process. The cost estimate prepared in the DP phase, including the agreed principles therein, direct the completion of the construction plan and its associated costs. The cost estimate in the construction plan prepared in the IP phase should not substantially differ from the one agreed in the DP phase.

In solving technical questions, the main emphasis is on questions regarding the transfer and safety of conduits and equipment owned by external parties. It is also important to take into account the conditions and rulings given in the planning permission document and other written permits.

Quality assurance is based on the planning organisation's own quality system and the quality assurance plan prepared in the beginning. This describes, inter alia, the quality assurance targets, working methods, process management, inspections, audits and reviews and hand-over.

Risk management work started in the earlier planning phases will be continued and specified in more detail in the construction phase. The risks are identified, listed and assessed together with planning of risk management activities.

Safety issue descriptions are updated and complemented with new data in connection with construction planning. The key part of this work is risk identification, where all potential risks are identified per issue type.

In the initial safety document prepared in the construction planning phase, the risks are described according the data available at the time. An initial safety document is prepared according to and applying the instructions on drafting a safety document.

An independent external inspector will assess the project's traffic safety towards the end of the planning phase. An inspection memo will be produced, which will contain any traffic safety problems found during the inspection, suggested solutions and activities taken.

The key point in a traffic safety inspection is that it only includes issues that can be solved in the construction plan, such as collision safety, visibility, traffic control devices etc. Issues that cannot any longer be changed in the construction phase are not included. A check is also made to confirm that any issues found in the road planning phase inspection are noted in the construction planning. The instructions on planning traffic safety inspections are followed in the inspection.

In addition to a legally valid road plan, the commencement of the road construction work requires several different permits and notices. During the planning, any additional permits required for the project implementation are identified and applied for.

Collection and analysis of initial data

Initial data was mostly collected in the DP phase. The validity of initial data is primarily the responsibility of the original contributor. The validity, timeliness and accuracy of the initial data are also ascertained by the Alliance according to the quality systems of the Alliance parties. Particular attention is paid to ensure that data from different sources uses the same coordinate and elevation system.

7.2 Construction plan

The following describes the construction plan content of the IP phase by technical discipline and in the order of the table of contents.

Shared documents

Shared documents are filled in and reconciled with different technical disciplines

- construction plan table of contents
- job specific work specification (work specifications for different technology types are placed in the planning materials of the technology type in question
- update of the safety memo
- commission of a traffic safety inspection of the construction phase, the memo is attached to the documentation

Plan for the main road

The planning maps and longitudinal sections are updated and the relative locations of railings, sound barriers, lighting columns, portals, traffic signs and other fixtures and fittings and equipment are checked in the cross-section. Structural and pole specific cross-sections are updated and the cross-sections are supplemented with data for foundation reinforcement, drainage, conduit and equipment.

Organisation plan for general roads

The longitudinal sections and pole specific cross-sections are updated.

Streets

The longitudinal sections and pole specific cross-sections are updated. Necessary street plans are prepared.

Plans for structures not belonging to the road authorities

The transfer plans for conduits and equipment were made in the DP phase. The plans are updated with potential procurements, material changes or on the basis of contract and work stages. The integration of fixtures, equipment and conduits owned by the road authorities and others with the foundation reinforcements, road structures and to each other is confirmed in the construction plan.

Drainage plan

The drainage plans are updated with potential procurement or material purchases as required. A plan of vertical levelling is made for tunnel intersections and tunnel openings.

Landscape plan

The landscape plan contains:

- road landscape plan
- lists of plants
- landscape plan for tunnel openings
- detailed plans for environmental targets
- quantity lists.

Mass financial plan

- pole specific mass lists are updated.
- mass transfer and operational plans are checked.

Lighting

Update of the construction plan with design measurements of the power supply network and power planning.

Tunnel lighting:
- light technology update of the lighting plan using the products available (LED)
- potential flexibility of integration with developing products (LiHA etc.)
- integration of lights with traffic control and HVAC technology equipment and refining the location plan
- final grouping of the lights for control and their division into control steps
- definition of control parameters
- main measurements for the western end anti-glare shield
- construction site timing plan
- testing and potential measurement

Safety lighting:
- technical update of the lighting plan using the products available
- refining light locations
- construction site timing plan
- testing

Lighting of open spaces:
- light technology update of the lighting plan using the products available
- refining the light locations
- design of the pylons
- street lighting junction points to the current street lighting network
- check-up the prioritisation of street lighting control
- construction site timing plan (diversions etc.)

Traffic control

Planning maps are updated and supplemented, traffic signs are added and the traffic sign list is updated. Measurement plans are prepared for lattice supports, portals and information boards.

Traffic light plan

Traffic light plans are updated as needed, with:
- shared poles
- potential changes due to new instructions or technical equipment

Traffic management

Update and refining of the construction plan with:
- supplementation of system diagrams
- prepared work description
- integration of equipment with lighting and HVAC planning
- update of the integration map
- preparation of general and measurement drawings
- sequence planning
- design of camera control and layout
- location planning and drawings for cameras
- traffic arrangements during construction time
- plans for stepped implementation
- design and implementation of training
- preparation of operating instruction cards for road traffic duty operators
- preparation of technical traffic test and operations plan
- attendance in shared usage tests
- testing and adjustment of sequences
- operational hand-over of the camera system

Foundation reinforcement plan

The planning of geotechnical solutions was done together with the planning for alignment and levelling, drainage and construction planning. The foundation reinforcement plan is supplemented with:
- action maps
- longitudinal sections
- water system fills, Santalahti filling area plans
- foundation reinforcement solutions for bridges and other structural plans
- special drawings
- detailed planning of construction site supports

Design measurements plan

The measurement plan is prepared to cover everything relevant. This is broken down per work stages according to the needs of the construction site:
- survey lines and levelling (vgp)
- primary point and coordinate calculations of kerb lines, traffic islands and middle lane cross-over points
- road line models
- mass exchange line models
- lists of railings
- municipal engineering conduits
- planning maps
- pillar maps for stabilisation
- cross-sections of foundation reinforcement targets

Bridge plans

Individual construction plans for bridges are prepared:
- supplement and update of general drawings
- features data card
- description of the construction plan
- individual bridge quality requirements
- list of quantities
- lists of reinforced steel
- substructure measurement drawing
- substructure reinforcement drawing
- bridge deck measurement drawing
- bridge deck reinforcement drawing
- span drawing

Preparation of noise barrier and retaining walls specific construction plans.

Tunnels

Construction planning (CP):

General
- inspection of planning principles
- inspection of initial data
- inspection of the planning order and schedule
- update of planning maps, cross- and longitudinal sections
- inspection of the location of railings, portals, traffic signs and other fitting and fixtures and equipment relative to each other in the cross-section
- update of structural and pole specific cross-sections, supplemented with drainage, conduit and equipment data
- inspection of the locations of ventilation blowers
- inspection of the location of HVACS brackets and fixings
- inspection of the location of wells and the floor substructure installations
- inspection of the locations of through passages
- inspection of the location of fire stops
- inspection of the type and junctions of modular parts (e.g. exit corridor)
- inspection of the junction points of the tunnel construction of the tunnel openings and bridge and tb tunnel
- preparation of a 3D data model for 150…300 m module parts, then extended to cover the whole tunnelling system, starting with the excavation start points.

Before excavation work, the following plans have to be prepared in the initial order given below:
- Detailed planning of the eastern tunnel opening. The plan will show the reinforcement structures of the tunnel openings, signposts and railings. The planning of the eastern tunnel opening will be integrated in more detail with open excavation and road plans.
- Detailed planning of the western tunnel opening. Integration with the concrete tunnel construction plans.
- Detailed measurement of the Näsinkallio ventilation shaft. Integration with the architectural plans for the shaft building.
- Implementation planning for the work/ drive tunnel from Nääshalli.
- Implementation planning for the Näsinkallio ventilation tunnel.
- Detailed measurement of subterranean spaces: Planning of the eastern ventilation tunnel and space. Planning of the ventilation tunnels' upstream integration with terrestrial plans.
- Implementation planning for the fire sprinkler pools (NK3): these will function as a road access with the Näsinkallio ventilation tunnel. Integration of the space plans with power, automation and HVAC plans.
- Inspection of the tunnel pipes' cross-section (e.g. junction reserve planning) due to potential changes of space. Integration with structural, road, signpost, power, automation and HVAC plans.
- Other technical rooms (NK2, NK1 and NK4)
- S4 – integration of the bridge structure with the bridge plans.

Rock engineering design (RCE):

Before excavation work
- Individual measurement of open cuts, entrances, shaft and underground spaces
- Inspection of reinforcement plans in case of potential space changes
- Inspection of sealing plans in case of potential space changes
- Participation in detailed implementation planning of work stages.

During/ after excavation work:
- Engineering geology survey of rock facilities
- Interpretation of the results of bilge water and bedrock observations
- Inspection of reinforcement plans to correspond to the realized rock circumstances and potential changes in excavation during the work (inspections of the quality and stability of the rock)

- Inspection of open cuts, entrances, shaft and underground spaces to correspond to the observations and inspection surveys during the construction
- Numerical rock mechanics calculations during the work
- Monitoring of control measurement results of the rock facilities (creation/update of a detailed rock model based on observations and control investigations)
- Inspection of execution plans
- Monitoring of quality assurance tests

In addition, due to an EU construction Products Act, which has come into effect, as well as Finland's statutory decrees, the RCE planning tasks in the IP phase is to select those products from CE marked construction products which are best suited to the intended site and which fulfil national construction regulations with the help of the Construction products compliance with requirements certificate.

Structural design (SD):

General
- Inspection of structural design principles and planning solutions in cooperation with the Traffic Authorities
- Inspection of initial data and integration of plans with CP, RCE and bridge planning
- Preparation of structure description regarding the structural engineering work of the rock tunnel.
- Preparation of foundation plans, element diagrams, structural base drawings, longitudinal and cross-sections and reinforcement drawings for the type module.

Cast-in-place structures:
- measurement and penetration drawings
- reinforcement drawings

Element structures
- element diagram of the type module
- measurement and reinforcement drawings of the element structures

Brackets and supports
- Securing the placements and loads

Module structures
- lists
- measurement and reinforcement drawings

Details
- firestops
- movement and construction joint structures
- feed-thru connections
- joints: casting structures, elements, supports, module structures and rock reinforcement in place

Rock reinforcement structures
- stabilisation and reinforcement structures for the low rock ceiling

HVAC and fire safety of the tunnels

Generally:
- preparation of planning order and schedule
- inspection of the planning and measurement principles and calculations
- inspection of initial data
- integration with power and automation planning
- update of functional descriptions
- functional integration of smoke abatement and fire extinguishing areas
- inspection of space requirements
- inspection of air ducts
- inspection of HVAC brackets and fixings
- inspection of the location of the wells and floor base installations
- inspection of the location of feed-through/ grommets
- location of firestops

Before starting the construction work, the following needs to be completed:
- completion of plans for the development phase
- HVAC construction methods description
- preparation of work descriptions (drainage, ventilation, construction automation, fire extinction)
- preparation of foundation drawings
- preparation of cross-section drawings
- update of general diagrams
- preparation of HVAC drawings and functional and control diagrams (ventilation, smoke extraction, construction automation, fire extinguishing, heating)
- location drawings of construction automation
- inspection of potential joins of tunnel openings' edge surfaces

During / after the construction work:
- drafting the work-time plans
- collation of service documentation materials re HVAC planning
- update of routing and location of the supports (installation of fixings)
- update of feed-throughs and structural reservations
- preparation of the final plans

Power, data communications and information systems, including telecommunications and safety systems

Data communications and information systems
- preparation of the systems architecture description
- integration with HVAC planning
- update of the data communications and control systems functional principles description
- update and supplementary additions to the principle diagrams
- update of system diagrams
- preparation of edge surface descriptions
- preparation of level drawings
- preparation of switching plans
- update of assembly drawings
- drafting of equipment lists
- preparation of traffic control (and HVAC) circuit diagrams
- detailed documentation of the data communications network
- supporting documentation regarding management and control services

Application programming related to the traffic control system and HVAC and safety systems:
- control room programming
- logic programming, traffic control
- logic programming, tunnel HVAC and safety systems
- programming of a training user interface for the control room programme
- programming of external interfaces of the control room programme
- programming of separate/stand-alone programmes to be connected to the control room programme
- database programming
- configuration of the data communications network
- approval of the programming phase
- documentation for the programming phase
- preparation of traffic management system user instructions

Factory tests and adoption of the traffic management system and the tunnel HVAC and safety systems
- a large scale factory test is performed on the control systems, where the total control system, data communications network and all programme functions are inspected and tested. The tests will include at least a part of the traffic control equipment and the logic centres
- in adoption, the functions of individual equipment and separate systems and the technical operation and functionality of the whole system are tested
- participation in drafting the test plan
- participation in factory and adoption tests

Power system and telecommunications and safety systems
- update of power and safety systems operational description
- inspection of power grid measurements and power design
- integration with HVAC planning
- inspection of compatibility with the tunnel's other technical system equipment and structures
- update of electric supply diagrams
- preparation of main diagrams (main and cluster centres)
- preparation of power distribution circuit diagrams
- preparation of level drawings

Other plans

The traffic arrangements during the work will be reconciled with the regional representative as the work advances. The site service includes refocusing of the plans according to work conditions and potential change requirements.

