

CREATING EFFICIENCY THROUGH DEFINING AND UTILIZ- ING SYNERGIES IN THE FIELD OF LOGISTICS

Case study: Tampere regional transport re-
search

Sami Gullstén

Tuukka Juntunen

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Degree Programme in International Business
Green Supply Chain Management

SAMI GULLSTEN & TUUKKA JUNTUNEN

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Tämä tutkimustyö tarkastelee yhteistyömahdollisuuksia neljän Pirkanmaalaisen organisaation välillä. Tutkimustyö analysoi synergiaetuja joita tutkimukseen osallistuneet organisaatiot voivat tulevaisuudessa hyödyntää. Tavoite on löytää samankaltaisuuksia reitityksissä, joita jokainen organisaatio tällä hetkellä käyttää ja luoda tulevaisuuteen mahdollisuus rakentaa paikallinen kuljetusjärjestelmä, jota on helppo laajentaa ja hallinnoida.

Tämä opinnäytetyö tehtiin tutkimustyönä Tampereen Logistiikka Liikelaitokselle, jonka tahtotila oli tutkia onko mahdollista yhdistellä kuljetuksia siten että se hyödyntäisi mukana olevia organisaatioita. Tutkimus määrittelee Tampereen Logistiikka Liikelaitoksen osallisuuden uudessa järjestelmässä. Tieto kerättiin organisaatioiden vastuuhenkilöiden kautta pitämällä heidän kanssaan tapaamisia.

Teoreettinen tausta tutkimukselle on tuotantoketjun hallinnassa ja tarkemmin tarkasteltuna kuljetushallinnassa. Lähestymistapa on loppuasiakkaan näkökulmasta. Kuinka he voisivat hyötyä uudesta järjestelmästä joka on luotu heitä varten. Tämä tutkimus tarkastelee myös teorioita logistiikan eri näkökulmista sekä hinnoittelusta.

Tärkein tulos tästä tutkimuksesta oli se, että on täysin mahdollista luoda kokonaan uusi kuljetusjärjestelmä. Uusi järjestelmä tuo organisaatioille tehokkaampia tapoja käyttää heidän logistisia toimintojaan samanaikaisesti alentaen kustannuksia. Organisaatioiden edustajat pitivät mahdollisuutta luoda uusi kuljetusjärjestelmä jossa on enemmän kuin yksi organisaatio kerrallaan. He myös näkivät mahdollisuuden leikata kuluja ilman laadun huonontumista mahdollisena.

Nämä tulokset osoittavat että on mahdollista luoda täysin uusia tapoja hyödyntää logistiikkaa Pirkanmaan alueella ja että organisaatiot ovat valmiita muutokseen.

Asiasanat: synergiaetu, kuljetusjärjestelmä, logistinen informaatiojärjestelmä (ArcLogistics), reittijärjestelmä, reittioptimointi, tuotantoketjun hallinta, kuljetushallinta, hinnoittelu, logistiikka.

ABSTRACT

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This research evaluates the possibilities of co-operation for four organizations in Pirkanmaa area in the field of logistics. In more detail the research analyses the synergies between organizations and how they could be exploited. The aim is to find similarities in the routes that each organization is currently using and make possibilities for future to create local routing system that is easily expanded and managed.

This thesis was carried out as a study for Tampereen Logistiikka Liikelaitos for creating new routing systems that could benefit the involved organizations. Also the study defines the participation of Tampereen Logistiikka Liikelaitos in the new created system. The data for this research was gathered from representatives of four organizations operating in the Pirkanmaa region.

Theoretical basis for this research lies in Supply Chain Management and in more detail in the transportation management. The approach is from the end users perspective. How could they benefit from the new system that has been created? Also this research takes theories from different logistical viewpoints and pricing structures.

The key result from this research is that it actually is possible to create a whole new routing system for the organizations. The new system provides organizations with more efficient ways of handling their logistic operations, meanwhile decreasing costs of those operations. The organizations representatives found that it is reasonable and possible to create a new routing system that involves more than one organization at a time. They also believed that it is possible to create savings through this new system without diminishing the quality of their services.

These results indicate that it is possible to create new ways of logistical operating in the Pirkanmaa region and that organizations are ready for a change.

Key words: synergy, transportation system, logistics information system (ArcLogistics), routing system, route optimization, supply chain management, transportation management, pricing, logistics

FOREWORD

This research topic was given to us by Tampereen Logistiikka Liikelaitos. We would like to thank their employees for the help and this amazing opportunity. Our special gratitude goes for the CEO Reko Martti and the Logistics Manager Erkki Harju. They really gave us a professional viewpoint for this thesis.

Dr. Anasse Bouhlal was the supervisor of this thesis. Without the advice and guidance from Dr. Bouhlal this thesis would have not been possible. Our special gratitude goes for you.

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1 INTRODUCTION

The movement of the goods has always been a crucial part of the business processes. It takes a lot of planning and management to reach the definitive goal; the fulfillment of the customer's order. In supply chain management (SCM) finding the most efficient ways to manage and control the flow of goods is the core of the whole process. The flow of goods has to be professionally supervised, starting from the raw materials and ending when the goods reach the consumers' hands.

In today's world, it is important to be open to change. Transition from the old habits to new one's can feel like a huge step. Cooperation and finding synergies between other operators is sometimes the best way to achieve the desired, more effective and high-performance outcome. This is also shown in this thesis.

In this research, new and ideal transportation system and unified schedule for the four organizations was created. This was possible, because of the theoretical background and especially due to the logistics soft wares it is possible to use in the Tampere University of Applied Sciences.

1.1 Thesis outline

This thesis includes five main parts. The first part is the introduction, which contains background information, research objectives, and research methods. The second part the authors present the five organizations, which were part of the research. The third part contains the theoretical part used in this thesis. In the fourth part the new routing system is shown and described based on the findings the authors found. The fifth part, recommendations, presents the new transportation system and how it is managed.

1.2 Research background

The organizations operating under the umbrella of Tampere are mostly solely in charge of their own business operative actions. There is no unified system to transport the organizations' goods around Tampere and Pirkanmaa region. Especially from the logistics

point of view, the operations might be still working in the old traditional way. Changes haven't been made because everybody is already used to the old customs, and change can sometimes be scary. This leads to the lack of optimal use of capacity and higher costs.

This research was made possible for the authors by Tampereen Logistiikka Liikelaitos. They contacted Anasse Bouhlal about the project and discussed the resources and capabilities they have in the Tampere University of Applied Sciences. The kick off meeting was held on the 21st of February 2012 in the premises of TAMK. The meeting was between the CEO of Tampereen Logistiikka Liikelaitos Reko Martti, the Logistics Manager Erkki Harju, Anasse Bouhlal, and the authors of the thesis. In the appointment, a presentation was kept, which gave a deeper insight of the logistic soft wares they have in TAMK. The presentation showed what is possible to achieve with these programs and what benefits they would bring for Tampereen Logistiikka Liikelaitos. The feedback was positive and the research was given the green light. The actual start of the project was on the 2nd of April 2012. On that date, a more instructive meeting was held between the authors of the thesis, and the representatives of Tampereen Logistiikka Liikelaitos.

Tampereen Logistiikka Liikelaitos had selected four organizations for this research:

- Fimlab Laboratoriot Oy
- Pirkanmaan kirjastot (Later referred to as PIKI)
- Tampereen aluepelastuslaitos (Later referred to as ALPE)
- Pirkanmaan koulutus konsernikuntayhtymä (Later referred to as PIRKO).

These organizations have daily movement of goods; therefore they use logistics services continuously. The purpose of this research is to optimize the transportation system of each organization, finding synergies between one another, and ultimately lowering the current costs. This would be possible if a unified transportation schedule was constructed. It would serve all four organizations by reducing their costs and increasing their

service quality. The new system would only be achievable by optimizing the current routes to a new optimal routing system.

The members of these organizations were invited to a meeting, which purpose was to clarify the topic of the research and its goals and objectives. During the meeting it became clear that the representatives of these four organizations were enthusiastic about this research, although the possible change of the current system was a little bit terrifying for some. The reason for the excitement was more or less the fact that none had actually concerned themselves about the issues related to the regional transport system within their organizations. Mentioning the lower costs and the improvement of the current system was enough to win the trust of the representatives.

1.3 Research objectives

The objective of this thesis is to reflect the benefits from optimizing transport routes in the logistics operations of local organizations so that savings are achieved. This means integrating the needs of different organizations and clarifying the transport system. The main focus in this thesis is the transport needs and routing. This is because each organization currently drives their delivery routes alone.

The main question in this research is “How could the organizations benefit from the new routing system?” Also reasons need to be given for “Why should the organizations take part in the new routing system?”

The interest of this research is to examine the needs of each organization and figure out how to improve the current delivery system, or at least maintain the same quality of service with lower prices. Furthermore Tampereen Logistiikka Liikelaitos’ involvement in this system needs to be figured out. The main questions to be answered are:

- What are the organizations’ needs?
- What is the current situation in the organizations’ logistical operations?
- What kind of synergy could be found?

- What would the organizations benefit from the new system?
- How is the new system managed (and who will manage it)?

To find answers to these questions this research involves four organizations whose logistical operations are investigated. This research also accounts how could Tampereen Logistiikka Liikelaitos benefit and manage this system and how the pricing could be done.

1.4 Research methods

1.4.1 Discussions with companies

The discussions were held to gather information directly from the organizations and to gain a clear view how the logistical operations are currently handled within the organization. Due to the different operations of each organization the research questions varied for each organization. The selection for representatives to be interviewed was done in the “kick-off meeting” where the representatives of different organizations gave us contact information of the people involved in their logistics operations. The main questions were:

- What is the current transportation system?
- What goods are being transported?
- From where are purchases done and by whom?
- What demands / restrictions exist for the delivery system?

The meetings were the main tool for gathering data from the organizations’ operations and needs. More detailed information about operations and needs were needed and this information was gathered via e-mail or phone.

For the optimization part the delivery addresses were gathered to one excel file that could directly be driven into the used logistics software. Software called ArcLogistics was used for making the optimization for the new routes.

Weekly meetings were held with Erkki Harju and Reko Martti, in which the progress and findings were presented. This gave them more insight of the research, but also opened the topic for detailed questioning. This way the authors of the thesis received more professional guidance, and the representatives gave us information what more they wanted to find out in the research.

To get more elaborate background information on how the transportation systems are usually managed and priced, literature was searched from a few different sources. TAMK library had all the required books for the theory part of the thesis. Most of the information for the theory part was found from the books and only a small amount of internet research was needed. Mostly information about the organizations involved was found from the internet.

2 ORGANIZATIONS

2.1 PIKI

PIKI comes from the words Pirkanmaan kirjastot (Libraries of Pirkanmaa). The cooperation of the PIKI libraries started in the year 2002 when the 11 municipalities wrote the agreement of involvement. At this moment, all of the 22 municipality libraries of Pirkanmaa are part of the PIKI organization. This means that there are approximately 70 offices and 11 mobile libraries now part of the whole chain.

The activity of PIKI libraries is consistent to the co-operation agreement of the general libraries of Pirkanmaa. The municipality law allows them to approve their services with voluntary cooperation. Because of this collaboration the customers get their hands on all of the services, collections and the professional expertise, with just one library card. There are over 3 million pieces of material in the collection of the libraries, and the customers lend almost 10 million copies per year. Transfers between the regional libraries contain over 170 000 copies.

All of the decisions concerning the cooperation are made by the steering group. Every PIKI library names their representatives for this team. The management group of PIKI, on the other hand, prepares matters for them. For the practical things, the libraries have their own mutual coordinator.

2.2 PIKI libraries

In the beginning of 2012 the libraries of Ruovesi, Parkano, Kihniö and Virrat joined PIKI. Currently, like mentioned before, the list consists of 22 libraries:

- Akaa
- Hämeenkyrö
- Ikaalinen

- Juupajoki
- Kangasala
- Kihniö
- Lempäälä
- Mänttä-Vilppula
- Nokia
- Orivesi
- Parkano
- Pirkkala
- Punkalaidun
- Pälkäne
- Ruovesi
- Sastamala
- Tampere
- Urjala
- Valkeakoski
- Vesilahti
- Virrat
- Ylöjärvi

2.3 Tampereen aluepelastuslaitos (ALPE)

Tampereen aluepelastuslaitos is the regional rescue department of Tampere, also known as ALPE. The organization has been divided into different functional areas, in which the staff and the fire departments work for the better of the people. Their main goal is to guarantee a good and safe living environment for the inhabitants of Pirkanmaa. In the map below, it is shown how the regional rescue and surveillance areas have been divided.



Figure 1. Regional rescue and surveillance areas of ALPE

2.3.1 The organization

ALPE's permanent and part-time employees work together with 50 different contract fire departments. Their main duties are the prevention of accidents, the actual rescue work, and the anticipation for the state of emergency. This takes place in 22 municipalities. ALPE operates in the whole of Pirkanmaa, and its operative organization is divided into three rescue areas (the north, east and west). There are 65 fire departments, 13 of them are so called 24/7 departments.

The rescue actions are based on various pre-made rescue plans for different accidents and emergencies. These plans cover all the actions that could take place in land, water, anywhere, anytime. The most urgent first aid operations and the transportation of the patients, is taken care in Tampere, Nokia, Pirkkala, Ruovesi and Valkeakoski.



Figure 2. The organizational chart of ALPE (2011)

2.3.2 Rescue work

Successful rescue operation requires a lot of various things. The rescue equipment has to be up-to-date, and the staff has to be well-trained. This training is a continuous process to ensure the safety of the people. The challenges that ALPE faces today demand that the whole rescue personnel have the knowledge of how to act in the many various areas, which take place in the operations. That said, one of ALPE's goals is the on-going development of knowhow of the staff.

The rationalization of the rescue activity is based on the knowledge, awareness and dimensioning of the risks in the area of operation. This is the first step of moving towards a safe environment. Pre-made alert propositions, which enable the best possible outcome of the rescue operations, are founded on mapping of the risks.

For every rescue operation, it is absolutely vital to always send in the closest and the most suitable units. This requires that the whole safety organization works perfectly in land and water areas. The situation starts from the emergency announcement and ends in the after work.

One of the most important goals of the future for ALPE is to direct more momentum to the prevention of accidents. This means actions, which are meant to decrease the probability of accidents, and to minimize the damages of the misfortune. The improvement of the safety culture is one of the core ideas in ALPE's functions. This doesn't just happen in the working hours, but also in the free time.

2.3.3 Voluntary fire department

The contract fire departments form an important operator group in the rescue work that takes place in Pirkanmaa. The chief of rescue made a decision that the contract fire departments formed a cooperation group. The president of the group is the head of the rescue work in the resources management. The group also consists of the representatives of the contract fire departments. Every department has two persons in the operator group. Depending on the issues that they are dealing with in the meetings, they also invite specialists to the meetings.

ALPE organizes the basic training, which is included in the course. You have to be at least 18 years old, healthy and appropriate to the task, to participate in the training. The fire department briefs the trainees before the basic course starts.

2.4 PIRKO

PIRKO was founded in 2007 from five vocational institutes in Pirkanmaa region. PIRKO provides vocational education and related services in Pirkanmaa and its 16 municipalities belonging to this system. The municipalities are Ikaalinen, Kangasala, Kuhmalahti, Kuru, Kylmäkoski, Lempäälä, Nokia, Orivesi, Pirkkala, Pälkäne, Ruovesi, Tampere, Vesilahti, Virrat, Ylöjärvi and Ähtäri.

PIRKO consists of three institutes:

1. Pirkanmaa Vocational Institute
2. Pirkanmaa Adult Education Institute
3. Pirkanmaa Apprenticeship Centre

These educational services are organized with 600 employees around Pirkanmaa, and these services are for youth & adult education as well as apprenticeship services.

PIRKO around Pirkanmaa:

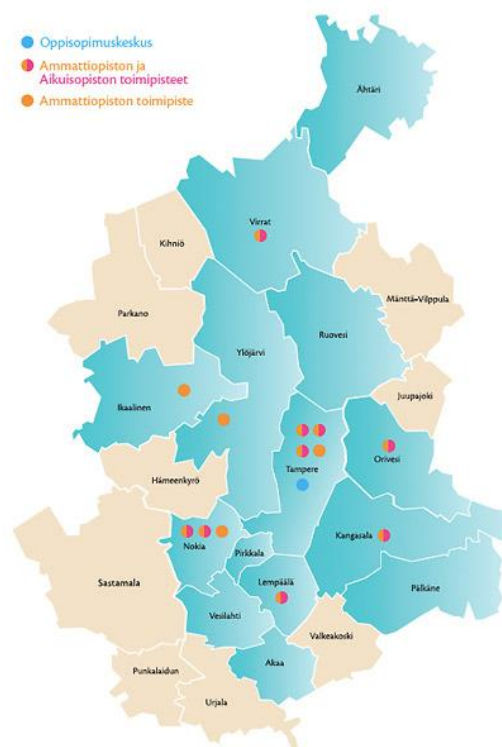


Figure 3. PIRKO's places of business in Pirkanmaa

2.5 FIMLAB Laboratoriot Oy

Fimlab is owned by ‘Pirkanmaan sairaanhoitopiirin kuntayhtymä’ and it is the first laboratory company formed to the public healthcare section. It is a Finnish company that provides all laboratory services, training and research in Pirkanmaa area for the public healthcare needs. Fimlab Oy has over 50 offices in the Pirkanmaa region and they commit over five million researches per year. It also has 500 employees and they work constantly with students from the laboratory and healthcare sector as trainees.

Fimlab Oy’s customers are:

- Hospitals
- Private hospitals
- Healthcare-centers
- Work healthcare
- Patients of the private hospitals

The main goal for Fimlab Oy is to be as cost efficient as possible. For the customers this means cheaper prices for the services without neglecting the quality of the service. They also inform that the sample taking is possible also without reserving an appointment and the results will be announced promptly.

Fimlab Oy is certified by these standards:

- SFS-EN ISO 17025 (International standard)
- SFS-EN ISO 15189 (Medical laboratory standard)

2.5.1 Current situation

Fimlab Oy has outsourced the transportation of samples, and it’s currently handled by Itella. With this project they seek to make their routes more cost efficient and simultaneously approve their service level.

The samples are transported in styrox boxes that are sealed shut. The demands for transporting medical samples:

TEMPERATURE	TIME
Room temperature	Tampere region + Nokia 4hrs Other Pirkanmaa region 24hrs

Figure 4. The demands for the medical samples of Fimlab Oy

The time that the sample needs to be taken to the laboratory varies because the samples are not handled with chemicals in Tampere and Nokia region. This means that if the samples are not tested within 4 hours the sample will be useless. Transportation wise this means that the schedules for Tampere city region and Nokia are really tight. Therefore there is no reason to implement extra stopping points to those routes. If we would add for example few libraries to the route that might risk the four hour time window that is crucial to the samples. The time-window is important because if the samples are not tested within four (4) hours they will be spoiled and cannot be used anymore.

At this point, there are only two well-planned routes with specific schedules. From those two, Fimlab Oy's is definitely the more demanding one, especially when considering the time available to use. Therefore, those schedules will work as a frame for the rest of the routes.

2.6 Tampereen Logistiikka Liikelaitos

Tampereen Logistiikka Liikelaitos organizes logistical operations for the city of Tampere. Their main functions are carrying out competitive biddings for other organizations belonging to the city of Tampere. They have specialized in purchasing, material care, transportation services, people transportation, and equipment rentals.

Tampereen Logistiikka Liikelaitos was founded in 2007. That year they started tendering for different organizations, and they began purchasing operations. In 2008 they created an in-house distribution system for the city of Tampere, and also started to manage the in-house mailings for the city. 2009 was the year they created a distribution center and founded KUOHKE, which is an operational center for transportation. They also created KÄTSY which is a shelving service for offices and office supplies. At the same time, OSTARI was created to support the shelving system. Now the organizations can order the needed equipment directly from them.