Compliation of documentation

Construction plan documents are drawn up according to the Construction plan compilation instructions for content and presentation style. The plans are mainly saved in an electrocnic folder. As the construction progresses, the plans are further defined as so called diacritic drawings.

8 IMPLEMENTATION PLAN AND GENERAL SCHEDULE

8.1 General schedule

According to the general schedule, the project construction work will take a total of ca. four years. The tunnel blasting and construction work and system installations define the total elapse time for the project. The interchanges at each end the tunnel will be built during the tunnelling work so that they will be ready on the tunnel adoption. The structures to be built at the site of the current Naistenlahti northern bridge and the northern carriageway on the east side of the bridge will be built first after the tunnel adoption. The schedule has been presented in more detail in the attached general schedules for the open cut section and the tunnel.

The critical path for the construction work and the adoption is the following:

Excavation for vehicle tunnels → Open-cut tunnelling of vehicle tunnels → Tunnel excavation → Bolting, injections and cladding structure → Building the technical systems → Systems adoption → Introduction of the tunnel to traffic → Dismantling of the current bridge at Naistenlahti → Northern carriageway road structures poles 3800 – 4200 with supporting retaining walls → Dismantling of the widening of the southern carriageway for the construction period by poles 3800 – 4200 and other finishing touches.

APPENDICES 8.1A General schedule, open-cut area
8.1B General schedule, tunnel

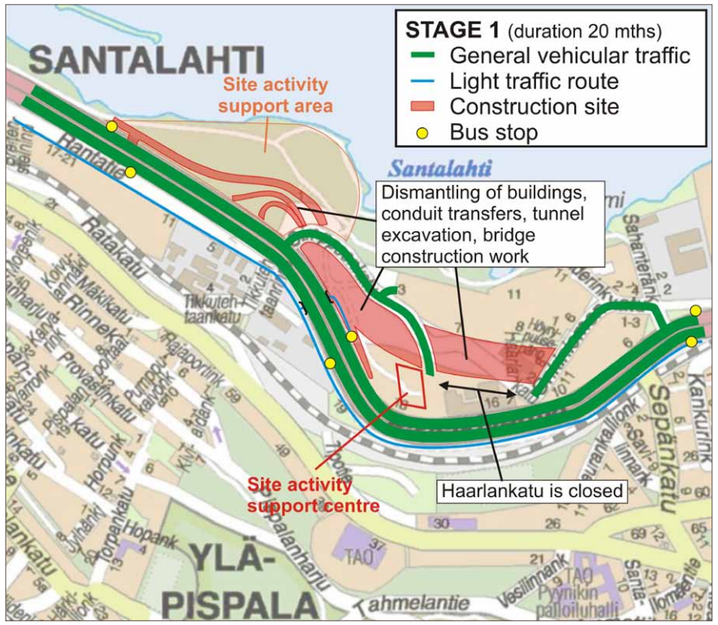
8.2 Traffic arrangements during the work and phasing of the construction

The work is done in a manner to ensure that traffic disturbances are kept to the minimum. The following images present the traffic arrangements at different work stages.

8.2.1 Santalahti interchange

Stage 1

- Public transport connections remain unchanged, apart from access from Onkiniemenkatu to Simppoonkatu, which will be cut off.
- Haarlankatu traffic between Simppoonkatu – Onkiniemenkatu will be decommissioned. The traffic to Haarla real estate area will be arranged on the work site as the construction advances.
- The work will start by dismantling the buildings, and transfer of conduits and pipes and removal of contaminated land. The major conduit transfers are those of natural gas conduits, transfer of a pressure relief station and the transfer of the district heating pipes in the northern corner of Highway 12.
- A supported trench will be built between Hw 12 poles 1200-1400, for the construction of S3 Onkiniemi concrete tunnel and trough as soon as possible.

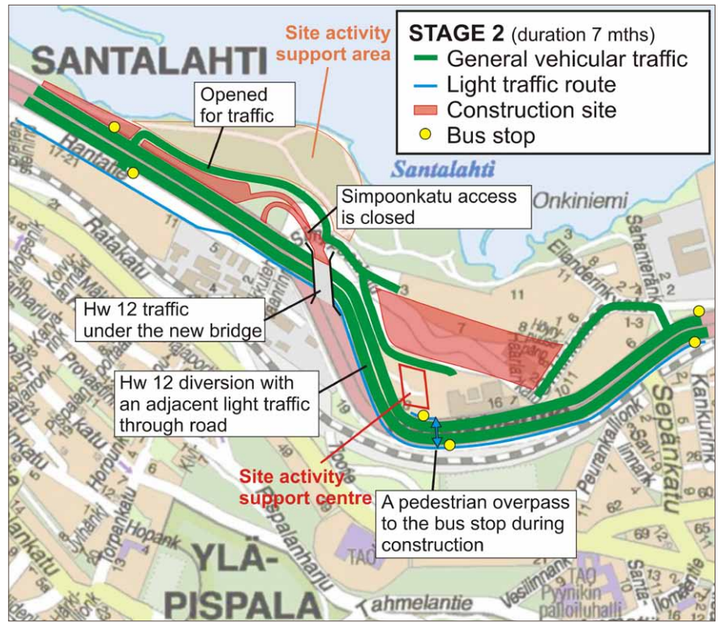


Picture 8.1. Traffic arrangements for the Santalahti interchange during construction in stage 1.

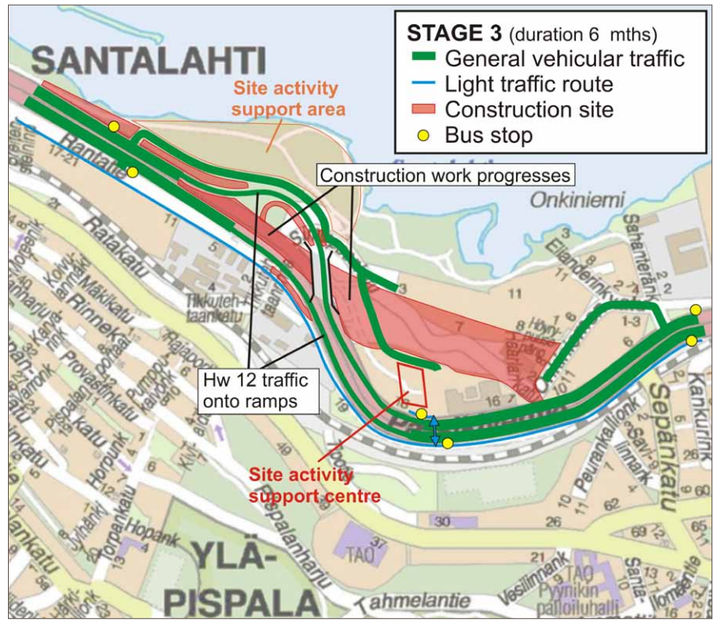
- The construction of the rock tunnel will commence by building a separate work tunnel and its open cut.
- Bridge S, Paasikivenkatu junction bridge construction work will be started during this stage, when conduit transfers of Hw 12 poles 900 – 1100 have been done.
- Diversion road will built as required by phase 2.
- 10/2013 -05/2015; DURATION 20 MONTHS

Stage 2

- Traffic moving to Simppoonkatu will be directed along the new K3 Sahansaarenkatu to the current traffic lights junction on Hw 12 at pol 500.
- One more traffic direction (north) will be built in the traffic lights.
- Hw 12 traffic will be directed to the diversion road built during stage 1, under bridge S1. Light traffic along Hw 12 will travel on the edge of the diversion road.
- A pedestrian walkway will be built over Hw 12 to the western direction bus stop.
- The current light traffic subway E1R1 at pole 400 will be dismantled.
- At this stage, the S1 Paasikivenkatu junction bridge, incoming embankments, the S2 Rantatie junction bridge and the through routes of E1R1, K1 and K3J will be built.
- Construction of Hw12 poles 1000 -1400 and K2, E1R3/R4 is continued. j
- 06/2015 -12/2015; DURATION 7 MONTHS



Picture 8.2. Traffic arrangements for the Santalahti interchange during construction in stage 2.



Picture 8.3. Traffic arrangements for the Santalahti interchange during construction in stage 3.

Stage 3

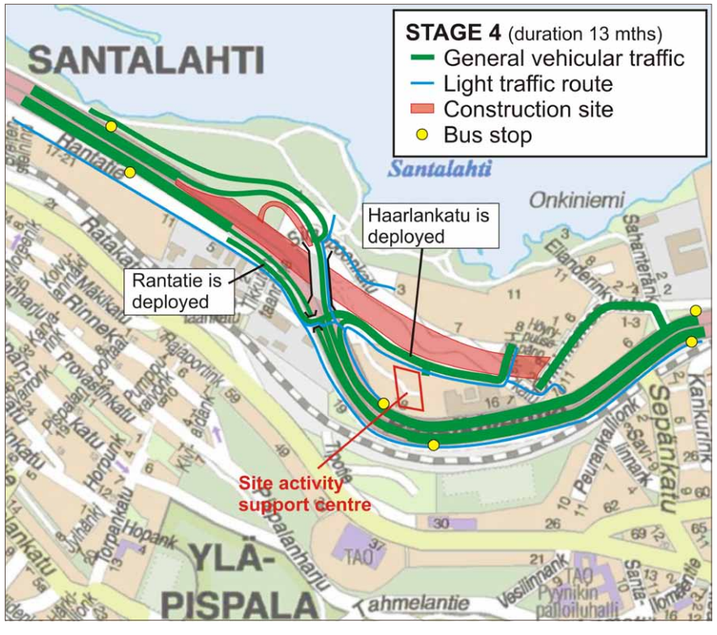
- Hw12 traffic will be moved to S2/E1R4 bridge and R1.
- The missing embankment on K4 by stage 2 diversion road will be built and the construction of K4 and K1 will be finished.
- The pedestrian access to the western direction bus stop will continue over the Hw 12 temporary light traffic bridge.
- Construction of Hw 12 poles 800 – 1400 will continue.
- 01/2016 -06/2016; DURATION 6 MONTHS

Stage 4

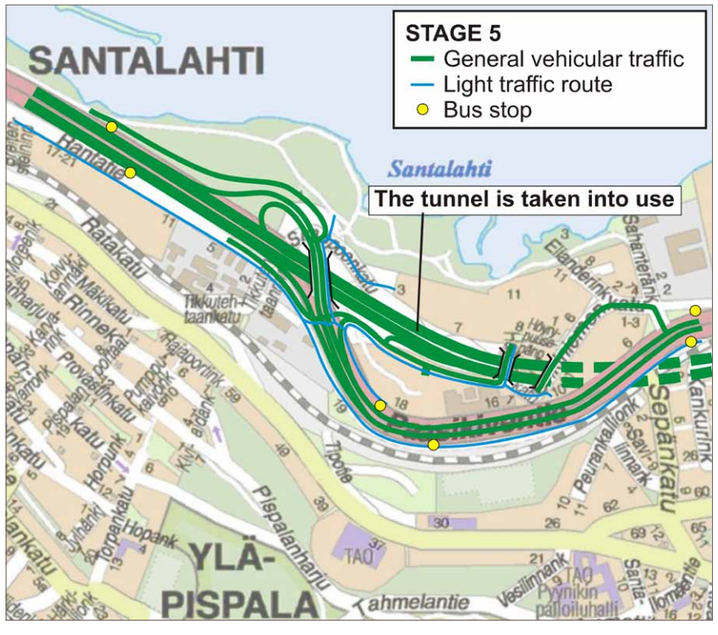
- K4 Haarlankatu and K1 Rantatie will be opened for traffic. The light traffic through routes in the area will be opened.
- Junction K1/K2/K4 traffic lights will be taken in use.
- Hw12 poles 800 -1400 finishing work continues.
- The finishing work of the area will be completed
- The through routes will be completely ready in November 2016.
- Testing of technical systems will be done from autumn 2016 to the spring of 2017
- 07/2016 -05/2017; DURATION 13 MONTHS

Stage 5

- Rantatunneli is opened for traffic on 15.5.2017.
- All through routes of the area are ready.



Picture 8.4. Traffic arrangements for the Santalahti interchange during construction in stage 4.



Picture 8.5. Traffic arrangements for the Santalahti interchange during construction in stage 5.

8.2.2 Naistenlahti interchange

Stage 1:

- Hw12 traffic will move along the current route.
- The current S7 Marjatta overpass is dismantled and the construction of the new bridge is started.
- Diversion road systems are built in the areas between Kalevan puistotie and Parantolankatu and between Soukanlahdenkatu and Tampella Esplanade.
- The current interchanges of Naistenlahti are closed to general traffic. The fuel transport vehicles to the power station and other heavy traffic will be directed through the work site. Connection to the plot will be organised under the current Naistenlahti northern bridge.
- Earth cutting and excavation is started by the tunnel openings.
- 10/2013 -12/2013; DURATION 3 MONTHS

Stage 2:

- Hw12 traffic will move along the current route.
- The diversion arrangements in the area between Kalevan puistotie and Parantolankatu will be deployed.
- K11 Parantolankatu is closed to the traffic during the construction of district heating and municipal engineering.
- K13 Soukanlahdenkatu will be cut at the tunnel during the building of tunnel openings and retaining wall structures. The traffic will use the temporary connection through Tampella Esplanade.
- The building of the new S7 Marjatta overpass continues.
- 01/2014 -07/2014; DURATION 7 MONTHS

Stage 3:

- Hw12 traffic will move along the current route
- Parantolankatu K11 and the new Marjatta overpass S7 is opened for traffic.
- Diversion arrangements in the area between Kalevan puistotie and Parantolankatu will still be in use.
- Light traffic along the Hw12 northern edgewill be directed to Parantolankatu between Rauhaniementie and Kalevan puistotie.
- K10 Rauhaniementie traffic will be transferred to the diversion through Parantolankatu and Kalevan puistotie. The current S6 Rauhaniemi flyover will be dismantled (phased-in traffic arrangements from Hw 12 during dismantling)
- Soukanlahdenkatu will be opened up to traffic again and the temporary arrangement is dismantled.
- A light traffic extension for the duration the construction work will be built on the current northern bridge of Naistenlahti.
- 08/2014 -10/2014; DURATION 3 MONTHS

Stage 4:

- The traffic of both carriageways of Hw12 will be moved to the northern Naistenlahti bridge, light traffic will move along the extension built in stage 3. The southern Naistenlahti bridge is dismantled.
- Construction of S5 Armonkallio overpass and S6 Rauhaniementie overpass. Water pipes and sewers will be hung on the bridge S6 in Rauhaniementie direction.
- The northern edge rock open cut will be widened on Hw 12 poles 3800 -4200.
- The natural gas conduit to Naistenlahti power station is moved away from the current bridge.
- 11/2014 -07/2015; DURATION 10 MONTHS

Stage 5:

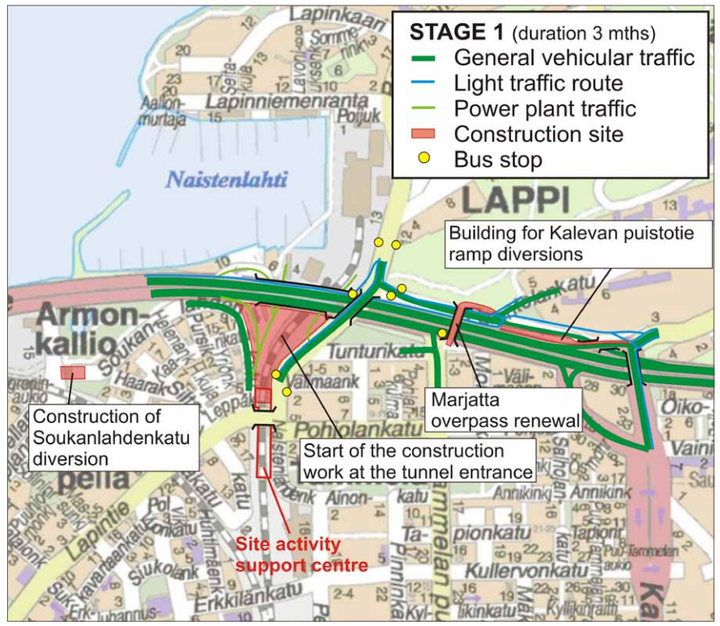
- Rauhaniementie K10 and the new S6 Rauhaniemi overpass are opened for traffic and the diversion arrangements on Kalevan puistotie are dismantled.
- The northern edge rock open cut will be widened on Hw 12 poles 3800 -4200.
- 08/2015, DURATION 1 MONTH

Stage 6:

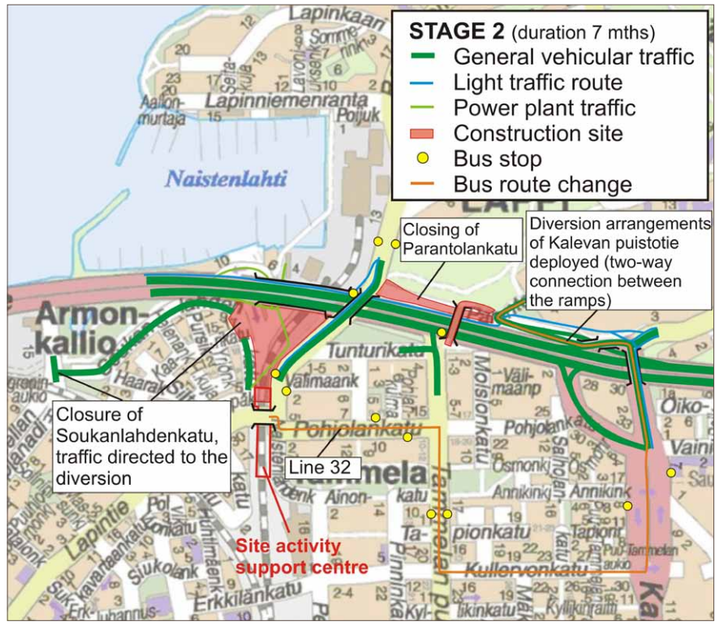
- Deployment of the Hw12 poles 3850 -4200 widening done for the duration of the northern work. All four lanes will be on the northern carriageway.
- Construction of Hw 12 poles 3800 -4200 southern carriageway widening (4 lanes).
- 09/2015 – 10/2016; DURATION 12 MONTHS

Stage 7:

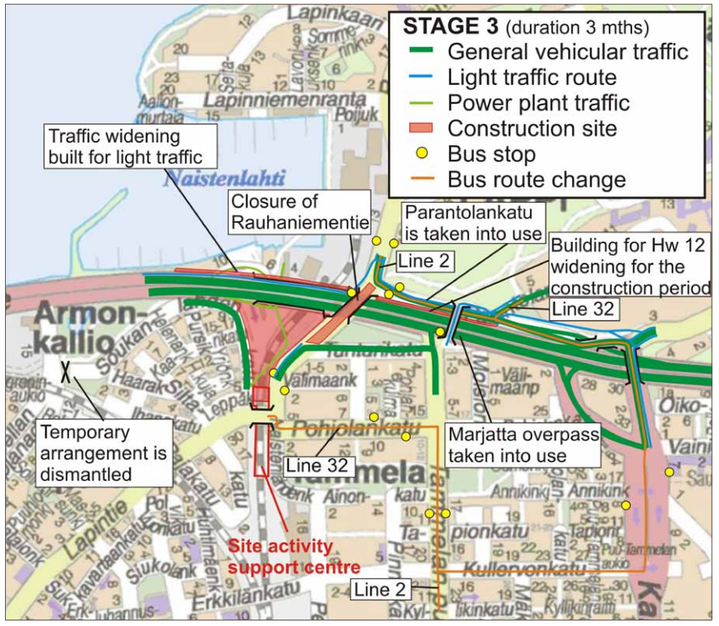
- The tunnel is opened for traffic on 15.5.2017. Hw12 traffic will use both tunnels and the traffic of both carriageways is directed to the southern carriageway at pole 3750. Light traffic on Hw12 northern edge is directed to the diversion on the southern side of the work site away from Naistenlahti northern bridge. The fuel transport vehicles to the



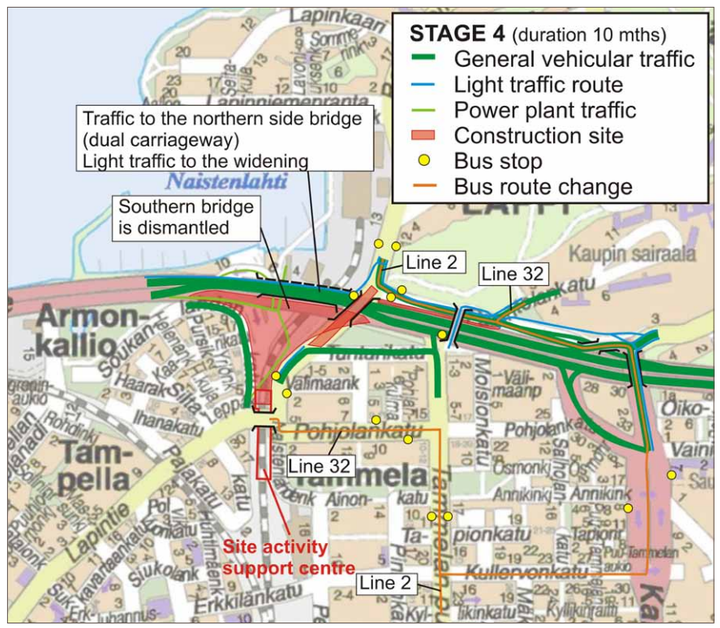
Picture 8.6 *The traffic arrangements of the interchange in construction stage 1.*



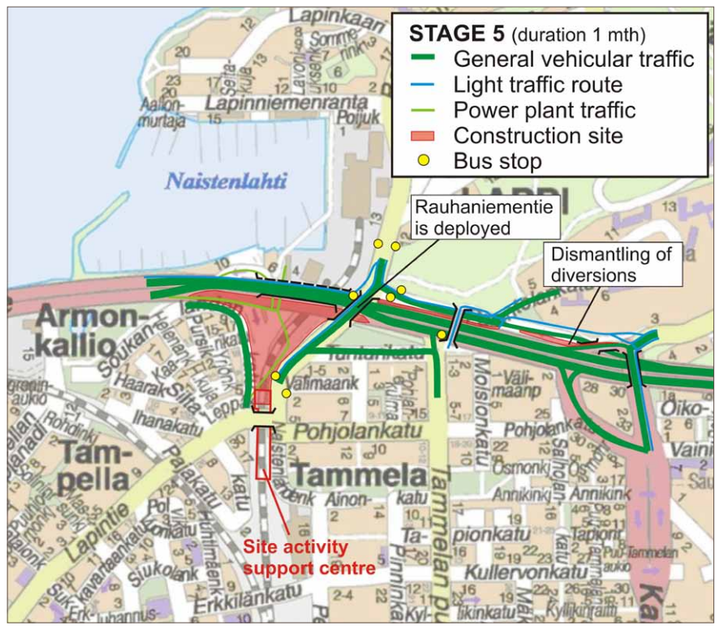
Picture 8.7 *The traffic arrangements of the interchange in construction stage 2.*



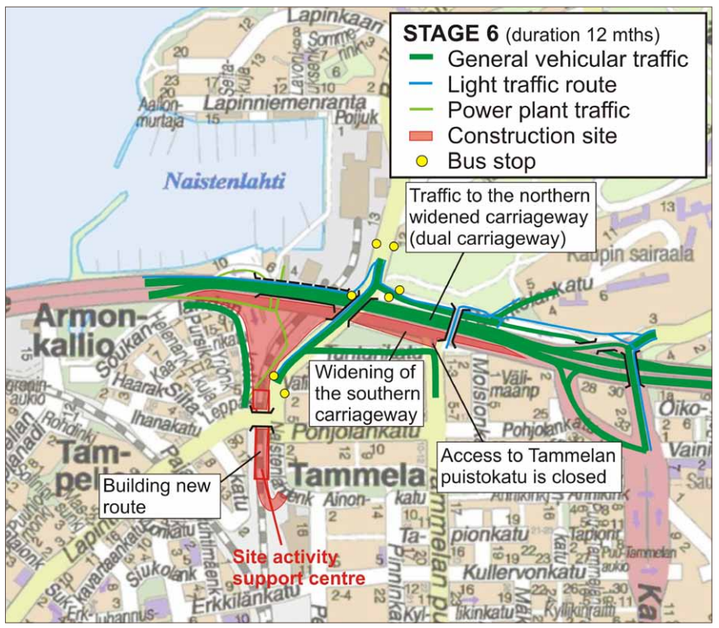
Picture 8.8 *The traffic arrangements of the interchange in construction stage 3.*



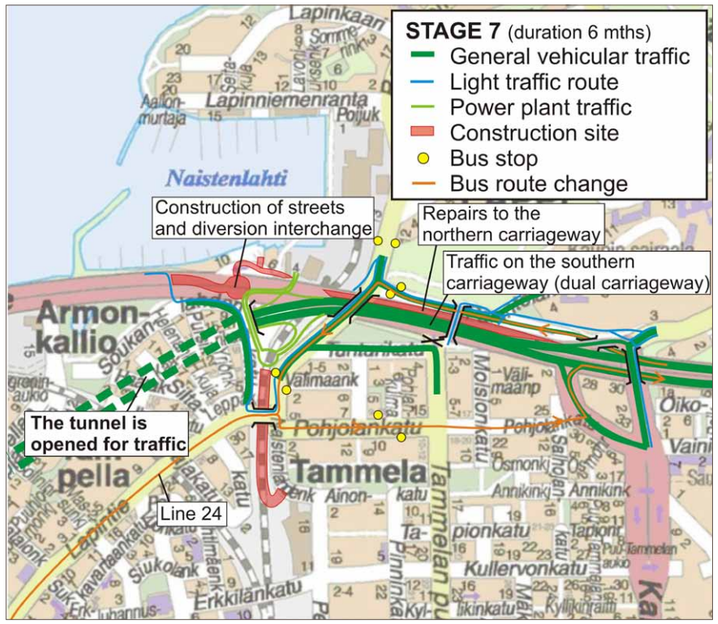
Picture 8.9 *The traffic arrangements of the interchange in construction stage 4.*



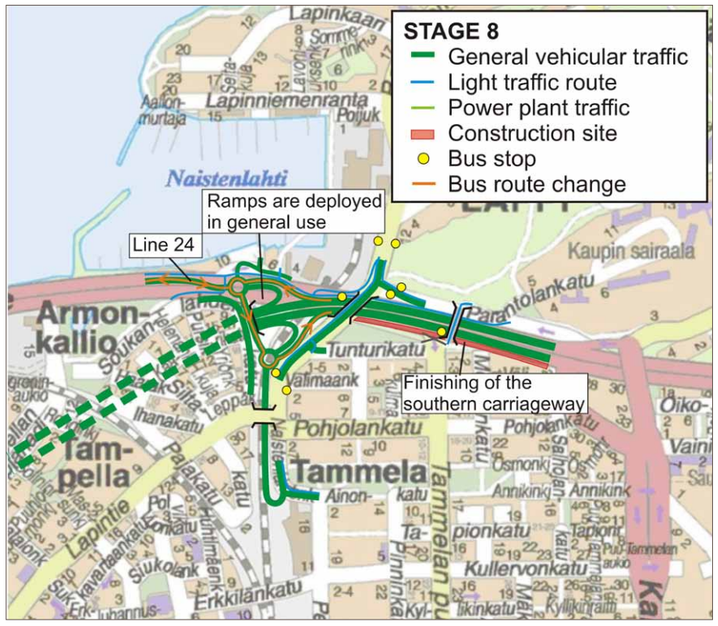
Picture 8.10 *The traffic arrangements of the interchange in construction stage 5.*



Picture 8.11 *The traffic arrangements of the interchange in construction stage 6.*



Picture 8.12 Traffic Arrangements in Naistenlahti interchange during construction in stage 7.