Currently Tampereen Logistiikka Liikelaitos also manages the school transportation services for special customers and they also have gained ISO 9001 certificate.

3 THEORETICAL BACKGROUND

3.1 Supply Chain Management (SCM)

A supply chain includes all stages, which will ultimately lead to the fulfilment of the customer's request. These stages can affect the outcome either directly or indirectly. The supply chain consists of manufacturers, suppliers, transporters, warehouses, retailers, and, of course, customers themselves. These organizations' cumulative effort is successful when the end user receives its products. In order to keep the chain jointed and effective, businesses should also focus on what is happening outside their “four walls”. The entire chain of several activities is connected; therefore every action has its consequences.

In supply chain management it is crucial to be in control of the flow. It can be divided into three main categories, which are products, information and finances. Supply chain management is the control of all that. These three main objects and their movement in the chain form a process when they move from the supplier to the manufacturer to the wholesaler, and again from the retailer to the consumers. Company that manages the coordination of the flow the best is many steps ahead of the competition. The organization who takes charge, and is in front of the group, is the so called supply chain champion.



Figure 5. Supply Chain

3.2 The key objectives of SCM

In supply chain management one of the most important objectives is to maximize customer value and achieve sustainable advantage among the competitors. The best way to do this is to be active in the management position. There's no time to be still and passive. The managers always have to think new ways to improve their business, and how to make the supply chain more effective and efficient. The supply chain covers many different activities, so the information flow has to be close to perfect. Every aspect has to be taken into consideration, because every action has an effect in the later stages.

One of the biggest priorities for businesses and organizations is to control and optimize the whole flow of products going through the supply chain in order to achieve competitive advantage. What should the managers think of? How to maintain the supply chain as efficient and successful as possible? Organizations should be reactive to the market. Think ahead the competition, be faster than them. For example, companies should put a new product in the market before everyone else does. This is how they ensure that the customers are still doing business with their company. This takes a lot of planning and research. Companies have to be sure that the product they bring to the market is wanted. They have to be “time to market”.

Price planning has to be done in a professional way to maintain the level of customers, which keep the company successful. What are the consumers willing to pay for a certain

product? How do you know is the price too high? After summing up all the expenses and the desired profit, the profit is visible. Is the price too high for this kind of a product? Businesses should always research information of the market in a way that they are sure what the customers need, and are willing to pay

Flexibility is absolutely necessary in today's business world. In supply chain there are so many organizations working in a joint mission, that without flexibility it would be impossible. There's always going to be that situation when someone has to wait. This could happen because of delay of a certain product, machinery breakdowns, accidents etc.

3.3 The flows of the SCM

Supply chains are linked together in three different ways:

1. Physical flow

- Transformation
- Movement
- Storage of goods and material

2. Information flow

- Coordination and planning of the long-term projects
- Control of the day-to-day flow of goods and material

3. Financial flow

- Credit terms
- Payment schedules
- Contracts
- Ownership agreements

3.4 Physical flow

The physical flow, also known as the product flow, includes the movement of goods from a supplier to a customer, as well as any customer returns or service needs. It is the most visible piece of the supply chain. This means the movement of the goods, which can happen by a truck, train, boat, airplane etc. Every moving product from a supplier to a customer is part of the physical flow.

Retailers and suppliers need warehousing systems, because of the quantities of the material, and to save in transportation costs. Products and different materials are stocked in a warehouse. From there they are being transported to, for example, other work stations or the customer. This is the flow of the physical goods.

3.5 Information flow

We live in a modern world full of new technical solutions, especially the various e-business applications. Therefore keeping updated with the information flow isn't that big of a problem it was before. Proper strategic planning of this flow is surely a way to reduce costs. Information can be found in today's world so easily, that the businesses have to make full use of this. Sharing information can be problematic for some companies. There could be many reasons, but the main thing is that people are afraid to lose their competitive advantage when they give away information of their company. This information can be production data, lead times etc. Supply chain doesn't work without trust between the partners.

3.6 Financial flow

Typical financial flow in a supply chain contains mostly of invoices and payments in a certain year. Although, usually multiple invoices are paid as a single payment. Financial flow also includes information transfer via electronic payments. The entire cash flow of a company can be massive. Plenty of different documents, transfers, payments etc., take place all the time in modern day business world. Most companies require significant amounts of working capital to deal with variable and somewhat unpredictable financial flows and outflows. Expanding businesses are always in the look of new partners for making themselves more efficient. Because of it new contracts are being made in a yearly, even monthly, basis. This means new financial flows and new agreements. Good management of the finances of a company is the back bone of successful operation.

3.7 Transportation management

This thesis focuses on the last part of supply-chain management, because the topic limits our scope. Transportation management is one of the most important concepts of this thesis. In all its essence transportation management is moving something from place A to place B as economically and timely as possible. If company fails to plan and manage transportation it will affect procurement, manufacturing and market distribution. Transportation management is divided into four categories; Rail, sea, road and pipes.

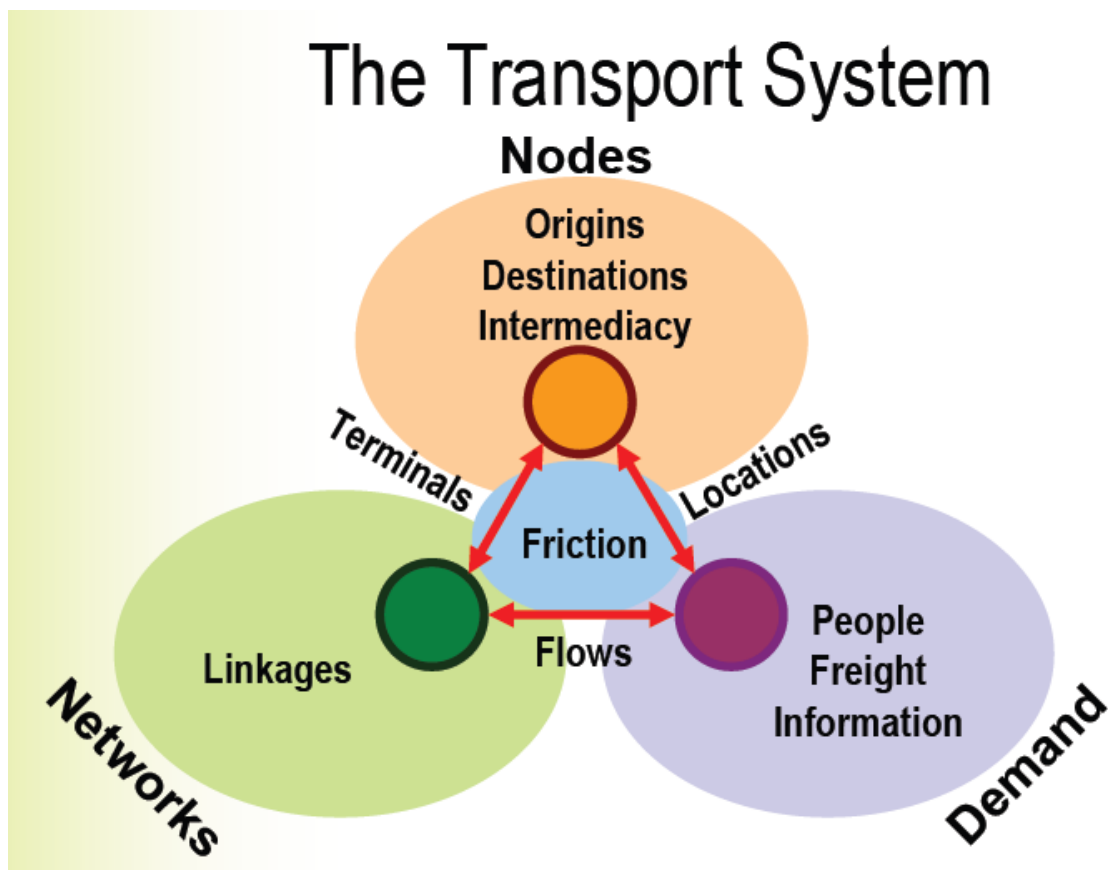


Figure 6. The transport system

Because of the topic in hand we are only going to focus on road transportation and legislation that concerns it. The transportation in question will only happen inside Finland so the legislation is a bit more relaxed than in international transport.

Transportation plays big part in all logistical functions and much of the companies' logistical performance rely on transportation. Traffic departments commit and manage nearly 60 percent of a typical firm's logistics expenditures. Transportation is really expensive and therefore its functions need to be carefully planned. Many companies have decided to use for-hire transportation companies. The for-hire business is booming and there are big and small actors in Tampere region in this line of business.

BIG TRANSPORTATION COMPANIES	SMALL AND MEDIUM SIZE
DB Schenker	Enset
UPS	Jykän Klapi
Itella	Länsiö Logistiikka

Figure 7. Examples of for-hire transportation companies in Tampere

The for-hire trend has occurred when logistics managers have noticed that it is more efficient to order the transportation service for goods from a company that is specialized in this type of functions, rather than buy big, heavy and expensive cars and drivers for them.

This thesis focuses solely on freight transport. There is movement of different kinds of goods over long distances and the focus is on the road mode. Road is selected because the movement of goods will happen inland and there are neither reasonable water nor rail ways to be used. Also the distances are not that long and the deliveries need to be delivered to the customers' door so the truck is the best option.

3.8 Economic drivers in transportation

Transportation costs are driven by seven factors; distance, volume, density, stowability, handling, liability, and market. All these factors react differently to the product characteristics. For example, paper machines have big volumes and require careful handling compared to letters. Also you can transport more letters with one truck.

Distance is one of the biggest influences to transportation costs. Distance directly affects the variable expenses such as labor, fuel, and maintenance (Tapering principle). Distance is also a key factor to this thesis. In international scale the distances are not that long but since there are many delivery points the distance will be quite long for example one route is 487 km on average.

Volume is also one of the key concepts to transportation. Scale economies work also in transportation movements, which mean that the cost per product is higher when there are fewer products in transport. This means that as freight volume increases the cost per transport unit decreases.

Liability is really important factor to this thesis. It means that if the liability is bad it will result in customer dissatisfaction reclaims, and damage. Since to goods that are transported are not that easily harmed the most important aspect to liability is to get the goods to the customers on time and so that everything is delivered.

Handling is one of the lesser factors in this research since the goods don't require any special handling devices compared to heavy items for example. Haven said that the handling of samples needs to be done carefully so that they are usable. It is also notable that only the books are handled in boxes.

3.9 Transportation risk

Transportation risk is the risk that the product doesn't arrive to the customer in right time, right quantity or in right condition or it goes to the wrong destination. This consists of external transportation and the information and material flows that enter or exit the company. There are several parts that concern this part of materials management:

Responsibility	Person, property and environment
Interruption	Own company, customer
Environment	Natural disasters e.g.
Property	Premises, equipment e.g.
Information	Information traffic and the reliability of transportation information

Figure 8. Transportation risk factors

3.10 Transportation damages

Five categories for the reasons of transportation damages:

1. Deliberate acts	
2. Exceptional product, deficient package	Large size, big total unit weight, big specific gravity, asymmetric center of gravity, obscure shape, under packing, specific temperature requirements, weak tolerance of vibration, shaking or impacts and valuable goods
3. Information errors	Insufficient packaging instructions, wrong or insufficient dispatch information, errors in unit-, amount-, and address information, loaded amount does not match with the documented information, calculation errors in different stages of the transportation chain, unawareness about special directions
4. The stress of the transportation environment	
5. Material handling errors and mistakes	

Figure 9. Reasons for transportation damages

The materialized transportation risk characteristics:

- Delivery terms determine the responsibility between seller and buyer. The damage may occur at any point in the transportation system
- Compensation receiver and the insurance buyer are usually different parties
- The originator of the damage may not have contract relationship with the cost bearer. The cost bearer has only indirect possibility to affect damages
- The responsibility of the originator is usually limited
- There are many risks in the transportation system also the probability of damage varies between goods, transportation routes and means of transport

3.11 Transportation planning

3.11.1 Selecting the transportation route

The selection of transportation route requires careful consideration of possible ways or routes to reach the target destination. To every transport there are usually a number of possibilities. For example, a full truck load (FCL) of home appliances from Tampere to St. Petersburg can be delivered via route directly through border or transferred via truck to Kotka - Hamina harbor and from there via carrier ship to St. Petersburg harbor. Depending on the INCOTERMs used it will be carried to the location by the seller or the buyer.

The conditions and exceptional dimensions in the destination may have effects on transport route selected as well. Also it is important that the familiar transportation is checked every once in a while to find out the best possible route this can be done by evaluating the pros and cons of the current route versus the alternative route(s).

There are three kinds of restrictions that affect the choice of route:

1. Geographical	Mountains, water and infrastructure for example is the tunnel wide enough for the cargo
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2. Traffic	The flow of traffic can have effect on the route because of traffic jams. Also the capacity and condition of harbor equipment belong to this group
3. Other	General situation in destination country. Sport events, customs

Figure 10. Three restrictions that affect the choice of route

3.12 Selecting the transportation method

When selecting the transportation method at least the following points have to be taken into consideration:

- The size of the delivered batch
- The urgency and availability of the product
- The vulnerability of the product
- The value of the product
- The special regulations
- Access to carriers
- The nature of goods
- Price
- Transit Time

Carrier characteristics and selection criteria:

- Accessibility
- Responsiveness
- Claims record
- Reliability

3.13 PL's

Logistics companies now days have developed into complete logistics providers. The development has been from 1PL, in which the producer handles their own logistics operations into 4PL companies who take care of the whole supply chain for the company. This means that the producers no longer need to think about their logistics operations because a company does it for them.

Tampereen Logistiikka Liikelaitos works as a 3PL company. They shop around to get the best offers for the customer organizations. This is done according to the Finnish Purchasing Law that requires them to get offers from three different providers. They don't have their own cars they only manage the transportation and purchasing operations. They have outsourced the transportation and the companies that take care of this are Enset Oy and Jykän Klapi.

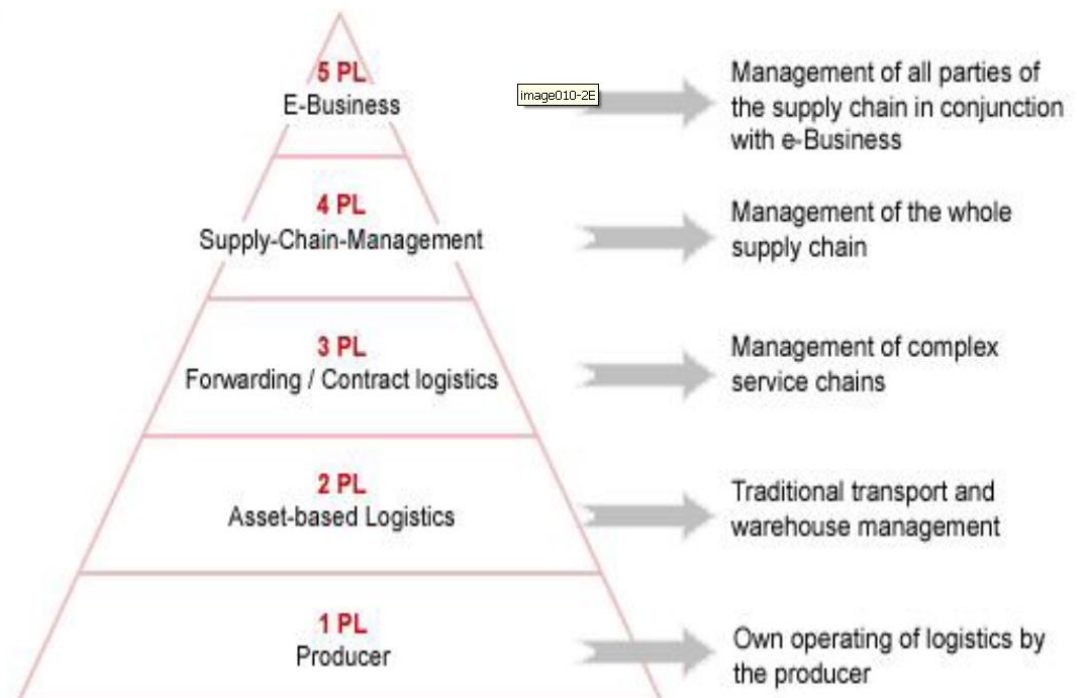


Figure 11. The 5 PL's

3.14 Cross docking

Tampereen Logistiikka Liikelaitos also has its own distribution centre located near the center of Tampere. In storage they usually have different kinds of tools and small items. But what they mostly use is cross docking, which means that the goods arrive to the warehouse and then leave within 24 hours. This enables Tampereen Logistiikka Liikelaitos to maintain a fairly small warehouse system, and make their warehousing operations more cost efficient. Cross docking also brings flexibility to their operations. This means that if something is ordered by any of the partner organizations it can and will be delivered within 24 hours. This is a value that Tampereen Logistiikka Liikelaitos is really proud of and we will also use this function for the orders that don't belong to the "on going" schedule.

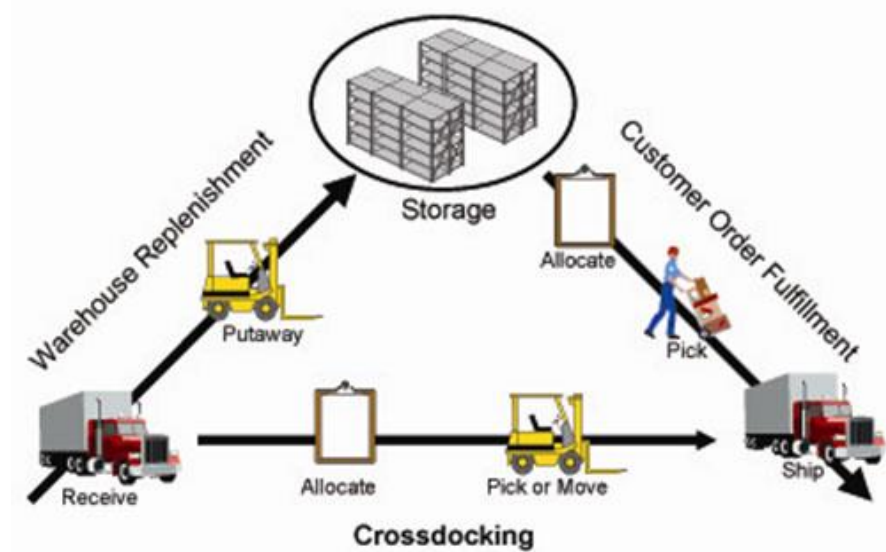


Figure 12. Gross docking

3.15 Push and pull strategy in logistics

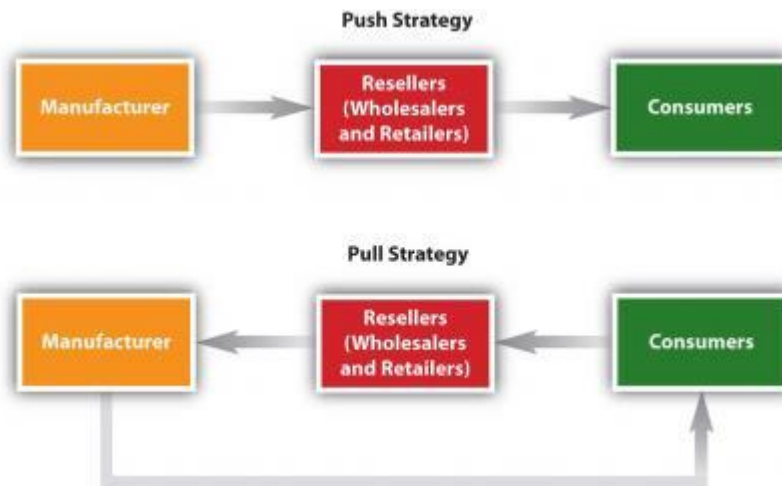


Figure 13. Push and pull strategy

3.15.1 What is push strategy?

When discussing about the push strategy, it is important to know where exactly the word “push” comes from. The basic foundation of this strategy is that companies use promotional strategies (sales force and trade promotion) to push the product through the whole channel. Producers use a lot of time for promotion of the product to wholesalers. And, just like in the supply chain model, this promotion reaches through the entire chain, all the way to consumers.