Picture8.13 Traffic Arrangements in Naistenlahti interchange during construction in stage 8.

power station and other heavy traffic will move through the northern edge temporary ramps.
- The current Naistenlahti northern bridge is dismantled
- Construction of Hw12 northern carriageway and ramps and installation of the northern carriageway traffic control equipment. Building of retaining wall structures on the northern edge of the carriageway.
- 05/2017 -11/2017; DURATION 6 MONTHS

Stage 8:

- The northern carriageway and ramps and K6 Ratapihankatu is opened for traffic in November 2017.
- The narrowing of the Hw 12 southern carriageway, poles 3800 – 4200 and other final work will be done in the summer of 2018.

8.3 Tunnel excavation and construction

8.3.1 Tunnel excavation work stages

Tunnel excavation is planned to be done from three support bases in Santalahti, Näsinkallio and Naistenlahti. One drilling platform is situated at each end of the tunnel, two in the middle, used by the respective work teams. Drilling and blasting work will take place on working days between 7 am and 10 pm. The loading, transport and scaling of the rock waste may be done at night time as well.

Pre-injection drilling is done using the same drilling jumbos as used in the tunnel excavation and the drilling jumbos are therefore equipped for long hole drilling. Pre-injection drilling is done during working days between 7 am and 10 pm. Injection work is done using two injection devices which are moved between locations as required. Injection work is done in three shifts. Areas that are to be injected systematically are shown in the plans, elsewhere injecting is done based on water loss measurements results from sounding drillings.

The final reinforcement bolting is done using after-injecting point anchored bolts. The drilling and placing of the bolts is done in connection with excavation cycle. The after-injection of the bolts is done later as a separate work stage as the excavation advances. The distance to the base to be excavated is at least 30 m.

Direct shotcreting will be possible using one shotcreting robot which can be moved between locations as necessary. A second unit will be taken into use when final shotcreting is started. Shotcreting work will be done in three shifts.

8.3.2 Technical construction work stages

The road tunnels are divided in modules for technical construction work and system installations. Each module is 150 m long (75 m each way from the connecting corridor). Hence, there are 15 modules in each of the two tunnels, and these are named according to the connecting corridors (A1 – A15 / southern tunnel and B1 – B15 / northern tunnel).

Technical construction work begins with installing a lining structure to the roof of the tunnel. The first work stage is drilling and installing the brackets after which a PE mat and mesh reinforcement is installed. Finally, fire protection is done using shotcrete.

When the roof lining structure is ready, the tunnel ground canals are dug open to install the drain and sewage pipes with wells. Then, a drainage mattress is made of crushed stone (#8-150 mm). A filter membrane then is placed on the drainage mattress and the splitting layer is filled with crushed stone (#0-150 mm). During the filling, the manifold of the fire-extinguishing system, fire-water pipe, cable pipes and heat insulation (XPS 50+50 mm) are installed.

When the underside structures of the road surface are built the construction of the kerb elements can be started with first installing the foundation blocks. The kerb elements are installed on top of the foundation blocks. When the elements have been installed, the element rock attachment is drilled and soldered with a chemical anchor. The final task is the casting and backfilling of the vertical seams of the elements. The wall elements are then installed on the top of the kerb elements which are anchored to the rock using drilled anchors.

The wall elements are attached to the lining material reinforcing from the top, after which a lining material band injection is done on the joining point. The last stage is to seal the elements, graphite protection and to install the relevant cupboards and centres to the elements.

The connecting corridors between the tunnels are done as element structures. The first to be installed is the exit corridor, which consists of four concrete elements. Then, steel construction power and transformer spaces are installed. The final task is to install complementing structures, such as stairs, railings and doors and finish off the spaces.

8.3.3 Construction of technical systems

The system installations in the tunnel are done in (blocks 1-5). One block consists of three adjacent modules.

Electrical installations in the tunnel begin in the autumn of 2015 from block 1at the same time as the installations in the open section. Installations will proceed from west to east as the technical construction work advances. The electrical installations for the control building will be done in the autumn of 2015, so that Tampereen sähkölaitos can install a main line connection for the final electrical connection.

When the block transformers and centres are installed, installation of safety systems and lighting can begin by module. The installation of Traffic Control equipment are done last in installation order, first after the main lighting and safety systems are all installed. The installation will begin with traffic and disturbance cameras, continuing with the installation of variable traffic control equipment.

The installation of smoke extraction ducts can be started as soon as the rock brackets have been inspected as fit for purpose. Installations will proceed from west to east as the technical construction work advances. The a/c equipment for electricity and transformer spaces and pump stations are installed parallel

with the work progress. The installation of pumps will similarly follow the same timing.

The fire extinguishing system is an independent system and its installation follows the technical construction work of the tunnel.

Installations in the open sections can start in the autumn of 2015 and will continue until the spring of 2016 when all the surface layers are built. Induction loops used by different systems are installed in the topmost surface layer.

The deployment of subsystems can start by block when the installations of the block in question are complete and when the data communications and electrical feed manifolds are connected. A separate plan has been prepared for the deployment of main systems, according to which the testing will progress in stages. Total, interconnected systems testing can be started in the autumn of 2016 and the road can be opened for traffic on 15.5.2017.

8.3.4 Work order in the tunnel

Tunnel work is done from three directions. Work site bases are established in Santalahti, Näsinkallio (Nääshalli eastern opening) and Naistenlahti. Open cut earthwork will be started in Santalahti and Naistenlahti in November 2013. Preparatory work will be commenced at the same time in the Nääshalli eastern vehicle tunnel.

Santalahti

A separate entrance will be constructed for the Santalahti work tunnel, through which the western end tunnel excavations are mainly done. This will speed up the start of the tunnel excavation, and the actual opencasting and structural concrete work can be done simultaneously without disturbing either party. The excavation of the work tunnel will begin in January 2014 and it will open to the north at the northern tunnel pole LB1440 in March 2014. The northern vehicle tunnel is excavated up to the first connecting corridor (LB1450) and the southern vehicle tunnel can also be excavated through this. After this, the tunnel excavation will continue as a 4-way extraction to west and east until the northern and southern vehicle tunnels cut through at the west end in June 2014. The excavation towards east will still continue as a 2-way extraction until March 2015, when the southern vehicle tunnel will cut through from the tunnel excavated from Näsinkallio direction at pole LA1980. The excavation of the northern vehicle tunnel from Santalahti will finish at the same time at the closed end pole LB1920. The northern tunnel will progress at a slower pace as excavation delays due to the proximity to the above railway will affect the length of time that can be spent for excavation.

The final reinforcing work will begin in the western end after the connecting corridor YK2 is cut through in September 2014. Hence the transport of rock waste and other traffic will be along the northern tunnel and in the first module A1 in the southern vehicle tunnel between poles LA1378 – LA1535, final shotcreting and the drilling and installation of the attachments of the lining structure and the brackets. After-injections are done as necessary. When the module is ready, traffic is moved to the already reinforced southern tunnel section and final reinforcing is started for the northern tunnel LB1382 – LB1535 (module B1). In this way, the final reinforcing will progress by module so that this is finished for the southern vehicle tunnel in June 2015 to pole LA1990 (modules A1 – A4) and for the northern vehicle tunnel in July 2015 to pole LB1985 (modules B1 – B4).

In November 2014 when the reinforcement work is finished in modules A1 and B1, stepwise installation of a lining structure, foundation work and element installations are started in the southern vehicle tunnel module 1. Corresponding work in the northern vehicle tunnel module B1 is started in January 2015. The work will progress in both tunnels module by module so that it will be completed in the southern vehicle tunnel in August 2015 to pole LA1990 (modules A1 – A4) and for the northern vehicle tunnel, in September 2015 to pole LB1985 (modules B1-B5).

Näsinkallio

The excavation of the Näsinkallio work tunnel through Nääshalli starts in January 2014 and it will reach the vehicle tunnels in April 2014. In connection with excavation of the junction area, hall NK3 / M7 is also excavated, allowing excavation of a ramp tunnel for the bridge S4. This is excavated and reinforced before the road tunnels go under it. The excavation of the road tunnel continues as a 4-way extraction to both directions until the southern tunnel comes through to pole LA1980 in March 2015. Then, ramp tunnel R2 and the tunnel to shaft NK2 are excavated as"fourth" way. The excavation of the northern vehicle tunnel will end up at LB2960 in June2015. The Näsinkallio tunnel excavations will be finished in July 2015, when the northern vehicle tunnel westward to pole LB1920, the southern vehicle tunnel eastward to pole LA2975 and the NK2-shaft base have been fully excavated.

The final reinforcement work at Näsinkallio can be started when the K7 – YK9 connecting corridors are excavated. Reinforcement work will be started first in the southern tunnel in the pole range of LA2435 – LA2585 (module A8). The corresponding module B8 will then be reinforced in the pole range of LB2425 – LB2575.

The final reinforcement work will progress as the excavation progresses in both tunnels to both directions so that they will be completed for the southern vehicle tunnel by August 2015 (modules A5 – A10 / poles LA1990 – LA2890) and for the northern tunnel section in October 12015 (modules B5 – B10 / poles LB1985 – LB2875).

As the final reinforcement work is complete in modules A8 – A7 and B8 – B7, a stepwise installation of the lining structure is begun. The foundation work and element installations in the southern vehicle tunnel in module A7 begin in March 2015. Corresponding work in the northern vehicle tunnel is started in module B7 in April 2015. The work progresses in both tunnels to both directions so that it is completed in the southern vehicle tunnel by December 2015 (modules A5 – A10
/ poles LA1990 – LA2890), and in the northern vehicle tunnel in 2016 (modules B5 – B10 / poles LB1985 – LB2875). The final task in the southern vehicle tunnel is to construct module A8 and in the northern, module B8, so that the vehicle access between the tunnels is preserved through the vehicle corridor YK8 for as long as possible.

Naistenlahti

The tunnel excavation in Naistenlahti will be started in no IV tunnel in February 2014 and the excavation will be complete by May 2014. A through connection from the connecting corridor YK15 is cut to the southern vehicle tunnel and the excavation of road tunnels is started as a 4-way extraction. The excavation to east towards the tunnel openings will be slow due to thinned rock roof and the necessity of its immediate reinforcement. The southern tunnel will cut through in October 2014 and the northern vehicle tunnel in February 2015. The excavation of the road tunnels will be continued westwards until they cut through to the tunnels excavated from Näsinkallio at poles LA2975 and LB2960 in August 2015.

The final reinforcements at the eastern end will be started when the connecting corridor YK14 has been excavated in 2014. The work site traffic will then move to the northern vehicle tunnel, between poles LB3550 – LB3390 and the final reinforcement work in the southern vehicle tunnel will be started in module (LA3620 – LA3490). The traffic will be moved to the reinforced section of the southern vehicle tunnel. When they are complete, the traffic is transferred to the southern tunnel reinforced section and final reinforcements will be made in the northern vehicle tunnel B15 (LB3603 – LB3475). Thus, the final reinforcements progress module by module so that the work is complete in the southern vehicle tunnel to pole LA2890 (modules A11 – A15) in November 2015 and in the northern tunnel to pole LB2875 (modules B11 – B15) in December2015.

In March 2015, as the reinforcement work is complete in modules A15 and B15, the step-wise installation of the lining structure, foundation work and element installations will be started in the southern vehicle tunnel as per module A15. The corresponding work in the northern vehicle tunnel as per module B15, will be started in May 2015. The work will progress in both tunnels by module so that the work will be completed in the southern vehicle tunnel by February 2016 to pole LA2890 (modules A11 – A15) and in the northern vehicle tunnel in March 2016 to pole LB2875 (modules B11-B15).

8.4 Mass operational plan

The earth and rock mass from the project will be used as shown in *Tables 8.1* and *8.2*.

Table 8.1. Utilisation of earth cut masses

EARTH CUT MASSES	350 000	m3ktr
• embankments, ramps, noise barriers and other fills by the project	65 000	m3ktr
• Santalahti water fill	90 000	m3ktr
• Contaminated soil, in the final location (tip)	36 450	m3ktr
Used in the project	**191 450**	**m3ktr**
Remainder (transported to external sites as indicated by the city	**158 550**	**m3ktr**

Table 8.2. Utilisation of rock open cut masses.

ROCK OPEN CUT MASSES (opencast working + tunnel rock waste)	755 000	m3ktr
• Santalahti water fill	140 000	m3ktr
• Ranta-Tampella water fill	133 333	m3ktr
• Rock waste and crushed stone used in the project structures	220 000	m3ktr
Used in the project	**493 333**	**m3ktr**
Remainder (transported to external sites as indicated by the city	**261 667**	**m3ktr**

8.5 Work during the first six months

The work during the first six months has been planned in more detail based on the general schedule. The prerequisites for an expedient start of the construction are that:

- The administrative decisions required are legal. The permits required are listed in the appendix "List of permits" of Chapter 9. The processing of the permit applications have been closely monitored during the development phase.
- The necessary construction plans required for the start-up exist. In addition to projecting the target outcome cost the objective of the development phase was to prepare the necessary plans to start the construction. The plans were ready within the agreed schedule and the work can be started in a controlled fashion.
- The required resources are available to the work site. The Alliance parties have reserved the necessary planning and construction resources so that the construction work starts efficiently and in schedule.
- The necessary land areas are under the control of the subscriber parties and the buildings to be dismantled are unoccupied.

APPENDIX 8.5A Start-up schedule 6 months

9 ALLIANCE MANAGEMENT SYSTEM

9.1 Project plan

The project has been partitioned by technical disciplines to responsibility areas and into clear procurement sections based on the schedule and cost estimates. Each section is analysed for, inter alia, risks, basis of payment, target requirements, decision making and the need for cooperation during the project as well as the tight schedule and the imperative of its achievement, quality requirements and flexibility required for the implementation period. Based on analysis, one of the following implementation options will be selected

- Lemminkäinen Infra Oy, in-house
- As Subcontractwork under Lemminkäinen Infra Oy's supervision
- Subcontract under Lemminkäinen Infra Oy's supervision
- Material procurement

In order to utilise all the opportunities in the Alliance project to the full, its working methods and principles are applied to the subcontractor chain as much as possible. The contract form used will be one of those commonly used. In addition, the format of a contract might be a combination of a total contract and a target priced cost-plus contract, in which case the target priced section might include risk related issues or targets to achieve a quick implementation. The potential subcontractors are given a clear explanation of the project requirements already in bid phase and also told that the requirements given will be used as targets for the work/delivery and recorded in the contract. The ITT describes effects of the procurement on the project schedule. The contract also affords the option of forming an alliance. The subcontractors are encouraged to innovate. An option for making alternative bids in terms of working methods or materials is given in the ITT, which should pave the way to open contract negotiations.

The bidders are requested to clarify their own subcontractor arrangements. The client would appreciate if most of the work was performed by the subcontractor's own workforce thereby avoiding a long chain of subcontractors. This would, of course, also ease the compliance with and monitoring of legal obligations.

The procurement for the implementation phase is based on the bids received the ITT bids received for the development phase. As far as the bids are straightforward both on content and price, contract negotiations will be begun immediately after the signing of the development phase contract. On other particulars, thought and consideration will be given, case by case, as to how the desired outcome is best achieved. All significant procurements are included in the procurement plan which is the blueprint for procurement target dates.

The procurement plan drawn up in the development phase forms the basis for the procurement plan for the implementation phase. The matrix will be updated and further detailed re those procurement particulars that were not part of the ITT of the development phase. A list of potential bidders will be collated in good time and sent out for comments (a view of all parties re suitable bidders.

The responsibility for the practical implementation of the procurement lies with the Heads of Construction. A project engineer from the headquarters will be assisting in the bidding process for larger procurements, and those involving subcontractors bidding for a number of technical disciplines.

The Alliance Project Manager will decide on procurements with the authorisation given by the Executive Team.

Bid comparison and justifications on the supplier chosen are made and documented accurately and with care. A contract review will be held with the chosen bidder when necessary, the contract is written using an RT form based on general contract conditions.

Small routine purchases and daily ironmongery purchases are made from Lemminkäinen's annual contractual partners (K-Rauta, Onninen etc.) with the help of the PM programme. The use of the programme speeds up routine purchases and increases the efficiency of the site management. It is worth taking advantage of Lemminkäinen concern's tendered annual contracts (an individual contract would not achieve the same price through project specific negotiations).

9.2 Deployment plan

The small number of traffic disturbances after deployment is one of the key result areas of the project. Repair work which necessitates lane closures should be kept at minimum.

9.2.1 Traffic arrangements of phased deployment

The plans for traffic arrangements during construction are hand in hand with deployment from the point when the tunnel tube has been taken in use. The phasing of traffic arrangements is shown in section *8 Implementation plan and general schedule.*

The tunnel will be taken in use before construction of the main road in Naistenlahti has been completed. Traffic to both directions will use the southern carriageway when the northern carriageway is being built. The traffic will however return to the northern carriageway before the tunnel. Both tunnel tubes will be opened for traffic at the same time.

The traffic control system will be implemented in two stages. The tunnel's traffic control diagram for the traffic deployment stage (stage 1) is shown in the drawing R12T/01-1 and the drawing for end stage is shown in drawing R12T/01-2. In stage 1, when driving to the west in Naistenlahti, in three cross-sections, the lane signals will be out of use. Temporary lane control sequences will be implemented for the user interface in this stage. Additionally, one congestion detection loop and one height restriction will be implemented as temporary structures.

9.2.2 Systems testing

Testing is divided to four stages. Each stage must be handed over to the supplier by himself and have been inspected by the Alliance before moving into the next stage. The stages are the following:

- Factory testing
- Equipment testing
- Operational testing
- Deployment inspection

Intensifying and phasing the testing is used to improve the functionality and reliability of the traffic control systems. The comprehensive testing in the previous stage will reduce the number of traffic disturbances and ease the final deployment.

The supplier will show that the systems function is defined in the operational description and is ready to be delivered to the installation point. The objective of the testing is also to identify potential errors and interpret any faulty definitions. The testing will be performed using the project's own equipment and the equipment will be assembled in the testing area as a complete entity, containing at least one traffic control device with its IP address.

During equipment testing, the installed equipment will be tested for its mechanical and electrical functionality by inspecting the signal process between the control room and the field device. The operation of the controls is verified by in situ observations.

The operational testing confirms the equipment's functionality with other devices as installed in its final operating environment. After trial runs of individual devices and trials of subsystems (signage, booms, traffic lights, monitoring devices etc.) and a self-handover, a joint interoperability test of all systems will be performed, where open road sections systems and the tunnel's technical systems are trialled.

In the joint testing trial, the devices are tested for self-diagnostics, error conditions processes and error recovery by introducing errors to the signs and devices. The joint trial will be done using a ready user interface. The functional testing also contains performance tests where the response times from control to the devices etc. are inspected.

The testing process is described in more detail in the documents attached to the subcontractor RFIs, which have been drawn up by the VALTTI unit of Southeast Finland ELY Centre, titled *Liikenteenohjausjärjestelmien testaus ja käyttöönotto, 14.5.2013* and *Rantatunnelin testaus ja käyttöönotto (initial plan), version 1 25.4.2013.*

9.2.3 User documentation

The tunnel must not be opened to general traffic before the control authorities have given their approval and given permission for deployment. The tunnel controller will forward the application for the tunnel approval to the control authorities and attach safety documentation for the tunnel in question, as well

as a statement by the Head of Safety. The safety documentation for a tunnel to be deployed includes the following in addition to the documentation from the planning phase:

- A description of the organisation, human and material resources and the instructions given by tunnel controller, the goal of which is to ensure the functionality and maintainability of the tunnel.
- The emergency plan drafted together with the rescue services, which takes into account persons with reduced mobility or less than normal functional capabilities.
- Description of the continuous feedback system for registration and analysis of dangerous situations and accidents and a description on how these will be reported.
- List of the risk analysis made.
- The plan for diversions and their effective communication when the tunnel is closed.
- The plan for regular exercises and their primary objective and purpose.

The Alliance will draw up the majority of the aforementioned documents and will contribute in the documents prepared by others.

9.2.4 User training and deployment communications

The user training of traffic control duty operatives will commence as scheduled in the tunnel technical systems planned implementation. Operating instructions for accidents and disturbances are drawn up in cooperation with the road traffic centre in good time before the tunnel is opened to traffic. The operating instructions for exceptional circumstances will be included in the traffic centre duty operatives' training programme.

The training of rescue authorities and maintenance operatives will be planned in cooperation with these parties. Any training needs of other key stakeholders (such as bus and taxi drivers) will be decided in the implementation phase.

communications campaign will be arranged before the tunnel is opened to traffic. The campaign will inform as to how the road users must act when they approach the tunnel and drive in the tunnel. Particular emphasis will be placed on actions required in case of vehicle faults, engine stops, congestion situations, accidents and fire. Communication campaigns will be continued after the tunnel opening on a regular basis.

9.3 Schedule management

Keeping on schedule is one of the project's key result areas. The tunnel will be opened to traffic on the date defined in the implementation schedule.

9.3.1 Schedule management objectives

The objectives of schedule management are:

- identify the project's critical path
- draft a realistic schedule for construction work which ensures the timing of the plan and procurements and sufficient resourcing
- act on any potential schedule deviations without delay

A scheduling system will be used as a tool for schedule management. This consists of a number of sub-schedules built from a general schedule (work schedule), required work stage schedules (3 months), weekly schedules (3 weeks) and weekly schedules of various subcontractors and the drawing schedule.

The Head of Construction will be responsible for drawing up daily and weekly schedules. The site manager and site foremen will also participate in the drafting of weekly schedules. The overall responsibility for schedule management lies with the Alliance Project Manager. Persons in charge will track and monitor the schedules weekly. New schedules and scheduling status will be tabled for discussion in meetings according to meeting practices where decisions will be made to address any potential deviations. The scheduling status is reported in meetings and monthly reports.

9.3.2 Required schedules

General schedule

A general schedule was drawn up in the development phase for both planning and construction. The schedule will be updated in the beginning of the implementation phase. Intermediate milestones, start and end of the contract and decisions, and work stages are shown as weekly vertical lines in the main domination.

Work stages schedule

The work stages schedule covers all work stages for ca. 3-4 months. The schedule is updated in 1-2 months intervals for the site meetings. Individual work stage schedules will be drafted for individual work combinations where necessary.

Detailed planning schedule will be drawn up and updated in parallel with the work stage schedule.

Weekly schedule

The weekly schedule covers ca. 3 weeks; the current week and two next ones. The subcontractors are tasked with tracking their own work performance using the rolling schedule and report to the contractor.

The Last Planner method used in the development phase will be exploited in the control of implementation phase construction where applicable.

Resource plan

Sufficient professional workforce suitable for the project will be secured already in the start phase of the project. Their main responsibility areas will be defined. The availability of key human resources will be secured using the resource plan according to requirements. A comprehensive resource plan covering all project needs will be drawn up for human and equipment resources, particularly for the tunnel excavations.

9.3.3 Tracking, control and integration of schedules

The project's progress will be tracked continuously by comparing it to the planned schedule (TARGET - OUTCOME) so that problem avoidance is possible and if they occur, they can be addressed without delay. The schedule status is monitored in meetings according to the project's meeting practices, such as:

- Weekly meeting of technical discipline
- Separate work planning and integration meetings as required
- Project team
- Executive team

Actions to address any schedule deviations are also decided in the meetings.

The foremen will track the work progress in situ daily. The work progress is recorded in the site minutes and confirmed in the weekly technical discipline meetings. The resource usage of the subcontractors is monitored daily so that any perceived lack of resource can be addressed without delay. The subcontractors are duty bound to track their own work progress based on the weekly schedule. The project's total schedule status will be integrated with the technical disciplines weekly and addressed in the project team meeting.

9.4 Financing

No financing costs will accrue to the service providers either in DP or IP phases as agreed contractually. An advance payment will be made based on the cash flow forecast which corresponds to the average cost for future months. The actual cash flow is analysed monthly and the advance amount is adjusted accordingly. Separate advances will be agreed for large, one-off costs (e.g. material costs).

The payment terms agreed between the client and the service provider are 21 days net. The payment terms between the service provider and a subcontractor are 30 days net. The payment terms will be negotiated in the subcontract contractual meetings. The payment period can be reduced if this gives a financial benefit.

The risk of material price increases is managed by monitoring price development and if necessary, buying a forward as the construction work advances. This method applies, in particular, to structures having a high metal content (reinforcement steel, cables, poles, portals and lighting posts).

9.5 Cost control

The cost control objective during the implementation phase is

- to prepare a reliable and realistic budget for decision support
- to create an efficient system for monitoring the project costs and control as per the agreed denomination
- to ensure that the contract bids are competitive and do not exceed the target budget
- to ensure that action can be taken to address problem areas in time to keep the project in budget
- to publish a fit for purpose, informative monthly report to various organisation levels or a more frequent report on those targets requiring special attention
- to save all information of cost control so that it can be accessed easily.

The costs incurred by the Alliance parties are updated in the open book accounting with actual costs. An independent financial expert will undertake accounting audits regularly throughout the project. The accrued costs reported by the Alliance parties are collected and reported monthly for the

use of the project and its management. The cash flow forecast will be updated at the same time.

The budget for the project is prepared on the basis of the DP phase target outcome cost estimate. The budget is updated by actual figures every 3 months. The denomination instruction is prepared based on the requirements of cost control. The denomination instructions are distributed to all personnel monitoring site purchases.