Push strategy takes a lot of careful and professional planning and forecasting, because the product is being made without a specific demand. It has to be in the market in just the right time. The idea is that companies must anticipate the future. Which products will the customers purchase? Just this isn't enough. The companies have to predict also the quantity of goods, which will be purchased. They have to produce the product in

advance or just in time (JIT). Plenty of careful forecasting, scheduling and production control is needed for push strategy.

The biggest disadvantage of push strategy is the uncertainty of forecasting. In today's market it is sometimes hard to know what will happen in the coming months. This reflects to sales and income. The sales can vary from year to the next. This creates uncertainty among the managers, and also the workers. If the company fails to sell the manufactured and produced products, they will of course stay in the inventory. This increases the costs for inventory control systems.

3.15.2 What is pull strategy?

Pull strategy is the opposite to push. Pull systems react to orders which have already been fulfilled out of stock for finished products or have to be fulfilled by the last process in the production chain.

Pull system begins with a customer's order. This is how the companies only make what is needed. Nothing more is produced. In pull approach, there will be no excess of inventory that needs to be stored. This ensures that the inventory costs (carrying and storing costs) are lower than in the push method. This is a big advantage in pull, because so much money is used to unnecessary storing of goods.

One of the biggest disadvantages of pull strategy is that it can create problems in trying to get the goods to the customer in time. Ordering problems are likely to occur in this system, because the supplier can't always get the shipment out on time. This leads to customer dissatisfaction. Examples of pull systems are the just-in-time (JIT) system. Inventory levels are kept to minimum by only having enough inventory to meet the customer demand.

3.15.3 The push-pull system

The great thing about these two systems is that companies can find the best aspects of both of the strategies, and then combining them as one. The push-pull system is also known as the lean inventory strategy. It's a very challenging system for companies because it demands a lot from them.

For example, in push-pull approach, the demand and sales forecast has to much more accurate than before. The inventory levels are also adjusted based on the actual sale of goods. The main objective is to create a stabilized supply chain with minimized product shortages. This results in customer satisfaction, and therefore bigger revenues, and also containing the client base. With this system planners use sophisticated systems to develop guidelines for addressing short – and long-term production needs.

3.16 Lean logistics

3.16.1 What is lean logistics?

Supply chain management was designed to take waste out of supply chains. This means inventories, time and, of course, cost. Supply chains are meant to pull, not push, inventory through the chain. This is the core idea in lean logistics. It focuses more on this certain aspect, therefore different than SCM. For example, the main objectives for a supply chain manager include:

- Minimize costs
- Control inventory levels
- Minimize waste
- Reduce supply base
- Minimize assets
- Optimize usage of assets

- Head outsourcing effort to reduce cost

These are the basic, core functions of a manager in a supply chain. Now that we are talking about lean logistics, nothing is more important than minimizing waste. Often people make the common mistake when they think that minimizing waste walks hand-in-hand with minimizing costs. This doesn't necessary mean that the costs will decrease, if there's a reduction in waste.

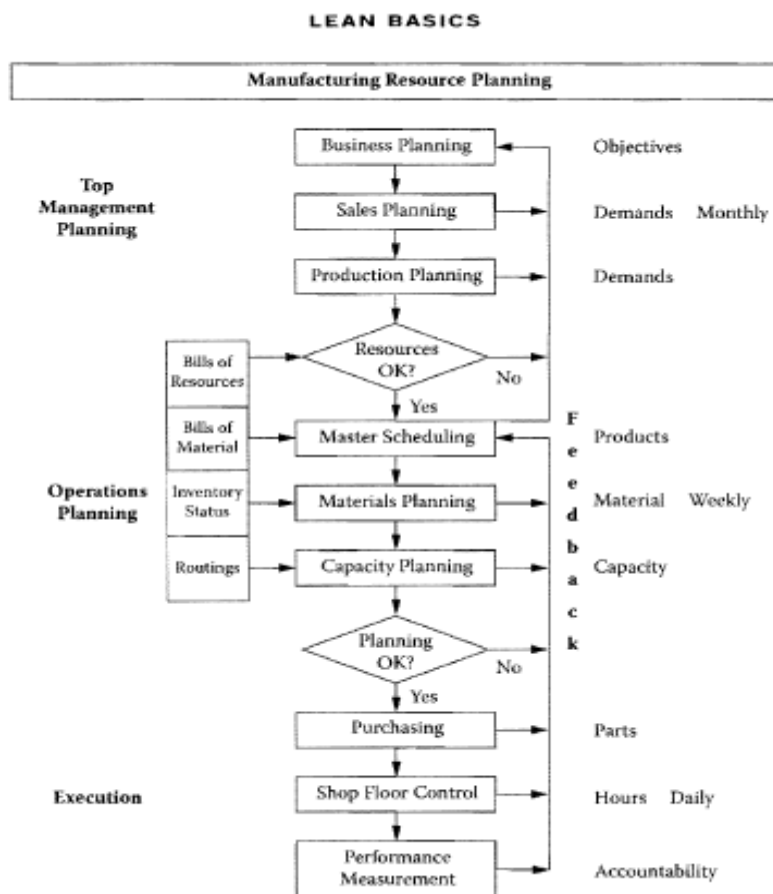


Figure 14. Lean basics (Kerber, Bill. Dreckshage, Brian J. 2011. Lean Supply Chain Management Essentials: A Framework for Materials Manager. (2011, Paperback))

Some experts describe lean logistics as a philosophy. This way of thinking and acting in the supply chain focuses on flowing value to the end user, eliminating waste from all processes, right-sizing the resources (machines, material, people, time, etc.) and providing the tools for people to continually improve their work.

3.16.2 The advantages of lean logistics

Elimination of waste is the key attribute of lean supply chain management. Why is it so popular nowadays and why do companies so widely adopt lean? Increasing velocity is one of the most important aspects. Customers appreciate speed. The shorter the lead time is, happier the customer will be. That's the basic rule in business. If you can offer something basically without any waiting time, you will have competitive advantage against your competitors. Increasing velocity can also decrease costs.

Companies go lean to decrease working capital and increasing cash flows. With eliminating waste and increasing speed of the process, the companies don't need such a big working capital. This reduces risks and improves their income. The cash flows will increase because of the same reasons. This whole philosophy of lean sounds so appealing, and if it's executed correctly, it will help the lean companies to gain market share. Other important reasons why businesses turn towards the lean method are to increase inventory turns and profitability, and to meet customer demand.

Every party involved in the supply chain (wholesalers, manufacturers, retailers, distributors, suppliers, 3PLs, etc.) has the same goal in business; to reduce and balance cost, time and inventory. The advantages are so visible and clear, that lean is gaining popularity all around the world.

3.16.3 Five lean principles

1. Specify what creates value from the customer's perspective
2. Identify all steps across the whole value stream
3. Make those actions that can create value flow
4. Only make what is pulled by the customer just in time
5. Strive for perfection by continually removing successive layers of waste.

(Womack and Jones, Lean Thinking)

The core idea of the whole lean philosophy is that it starts with the customer. The company has to be sure that they know what the customer wants and what are they willing to pay. There are ways to be sure that the decisions made are correct, mainly by using professional and thorough research and strategical planning.

Specify what creates value from the customer's perspective

Specifying what creates value from the customer's perspective requires a correct approach. Companies have to make sure that they know their clientele, and more importantly, know what they are willing to pay for. The company has to be sure that they provide value to the desired market area. Without this there will be decrease in market share and the company will lose a lot of valuable assets and time. Are we bringing value to the customers? That is the million dollar question, which all managers should ask themselves. Seeing with the eyes of the end user, is the main conception.

Identify all steps across the whole value stream

What is a value stream? When you look at the whole picture of a supply chain, it starts with the raw materials and goes towards the finished product. Value stream is all of the

activities that happen in the chain, value-added and non-value-added. It begins when the customer places an order for a desired product, until the customer has received that same product. In value stream mapping, which is used to accomplish this step, you create a "one page picture." In this second principle, the managers really have to think about the whole picture, and identify all the steps.

Make those actions that can create value flow

Actions that create value are the most important phases in the flow. Those steps that don't create value should be decreased to the minimum, preferably eliminate them completely. In this third lean principle, the ultimate goal is one-piece-flow eliminating all the non-value-added activities, which is the whole idea behind lean logistics.

Only make what is pulled by the customer just in time

Only make what is pulled by the customer just in time

To decrease inventories and lead time, the company should concentrate on making only those products which are asked. Let's say that the customer wants to buy a certain product. Order is placed, and that is when the product manufacturing process starts. No inventories, which is one of lean's objective. This also decreases the need for a forecast, because the product is only made if there's a need. This is a system of production that makes and delivers just what is needed, just when it's needed, and just the amount it's needed.

Strive for perfection by continually removing successive layers of waste

This is the last step in the lean process. After removing some layers of waste, companies have the tendency to slow down in the sense of improving. Once some improvements

have been implemented, it doesn't mean that the development should stop. In fact, it is exactly the opposite. Managers have to make decisions continuously, which will remove waste and make the whole lean system more competent. Important note is that this step doesn't work without the previous ones. Lean logistics is a complete system of operation.

3.17 Purchasing

3.17.1 The purchasing cycle

Traditional purchasing and its process, is quite easy to define and present. The cycle is fairly standard and the basic model stays the same. The purchasing cycle consists of seven steps:

1. Recognizing the need of the customer
2. Specifying the need of the customer
3. Determine sourcing options
4. Pricing strategies (and terms)
5. Develop and deliver purchase order
6. Receive and examine
7. Approve the payment

3.17.2 The main objectives of purchasing

Organizations have to be aware of the actual and also the hidden costs. The basic idea is to obtain the lowest possible unit cost for items purchased. This is the main target for

many companies. Chasing the cheapest unit cost can also, and is often brought problems for managers and CEO's. The low price tag can also be deceiving. It can hide behind it high hidden costs, or the actual deal can be shady, or the supplier can be unreliable.

One of the most important targets for successful purchasing is communicating specifications for purchased materials. Sometimes the purchasing area just follows the specifications set in the other area. This happens often in, for example, product design or engineering areas. The people just sometimes don't understand fully what they are buying, and need specifications.

Suppliers for companies are their livelihood. That's why it is vital for the businesses that everything works in this relationship. One objective is the supplier qualification and selection, making sure that the supplier is what promised. Companies, suppliers' clients, can also make mistakes in this relationship by start bidding each new material purchase after the other one. This can be costly, because it makes the whole purchasing process quite shallow.

3.17.3 The change in purchasing

Logistics deals broadly with both inbound and outbound processes of a company. The purchasing team is mainly part of the inbound flows into the organization. Something is purchased, which means that it has to be delivered in to the warehouse, manufacturing site, etc. Purchasing and its relationship have changed drastically in the past years. Before it was seen mostly as a service function of a company. If there was a need in the manufacturing function or other internal functions for which it was buying, purchase was made. That was basically it. Nowadays the purchasing department can also be responsible of making long-term relationships with customers, question their needs, but also question the suppliers' need. This way of thinking limited the contribution of the purchasing department. Back then it wasn't clear what could be done with an efficient and hard-working purchasing team. The scope of purchasing activities was very limited;

therefore the possible income for the company was smaller than now.

3.17.4 The strategical role of purchasing

Every company has its own main objectives, which they try to reach. The objectives have been, most likely, carefully planned and well-thought. Some sort of a strategical plan has been made to ensure that the company is taking the right steps towards the goals. The purchasing department can also make many great contributions to the strategic success of the company. This is possible, because purchasing's main function is to push the company's boundaries. Trying to get new relationships or just maintaining the old ones.

Purchasing has very important connection to the supply market. This means that the relationship they have can be used to help the company. It can help them to gain access in the external market, because they already have important information about the market, thanks to the supplier relationship. They can now get more knowledge of:

- New technologies
- Potential new materials or services
- New sources of supply
- Changes in the market conditions.

Because of this special relationship with the suppliers, purchasing department can also help the organization to be more successful by identifying and developing new and existing suppliers. If the company would be prosperous in this development project, that could lead to the decrease in development times for new products, because the suppliers had been involved already in the earlier stages.

Virtually almost every department within a company relies on the purchasing function

for some type of information or support. They have been in contact with the customers and suppliers, so they have received more information than the other departments. This is why the purchasing is also seen as a support function. It provides value for all the other sections of the company. Because the purchasing have been part of many different areas, it can be useful when making important company decisions. They bring support and expertise to the table. That's why purchasing and logistics have to work closely in coordinating inbound logistics and associated material flows.

3.18 Quality management

Quality management programs have been implemented globally, especially in the field of logistics. Customers demand quality, among other things. Maintaining long-term customer relationships with poor quality management is nearly impossible. The product, and the company itself, should be high-class for the sake of market share, competitive advantage and resistance in the business. One of the main key factors of quality management are leadership and team building. Good leadership brings a lot to the table, but the main objective for that is the communication of values. The importance of quality management, especially in logistics, can't be underlined enough. When done correctly, it can lead to operational results and customer satisfaction.

Different to many other theories and terms, quality management doesn't have a globally accepted and used framework as a basis for assessment of improvement efforts. One of the most common one's is the Baldrige criteria, which was created by the United States government in 1987. It assesses quality in seven categories, and it was one of the pioneers in the field of quality management.

3.18.1 The Baldrige criteria:

1. Leadership

- The company's leadership system, values, expectations, and public responsibilities

2. Information and analysis

- The effectiveness of information collection and analysis to support customer-driven performance

3. Strategic planning

- The effectiveness of strategic and business planning and deployment of plans, with a strong focus on customer and operational performance requirements

4. Human resource focus

- The success of efforts to realize the full potential of the work force to create a high performance organization

5. Process management

- The effectiveness of systems and processes for assuring the quality of products and services

6. Business results

- Performance results, trends and comparison to competitors in key business areas – customer satisfaction, financial and marketplace, human resources, supplier and partners and operations

7. Customer and market focus

- How the company determines customer and market requirements

and expectations enhances relationships with customers and determines their satisfaction.

(Quality management influences on logistics performance, 1998)

3.18.2 Total Quality Management (TQM)

Total Quality Management, from this point on known as TQM, is in a huge role when talking about achieving value addition and customer satisfaction. It's an approach, which main target is to exceed customer expectations. This can be done by offering a product with really improved quality and performance. Companies try to achieve this by integrating all quality-related functions and processes throughout the company. TQM doesn't just focus on certain aspects of product quality, or the state of leadership in a company. It takes into account all quality measures taken at all levels. This means also the company employees, which are now under quality control. Quality management has evolved a lot since the beginning. After the First World War, there were a huge number of large scale manufacturing efforts, which often lead to poor quality. They begun to attack this problem by introducing quality inspectors on the production lines. The inspectors' main objective was to ensure the level of failures was minimized.

Two main principles of TQM are executive management and training. Executive management means that the very top of the organization has to be in charge of the quality control. They are responsible for their products, and they have to push the company forward. One of the best ways to do this is to ensure that the quality of the product is as good as possible.

Managers' job is to create an environment, which makes this possible. The second principle was training, which contains employees' regular training on the methods and concepts of quality. The employees have to be aware of the company's line on quality.

They are the ones who are working in the production line, which means that they are the first ones to notice if something is wrong and the product is faulty.

3.18.3 Quality inspections in the supply chain

The inspection of quality happens all over the supply chain. It takes place in the manufacturing process, in the end with the finished products, but also in between while the goods are stored in the warehouse. The quality should be clear throughout the whole supply chain. This is management's responsible to take care that this happens.

After the purchasing process has been successful, the company will receive the goods. It depends; sometimes the quality of those goods may have been informed, but not always. So, this is the first opportunity to perform a quality inspection. Why is the product being inspected? The main reason is that the product has to be useful for the company. If there's something wrong with the product, and the company can't use it, the whole purchase process was a waste of time and money. That's why it's really important to have some sort of agreements with the vendor, to make sure that you have the right to return the goods if the quality is poorer than in the contract.

The company can also send quality inspectors straight to the vendor's facility. This is a great and a fast way to make sure that quality is what expected. This eliminates the chance that faulty goods would arrive in the company's facility, because the quality is being checked before the transportation. Some vendors may have ISO 9001:2000 Quality Management Standards (QMS) certification, which offers customers a great sense of expected quality and may lessen the requirement of regular inspections.

There also has to be quality checks in the production line. This takes place if we are discussing about manufacturing companies. They can't afford to wait until the end of the line when the product is finished. That would be, again, waste of time and money, and

could lead to customer dissatisfaction. If some problems occur, they have to be addressed early in the process. This way, the company can save money on raw materials and reduce the overall time that the production process is shut down.

When the products are coming off the production line, meaning that they are finished, they have to be inspected again. The company has its own quality standards, in which the customers are surely aware of, so no goods can be transported without a quality check. During this quality inspection, happens also the packaging. It should be done in a way that the goods will stay undamaged.

If the manufacturing company has a warehouse where they store the goods before the shipment to the customers, inspections happen also in there. Some items stay in the warehouse longer than the others, so during that time every good, even the fast movers, should be quality-checked. In this way the company can ensure that the finished goods are still able to be shipped to the customer.

3.19 Logistics tools for transportation purposes

To help companies to plan their logistics operations many different IT system are developed and continuously new and improved ones pop up on the market. These systems are used to provide continuous information and help with the planning and controlling of the whole supply chain in one consisted package. For example Arc Logistics provides companies with the possibility to easily create routing systems and plans for upcoming deliveries. Also the system is capable of providing drivers with real-time information if added deliveries have happened during their route.

Basically all logistics companies use some sort of IT system to help control their routing systems. The IT systems are used because they gather and storage the data in a simple manner and they speed up the information flow within the company and also speed up the information flow to the external sources e.g. the customers. Usually all these sys-

tems are build up so that when you create a delivery schedule all of the needed documents can then be printed out directly from the system.

3.19.1 Process for using logistics tools (example ArcLogistics)

1. Defining the needs

- In this part all the essential data for the new routing system is defined and gathered. To help with the Arclogistics the data is gathered to an excel file, because then the data can be uploaded directly to the system as a whole.

2. Creating new routing folder

- In this part the new routing system is created to the IT system. In the beginning the distribution centers are defined and located. After that the available resources for that specific routing system are inputted to the system.

3. Creating the routing system

- In this part the collected excel data is downloaded to the system directly and the system will build up the best possible routes in regard to the given restrictions
- Important to notice here is that the routing system in many IT tools can be later changed if additional deliveries or time changes occur

4. Information flow

- When these systems are used it is possible to handle all of the documents regarding the deliveries through the system so that everything is in one consisted package and always updated according to the changes done.

Also these types of systems are useful if a company wants to research best possible locations for new distribution centers. This can be achieved by analysing the costs of the

transportations separately from each possible place of the new distribution center. The way to process this sort of research is as follows:

1. Define the possible locations for the DC's
2. Collect the delivery addresses to Excel
3. Build the routes to the program
 - In this part every route needs to be assigned separately to every possible DC location. Also it is important that every route is "identical" for each and every DC
4. Analyse the results
 - Compare costs, time used, distance travelled etc. to find the best possible location

As a result it is clear that acquiring a logistics tool for a company will help them in many ways mainly in their day-to-day activities. It makes the information upkeep easy and also it is easier to track and monitor the deliveries. Also with a little tweaking the logistics tools can be used for research purposes in the company which makes them an really useful tool for logistics companies to have.

3.19.2 Why ArcLogistics?

ArcLogistics was chosen for the planning of the new routing system first and foremost because it is easy to use and if added delivery points would've occurred the implementation of those would've been simple in that system. Also the system is capable of handling huge amounts of data so it made our job for the route planning simple. The system itself builds up the most cost efficient route for the given deliveries and also takes to account the time windows and capacity amounts.

ArcLogistics proved to be a very agile tool for the usage purposes. The routes needed some modifying and that was easily achieved by making small changes into the system.

All in all the system had so many advantages concerning the goal of the thesis project, that it would've been unwise not to use it.

4 CASE STUDY OF THE LOGISTICS SYSTEM OF PIRKANMAA

The goal of the project is the organizational cooperation between the units working in Pirkanmaa, and their procurement in goods logistics. In the beginning point of the tendering, the organizations involved are Pirkanmaan maakuntakirjastot (PIKI) and Fimlab Oy, which have regular and scheduled transportation. Tampereen aluepelastuslaitos (ALPE) will most likely take part in the project for random, unscheduled deliveries. There's not going to be any intervening in the transportation happening within Tampere, nor in Fimlab Oy's frequent deliveries taking place in the vicinity of Tampere.

At the starting point, the project should be built in that way that it is also available for other organizations in the city, or nearby.

The system requires constant maintenance, and it should have centralized unit of responsibility – the host of the contract. Soluble in the future:

- Cost allocation of the tendering
- Cost allocation of using the services
 - Regular
 - Irregular
- Managing the contract

4.1.1 Meetings and discussions

This part of the research analyses the organizations' logistical needs and current systems that they use. The organizations are PIKI, PIRKO, Fimlab Oy and ALPE. Analysis will also be given of the logistics services that Tampereen Logistiikka Liikelaitos provides.

Data was collected from the representatives in the organizations by asking questions about their current situation and transport needs. These questions varied greatly with each organization because every one of them is operating in a different field. The

framework questions however were the same for each organization. These questions included:

- What items do you transport?
- What are the costs of your transportation system?
- Who is the carrier?
- How often do you have movement of goods, mail etc.
- Do you have specific transport demands? (For example certain heat level)
- Do you have schedule restrictions?

Also the authors tried to dig in to more detail by asking a lot of “why” questions these questions helped us and the representatives to get a more detailed picture from their transportation needs and development areas.

4.1.2 With PIKI

On the 6th of June 2012 a meeting was held with the representatives of Pirkanmaa libraries in the conference hall in Metso. This was the first, and the only, real face-to-face meeting with just us and them. A project presentation was made for the executive board of PIKI on the 3rd of May, but due to their hectic schedules, it was cancelled. This wasn't a problem because a lot of necessary information was already received from them, for example the transportation schedule papers, contact information of the Enset Oy staff, etc. Connection was also maintained in the future via e-mails.

There were discussions about the flexibility of the whole delivery system. They informed that it is, in fact, pretty strict. This raised some questions, which were answered later when the authors had the chance to join Enset Oy for the route. Some other points were brought to light. PIKI uses quite regular size boxes, without covers, in the transportation. There is a separate box for every library in the route. For instance, if the library in Kangasala is getting 10 books and 5 CD's, there's a significant amount of air in the box. Meaning that the space capacity of all the boxes isn't used as efficient as possible. It was asked why couldn't you put several other libraries' goods in the same box, but

the answer was that every library needs its own box. Plus the sorting of the items in the locations would this way take a lot longer, and it wouldn't work with the tight schedule.

The meeting was helpful and it brought up a lot of fascinating questions and problems, which is always good in a research. PIKI representatives were a little bit of scared of change, which is natural because everything has worked this way for so long now. On the other hand, they weren't against being more efficient and profitable in the future. These two mentalities clash against each other, but in the current situation we are in, change is inevitable.

4.1.3 With ALPE

Two meetings were held with the staff of ALPE. The first one was held on the 20th of April 2012 in the fire station in Nokia. The second one was in Hämeenkyrö fire station, on the 4th of May. The staff was very helpful, but because of the vague condition of the whole process chain, there were a lot of questions that needed to be answered for the sake of our research work.

4.1.4 The 20th of April 2012, Nokia

The meeting started at 10am in the fire station where we met Mr. Joni Hakala and Mr. Jari Veija. It felt like they were excited to talk to about the research, and they were well prepared. They even gave the authors a tour around the station. This gave more information of the storage space, the washing equipment, fire hoses, etc.

First approach was to discuss about the expenses of the station. That area was never really thought of. The only real expense data that they follow is the gas consumption. They have a buyer's option, but it's not followed accurately enough to give us any useful information. The whole purchasing regime is based on old municipality agreements, which are quite incoherent.

The next subject was transportation. What is moving from one station to another? Who is in charge of it, and how often does it happen? They told that biggest problem was the internal post. The system doesn't really work at all, because nobody feels like that it's their duty. For example, one letter can be untouched on a desk for weeks. This area really needed some improvement.

Later there were discussions about the other movers. The list consisted of hoses, office supplies, cleaning supplies, cleaning material, clothes and uniforms, health care transport, staff, etc. A great number of items are being moved on a daily basis, without any well-thought system.

4.1.5 The 4th of May 2012, Hämeenkyrö

In Hämeenkyrö the authors of the thesis met Mr. Jere Helenius and began the conversation about the whole project and the possible future of the department, also the current state of the fire station. list of all of the supplies they handle every day was given. It answered the following questions: Where do they come from and who is in charge of it? Next part was the hose maintenance and the transportation of it. Responsibility is on one certain person, and that every station has its own small storage space for hoses. Mr. Helenius also informed about the everyday use of envelopes, copy paper, ink, and calendars. The fire station in Hämeenkyrö distributes these products to three other fire stations as well. For instance, car parts are either bought from the local stores, or picked up from the center fire station in Tampere.

After the first meeting, a lot questions about the staff transportation rose. Mr. Helenius told that the fire fighters move, from time-to-time, between stations. So, they can actually work in different cities. From Hämeenkyrö, the staff moves to four other stations as well, mainly to the fire station in Ikaalinen. This happens a lot especially during the holidays. Difference between Nokia and Hämeenkyrö is that the latter one doesn't have a buyer's option. So, they really didn't keep up with the cash flow of the station.

This meeting and discussion with Mr. Helenius really gave more clear view on the subject. There were a lot of issues concerning the money flow, and the logistics. No one really knew what happened around them, but somehow it worked. At this point, many ideas of how to improve ALPE's system were discovered.

4.1.6 With Fimlab Oy

The representative from Fimlab Oy was Pauli Vuorinen. Discussion was about their current situation and he gave schedules that they had for their transportation system. He also talked about the restriction and demands that they have for the transportation.

Fimlab Oy is expanding heavily in autumn 2012 and spring 2013. The sample movement from Kanta-Häme will be included to their system as well as Jämsä region. Because the situation is developing simultaneously with our research we will try to implement the changes to our routing system.

It was found that they have around 20 stations from which they have daily movement of samples to their main laboratory in Biokatu 4 in Tampere. The transportation is handled by Itella Oy and that there is only one restriction to the transportation system which is room temperature for the samples. The samples are transported in a styrox- box which is easy to carry and it helps to keep the temperature correct.

The delivery process is simple. The driver starts his day from Biokatu 4 from which he takes empty sample boxes to the truck. After this he starts the round and replaces the full boxes with empty ones. The day ends to Biokatu 4 to which the sample boxes are delivered and then handled.

Fimlab Oy has a really well thought transport system and clear driver for them to take part in this research is the reduction of costs. Important is also to improve their service level and by any means their service level cannot decrease. Also Vuorinen said that it would be good if we could organize the system so that not all samples would arrive at the same time.

4.1.7 With PIRKO

First meeting was in Ajokinkuja where the main office of PIRKO is located. In the beginning of the meeting questions were asked how they deliver their in-house mail. They told that they have hired a driver and leased a car purposefully to this function.

Other things that PIRKO transports:

- bakery goods
- Student transports (done by the service team)
- Classroom equipment
- Teaching material and equipment
- Remove or storing of old equipment

Next they told how they handle their laundry and that they have executed a competitive survey for the delivery and that they have their own industrial laundry service. Basically all their transport are handled using logistics students or service employees.

Also interesting fact was that they pay an average of 700-800 000 kilometers as refunds. This problem isn't concerned in the research project because the teachers move by their own and usually from their home.

PIRKO is also going to unite with TAO during autumn 2012 this means that they have many issues to tackle and they said that this is not the priority at this point. However their stations will be included to the scheduling for later reference.

4.2 Findings

4.2.1 Fimlab:

Fimlab Oy's collection of the samples in Pirkanmaa is taking place every weekday. There are nine different collection routes, and mainly every target is visited every weekday. Inspection, which just took place, showed that other stops have been combined with three daily routes, and the comparison is of those.

- Stops per week: 125
- The combined length of the routes: 3400km per week
- Time consumed: 104 hours per week
- Boxes: 360 per week

4.2.2 PIKI:

PIKI's places of business are visited twice a week on four different routes. Currently they are using plastic boxes, without covers.

- Stops per week: 58 per week
- The combined length of the routes: 1100km per week
- Time consumed: 26 hours per week
- Boxes: 180 per week

4.2.3 The new, combined route:

The observations made from the Fimlab Oy's routes tell that the schedule is relatively loose, so the consumed time might actually be less. With this new route the time consumption would decrease by 15%. This would mean savings of 2000-3000€ per month compared to the old route.

- The combined length of the routes: 3800km per week
- Time consumed: 115 hours per week

At this point, Fimlab Oy's current expenses were unknown. PIKI's cost per drop is distinctly much higher than in the similar organizational cooperation they have currently in

Kuopio. This supports the assumption of lower unit costs in the joint system. There are several organizations in the operational district of Kuopio, and that should be the goal in Pirkanmaa as well.

4.2.4 Tendering

The suggestion is that Tampereen Logistiikka would handle the tendering. PIKI and Fimlab will produce the necessary information of:

- Quality
- Volume
- Schedules.

If needed, Tampereen Logistiikka will adapt the previously mentioned matters in to a form, which would satisfy both parties.

4.2.5 Allocation of the costs

The system requires hosting and maintenance. The suggestion is that Tampereen Logistiikka takes control of those matters, becoming the head settler of the service provider's transportation agreement. Between Tampereen Logistiikka and the other parties, a service provider contract is to be made. Tampereen Logistiikka will invoice for the services, according to the matching principle.

Agreement will be made of how the costs of the regular transportation will be allocated, and how the irregular jobs affect the allocation. The aspects affecting the costs:

- The quality level of the transportation equipment
- The quantity of the transported goods.

The factors, which will employ Tampereen Logistiikka after the tendering:

- Compiling the contracts
- Launching the operation
- Organizing and billing the irregular jobs
- Settling the disruption of operations.

5 NEW ROUTES

5.1 Routing requirements

The new routes are built from the requested delivery days pointed by the organizations.

The requests for delivery days were as follows:

FIMLAB Oy	Each route has to be driven every day from Monday - Friday
PIKI	Two deliveries per week and additional request that first delivery would take part in the beginning of the week and that the second delivery would take part in the end of the week
ALPE	One delivery per week or delivery when needed

Figure 15. The requested delivery days per week

Three routes from the Fimlab Oy's current routing system were chosen. This was done because the routes were already well divided to clear routes that also went near the delivery points of the other two organizations. Also one important contributor was that Fimlab Oy has to drive the routes five days per week..

After that, delivery points for PIRKO and ALPE was added. This was done by inserting the stoppages in the map and then pointing them to a selected route that went nearby. ALPE and PIKI were given fixed days for deliveries and the pointed days were Tuesday and Thursday for PIKI and Wednesday for ALPE. Later on this system was modified by the request done from the ALPE so that there wasn't a fixed day for their deliveries. This means that ALPEs deliveries will be done when requested. This action adds the workload for Tampereen Logistiikka and will therefore add costs for ALPE.

The delivery system is based on the needs gathered by discussions with the involved organizations' representatives. Fimlab Oy has the highest density in which the medical

samples need to be transported. The transport days are Monday- Friday. Fimlab Oy's samples take approximately 2/6 of the total capacity. PIKI has the highest amount of goods to be transported. The goods that are being delivered are mainly books, CDs and DVDs. PIKI takes approximately 3/6 from the total capacity of the goods that are being transported. PIKI has needs to deliver the goods twice per work week with longest possible time between transport days. In current system they deliver goods between Tuesday and Friday.

ALPE decided that they need only deliveries on ad hoc basis which means in this case that they will inform the organizing party when there are items to be transported. The amount from total capacity could be informed as 1/6 from the total capacity. This is because items that ALPE would need transporting are mainly mail and office supplies that don't count in the total capacity with as large numbers than those from Fimlab and PIKI.

5.1.1 Demands for the delivery vehicle

The most demanding goods that are being delivered is the medical samples. The representative from Fimlab informed us that the delivery vehicle needs to hold up room temperature in the cargo-hold. They also want to have surveillance equipment in the cargo hold so that they and the driver can monitor the temperature changes in the "trunk".

Discussion with the representatives from PIKI and ALPE were held and the only real demand came from PIKI. They told that the trunk or container needs to be dry and dust free because the goods that are transported could easily gather moisture or dust that could affect the air-conditioning systems in destination libraries. Later on the moisture and dust could also form mold that would bring further harm for the goods.

5.1.2 Planning the new routes

After analyzing the transport needs and routes started the planning for the new routing system. The decision was made that the best way to use Fimlab Oy's routes was to use them as a basis for the whole routing system. Three routes were selected which went by

the most of the points for other companies. This way the need to change already existing schedules and delivery days would be as low as possible.

The biggest transportation risk in the routing system is making sure that the samples would arrive to the Fimlab main laboratory within the 24 hour time window. This isn't a problem in the routing system since the longest drive route went clearly faster than the maximum time window. Another big risk was accidents which sometimes occur on roads. If an accident should happen the samples would become unusable and the other items would lost their order which means there would be miss deliveries. This risk factor is handled by the transport companies by giving the drivers training in road safety.

The best possible routing would've been totally different and the routes would've varied greatly from the old ones. This would've of course been the ideal situation to start building the new system, but after consulting with the representatives it was clear that they wanted the new routing system to make as little change to the old one as possible.

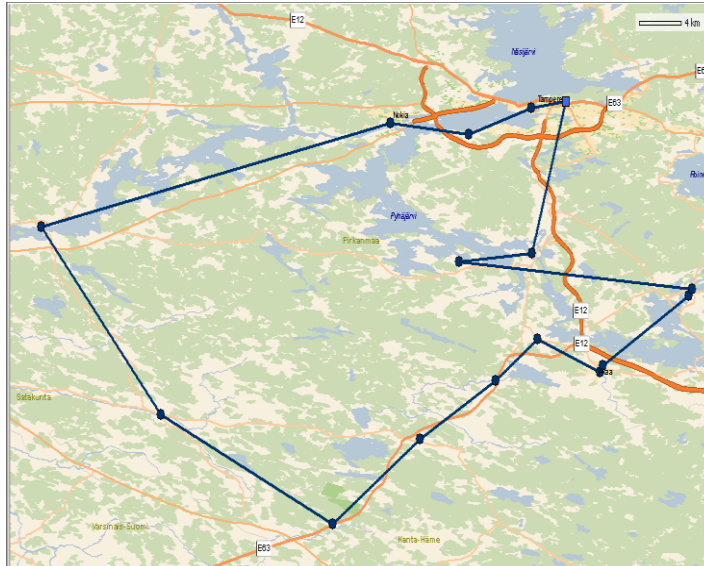
Our plan for the new routing days was:

Monday, Wednesday and Friday	Only Fimlab Oy
Tuesday and Thursday	PIKI and Fimlab Oy
Ad Hog	ALPE

Figure 16. The planned transportation days

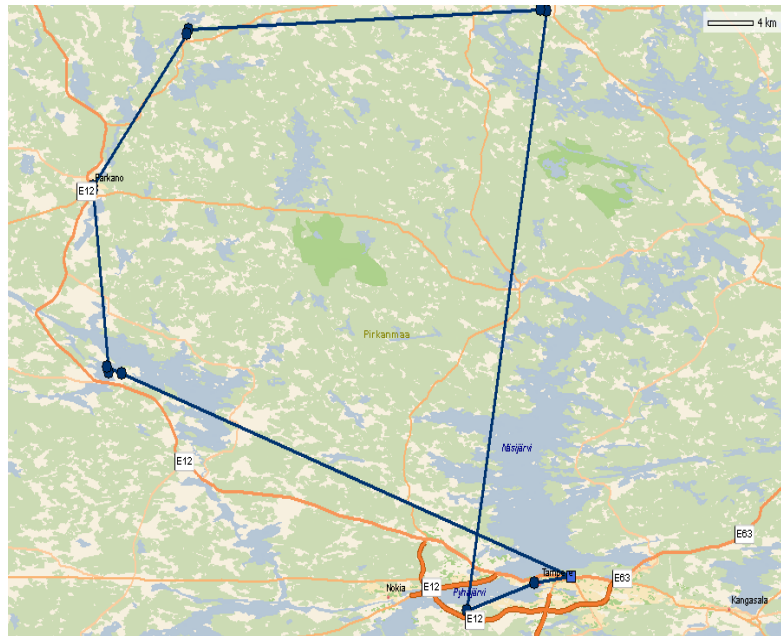
The week is divided as such because we didn't find it reasonable to try and divide the delivery points of PIKI and ALPE throughout the whole week. It was more effective to deliver PIKI's goods on Tuesdays and Thursdays and ALPE's on Wednesdays. This also met their needs for transportation time gap.