9.6 Payments

The service provider will forward the invoices to Tampere City and also to Finnish Transport Agency as a PDF copy, the latter will check the correctness of the invoices and approve the payment. The invoice must contain a break-down of costs and bonus payments invoiced. The invoice should be addressed to Tampere City and will be paid in two tranches:

- Tampere City share (inc. The city share of 67 %)
- Finnish Transport Agency share (inc. Finnish Transport Agency share of 33 %)

The detail required in an invoice is covered in the document *Hw 12 Tampere Rantatunneli Alliance, invoicing instructions* to service providers. Tampere City will pay the invoices from the service providers; the Finnish Transport Agency will remit their share of the cost to Tampere City.

The invoicing is done by the parties once a month on average. The construction work in the implementation phase lies within the auspices of reversed VAT (zero VAT). Invoices re other than construction services must detail the VAT

9.7 Quality management

9.7.1 Planning

The planners will adhere to the quality systems used in their company. A project specific quality plan will also be drawn up per office.

The initial data and planning objectives and activities due to deviations are finalised in the initial data reviews, which will be held at the beginning of the planning and also when planning of particular planning targets is refined or, they are entered in, for example, the project diary or meeting minutes.

Workshops are part of the Rantatunneli IP phase initial data reviews. Planning objectives of a planning target, function or solutions related to a technical discipline is worked through in the workshops. Minutes are written on the workshops. The workshops are also the stage in plan integration. During the planning work, the planner will work through the plan under work with the person responsible for the planning to ensure the plan adheres to the objectives and integration. Even uncompleted plans can be saved in the project bank so that any comments from other planning areas and from cost control can be noted.

When the plan has been completed; it will be distributed to cost accounting and sent around for comments. The comments are then inspected for compliance with the objectives and may be incorporated in the plan.

The specific inspection of the plans is part of the usual planning process. Any notations addressing part of the plan, such as inspection comments re drawings, are recorded in the documents list or in the drawing/planning document. Issues requiring external inspection or at least a principle agreement with the principles used are collated into a table which will include the information as to who will perform the inspection and when.

9.7.2 Construction

The technical quality assurance is a central factor for the successful completion of the project together with the quality of operations. The quality assurance consists of the following sub-areas:

- ensuring that the quality criteria and requirements defined by the
- prequalification of bidders and assessment of technical know-how
- inspection of the project's quality requirements and work descriptions
- technical comparison of bids and inspection of potential quality plans
- statement of the adequacy of start-up conditions and start-up meetings
- weekly meetings
- supervision of subcontracts and ensuring hand-over readiness

Technical quality assurance will be described in the quality assurance plan. The quality assurance measures will ensure that the total quality of the target corresponds to the regulations by the authorities and the Alliance.

Quality Assurance objectives, planning and implementation

The project's technical quality level will be determined in the planning. The minimum level of technical quality is best practice construction according to the Infrastructure construction general quality requirements 2010

The project's functional and technical quality is sought to be ensured by operating according to the project plan. The quality of a product or a service is controlled by the project plan according to the Alliance's internal, agreed inspection, approval and review methods.

Quality Assurance during work

The control activities of Quality assurance are

- quality assurance plan
- work stage implementation plans
- start-up meetings, orientation and weekly meetings
- model settings
- inspections and reviews
- observation and quantity measurements
- work stage acceptance testing

Control operation activities are defined in the implementation phase by subcontract. The primary contractor will hold a start-up meeting with the subcontractors and suppliers before work is started. The meeting's agenda includes reviewing the task's initial documentation, schedule and work order, work to be undertaken and prevention of problems, receipt of materials and storage, quality requirements and quality assurance, site meeting practices and environmental and work safety issues. The meeting is chaired by the head of construction or the site supervisor. Alliance experts will participate in the meetings as required, foremen are present as representing subcontractor.

The head of construction will control and monitor the subcontractor's work within his technical discipline (schedule and technical quality / subcontractor's quality assurance plan) throughout the implementation. Significant quality deviations will be recorded per contractor in the contractor meetings.

The acceptance inspection of a subcontract ensures that work to be handed over to the Alliance conforms the contract conditions, The head of construction will gather the quality assurance materials given by the subcontractor and a project engineer will archive those with the transfer materials.

A work stage specific quality assurance programme will be drawn up for site quality control. This defines the tangible quality control measures to be taken.

Quality Assurance plan

The quality assurance measures of the work stages are collated into a separate quality assurance plan, where the project's key work stages, required implementation plans and technical work plans (incl. persons responsible,) work specific quality assurance measures (such as measurements and tests, the operative and timing), fit for purpose assurance and related required documentation are presented in a table format quality assurance activities. The table will be used to monitor and ensure that the required quality assurance measures have been undertaken at the correct time. Quality assurance measures of subcontracts will also be recorded in the quality assurance plan. Additionally, a site inspection document is maintained, according to the construction authorities' requirements.

Quality requirements of an individual work stage, required work methods, quality measures and fit for purpose evidence to fulfil the quality requirements, will be recorded in detail in the work stage implementation plan which is drawn up by special work stages chosen by work groups and which is walked through with all participating operatives. Fit for purpose measurements and is situ continuous control and monitoring is used to ensure that the work progresses according to plans. The work stage implementation plan also includes major environmental, safety and risk management activities.

If deviations to plans and instructions are found in operations or the end result despite all, an exception report will be issued. With the open and extensive handling of exception reports will prevent like deviations in the future.

Qualification of acceptability of materials

The material and quality certificates required from the material suppliers are recorded in the contract quality assurance plan. When material batches are received, the work managers will inspect the quality of the materials according to the material certificates and quality documents given by the supplier and by eyeball assessment. The quality of the materials is compared to the requirements in the quality assurance plan. The quality engineer will collect the certificates in the work time quality folders.

All materials must fulfil the required quality requirements and they must be intact and fit for use. Work managers make reclamations on any quality deviations immediately. The reason for the reclamation will be recorded in the

delivery documentation. If a fault in the material is found later on, this will be reported to the project engineer responsible for acquisition, who will issue a reclamation to the supplier. Faulty materials will be removed from the site and marked carefully before any potential after handling (e.g. return to the supplier or removal to the waste bin) so that the material will not be used in construction by accident

The handling, storage and protection of materials on the site are part of materials quality assurance. The internal material batch transfers and lifts on the site have been taken into account in storage location planning so that the site will function well logistically and that the necessary transfers are only of short distance. In material lifting and transfer, appropriate lifting equipment will be used which will prevent any damages caused to the environment or the materials as well as preventing any human injuries. The work managers will be responsible for appropriate material storage and handling on the site.

Image dimension and quantity measurements

Infra RYL measurement instructions and principles are followed in the measurements. The control points system will be built with care and will be updated regularly. The in situ measurements are planned beforehand so that they are performed in time and without any delay to the work. Approved and inspected measurement equipment is used in the measurements. All measurement devices will be calibrated regularly according to the manufacturer's instructions. Copies of device calibration certificates will be saved in the quality folders. The Head of measurements will be responsible for the planning and execution of measurements.

Handling of non-conformance

Non-conformance in this context is defective work performance or end result of work that does not correspond to Alliance's specifications or ways of working methods presented in the implementation plan or the project plan. These are divided into technical and functional deviations. Technical defects are, inter alia, situations that have not been planned in advance or deviation from plans or specified requirements that were planned in advance. Functional deviations are deviations from the described actions in the project plan, such as non-conformance with safety or environmental instructions. Every operative is duty bound to report any non-conformance to their manager immediately. This duty is explained in the orientation training. The subcontractor's work plans must include work methods and corrective actions to deal with non-conformance cases. In order to detect material defects, the work managers will do an incoming material inspection of all materials and supplies to be used.

The subcontractors or the their work managers will prepare non-conformance reports of any deviations found where the non-conformance is described and in addition, will detail corrective actions and their timing, who is responsible for the issue, the actions to prevent its reoccurrence and whether the deviation needs approval from the client. If the deviation cannot be corrected or if the cost for doing so would be unreasonable with regard to the drawbacks caused by the non-conformance, the report will state the reasons why corrective actions have not been undertaken. The Area head will inspect and approve the non-conformance exception reports for his technical discipline and will request a statement from experts in the discipline if needed. Major deviations and corrective actions are analysed in the project team based on the exception report and if necessary, the issue is taken to the Executive Team.

Non-conformance that exceeds tolerance limits and which are not corrected, are updated in the drawings as "as-built".

The quality engineer will save the exception reports in the project bank and in a folder on the site which can be viewed by the Alliance. A list of exception reports will be maintained in the project bank.

Defective materials and supplies will be marked and set aside so they will not be mixed with those that are usable. Defective materials and supplies are returned and replaced with correct, faultless supplies unless a refund or other concessions are agreed. If the deviation can be corrected on the site a correction plan is drawn up.

Actions to stop further non-conformance are presented in the exception report. The effects of the non-conformance (e.g. deficiencies, deviations) must be traceable. Exception reports are dealt with in site meetings, the weekly meeting and in the contractor meetings. Particular emphasis is placed on what went wrong, i.e. the causes of the non-conformance and what actions should be undertaken to prevent future non-conformance issues. Information on the non-conformance and agreed actions for prevention of non-conformance is distributed to the whole workforce by the work management.

9.7.3 Hand-over of the project to the client

Handover to self (pre-hand-over process)

A hand-over plan is drawn up for the project. This will ensure the project implementation in all its stages so that the project hand-over with required documentation is realized and potential errors and deficiencies are addressed immediately at their identification at source. The hand-over plan includes the project's quality and schedule data and financial issues.

The project hand-over plan contains at least the following points:

- hand-over resposibilities
- hand-over schedule
- definition of fitness for hand-over
- hand-over folders (electronically Sokopro)
- inspections by authorities/ regulatory bodies
- financial hand-over.

Subcontracts are received as their own entity according to the quality criteria in the quality assurance plan and other contractual requirements. The basis of the hand-over method is so called hand-over to self or pre-hand-over, purpose of which is to ensure that before the handover to the client:

- the contracted work involved (subcontracts, planning contracts, material deliveries) has been done according to the contractual requirements and that the quality criteria have been fulfilled and documented
- errors and deficiencies identified in inspections and reviews have been recorded (exception reports), reported and corrective actions have been taken
- response to possible reclamations has been received and corrective actions have been taken.

Project hand-over to the client

Project hand-over to the client is done when the work has been found to fulfil the set quality criteria in hand-over to self, regulatory body inspections and possible functional tests. As the contractor goes to the hand-over inspection, he shall by then have checked the actions required to cancel the insurance guarantee during the construction and to arrange the insurance for the guarantee period. The contractor should also check the cancellation conditions of the construction work insurance.

The client is given the related material collected in the project bank at hand-over: IM drawings, updated as-built plans, installation drawings of the final installation, permit drawings with regulatory body stamps including the permits, inspection minutes by authorities, other inspection minutes of the target, user and maintenance instructions, guarantees and a list of the materials used on the site.

The site area and its environment will be organised and brought to the condition required contractually and a check is made to ensure that no third parties have claims regarding the project. Any such claims are reconciled. A signed document of any claims settlement will be forwarded to the client before the hand-over.

Maintenance responsibility will be transferred to the client's maintenance contractor in stages as the construction progresses, as a rule, always at the stage when the target has been opened for traffic. The tunnel's technical systems are handed-over for maintenance so that the start of maintenance overlaps with the testing periods. The systematic deployment of the system will have an effect on the life cycle costs of the automation system on its part. The fact that the maintenance body will participate already at the deployment stage will contribute to familiarization of the systems and maintenance targets.

Plan of action for the guarantee period

The Alliance is responsible for the actions during the guarantee period as described in the contract. The contract guarantee period is mainly five years from the deployment inspection. A plan of action for the contract's guarantee period is prepared for the project, which includes the person responsible and potentially agreed and scheduled monitoring, inspections and service during the guarantee period. The person responsible during the guarantee period will keep a diary where all pertinent information, such as contacts, inspections, measurements etc., is recorded. The operation during the guarantee period will be documented in its own folder where the actions and measures taken are classified in sections.

An intermediate inspection is done after the first year of guarantee and a final inspection at the end of the guarantee period. An exception report is written on any potential non-conformance issues found. An exception report is always based on the minutes made of the guarantee period inspection according to the monitoring and management plan.

9.8 Planning control

Planning is divided in four different technical groups: routes, bridges and geo-technics, tunnel and tunnel systems. Planning is done in each group led by the planning and area manager according to the design programme. Site needs

and making potential plan changes are emphasised in planning. Coordinating cooperation of planning between the different technical groups is a common theme in the Planning Steering group meetings and workshops. The persons responsible for coordinating planning are the design manager and the corresponding managers of the different groups.

Scheduling the planning and resources are walked through weekly for the following six weeks. All technical group design managers are present in the scheduling meeting. Information needs of the groups from other groups are discussed and the information exchange and its schedule are agreed. Integration of planning is emphasised as the construction plan progresses in detail. Initial data and the plans are taken to the project bank to ensure that up to date information is accessible to all.

The plans are inspected by the technical groups. The drawings and files for construction are approved within the Alliance in reviews by the planners and the Head of the technical discipline. Plans that are given to the builders must carry a "approved for site use" mark.