5.2 New routes



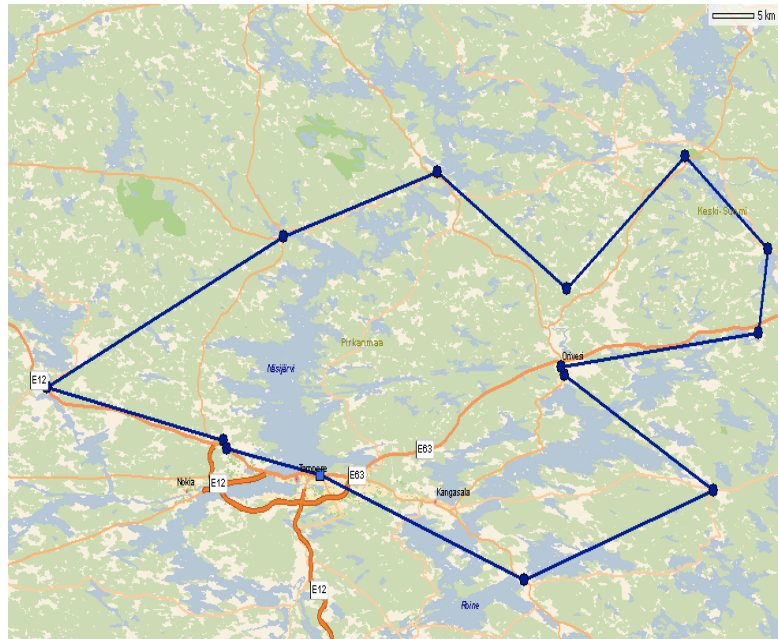
Organisaatio	Osoite	Kello
Fimlab Oy Delta	Biokatu 4	08:00
PIKI	Pirkankatu 2	08:15
PIKI Pirkkala	Suupankuja 2	08:45
PIKI Nokia	Välikatu 11	09:05
PIKI Sastamala	Sillankorvankatu 1	09:50
PIKI Punkalaidun	Urjalantie 27	10:30
PIKI Urjala	Tampereentie 4	11:00
Fimlab Oy Urjala	Sairaalantie 1	11:20
PIKI Kylmäkoski	Koulutie 0	11:40
Fimlab Oy Kylmäkoski	Koulutie 5	11:55
Fimlab Oy Viiala	Koivistontie 3	12:10
PIKI Akaa	Köyvärintie 1	12:30
Fimlab Oy Toijala	Akaantie 2	12:40
PIKI Valkeakoski	Kauppilankatu 2	13:30
Fimlab Oy Valkeakoski	Salonkatu 24	13:50
PIKI Vesilahti	Tapolantie 3	14:30
PIKI Lempäälä	Lempäälän aleksi 1	14:50
Fimlab Oy DELTA	Biokatu 4	15:15

Figure 17 & 18. The map and schedule for the route 1



Organisaatio	Osoite	Kello
Fimlab Oy Delta	Biokatu 4	07:37
PIKI METSO	Pirkankatu 2	07:55
Fimlab Pirkkala	Lentoasemantie 60	08:30
PIKI Virrat	Mäkitie 2	10:00
Fimlab Virrat	Sairaalantie 1	10:15
Fimlab Kihniö	Kivinevantie 11	10:55
PIKI Kihniö	Kihniöntie 46	11:05
PIKI Parkano	Parkanontie 57	11:40
Fimlab Parkano	Parkanontie 48	11:50
PIKI Ikaalinen	Poppelikatu 10	12:30
Fimlab toivolansaari	Toivolansaarentie 1	12:45
Fimlab Ikaalinen	Vanha tampreentie	13:00
Fimlab Oy Delta	Biokatu 4	14:00

Figure 19 & 20. The map and schedule for the route 2



Organisaatio	Osoite	Kello
Fimlab Oy Delta	Biokatu 4	08:00
Pälkäne kirjasto	Kehätie 4	08:45
Kuhmalahti kirjasto	Rautajärventie 26	09:30
Oriveden terveyskeskus	Sairaalantie 6	10:15
Orivesi kirjasto	Keskustie 23	10:30
Länkipohjan terveysasema	Kauppilantie	11:00
Kuoreveden terveysasema	Puistotie 5	11:30
Mäntän aluesairaala	Sairaalantie 168	12:25
Juupajoki kirjasto	Kirkkotie 1	13:00
Ruoveden terveyskeskus	Ruovedentie 56	13:40
Kurun terveyskeskus	Kisatie 1	14:10
Hämeenkyrö kirjasto	Kyrönsarventie 16	15:05
Ylöjärvi kirjasto	Koivumäentie 2	15:35
Ylöjärven terveyskeskus	Mikkolantie 10	15:45
Fimlab Oy Delta	Biokatu 4	16:10

Figure 21 & 22. The map and schedule for the route 3

5.3 Model for the new operation structure

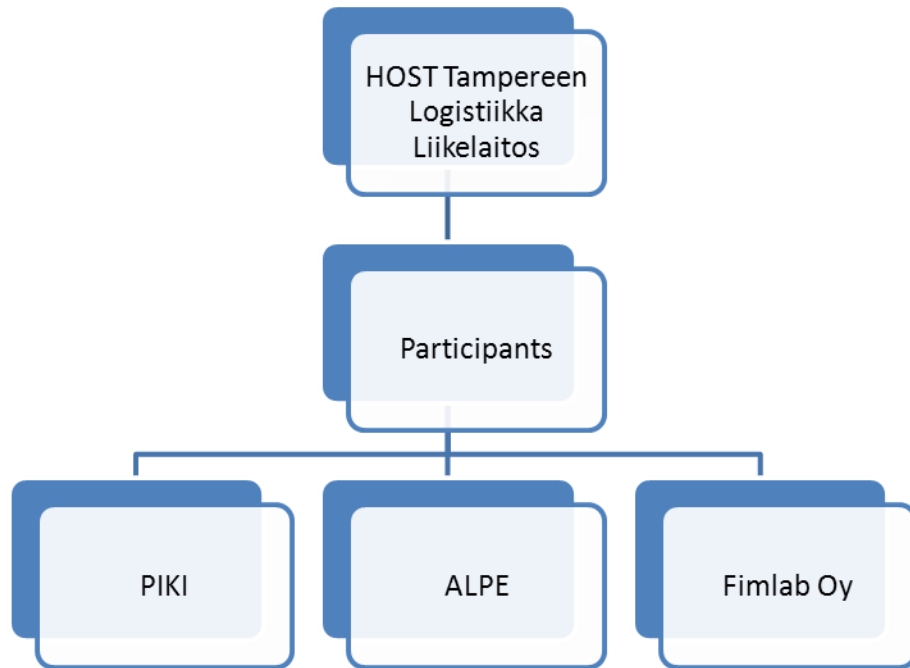


Figure 23. The new operation structure model

In this hierarchy the host takes care of the whole system. The host has to take care of doing competitive bidding for the new delivery system. They also have to decide how they will divide the billing. One example for this is to bill the organization “by stoppage”. This means a fixed cost per delivery point with additional fee for example for a beginning trolley.

The host also has to take care of information flow between the consignee and the consignor. This means informing the delivery company from additional deliveries and informing the organizations about possible schedule changes. These types of operations require work which means that the host organizations will bill the participant organizations from the work that occurs to them from running this system.

The financial flow in this system would work as the transport company would bill Tampereen Logistiikka Liikelaitos who then would bill or forward the bill to the organizations involved.

5.4 Pricing

When discussing about the pricing policies with the representatives from Tampereen Logistiikka Liikelaitos it was found out that there would be several different possibilities to use as a pricing method for the new system. In the result meeting no actual numbers for the costs of this service was presented. This was the recommendation from Martti Reko (CEO) of Tampereen Logistiikka Liikelaitos. The reason for this was that the actual costs for the new system weren't known, because the competitive bidding hadn't taken place at this stage. Also affecting factor was the cost of the running service for Tampereen Logistiikka Liikelaitos.

The main question when determining the pricing policy was how to set the correct pricing. Should the price change with the distance of the delivery? Also it was needed to remember that the pricing was only for the usage to the competitive bidding. The actual cost will differ when the transport companies give their offer for their services and Tampereen Logistiikka Liikelaitos adds their own price on top of that.

5.4.1 Pricing by the distance travelled

Commonly used in people transport and was one of the three possibilities for the pricing method for the new system. SWOT-analysis was used to compare the pricing possibilities. This pricing was considered easy to follow, because we would know the distance travelled on each route via transport log or navigation log. This makes the overall distance travelled easy to check and it also enables easy cost addition when added deliveries occur.

This type of pricing policy does not differentiate the fact that how much goods are being transported. This was a clear weakness on this pricing policy. Also it is problematic to separate the costs to every organization because in some cases the delivery points may

be relatively close to each other and then in some municipalities there could only be one organization which receives goods.

Strengths <ul style="list-style-type: none"> - Easy to follow - Clear effect/cost relation 	Weaknesses <ul style="list-style-type: none"> - No regard on quantities - How to separate the distance to each organization
Opportunities <ul style="list-style-type: none"> - Added deliveries are easy to implement to the cost structure 	Threats <ul style="list-style-type: none"> - unfair deviation in billing - Who will target the costs to different organizations and how

Figure 24. SWOT-analysis of the distance travelled pricing strategy

5.4.2 Fixed cost per drop-off

This model of pricing is currently used for some deliveries for Tampereen Logistiikka Liikelaitos. This means that there is a fixed cost for drop-off and additional cost for “new pallet” (For example, 10€ for delivery and 4€ for beginning pallet). So if the quantity is two pallets to some location the cost of delivery is $10€ + 4€ * 2 = 18€$.

This pricing policy is really clear and fair to each organization taking part in the routing system. The costs are easily divided and pointed to the consignees and it also accounts the quantities that are being delivered to each and every organization.

The biggest threat for this pricing policy is the “zone” thinking. This means that the fixed cost may vary through the distance travelled. The pricing for nearby deliveries would be different than those transported to the further regions of Pirkanmaa. This however is a fair way of thinking because the fuel costs are naturally bigger when the distance grows.

Strengths <ul style="list-style-type: none"> - Easy deviation of costs - Clear effect/cost relation - Accounts the quantities 	Weaknesses <ul style="list-style-type: none"> - Does not account the distance travelled
Opportunities <ul style="list-style-type: none"> - Easy billing for added deliveries 	Threats <ul style="list-style-type: none"> - Cost variation through “zone” thinking

5.5 Figure 25. SWOT-analysis of fixed cost per drop-off

5.6 Routing scheduling using ArcLogistics

New schedules were created by building excel sheets from every new route. After this was done we constructed a new project to ArcLogistics software.

5.6.1 Using ArcLogistics

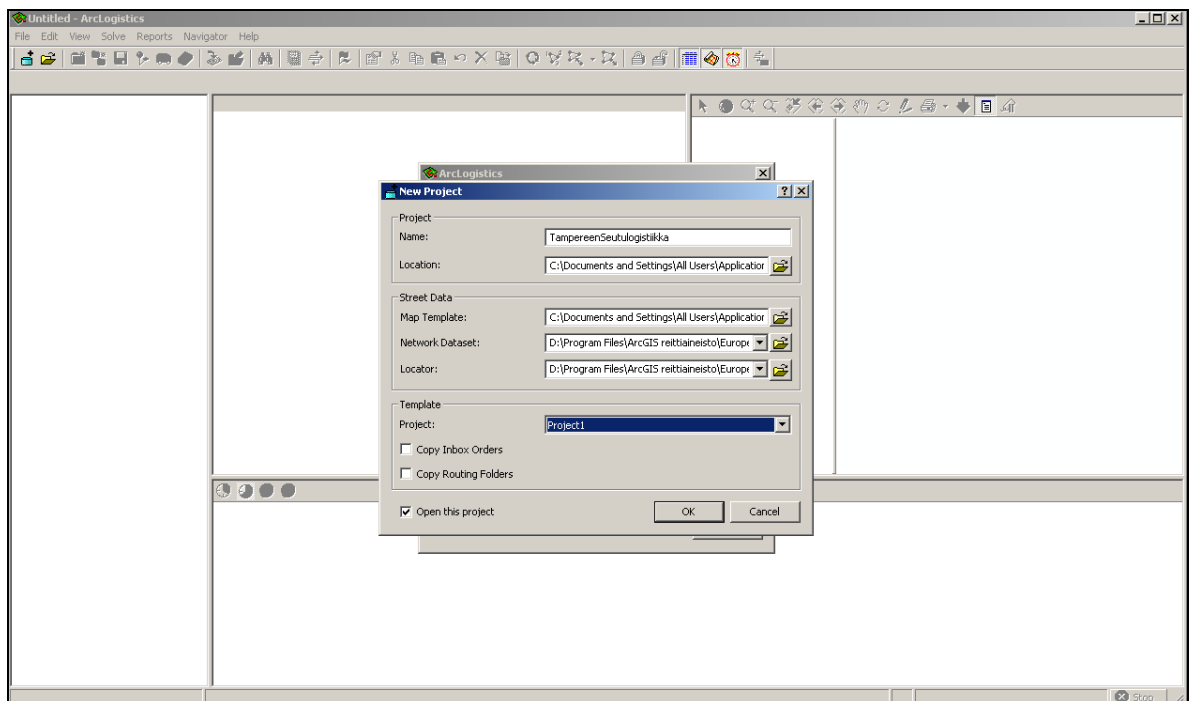
Open ArcLogistics user interface

Windows menu → All programs → ArcLogistics 10 → ArcLogistics
--

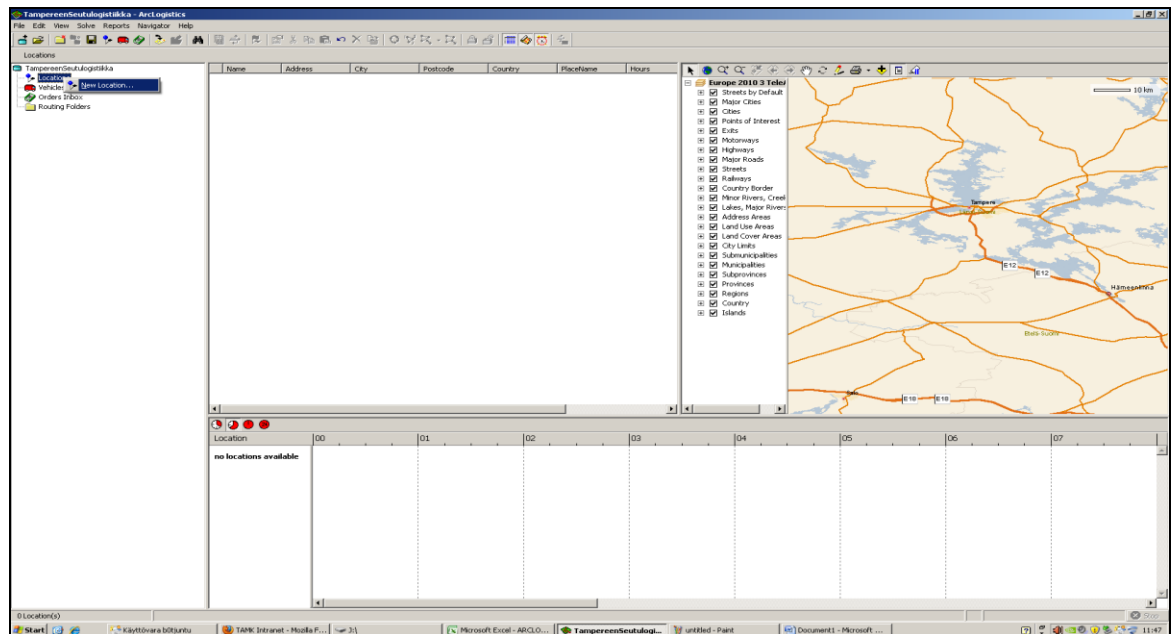
Opening new project to ArcLogistics

Choose “new project” and click Ok → Name your project → Choose any of the “Old” projects as a template → Click Ok

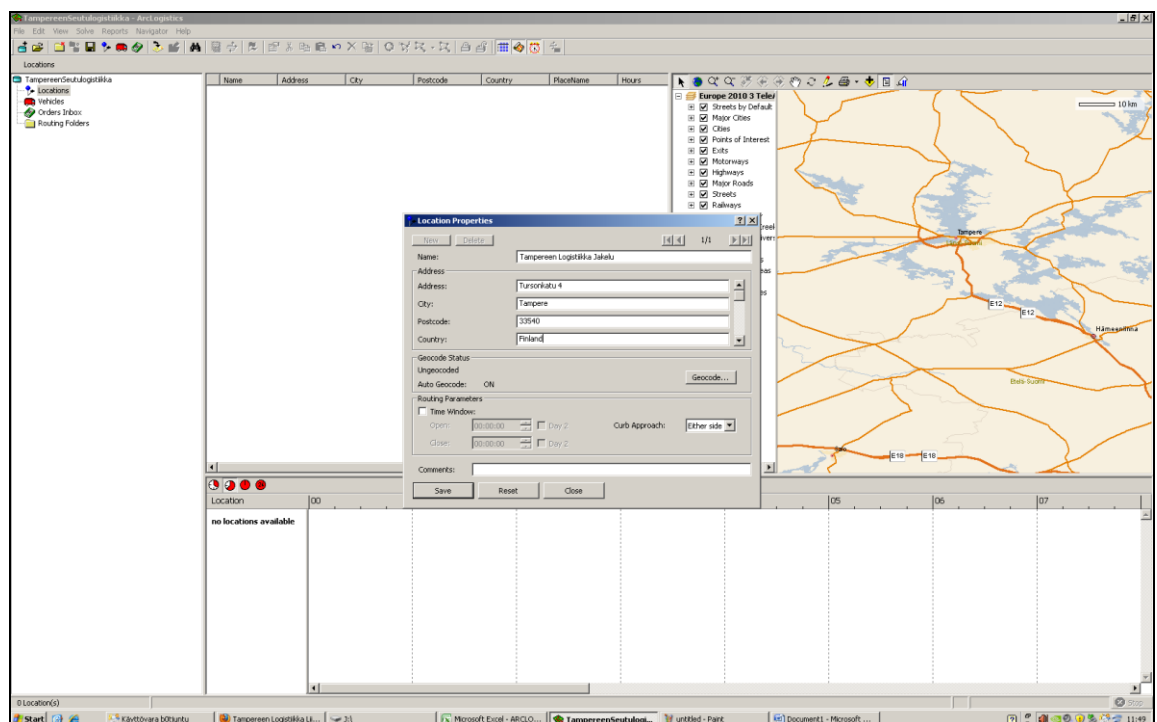
We named our project as “Tampereen Seutulogistiikka” and used project one as a template. The following captions were taken from the ArcLogistics software.



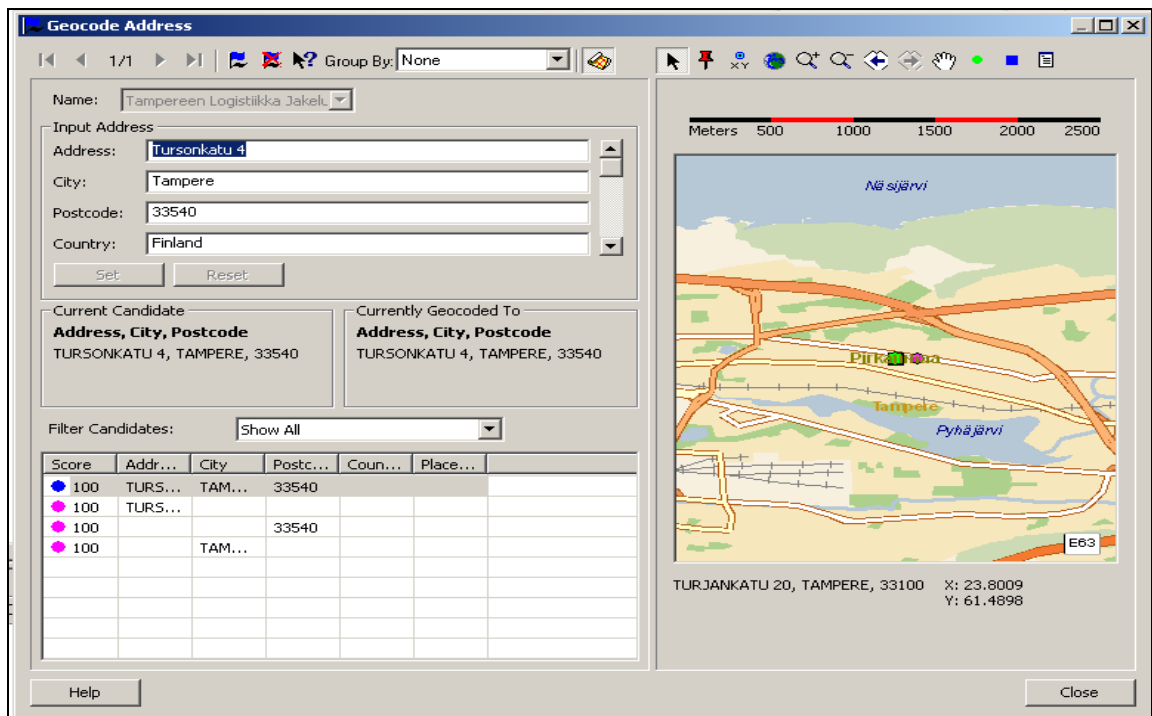
Defining the location



Location → Right click → New location

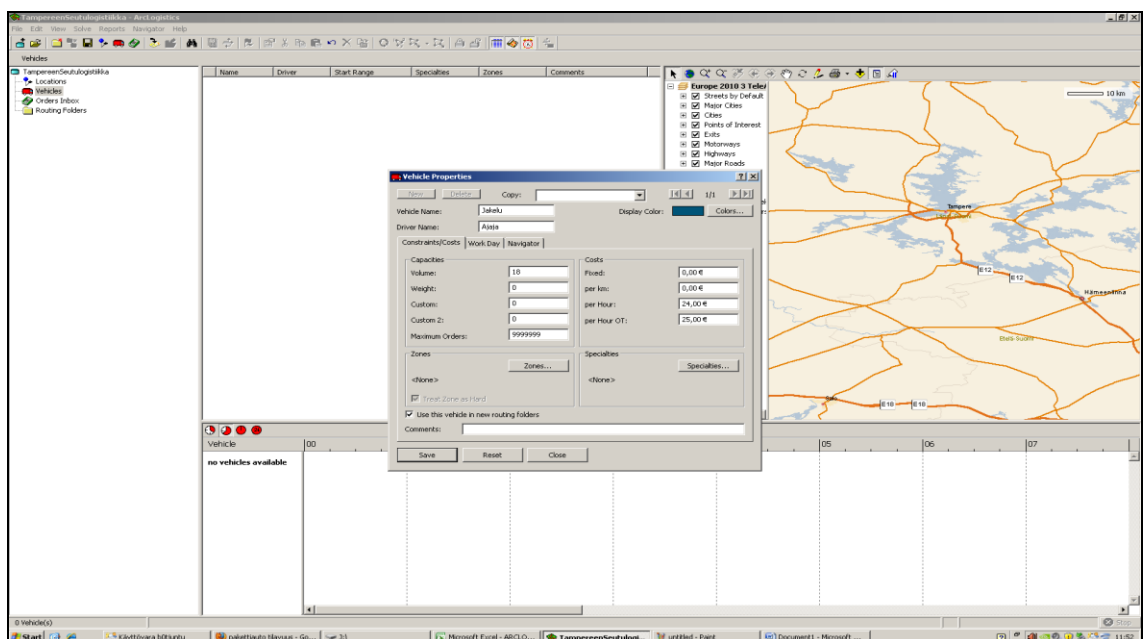


Location properties box opens → Add the information of the DC → Click the “geocode” button



Check that the address is correct (other information comes automatically) → Click

Defining the vehicle



Right click the “vehicles” → Open “new vehicle” → Vehicle properties box opens → Add the information you need for your project

Make sure that you fill in the “work day” and “locations”

Vehicle Properties

New Delete Copy: 1/1

Vehicle Name: Jakelu Display Color: Colors...

Driver Name: Ajaja

Constraints/Costs **Work Day** Navigator

Work Day

Earliest Start: 07:00:00 Day 2

Latest Start: 08:00:00 Day 2

Max. Travel Distance: 999 99 km

Max. Travel Duration: 12 hours

Max. Total Duration: 12 hours

Time before OT: 8,5 hours

Lunch Break

Length: 30 mins

Start between: 11:00:00 Day 2 and 13:00:00 Day 2

Locations

Locations...

Start: Tampereen Logistikk

Time at Start: 15 mins

End: Tampereen Logistikk

Time at End: 15 mins

Renewal Locations: <None>

Time at Renewal: 0 mins

Save Reset Close

Creating routing folders

Routing Folder Wizard

Welcome to the Routing Folder Wizard, which will guide you through the process of creating a new routing folder.

Routing Folder Name: 1

Template Routing Folder: <None>

Routing Preferences

Rate the importance of meeting time windows.

Low Medium High

Rate the importance of reducing excess transit time for paired orders.

Low Medium High

Depart within Time Window

Dynamic Point Zones

Allow U-Turns: Everywhere

Time Attribute: Time

Length Attribute: Length

Restrictions:

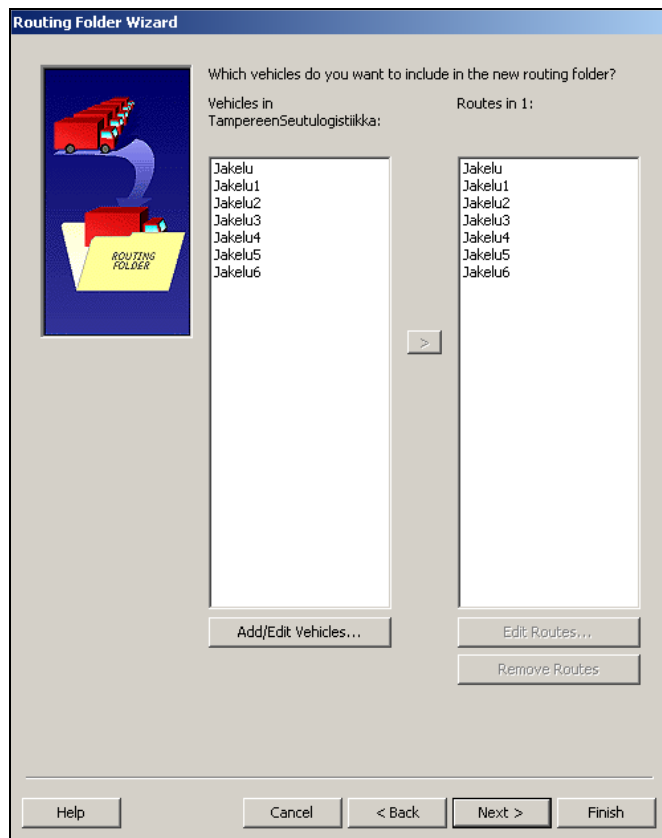
Avoid Ferries

Avoid Toll Roads

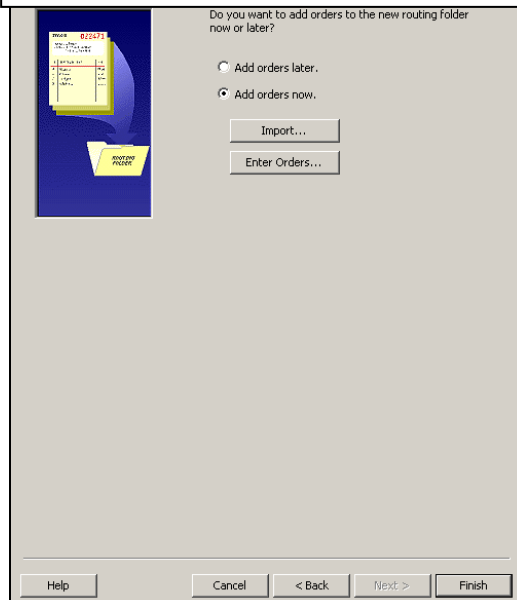
Non-routeable Segments

Parameters... Barriers...

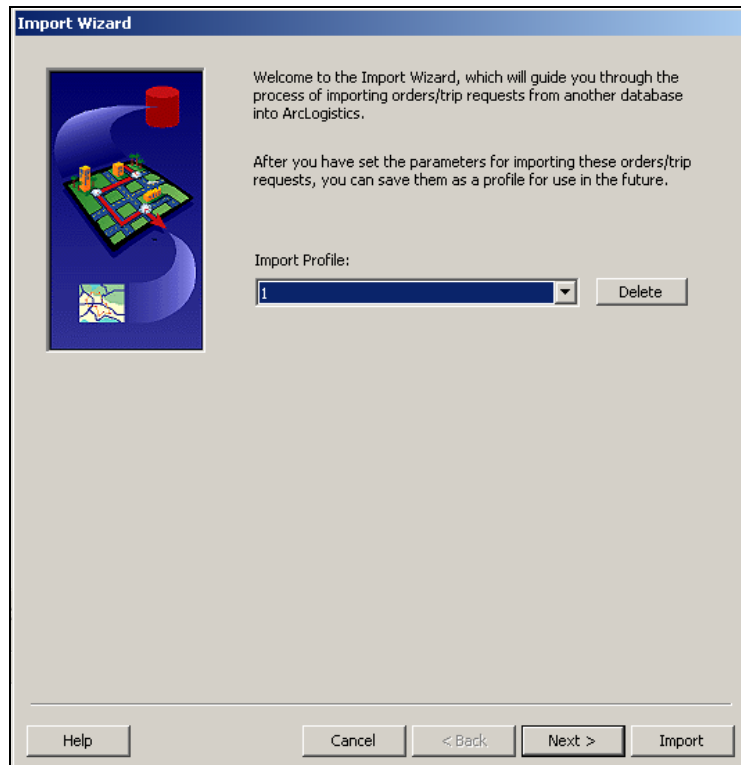
Right click the “Routing folders” from the main menu → Open “New routing folder” → Add the necessary information → Click “Next”



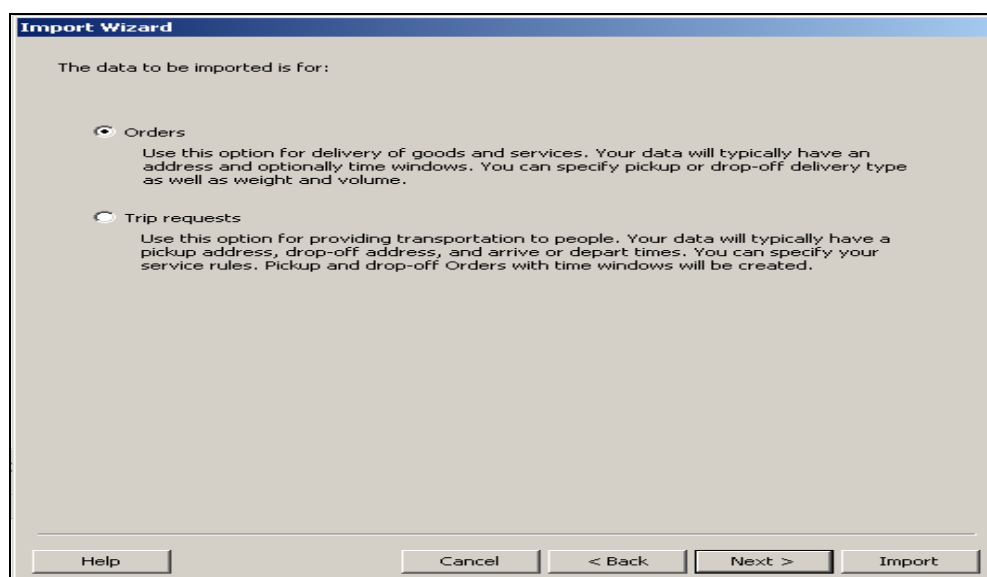
Choose the vehicles for your projects (Add or edit) → Click “Next”



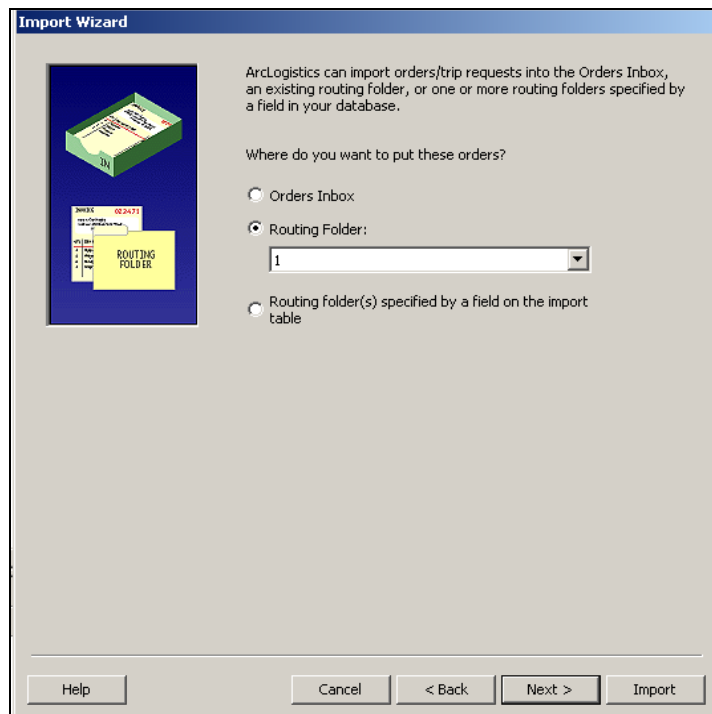
Adding orders → Add orders now → Click the “Import” but-



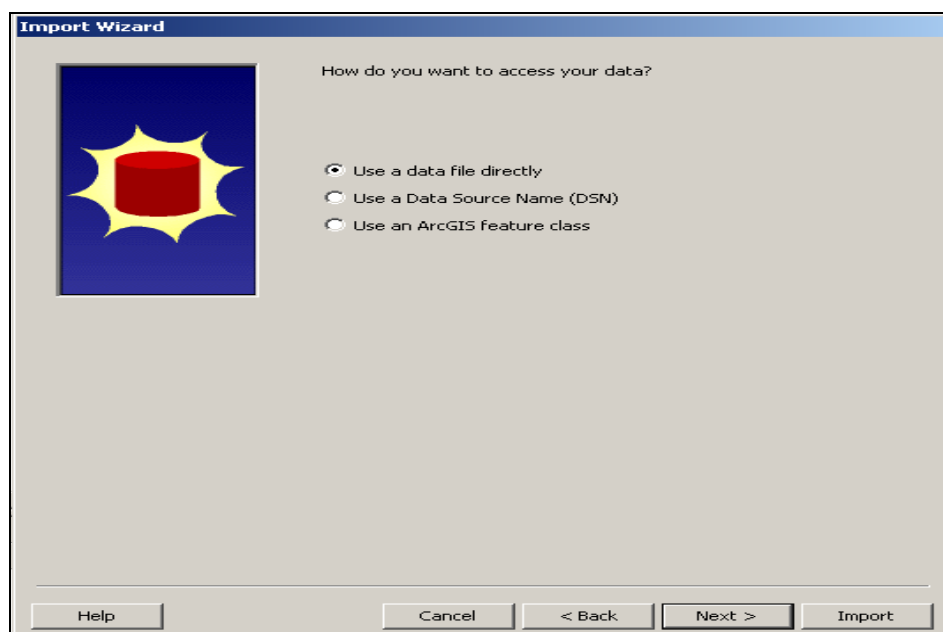
The Import wizard box opens → Click “Import Profile” → Choose “New import profile” → Click “Next”



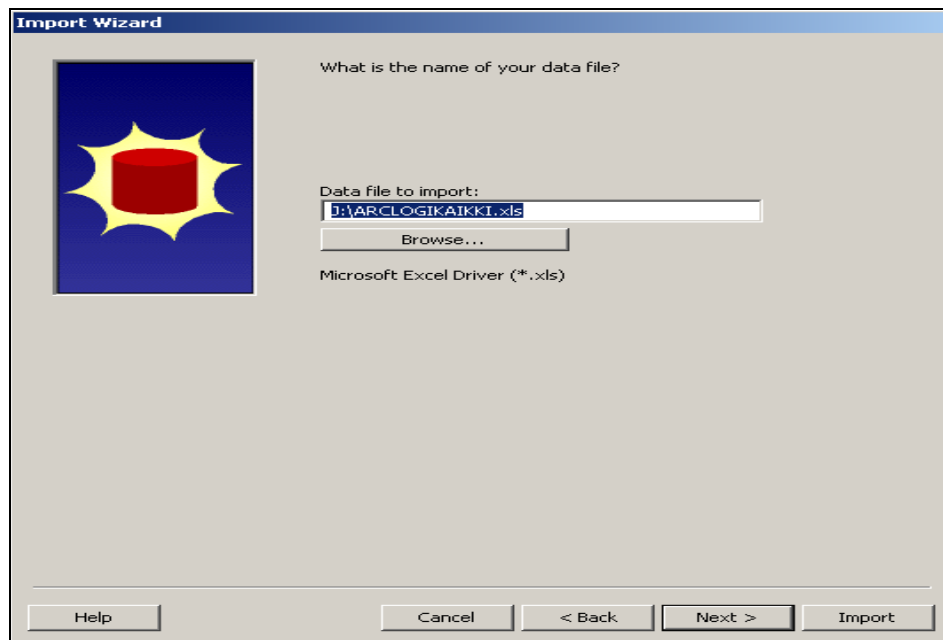
Now you can decide if the data is imported for delivery of goods and services, or transportation to people. Choose “Orders” or “Trip requests” → Finally, click



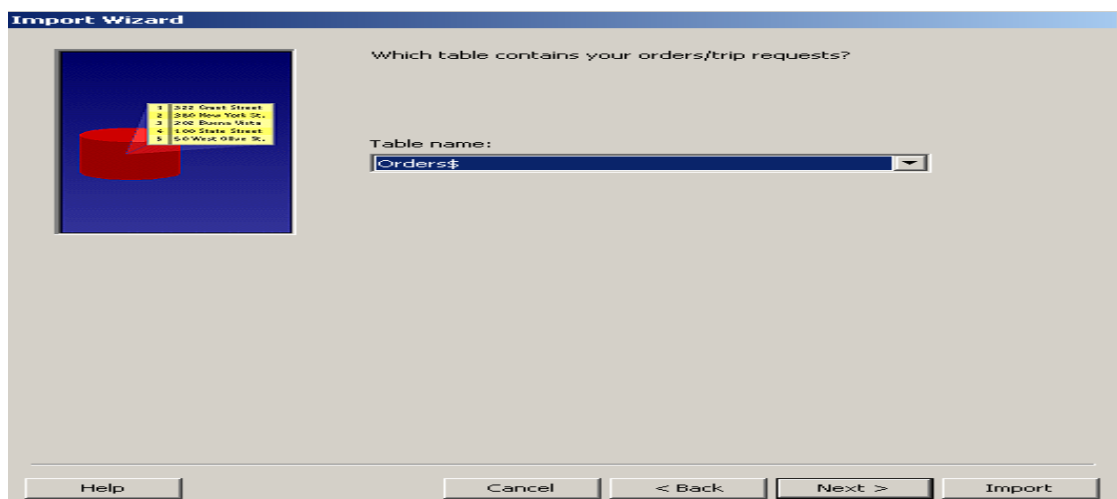
In the next box we don't have to have to change anything because the settings are correct and suitable for us. Just click "Next".