The planning status and scheduling of the total project is visited in each project team meeting as an individual agenda item. Representatives from different technical disciplines attend the meeting. New planning needs are also discussed in the site weekly meetings

Construction planning in the implementation phase is increasingly connected to construction and is more detailed than it was in the development phase (measurement plans, structural calculations, planned changes etc.). Construction is present more in planning and the builder's direction in planning is a daily event and more intensive than in the development phase. The planners and builders work in the same premises enabling seamless cooperation.

9.9 Construction management

9.9.1 Meeting practice and group working

Clear and tight meeting practice creates a basis for Alliance's management system *(Table 9.1)*. The objective of the meeting practice is to ensure efficient use of time, effectiveness (the meetings have a predetermined goal which is reached) and good flow of information.

The project's meeting practice has been designed so that all the parties to the project have always access to the data they need and the the data is non-conflicting and up-to-date. With the help of systematic meeting practice, data exchange between the parties is ensured. Meetings are prepared using issue list templates well in advance so that going through them is efficient and within the subject area. The Alliance Project Manager is responsible for the meeting practice.

The purpose of the meeting practice is to create an overall understanding of the project objectives and status and to monitor the implementation outcome of the plans. The purpose of the meeting practice is also primarily to function as planning and management tool and secondly as its information system.

In addition to meetings according to the meeting practice, the parties are in contact with each other whenever the need is there. The majority of the meetings and the daily interaction between the different parties is usually held in the Tampere project office. The manning of the office varies with project progress but is always manned with at least on representative from every Alliance party. The office challenges people to meet, discuss and motivate.

Table 9.1. Meeting practice

Meeting	Responsible	Tasks	Frequency IP-phase
Executive Team	Chairman	Management of the Alliance, personnel issues, target setting for schedules, costs, quality and safety, and implementation control.	1 / month
Project Team	Alliance Project Manager	Daily personnel management, work integration, cost monitoring, quality management, schedule planning and tracking, risk management and monitoring and management of safety issues.	1 / week
Planning Steering Group	Design Manager	Management of planning, integration, management of risks and quality and monitoring costs of schedule and planning solutions, all technical disciplines.	1 - 2 / month
Technical groups, planning	Planning Supervisor	Planning options and their feasibility, initial cost estimates, schedules for planning and construction.	1-2 / months
Technical group, weekly meeting	Head of Construction	Work safety, plans, procurement, construction, schedule, integration of construction, quality assurance.	1 / week
Weekly meetings with subcontractors	Head of Construction	Work safety, schedule, integration of construction	1 / week
Work shops	Project Manager or Project Engineer/ Site Manager responsible for the area	Brainstorming, challenging, innovations; concentrated on one topic area at a time	Problems identified separately

When the IP is started, the following internal meetings will be held (by technical discipline):
- Start-up meeting I
- Update of risk analysis (may also take place in start-up meeting II)
- Safety meeting
- Start-up meeting II

During the project implementation, following meetings are held:
- Weekly meeting
- Work management meeting
- Meetings with subcontractors or suppliers

The following meetings are held with subcontractors and suppliers:
- Subcontract negotiations/ contract reviews
- Subcontract start-up meeting
- Subcontract weekly meeting
- Subcontract hand-over meeting
- Final financial report of a subcontract
- Subcontract guarantee inspection (in connection with total contract final inspection)

9.9.2 Subcontractor's own work tasks

An implementation plan is drawn up for work in the work stage. It will include a description of the implementation and a quality plan for the work stage, which will also include matters related to safety and the environment. Work managers are responsible for drafting the implementation plan which is inspected by the Head of the area. In addition, a more detailed work plan is drawn up for more demanding work packages.

All plans written for the project are presented in the project quality assurance plan (see Appendix in Quality management), which will detail the required quality assurance actions and persons responsible. The basis for achieving the correct work outcome is a sufficiently detailed and well-designed plan which when followed, ensures meeting the objectives set to work and sufficient preparation for deviations. The site engineer collates the plans in separate folders.

Technical and functional objectives set to the work and their documentation specifications are observed in the work plans. The criteria set for the work is defined in the plans so clearly that meeting the objectives can be reliably monitored.

9.9.3 Management of subcontracts

The following major stages are part of work implementation management:

- A work start-up meeting will be held with all subcontractors, going through questions regarding the work area, work protection, safety, implementation plan, schedule, cost budget, working times and responsibilities. Work progress reporting and timing and follow-up meetings (subcontract weekly meetings and reviews) are also agreed.
- Continuous control and monitoring by work managers.
- The work manager ascertains that the plans, working methods and instructions agreed with the subcontractor have been disseminated to his machine operators and other workforce.
- Any identified non-conformance issue must be reported to the nearest manager. An exception report will always be drawn up on any major non-conformance issues, such as related to the schedule, costs or plans. Exception reports related to production are drawn up by the subcontractor's person who has been assigned the responsibility, and the work manager will review these.
- In site meetings, work progress, integration of subcontracts and coordination between the parties is monitored site wide,

The purpose of the weekly meeting (as required) with a subcontractor is to monitor the implementation of the plans (TARGET - OUTCOME) and act as a site information channel between the managers and the rest of the workforce. Site supervisors have a key role in information distribution.

If the subcontractor ignores given instructions continuously or the work does not fulfil the set quality requirements or he does not stay in schedule then a work review will be held. This review covers matters such as outcome status, implementation plan, quality requirements, work stage handover to self, and persons responsible, for a second time. If the error of deficiency is not corrected, a written reclamation will be given. A contract condition will be added to subcontractor contracts which in case of neglect, allows action to be taken and even for the subcontractor's dismissal.

Additional work and changes will be agreed and a written contract issued on these before the work is started. Additional work can be requested from others than the subcontractor conducting the work.

Subcontract inspections are held according to YSE98 (hand-over inspections, final financial report and guarantee inspection).

A work stage implementation plan is drawn up for a subcontract in the same way as described in subcontractor's own work tasks.

All subcontractors must have either a RALA certificate or a recent tax debt certificate (< 2 months) and documentation showing fulfilment of pension obligations or other reliable documentation showing that the subcontractor has paid his taxes, PAYE, social security payments and pension payments. Subcontractors are obligated to use the same principle with their subcontractors. A secretary will collect the certificates into a separate folder and makes copies for the client on request.

The project secretary will forward the following information on the subcontract companies to the tax office for fiscal control:

identification and contact information, contract type and duration, site location and payments made to these companies by the client during the notification period, and the total subcontract value. (HE 92/ 2012)

Monitoring of the obligations of subcontractors and employees is presented in detail in *1.17 Personnel Management.*

9.9.4 Site plan

The site organisational plan is shown with a plan map in the office and on the wall of the social area for personnel. The following matters will be marked on the organisational plan:

- location of office and social rooms
- location of explosive storage depots
- storage areas, logistics
- excavation targets
- site pathways
- electricity centres
- location of fire fighting equipment and first aid supplies
- cautions for pipes, cables and leads
- waste collection points

The area Head is responsible for updating the drawings when required as the project progresses. An organisational drawing is presented as an appendix to the project plan. The same plan describes the excavation fire and rescue plan and detonation plan.

9.10 Safety

The project target is zero work related accidents and maintaining the health of the workforce. In order to reach the target, continuous and systematic safety work has to be undertaken in both planning and implementation phases. "Safety First" principle is the main ethos in all work planning and implementation safety issues.

Safety is one of the key result areas. Accident frequency must be less than 16 days (accident occurrences per a million of man hours) and the absences due to accidents must be less than 200 days per year.

A safety document has been drafted in the development phase for the planning and preparation for construction, which has to present the danger and impediment factors due to the features, conditions and characteristics of the construction project. It must also include information regarding work health and safety.

Additionally, the Alliance has to issue written safety regulations for the construction implementation. These have to include safety management objectives and actions, including instructions for safety monitoring and inspections, cooperation and site meetings, use of personal identifiers, site entry permits and handling of security plans requiring approval by the parties.

The risks related to work safety (impediment and danger factors) are minimised with systematic safety work. Work safety risks are analysed by work stages (cause, impact, risk classification) and actions to eliminate / reduce the risk are agreed with schedules and named persons responsible. A site safety plan is drawn up which contains the risk management plan of the safety risks in question. The plan is updated during the contract. The safety plan is walked through in the site start-up meeting and also in the orientation training for the whole workforce. Safety risks and actions are included also in the work stage plans and these are discussed with the employees participating in the work stage before starting the work. Additionally, an organisational plan (area plan) and fire and rescue plan is devised for the site.

Every member of the workforce (also subcontractors) has to have a valid work safety card. Those involved with fire prevention and those granting fire work permits must have a valid fire work card. Access to the site requires a photo identity access permit and the use of personal protection equipment (visible safety clothing, safety helmet, safety goggles, safety footwear and hearing protection, as needed. The issue of an access permit requires attendance in site orientation training and the required skills. In connection with the orientation, every operative's tax number and work safety card will be inspected (also subcontractors). Every work shift must have the required number of First Aid trained personnel as required by law.

An MVR measurement (a work safety measurement of site safety) will be weekly on the site just before the weekly meeting. The results of the measurement and other work safety issues are handled in the beginning of the weekly meeting. The whole workforce is issued with Safety observation leaflets and urged to make continuous safety observations, which can be reported by SMS and email. The observations received are discussed in the weekly meetings. This observation method is used to reduce accidents where possible.

The safety plan and the documents relating to safety will be filed in their individual folder. Other documents that need to be filed in addition to the safety plan are, inter alia, orientation forms and access permit lists, fire work plans, work stage implementation plans, MVR measurement results, accident reports and "close shave" notifications, traffic accident reports, safety observations, incoming equipment inspection documents, lists of chemicals, user safety notifications and a list of First Aid trained operatives.

9.11 Risk management

In the Alliance development phase, the project risks were handled in risk management workshops and risk management matrices were drawn up by technical discipline. These will be updated to IP tables as the project starts and during the project. Identified risks and their management actions will be collated to the tables. The issue has been presented in detail in *section 5, Risks and Opportunities*.

Work safety risks will be further analysed by work stages and environmental risks by views in the site safety and environmental plan. Work stage specific risks are also analysed in the work stage specific implementation plans, which are discussed before the work is started with those members of the workforce who will be participating in the stage.

Table 9.2. Issues to be monitored and the implementers

Target of monitoring	Implementer
1. quality of surface water	Kokemäenjoen vesistön vesiensuojeluyhdistys
2. height and quality of ground water, also arsenic	Kokemäenjoen vesistön vesiensuojeluyhdistys
3. slumps	A-Insinöörit Geotesti Oy
4. air quality	Ilmatieteenlaitos
5. traffic noise	SITO Oy
6. tremors	Lemminkäinen Infra Oy
7. rock movements	tba
8. traffic (quantity, flow etc.)	A-Insinöörit Suunnittelu Oy, Pirkanmaa and Southeast ELY Centres, Tampere City
9. landscape	A-Insinöörit Suunnittelu Oy
10. human effects	A-Insinöörit Suunnittelu Oy

9.12 Environment management

The environmental monitoring due to the project implementation will follow the Environmental change monitoring programme (Environmental change monitoring programme) (16.6T-1). The project team coordinates the monitoring of environmental changes and is responsible for reporting to authorities accordingly. Hence, issues to be monitored and the implementers of monitoring are shown in *Table 9.2.*

The objective is to minimise the risks caused to the environment with systematic risk management: Environmental views are taken into account in the technical discipline risk matrices (analysis and agreement on actions), site start-up meetings, site implementation plans and in connection with orientation.

The site environmental issues will be discussed in the contract start-up meetings and in connection with orientation. The methods of dealing with environmental issues are also described in each separate work stage specific implementation plan, and these are walked through with the workforce before the start of a work phase. The environmental plan is detailed further as the project progresses.

Disturbances to the environment, such as caused by noise, dust, tremors and emissions are noted and minimised in the construction work. Methods and equipment which cause minimum noise, dust, tremors and emissions disturbances will be used where possible. Work stages causing noise and tremors will be scheduled so that they cause minimal disturbance to local residents. Before the work is started (minimum 30 days), a noise notification will be made and residents, care and educational establishments and other potentially affected parties within the catchment area will be informed. The information leaflet distributed will explain the duration of the work or event and give contact details. Irrigation and protection where possible is used in dust prevention.

The quantity of waste products from the site will be reduced as much as possible by careful procurement and work stage planning, applying exact material quantities, careful protection of materials, storage and site handling, recycling mould goods, etc. Construction waste is collected separately and sorted (into wood, concrete, metal, carton, problem and miscellaneous waste) and delivered to an approved tip where the recycling factor is as high possible. Similarly, the site office and social rooms waste is sorted (into paper, glass, metal, bio and miscellaneous waste).

Official regulations are adhered to with the management of construction phase problem waste materials, such as chemicals, solvents, oils etc. The substances are kept and stored in facilities that are equipped with security vats and have immediate access to sorbents, cleaning equipment and fire extinguishing and first aid implements. Poisonous substances are kept behind lock and key. Transport of these substances will adhere to the regulatory permits. The workforce is instructed in dealing with the chemicals. User safety leaflets for the substances are easily available to all.

Problem waste, such as paints, solvents, glues, oils etc., will be stored in their original containers if possible. If the substance classified as waste is transferred to any other receptacle than the original one, the data regarding the content is transferred as well. Problem waste is collected separately and delivered to problem waste collection. Any accidental spills of oils or other problem waste on the ground will be handled in accordance with the instructions approved by the municipal authorities.