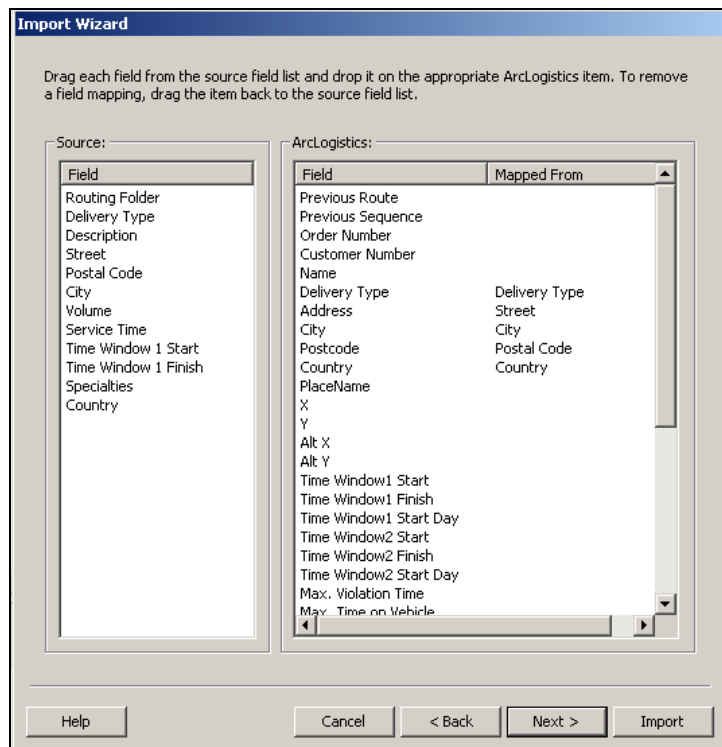
Next we can choose how to access to our data. Click "Use a data file directly", and import the data. We created an excel file, which contains all the necessary infor-



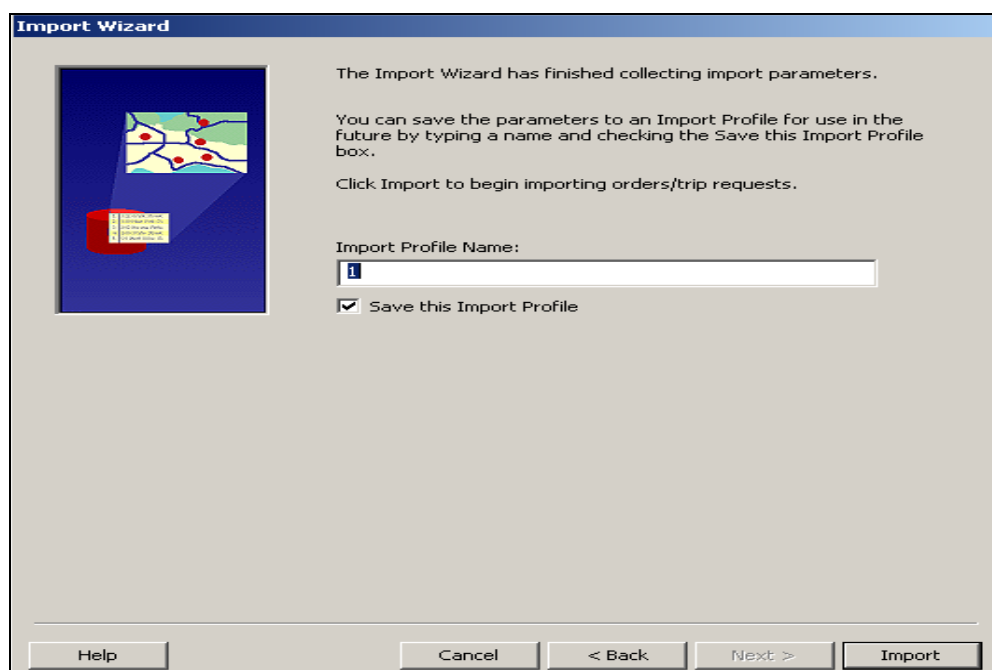
In the next box we choose the file from the computer. After this, click



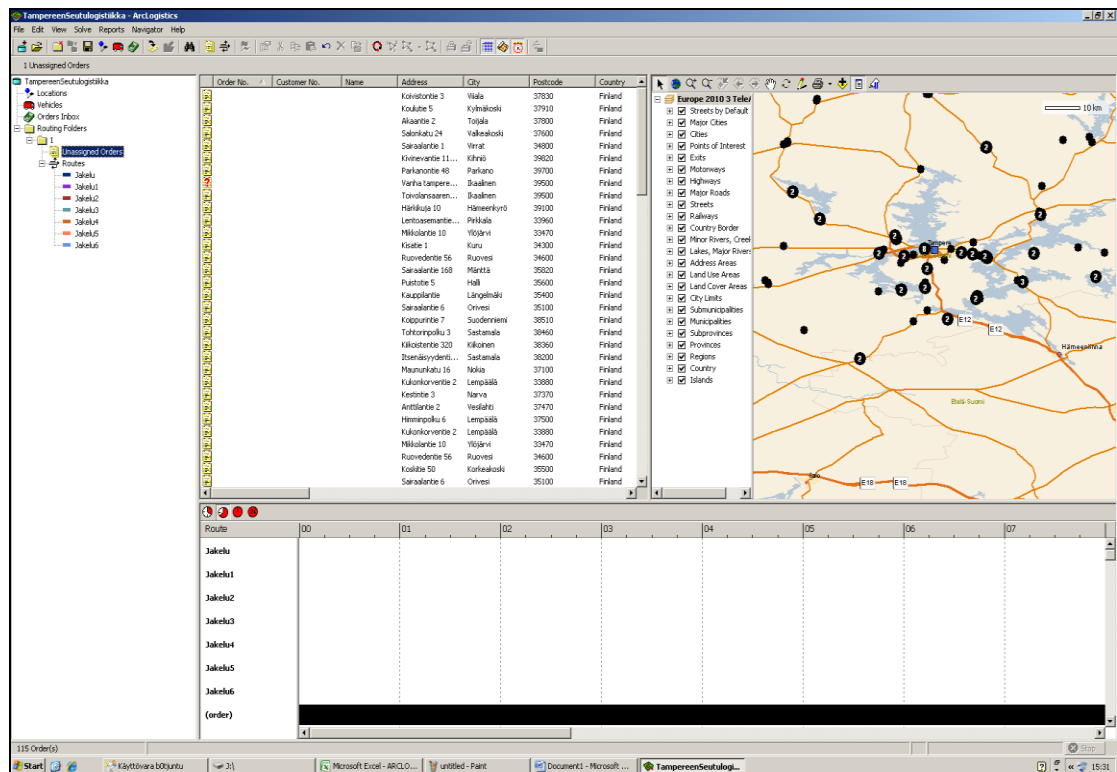
Next step is to choose the correct table, which contains our orders/trip requests. Click "Next".



In this box you have to make sure that all the fields on the left side match the ArcLogistics items on the right side. Also, check that all the fields from the used excel



Now the parameters have been imported. You can save the parameters for the future use, if you want. Finally, click "Import".



Choose the "Unassigned Orders" and press F7. Now the software builds the routes.

Now the routes are built....

6 CONCLUSIONS

6.1 Result meeting 11.9.2012

After analyzing the routes and carefully planning them a result meeting was held with all the participants. The themes that were discussed in that meeting were:

- Proposal for the new routing system
- Comments on the new routing system
- Possible changes
- Who will be the host of the new system

The representative from Fimlab Oy Production Manager Pauli Vuorinen said that they might have upcoming changes to their routing system because of another research done by Delfoi Oy. The changes are caused by the addition of Kanta-Häme and Jämsä to their operations. It was decided to wait for the suggestion from Delfoi Oy and see how it would affect our system. The most probable outcome would be that three routes would be planned as a separate system because of the participation of two other organizations. Mr Vuorinen also commented that the new routing would cause changes to the current service times in the municipalities. This problem was solved by suggesting that the drivers could use keys to pick up the samples. This was an easy way to solve this problem. Mr Vuorinen also stated that it is not a difficult task to change the opening times of the sample taking stations.

The representatives from PIKI also informed that they would have to make changes to the schedules for the municipality libraries. Again it was suggested that the drivers could use keys to enter the specific premises. This was held as one possibility. They also were concerned about the size of the delivery truck. They commented that it might not be possible to get to the loading docks in some of the libraries with a big truck. This was a smaller concern because the suggested car for this system is a delivery-van, which should get into the loading docks fairly easily. They also told that they would like to do competitive bidding for this project as soon as possible because they have an open ended contract for their current system and would like to get a fixed one as soon as possible.

Lastly it was discussed what the structure of the management of this system should be.

The suggestions were:

- Tampereen Logistiikka Liikelaitos will be the host of this system
- One of the three organizations would be the host of this system.

It was decided that Tampereen Logistiikka would be the host. This was due to the fact that none of the organizations didn't want the responsibility of handling all the operations including to this system. These operations were adding deliveries and billing. Since Tampereen Logistiikka Liikelaitos already has specialists for these they were the best suited. Of course this will mean added expenses to this system but the representatives were not worried about this.

Also Erkki Harju mentioned that in the end the carrier company will decide how they will drive the given route. This means they might not drive it with one car and not directly from point A-B-C-D. They might have other stoppages during the route that they would also handle for the other companies outside this system. This brings a challenge in the tendering because Tampereen Logistiikka will need to make sure that the company understands that the goods need to be in the destination in the given time.

As an outcome, it was proven that with careful and professional planning, the help of logistic soft wares, and evaluating the needs of the organizations, it is possible to create properly functioning synergies. Utilizing and analyzing the needs and the possibilities, the research showed that a new transportation routing system could be created.

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APPENDICES:

Appendix 1. Fimlab Oy's current routing schedule

Route	Description	Street	Postal Code	City	Volume	Service Time	Start Time	End Time	Specialties	Country
1	De li-ve-ry Ty pe	Viialan terveysasema	83000	Viiala	1	10	08:00	16:00	Ma	Finland
1	De li-ve-ry Ty pe	Kylmäkosken terveysasema	91000	Kylmäkoski	1	10	08:00	16:00	Ma	Finland
1	De li-ve-ry Ty pe	Toijalan terveysasema	80000	Toijala	1	10	08:00	16:00	Ma	Finland
1	De li-ve-ry Ty pe	Valkeakosken sairaala	60000	Valkeakoski	1	10	08:00	16:00	Ma	Finland
1	De li-ve-ry Ty pe	Virtain terveyskeskus	80000	Virrat	1	10	08:00	16:00	Ti	Finland

	ry										
	De										
	li-			39							Fin
	ve-	Kihniön ter-	Kivinevan-	82	Kih-			08:	16:		lan
1	ry	veyskeskus	tie 11-13	0	niö	1	10	00	00	Ti	d
	De										
	li-			39							Fin
	ve-	Parkanon	Parkanontie	70	Par-			08:	16:		lan
1	ry	terveyskeskus	48	0	kano	1	10	00	00	Ti	d
	De										
	li-		Vanha	39							Fin
	ve-	Ikaalisten	tampereen-	50	Ikaa-			08:	16:		lan
1	ry	terveyskeskus	tie 21	0	linen	1	10	00	00	Ti	d
	De										
	li-	Toivolansaa-		39							Fin
	ve-	ren vanhain-	Toivolan-	50	Ikaa-			08:	16:		lan
1	ry	koti	saarentie 1	0	linen	1	10	00	00	Ti	d
	De										
	li-			39	Hä-						Fin
	ve-	Hämeenkyrön	Härkikuja	10	meen-			08:	16:		lan
1	ry	terveyskeskus	10	0	kyrö	1	10	00	00	Ti	d
	De										
	li-			33							Fin
	ve-	Pirkkalan	Lentoase-	96	Pirk-			08:	16:		lan
1	ry	terveyskeskus	mantie 60	0	kala	1	10	00	00	Ti	d
	De										
	li-			33							Fin
	ve-	Ylöjärven	Mikkolan-	47	Ylö-			08:	16:		lan
1	ry	terveyskeskus	tie 10	0	järvi	1	10	00	00	Ke	d
	De	Kurun terve-		34				08:	16:		Fin
1	li-	yskeskus	Kisatie 1	30	Kuru	1	10	00	00	Ke	lan

	ve-			0							d
	ry										
	De										
	li-			34							Fin
	ve-	Ruoveden	Ruoveden-	60	Ruo-		08:	16:			lan
1	ry	terveyskeskus	tie 56	0	vesi	1	10	00	00	Ke	d
	De										
	li-			35							Fin
	ve-	Mäntän alue-	Sairaalantie	82	Mänt-		08:	16:			lan
1	ry	sairaala	168	0	tä	1	10	00	00	Ke	d
	De										
	li-			35							Fin
	ve-	Kuoreveden		60			08:	16:			lan
1	ry	terveysasema	Puistotie 5	0	Halli	1	10	00	00	Ke	d
	De										
	li-			35	Län-						Fin
	ve-	Länkipohjan	Kauppilan-	40	gel-		08:	16:			lan
1	ry	terveysasema	tie	0	mäki	1	10	00	00	Ke	d
	De										
	li-			35							Fin
	ve-	Oriveden	Sairaalantie	10	Orive-		08:	16:			lan
1	ry	terveyskeskus	6	0	si	1	10	00	00	Ke	d
	De										
	li-			38	Suo-						Fin
	ve-	Suodennie-	Koippurin-	51	den-		08:	16:			lan
1	ry	men tk	tie 7	0	niemi	1	10	00	00	To	d
	De										
	li-			38							Fin
	ve-	Mouhijärven	Tohtorin-	46	Sas-		08:	16:			lan
1	ry	tk	polku 3	0	tamala	1	10	00	00	To	d
1	De	Kiikoisten tk	Kiikoisten-	38	Kii-	1	10	08:	16:	To	Fin

	li-		tie 320	36	koinen			00	00		lan
	ve-			0							d
	ry										
	De										
	li-			38							Fin
	ve-	Vammalan	Itsenäisyy-	20	Sas-			08:	16:		lan
1	ry	aluesairaala	dentie 2	0	tamala	1	10	00	00	To	d
	De										
	li-			37							Fin
	ve-		Maununka-	10				14:	16:		lan
1	ry	Nokian tk	tu 16	0	Nokia	1	10	15	00	To	d
	De										
	li-			33							Fin
	ve-	Kuljun terve-	Kukonkor-	88	Lem-			08:	16:		lan
1	ry	ysasema	ventie 2	0	päälä	1	10	00	00	Pe	d
	De										
	li-			37							Fin
	ve-	Narvan terve-		37				08:	16:		lan
1	ry	ysasema	Kestintie 3	0	Narva	1	10	00	00	Pe	d
	De										
	li-			37							Fin
	ve-	Vesilahden	Anttilantie	47	Vesi-			08:	16:		lan
1	ry	terveysasema	2	0	lahti	1	10	00	00	Pe	d
	De										
	li-			37							Fin
	ve-		Himmin-	50	Lem-			08:	16:		lan
1	ry	Lempäälän tk	polku 6	0	päälä	1	10	00	00	Pe	d
	De										
	li-			33							Fin
	ve-	Kuljun terve-	Kukonkor-	88	Lem-			08:	16:		lan
1	ry	ysasema	ventie 2	0	päälä	1	10	00	00	Pe	d

	De			33							Fin
	li-										lan
	ve-	Ylöjärven	Mikkolan-	47	Ylö-		08:	16:			lan
1	ry	terveyskeskus	tie 10	0	järvi	1	10	00	00	Pe	d
	De										Fin
	li-			34							lan
	ve-	Ruoveden	Ruoveden-	60	Ruo-		08:	16:			lan
1	ry	terveyskeskus	tie 56	0	vesi	1	10	00	00	La	d
	De										Fin
	li-			35	Kor-						lan
	ve-			50	kea-		08:	16:			lan
1	ry	Juupajoen tk	Koskitie 50	0	koski	1	10	00	00	La	d
	De										Fin
	li-			35							lan
	ve-	Oriveden	Sairaalantie	10	Orive-		08:	16:			lan
1	ry	terveyskeskus	6	0	si	1	10	00	00	La	d
	De										Fin
	li-			36							lan
	ve-	Ruutanan		11	Ruu-		08:	16:			lan
1	ry	terveysasema	Leppätie 3	0	tana	1	10	00	00	La	d
	De										Fin
	li-			36							lan
	ve-	Sahalahden	Kurvishöl-	42	Saha-		08:	16:			lan
1	ry	terveysasema	lintie 8	0	lahti	1	10	00	00	Su	d
	De										Fin
	li-			36							lan
	ve-	Pälkäneen		60	Pälkä-		08:	16:			lan
1	ry	terveysasema	Keskustie 3	0	ne	1	10	00	00	Su	d
	De										Fin
	li-		Herttualan-	20	Kan-		08:	16:			lan
1	ve-	Kangasalan tk	tie 28	0	gasala	1	10	00	00	Su	d

	ry										
	De										
	li-			36	Kuh-						Fin
	ve-	Kuhmalahden	Pappilantie	81	ma-			08:	16:		lan
1	ry	vanhainkoti	2	0	lahti	1	10	00	00	ma1	d
	De										
	li-			36							Fin
	ve-	Kuhmalahden	Rautajär-	84				12:	16:		lan
1	ry	terveysasema	ventie 22	0	Pohja	1	10	15	00	ma1	d
	De										
	li-			36							Fin
	ve-		Herttualan-	20	Kan-			08:	16:		lan
1	ry	Kangasalan tk	tie 28	0	gasala	1	10	00	00	ma1	d
	De										
	li-			36							Fin
	ve-	Vatialan ter-		24	Kan-			08:	16:		lan
1	ry	veysasema	Junatie 1	0	gasala	1	10	00	00	ma1	d
	De										
	li-	Harjutuulen		36							Fin
	ve-	päivystyskes-	Onkkaalan-	60	Pälkä-			08:	16:		lan
1	ry	kus	tie 170	0	ne	1	10	00	00	ke2	d
	De										
	li-			36	Luo-						Fin
	ve-	Luopioisten		76	pioi-			08:	16:		lan
1	ry	terveysasema	Pereentie	0	nen	1	10	00	00	ke2	d
	De										
	li-			36							Fin
	ve-	Pälkäneen		60	Pälkä-			08:	16:		lan
1	ry	terveysasema	Keskustie 3	0	ne	1	10	00	00	ke2	d
	De		Herttualan-	36	Kan-			08:	16:		Fin
1	li-	Kangasalan tk	tie 28	20	gasala	1	10	00	00	ke2	lan

	ve-			0							d
	ry										
	De										
	li-			36	Luo-						Fin
	ve-	Luopioisten		76	pioi-		08:	16:			lan
1	ry	terveysasema	Pereentie	0	nen	1	10	00	00	to2	d
	De										
	li-			36							Fin
	ve-		Herttualan-	20	Kan-		08:	16:			lan
1	ry	Kangasalan tk	tie 28	0	gasala	1	10	00	00	to2	d
	De										
	li-			36							Fin
	ve-	Pälkäneen		60	Pälkä-		08:	16:			lan
1	ry	terveysasema	Keskustie 3	0	ne	1	10	00	00	pe2	d
	De										
	li-			36							Fin
	ve-		Herttualan-	20	Kan-		08:	16:			lan
1	ry	Kangasalan tk	tie 28	0	gasala	1	10	00	00	pe2	d
	De										
	li-			37							Fin
	ve-	Valkeakosken	Salonkatu	60	Sas-		09:	10:			lan
1	ry	sairaala	24	0	tamala	1	10	45	45	ti2	d
	De										
	li-			37							Fin
	ve-		Himmin-	50	Lem-		10:	10:			lan
1	ry	Lempäälän tk	polku 6	0	päälä	1	10	15	45	ti2	d
	De										
	li-			33							Fin
	ve-	Metso pääkir-	Pirkankatu	10	Tam-		08:	16:			lan
1	ry	jasto	2	0	pere	1	10	00	00	ti2	d
1	De	Vatiala	/ Konkka-		Kan-	1	10	08:	16:	ma1	Fin

	li- ve- ry De	Kangasalan länkirjasto	länkuja 3	gasala			00	00		lan d
	li- ve- ry De	Suorama / Kangasalan länkirjasto	Suoraman- tie 19	Kan- gasala	1	10	08: 00	16: 00	ma1	Fin lan d
1	li- ve- ry De	Sahalahti / Kangasalan länkirjasto	Kurviksen- kuja 2	Kan- gasala	1	10	08: 00	16: 00	ma1	Fin lan d
1	li- ve- ry De	Kangasala pänkirjasto	Keskusau- kio 2	Kan- gasala	1	10	08: 00	16: 00	ma1	Fin lan d
1	li- ve- ry De	Valkeakoski kirjasto	Kauppilan- katu 2	Val- kea- koski	1	10	08: 00	16: 00	ma1	Fin lan d
1	li- ve- ry De	Lempäälä kirjasto	Lempäälän Aleksi 1	Lem- päälä	1	10	08: 00	16: 00	ma1	Fin lan d
1	li- ve- ry De	Vesilahti kir- jasto	Tapolantie 3	Vesi- lahti	1	10	08: 00	16: 00	ma1	Fin lan d
1	li- ve- ry	Akaa kirjasto	Köyvärintie 1	Akaa	1	10	08: 00	16: 00	ma1	Fin lan d