The groundwater during the construction phase is managed, inter alia, with the following actions: groundwater surface observation, monitoring of subsidence and displacement of buildings and structures, protection of the ground surface in areas of machine holding and service stations, machine deployment inspections, biodegradable use of hydraulics oil, fuel and oil silo catchment pools, peat near the machines. A separate plan will be drawn up for groundwater management.

Water from the construction period (leakages, rinsing, washing and irrigation water), is pumped into sedimentation basins where the water is separated from oil and solid matter before release. The acidity of the released water from the basins is measure continuously. If the pH exceeds standard limits the water is neutralised before the release. The emptied oil waste is delivered to the problem waste utility. A separate water purification plan will be drawn up if necessary.

Documents are written on all environmental reviews, measurements (noise, tremors, subsidence etc.), exception and damage notifications and possible complaints, and these are saved in their individual environment folder and also to Louhipalvelu and the project bank. Environmental issues are also reported in the site meetings. The Alliance is informed of any significant non-conformance and damages immediately.

9.13 Communications and stakeholders

Public image is one of the key result areas. A detailed project communications plan was made in the development phase, currently in the project bank. The communications plan is updated continuously but at least biannually. The Alliance communications group will handle plan updates and bring them for the approval of the Executive Team. The update to be done in the end of the DP phase covers the first months of the IP phase as a whole. The following presents a summary of the key content of the communication plan. In a disturbance situation, a separate instruction will be used which is also saved in the project bank and a printed version can also be found in all Alliance offices and the site employee social facilities.

9.13.1 Key messages for everybody

The key messages were determined in the beginning of the DP phase. These do not change in the IP phase.

1. The venture will improve the development opportunities of Tampere centre and the western urban areas
   - increased land use efficiency
   - adoption of Näsijärvi coastal areas for leisure and habitation
   - benefits to trade and industry and travel

2. The venture will improve traffic flow and remove congestion from the highways
   - benefits to work travel and public transport
   - improvement in traffic facilities for the western urban areas
   - benefits to trade and industry and travel

3. The venture will improve attractiveness of the area for habitation
   - adverse effects of traffic noise and emissions will reduce although cannot be completely removed
   - obstruction by the road is reduced

9.13.2 Objectives of communications and participation

The objective of project communications and dialogue is

- to offer key stakeholders (inhabitants, decision makers, authorities, housing associations etc.) the right information at the right time regarding the project, its progress and impact
- improve the image of the venture so that Rantatunneli can be seen as a good example of an Alliance contract
- support the project progress through communications
- prepare for communications in case of disturbances
- gather and communicate necessary information regarding environmental changes (human effects, landscape effects) and engage people.

9.13.3 Communications responsibilities

- Esko Mulari (Project Manager) is responsible for the total project communications.
- Emphasis is on internal communications.
- Mauri Mäkiaho (Deputy Project Manager) is responsible for media communications and communications to other target groups.
- Inka Koskenvuo (Finnish Transport Agency, project communications) is responsible to ensure that the Alliance communications adhere to the guidance given by the Finnish Transport Agency and to Mauri Mäkiaho in communication matters. Anna-Maria Maunu (Tampere, communications director) will act as a responsible contact person in the communications cooperation between Tampere City and Rantatunneli Alliance.
- Päivi Korpela (Pirkanmaan ELY Centre, communications) will act as a responsible contact person between Pirkanmaa ELY Centre and the Alliance communications cooperation.
- Merja Tyynismaa (Alliance project team member) is responsible for acting on communication tasks such as weekly information bulletins, drawing up and updating the communications plan, for communications regarding the monitoring of environmental changes and engagement etc. and making sure that the tasks and contact information of the responsible persons are always up to date in the Tampere City service centre and the traffic customer service centre.
- Sirpa Koivisto (Alliance office, office secretary) will take care of guest reception and given internal communications tasks. She will also follow the media and collect any news particulars re the project, such as reader comments which will be replied if needed in the way agreed with the Project Manager.
- Every employee is instructed to receive any direct feedback either on site or its immediate surroundings with good grace. The person who receives this feedback, should record it straight away and forward it to the manager who will forward it further to the project engineer specialised in excavation communications.
- The project engineer as per above will collate the received feedback. This and the following actions will be documented and saved in a separate feedback folder (project bank) and the incident will also be reported to the site supervisor. If the person who gave the feedback has left their contact information, a response will be sent. Feedback is discussed in site meetings if deemed appropriate (site weekly meetings and major site meetings).

9.13.4 Excavation communications

Communications regarding excavations will be handled by a project engineer who is an expert in the field. The communication is open are factual and the purpose is to ease the site work.

A few big media events are arranged in the start-up of the site work, which aim to communicate and disseminate information about the project and the traffic arrangements during construction. In the first events of this kind, a representative group of experts were present to answer any questions and to give different perspectives on the project.

Information events are arranged once a month throughout the project. The same stakeholders are always invited, e.g. property owners, house managers, traders, officials, media and other key stakeholders. The event is always held in the same premises.

The communications to the inhabitants within the catchment area is done in several stages:

- In the first phase, the residents are given a leaflet informing them that their apartments will be surveyed and that their IT equipment will be made tremor proof. The leaflet includes a map and gives a general description of the project, its duration and contact information. Consideration may be given to arranging individual information events for some particular properties
- In the second phase, information events are arranged for the residents a few weeks before they can feel the effects of the excavation in their building. The residents are told how long the excavations will last and other details. By previous experience, these events often change the uncertain perception of the residents into an interest in the excavations.
- The third phase is to inform the residents about estate end reviews. The residents are given a leaflet to inform them about this in advance, which tells them what is going to be done, when and when.

9.13.5 Communications regarding traffic arrangements during working time

A plan for traffic arrangements during the work period is drawn up for the site. Any impediments and delays due to the site will be mitigated as much as possible with advance communications. Traffic arrangements during construction are communicated the road users and authorities regularly, e.g. once a month or as and when changes occur.

9.14 Permits and notifications

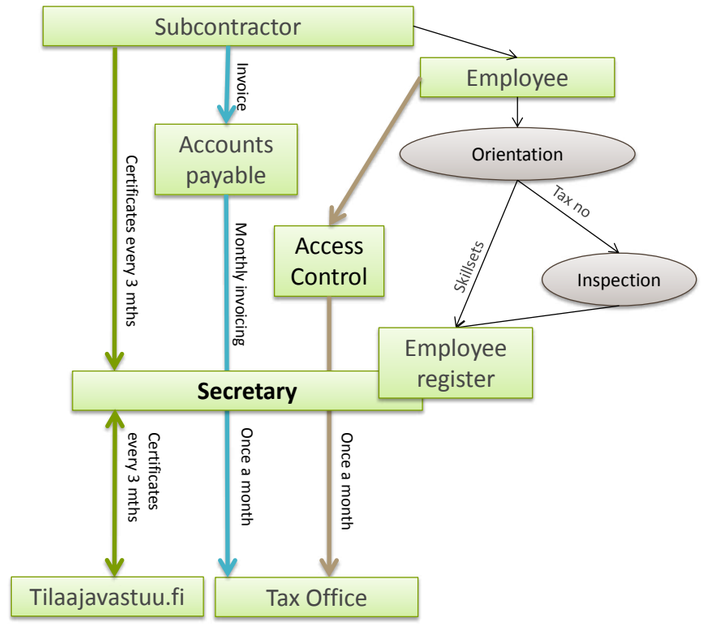
The permits required for the project implementation have been analysed and recorded in the list of permits. Exact permit requirements and timing will be agreed in more detail with the appropriate regulatory body. Each permit will be governed by a nominated person, who will be responsible for submitting the application for the permit in time, its monitoring and contribute to its approval.

9.15 Personnel management

The orientation of functionaries is done on site as follows:
- walk-through of the project plan
- walk-through of job descriptions / key result area discussions
- presentation of systematic meeting practice

The Project Manager is responsible for the orientation of key personnel.

A general orientation session regarding the whole project is held for the workforce (responsibility: the Project Manager), in addition to which the area work manager orientates his own and subcontractor workforce in the target and the practices required by the project plan. Additionally, the employees are given an orientation to the work stage or phase in the work stage start-up meeting. The employees will be informed about acute general issues regarding the site.



Picture 9.1. Actions to ensure the subcontractor's handling of public obligations

All attendees of the orientation will sign an attendance form. This will include their tax identification number, home country (whether they have a E101, E102 or A1 certificate), work/agency relationship and description of skills. The project secretary will record the above information in the access permit list and grant an access pass. The work permit requirements of foreign nationals will be confirmed according to RT Ry instructions.

The project secretary will forward the necessary identification and contact information about the site workforce to the tax authorities for fiscal reasons, also informing them of the dates of when the work was started and finished, the employer's home country/state, the nature of the contract and information regarding working and residency in Finland as well as insurance information. The care of these obligations is shown in *Picture 9.1*.

9.16 Data management

The project documentation includes construction planning materials, all plans related to the project planning and other work related plans and other contracts, meeting minutes, letters etc. regarding the work. A register/ lists are kept of documents and files, and a document version and date is inserted in the document. In practice, various document lists are kept, e.g. one list of drawings of plans and an individual list for each technical discipline. The site files document work progress and are used to show achieved targets.

The documents directing the work are managed with the help of the document list. Latest versions are used and all documents can be found when required.

An electronic project bank is used in document management and distribution. All materials from the project are saved in the project bank in an electronic format which also functions as a hand-over material bank as the project is implemented – no paper based materials are used. Preparatory documents and file transfers between the planners are done via the project bank.

The planning copies required by construction work are ordered and delivered automatically form the project bank. Subcontractor queries are made through the project bank, at least for planning materials.

The document management responsibility principles are the following:

- The signed subcontractor contracts with appendices and add-on/ change orders are kept in the premises of the area Head in the project office. Contracts are saved in the project bank which can only be accessed by those with the correct authorisation.
- The site engineer will take receipt of and keep a record of all documents related to planning and keep all the documents, including drawing series and lists up to date. A valid paper copy of the construction plan is always available in the site engineer's office. Any deficiencies in the plans should be reported to the site engineer, who will keep a track of such issues and will inform the planner of any revisions required.
- The documents received form the authorities, planners and third parties (faxes and letters), will be kept in separate communication folders in the site engineer's office, in a locked facility. The documents are also taken to the project bank.
- The site engineer will collect customer feedback in a separate folder and all comments received from the customer will be forwarded to the client's feedback system.

The documents are entered into the Sokopro project bank in an electronic format. The file management is done according to the hand-over documentation distribution presented in the hand-over plan. The maintenance of the files is the responsibility of either the site or the project engineer. Sokopro is responsible for file backups.

9.17 Reporting

The highest deciding authority in the Alliance is the Executive Team. The Alliance Project Manager reports to the Executive Team regarding key issues on safety, schedule, costs, quality and organisation, which is done in a graph format. The Project Manager will deliver a report to the Executive Team three days before the meeting.

The technical groups (including planning), will report the financial situation to the project team as per the monthly schedule. Personnel and fixtures data to the report will be automated through the site diaries kept in the project bank. Other issues are reported by the technical groups on a weekly basis in the project team meetings.

9.18 Internal inspections

The client and the Executive Team can order and inspection to ensure that the Alliance management method is being followed. The inspection is undertaken by an Alliance financial expert or other, external and independent inspector, who will state in his inspection report whether the management system has been followed and which corrections, if any, should be done.

Lemminkäinen Infra Oy audits the project once a year according to the ISO 9001- ja ISO 14001- and OHSAS 18001standard requirements against the built functional system and project specific project plan. Lemminkäinen Infra Oy's Quality Manager is responsible for the internal audits. The external audits on Lemminkäinen Infra Oy's certified operational systems is done by Inspecta Sertifiointi Oy. Any non-conformance found in an audit necessitates the site to make a revised plan and make the reparations required to the plans or operations.

9.19 Training plan

The project team will prepare the IP training plan which will be approved by the Executive Team. This is part of improving the Alliance performance. The subjects of training are presented in Table 9.2, detailing each target group and training method (not in priority order).

Wall chart type, short instructions are made of some key themes, such as disturbance communications or value for money, which will be visible in all Alliance premises. The value for money theme will be reinforced to ensure the key messages by using a somewhat unorthodox presentation method or visual image (such as cartoons, posters, videos etc.). The instructions regarding disturbance communications are brief (one A4), unambiguous and clear.

Table 9.2. Training offered

Theme of training	Target group	Method
Value for money	• All	• Written materials • Training / Fact sheets
Cooperation and Team work	• Management	• External coaching
Communications and interaction Meeting of persons involved Managing conflicts	• Communications Team • Management	• External coaching
Using a data model on site	• Heads of contruction • Work management	• Training
Technical systems and data management	• Technical discipline group	• Training
Standardisation and modularisation of planning and construction	• Area heads • Technical Groups	• External coaching • Workshops with an experienced facilitator
Other training needs identified in the IP phase		

Picture 9.2. Workshops have proven to be an efficient way to solve problems and innovate new ideas in the development phase. The use of this working method will be developed further with facilitation training for the technical groups. Source: Rantatunneli Alliance.

Appendices

Appendix 4.1A List of Drawings, DP phase initial construction plans (28.6.2013)
Appendix 4.2A Samples of DP phase construction plan drawings
Appendix 5.2A Idea and innovations matrix
Appendix 8.1A General schedule, open part
Appendix 8.1B General schedule, tunnel
Appendix 8.5A Start-up schedule, 6 months

Liikennevirasto

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A-INSINÖÖRIT