	De									
	li-			Kylmä						Fin
	ve-	Kylmäkoski		mä-		08:	16:			lan
1	ry	kirjasto	Koulutie 0	koski	1	10	00	00	ma1	d
	De									
	li-									Fin
	ve-	Urjala kirjas-	Tampereen-			08:	16:			lan
1	ry	to	tie 4	Urjala	1	10	00	00	ma1	d
	De									
	li-			Punka						Fin
	ve-	Punkalaidun	Urjalantie	ka-		08:	16:			lan
1	ry	kirjasto	27	laidun	1	10	00	00	ma1	d
	De									
	li-									Fin
	ve-	Sastamala	Sillankor-	Sas-		08:	16:			lan
1	ry	kirjasto	vankatu 1	tamala	1	10	00	00	ma1	d
	De									
	li-									Fin
	ve-					08:	16:			lan
1	ry	Nokia kirjasto	Välikatu 11	Nokia	1	10	00	00	ma1	d
	De									
	li-									Fin
	ve-	Pirkkala kir-	Suupankuja	Pirk-		08:	16:			lan
1	ry	jasto	2	kala	1	10	00	00	ma1	d
	De									
	li-	Nuoliala /								Fin
	ve-	Pirkkalan		Pirk-		08:	16:			lan
1	ry	lähikirjasto	Jaakontie 3	kala	1	10	00	00	ma1	d
	De									Fin
	li-	Metso pääkir-	Pirkankatu	Tam-		08:	16:			lan
1	ve-	jasto	2	pere	1	10	00	00	ma1	d

	ry										
	De										
	li-									Fin	
	ve-	Metso pääkir-	Pirkankatu	Tam-			08:	16:		lan	
1	ry	jasto	2	pere	1	10	00	00	ke2	d	
	De										
	li-									Fin	
	ve-	Ylöjärvi kir-	Koivumä-	Ylö-			08:	16:		lan	
1	ry	jasto	entie 2	järvi	1	10	00	00	ke2	d	
	De										
	li-			Hä-						Fin	
	ve-	Hämeenkyrö	Kyrönsar-	meen-			08:	16:		lan	
1	ry	kirjasto	ventie 16	kyrö	1	10	00	00	ke2	d	
	De										
	li-									Fin	
	ve-	Ikaalinen	Poppelikatu	Ikaa-			08:	16:		lan	
1	ry	kirjasto	10	linen	1	10	00	00	ke2	d	
	De										
	li-									Fin	
	ve-	Parkano kir-	Parkanontie	Par-			08:	16:		lan	
1	ry	jasto	57	kano	1	10	00	00	ke2	d	
	De										
	li-									Fin	
	ve-	Kihniö kirjas-	Kihniöntie	Kih-			08:	16:		lan	
1	ry	to	46	niö	1	10	00	00	ke2	d	
	De										
	li-									Fin	
	ve-						08:	16:		lan	
1	ry	Virrat kirjasto	Mäkitie 2	Virrat	1	10	00	00	ke2	d	
	De	Ruovesi kir-		Ruo-			08:	16:		Fin	
1	li-	jasto	Urheilutie 4	vesi	1	10	00	00	ke2	lan	

	ve-									d
	ry									
	De									
	li-									Fin
1	ve-	Metso pääkir-	Pirkankatu	Tam-		08:	16:			lan
	ry	jasto	2	pere	1	10	00	00	ke2	d
	De									
	li-									Fin
1	ve-	Metso pääkir-	Pirkankatu	Tam-		08:	16:			lan
	ry	jasto	2	pere	1	10	00	00	Ke	d
	De									
	li-									Fin
1	ve-	Orivesi kir-	Keskustie	Orive-		08:	16:			lan
	ry	jasto	23	si	1	10	00	00	Ke	d
	De			Mänt-						
	li-	Mänttä-		tä-						Fin
1	ve-	Vilppula kir-	Seppälän	Vilp-		08:	16:			lan
	ry	jasto	Puistotie 16	pula	1	10	00	00	Ke	d
	De									
	li-									Fin
1	ve-	Juupajoki		Juupa-		08:	16:			lan
	ry	kirjasto	Kirkkotie 1	joki	1	10	00	00	Ke	d
	De									
	li-			Kuh-						Fin
1	ve-	Kuhmalahti	Rautajär-	ma-		08:	16:			lan
	ry	kirjasto	ventie 26	lahti	1	10	00	00	Ke	d
	De									
	li-									Fin
1	ve-	Pälkäne kir-		Pälkä-		08:	16:			lan
	ry	jasto	Kehätie 4	ne	1	10	00	00	Ke	d
1	De	Metso pääkir-	Pirkankatu	Tam-	1	10	08:	16:	Ke	Fin

	li- ve- ry De	jasto	2	pere			00	00		lan d
1	li- ve- ry De	Metso pääkir- jasto	Pirkankatu 2	Tam- pere	1	10	08: 00	16: 00	Ke	lan d
1	li- ve- ry De	Vatjala / Kangasalan lähikirjasto	Konkka- lankuja 3	Kan- gasala	1	10	08: 00	16: 00	Su	lan d
1	li- ve- ry De	Suorama / Kangasalan lähikirjasto	Suoraman- tie 19	Kan- gasala	1	10	08: 00	16: 00	Su	lan d
1	li- ve- ry De	Sahalahti / Kangasalan lähikirjasto	Kurviksen- kuja 2	Kan- gasala	1	10	08: 00	16: 00	Su	lan d
1	li- ve- ry De	Kangasala pääkirjasto	Keskusau- kio 2	Kan- gasala	1	10	08: 00	16: 00	Su	lan d
1	li- ve- ry De	Valkeakoski kirjasto	Kauppilan- katu 2	Val- kea- koski	1	10	08: 00	16: 00	Su	lan d
1	li- ve- ry	Akaa kirjasto	Köyvärintie 1	Akaa	1	10	08: 00	16: 00	Su	lan d

	De										
	li-										Fin
	ve-	Urjala kirjas-	Tampereen-			08:	16:				lan
1	ry	to	tie 4	Urjala	1	10	00	00	Su		d
	De										
	li-										Fin
	ve-	Vesilahti kir-	Tapolantie	Vesi-		08:	16:				lan
1	ry	jasto	3	lahti	1	10	00	00	Su		d
	De										
	li-										Fin
	ve-	Lempäälä	Lempäälän	Lem-		08:	16:				lan
1	ry	kirjasto	Aleksi 1	päälä	1	10	00	00	Su		d
	De										
	li-										Fin
	ve-	Pirkkala kir-	Suupankuja	Pirk-		08:	16:				lan
1	ry	jasto	2	kala	1	10	00	00	Su		d
	De										
	li-										Fin
	ve-					08:	16:				lan
1	ry	Nokia kirjasto	Välikatu 11	Nokia	1	10	00	00	Su		d
	De										
	li-										Fin
	ve-	Ylöjärvi kir-	Koivumä-	Ylö-		08:	16:				lan
1	ry	jasto	entie 2	järvi	1	10	00	00	Su		d
	De										
	li-			Hä-							Fin
	ve-	Hämeenkyrö	Kyrönsar-	meen-		08:	16:				lan
1	ry	kirjasto	ventie 16	kyrö	1	10	00	00	Su		d
	De										
	li-	Ikaalinen	Poppelikatu	Ikaa-		08:	16:				lan
1	ve-	kirjasto	10	linen	1	10	00	00	Su		d

	ry												
	De												
	li-												Fin
	ve-	Metso pääkir-	Pirkankatu		Tam-			08:	16:				lan
1	ry	jasto	2		pere	1	10	00	00	Su			d
	De												
	li-			34									Fin
	ve-	Virtain Alue-	Virtaintie	80				08:	16:				lan
1	ry	paloasema	24 B	0	Virrat	1	10	00	00	Ti			d
	De												
	li-			39									Fin
	ve-		Fennokatu	70	Par-			08:	16:				lan
1	ry	Parkano Alpe	3	0	kano	1	10	00	00	Ti			d
	De												
	li-			34									Fin
	ve-			60	Ruo-			08:	16:				lan
1	ry	Ruovesi Alpe	Kuruntie 26	0	vesi	1	10	00	00	Ke			d
	De				Mänt-								
	li-			35	tä-								Fin
	ve-	Mänttä-		70	Vilp-			08:	16:				lan
1	ry	Vilppula Alpe	Mäntäntie 2	0	pula	1	10	00	00	Ke			d
	De												
	li-			37									Fin
	ve-			15				08:	16:				lan
1	ry	Nokia Alpe	Öljytie 3	0	Nokia	1	10	00	00	ma1			d
	De												
	li-			33									Fin
	ve-		Takamaan-	48	Ylö-			08:	16:				lan
1	ry	Ylöjärvi Alpe	tie 3	0	järvi	1	10	00	00	Ke			d
	De	Sastamala	Itsenäisyy-	38	Sas-			08:	16:				Fin
1	li-	Alpe	dentie 17	20	tamala	1	10	00	00	ma1			lan

	ve-			0							d
	ry										
	De										
	li-			33							Fin
	ve-		Lentoase-	96	Pirk-		08:	16:			lan
1	ry	Pirkkala Alpe	mantie 568	0	kala	1	10	00	00	Ti	d
	De		Niementie	39							
	li-		5	10	Hä-						Fin
	ve-	Hämeenkyrö		0	meen-		08:	16:			lan
1	ry	Alpe			kyrö	1	10	00	00	Ti	d
	De										
	li-			39							Fin
	ve-	Ikaalinen	Teinintie	50	Ikaa-		08:	16:			lan
1	ry	Alpe	17	0	linen	1	10	00	00	Ti	d
	De										
	li-			37	Val-						Fin
	ve-	Valkeakoski	Roineenka-	60	kea-		08:	16:			lan
1	ry	Alpe	tu 22	0	koski	1	10	00	00	Ma	d
	De										
	li-			37							Fin
	ve-	Lempäälä	Keskuskatu	55	Lem-		08:	16:			lan
1	ry	Alpe	25	0	päälä	1	10	00	00	Su	d
	De										
	li-		Kaarina	36							Fin
	ve-	Kangasala	Maununtyt-	20	Kan-		08:	16:			lan
1	ry	Alpe	tären tie 6	0	gasala	1	10	00	00	Su	d
	De										
	li-			33							Fin
	ve-	Keskuspalo-	Satakun-	10	Tam-		08:	16:			lan
1	ry	asema	nankatu 16	0	pere	1	10	00	00	ti2	d
1	De	Hervanta Al-	Hervannan	33	Tam-	1	10	08:	16:	ti2	Fin

	li- ve- ry De li- ve- ry	pe Linnainmaa Alpe	valtaväylä 100 Aitolahden- tie 19	72 0 33 58 0	pere Tam- pere			00 08: 10 00	00 16: 00	ti2	lan d Fin lan d
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Reit-
ti 1

Aika	Paikka	Osoite	Aj oa ik a	Ta uk oai ka	Aj op äi- vät	Ki- lo me trit	ko- ko- nais aika	Aj oa ik a	Ta uk oai ka	Pal ve- luai ai- ka
7:21	FinnMedi 5 (3.krs)	biokatu 2, 00 33520 Tampe- re	:0 9	00: 00		14 5,9	08: 52	:3 3	02: 07	03: 12
7:30	Hatanpään labora- torio	Hatanpäänkatu 00 24 33100 Tampere	:0 9	00: 00						
7:47	FinnMedi 5 (3.krs)	biokatu 2, 00 33520 Tampe- re	:0 9	00: 00						
8:15	Hatanpään labora- torio	Hatanpäänkatu 00 24 33100 Tampere	:0 6	00: 11						
8:30	Tuulensuun labo- ratorio	Hämeenkatu 00 28, 33200 Tampere	:0 6	00: 01						

			Parantolankatu	00		
8:45	Kaupin laborato- rio	6 33500 Tam- pere		:0 00: 6 01		
			Hammarenin- katu 5 B,	00		
8:59	Tullinkulman la- boratorio	33100 Tampe- re		:0 00: 5 00		
			biokatu 2,	00		
9:12	FinnMedi 5 (3. krs)	33520 Tampe- re		:0 00: 9 00		
			Hatanpäänkatu	00		
9:29	Hatanpään labora- torio	24 33100 Tam- pere		:0 00: 6 00		
			Hämeenkatu	00		
9:43	Tuulensuun labo- ratorio	28, 33200 Tam- pere		:0 00: 5 00		
			Hammarenin- katu 5 B,	00		
9:56	Tullinkulman la- boratorio	33100 Tampe- re		:0 00: 5 00		
			biokatu 2,	00		
10:58	FinnMedi 5 (3. krs)	33520 Tampe- re		:0 00: 5 49		
			Parantolankatu	00		
11:11	Kaupin laborato- rio	6 33500 Tam- pere		:0 00: 6 00		
			Hammarenin- katu 5 B,	00		
11:30	Tullinkulman la- boratorio	33100 Tampe- re		:0 00: 6 05		
11:4	Hatanpään labora- torio	Hatanpäänkatu		00 00:		

4	torio	24	33100	:0	00
		Tampere		6	
		Hämeenkatu		00	
11:5	Tuulensuun labo-	28,	33200	:3	00:
8	ratorio	Tampere		8	00
				00	
13:0	Pälkäneen terve-	Keskustie 3,		:3	00:
0	ysasema ja lab.	36600 Pälkäne		5	15
		biokatu 2,		00	
13:4	FinnMedi 5 (	33520 Tampe-		:0	00:
3	3.krs)	re		5	00
		Parantolankatu		00	
14:0	Kaupin laborato-	6 33500 Tam-		:0	00:
0	rio	pere		6	05
		Hammarenin-			
		katu 5 B,		00	
14:1	Tullinkulman la-	33100 Tampe-		:0	00:
4	boratorio	re		4	00
		Hämeenkatu		00	
14:2	Tuulensuun labo-	28,	33200	:0	00:
6	ratorio	Tampere		7	00
		Hatanpäänkatu		00	
14:4	Hatanpään labora-	24	33100	:0	00:
1	torio	Tampere		9	00
		biokatu 2,		00	
14:5	FinnMedi 5 (	33520 Tampe-		:0	00:
8	3.krs)	re		5	00
		Hammarenin-			
		katu 5 B,		00	
16:0	Tullinkulman la-	33100 Tampe-		:0	00:
0	boratorio	re		5	49

16:1 3	FinnMedi 5 (3.krs)	biokatu 2, 33520 Tampe- re
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Reit-
ti 2

Aika	Paikka	Osoite	Aj oa ik a	Ta uk oai ka	Aj op äi- vät	Ki- lo me trit	ko- ko- nais aika	Aj oa ik a	Ta uk oai ka	Pal ve- luai ai- ka
8:15	FinnMedi 5 (3.krs)	biokatu 2, 33520 Tampe- re	00 :2 0	00: 00		26 3,7	06: 18	:5 0	00: 00	01: 28
8:34	Kangasalan laboratorio	Herttualantie 28, 36200 Kangasala	00 :1 9	00: 00						
9:02	FinnMedi 5 (3.krs)	biokatu 2, 33520 Tampe- re	00 :1 3	00: 00						
9:23	Tesoman laboratorio	Kohmankaari 9, 33310 Tam- pere	00 :1 1	00: 00						
9:42	Ylöjärven laboratorio + tk	Mikkolantie 10, 33470 Ylö- järvi	00 :2 6	00: 00						
10:1 6	Ylisen hoiva- ja kuntoutuspalvelut	Kuruntie 980 34130 Ylinen	01 :0 4	00: 00	ma ,ke ,pe					
11:2 7	Kuntoutuskeskus Apila	Reumantie 6, 36280 Kan-	00 :1	00: 00						

		gasala	3							
11:4 9	Kangasalan labo- ratorio	Herttualantie 28, 36200 Kangasala	01 :0 00: 0 00							
12:4 9	Ikaalisten labora- torio +tk	Vanha Tampe- reentie 21, 39500 Ikaali- nen	00 :1 00: 6 00							
13:1 3	Hämeenkyrön laboratorio	Härkikuja 10, 39100 Hä- meenkyrö	00 :1 00: 7 00							
13:3 9	Ylöjärven labora- torio + tk	Mikkolantie 10, 33470 Ylö- järvi	00 :1 00: 3 00							
14:0 0	Pirkkalan labora- torio	Lentoaseman- tie 60, 33960 Pirkkala	00 :1 00: 6 00							
14:2 4	FinnMedi 5 () 3.krs)	biokatu 2, 33520 Tampe- re	00 :0 00: 0 00							

Reit-
ti 3

Aika	Paikka	Osoite	Aj oa ik a	Ta uk oai ka	Aj op äi- vät	Ki- lo me trit	ko- ko- nais aika	Aj oa ik a	Ta uk oai ka	Pal ve- luai ai- ka
8:55	FinnMedi 5 () 3.krs)	biokatu 2, 33520 Tampe- re	00 :1 5	00: 00 00		19 2,6	05: 24	:1 7	00: 15	01: 52

			Lentoaseman-	00
		Pirkkalan labora-	tie 60, 33960	:1 00:
9:10		torio	Pirkkala	2 00
			Maununkatu	00
		Nokian laborato-	16 37100 No-	:1 00:
9:30		rio	kia	9 00
			biokatu 2,	00
		FinnMedi 5 (	33520 Tampe-	:0 00:
9:57		3.krs)	re	6 00
			Rauhaniemen-	00
10:1		Rauhaniemen	tie 19, 33180	:2 00:
1		laboratorio	Tampere	2 00
			Himminpolku	00
10:4		Lempäälän labo-	6, 37500 Lem-	:2 00:
1		ratorio	päälä	7 00
			Maununkatu	00
11:1		Nokian laborato-	16 37100 No-	:1 00:
6		rio	kia	2 00
			Lentoaseman-	00
11:3		Pirkkalan labora-	tie 60, 33960	:1 00:
6		torio	Pirkkala	6 00
			biokatu 2,	00
12:0		FinnMedi 5 (	33520 Tampe-	:2 00:
0		3.krs)	re	0 00
			Pitkäniemen	00
12:2		Pitkäniemi labora-	sairaala, 33380	:0 00:
8		torio	Nokia	9 00
			Maununkatu	00
13:0		Nokian laborato-	16 37100 No-	:1 00:
0		rio	kia	1 15
13:1		Tesoman labora-	Kohmankaari	00 00:

9	torio	9, 33310 Tam-	:0	00						
		pere	8							
		Lielahdenkatu	00							
13:3	Lielahden labora-	15, 33400	:1	00:	ti,t					
5	torio	Tampere	2	00	o					
		Rauhaniemen-	00							
13:5	Rauhaniemen	tie 19, 33180	:0	00:						
5	laboratorio	Tampere	8	00						
		biokatu 2,	00							
14:1	FinnMedi 5 (	33520 Tampe-	:0	00:						
1	3.krs)	re	0	00						

Reit-
ti 4

Aika	Paikka	Osoite	Aj oa ik a	Ta uk oai ka	Aj op äi- vät	Ki- lo me trit	ko- ko- nais aika	Aj oa ik a	Ta uk oai ka	Pal ve- luai ai- ka
12:1 8	FinnMedi 5 (3.krs)	biokatu 2, 33520 Tampe- re	:4 4	00: 00		16 3,7	03: 57	:0 9	00: 00	00: 48
13:1 0	Mouhijärven labora- torio	Moisionpolku 3, 38460 Sas- tamala	00 :1 7	00: 00	ma ,to, pe					
13:3 6	Suodenniemen laboratorio	Koippurintie 7, 38510 Suo- denniemi	00 :3 8	00: 00	ke					
14:2 1	Kiikoisten labora- torio	Kiikostentie 320, 38360 Kiikoinen	00 :3 4	00: 00	ti					

15:04	Vammalan laboratorio	Itsenäisyyden- tie 2, 38200 Vammala	00 :4 8	00: 00						
16:00	Tuulensuun laboratorio	Hämeenkatu 28, 33200 Tampere	00 :0 8	00: 00						
16:16	FinnMedi 5 (3.krs)	biokatu 2, 33520 Tampe- re								

Reit-
ti 5

Aika	Paikka	Osoite	Aj oa ik a	Ta uk oai ka	Aj op äi- vät	Ki- lo me trit	ko- ko- nais aika	Aj oa ik a	Ta uk oai ka	Pal ve- luai ai- ka
11:10	FinnMedi 5 (3.krs)	biokatu 2, 33520 Tampe- re	00 :0 0	00: 00		19 2,8	03: 53	:1 3	00: 00	00: 40
11:33	Ruutanan terveys- asema	Leppätie 3, 36110 Ruutana	:3 8	00: 00						to
12:19	Juupajoen (Kor- keakoski) labora- torio	Koskitie 50, 35500 Juupa- joki	:3 3	00: 00						
13:00	Mäntän laborato- rio	Sairaalantie 168, 35820	00 :4 5	00: 00						
13:50	Oriveden labora- torio	Mänttä- Vilppula	00 :4 5	00: 00						
13:56	Oriveden labora- torio	Sairaalantie 6,	00 :4 5	00: 00						

3 torio 35100 Orivesi :3 00
7
Kämmennie-
menkatu 42, 00
14:3 Kämmenniemen 34240 Käm- :2 00:
8 laboratorio menniemi 4 00 ke

14:3
0 (ke biokatu 2,
15:0 FinnMedi 5 (33520 Tampe-
3) 3.krs) re

Reit-
ti 6

Aika	Paikka	Osoite	Aj oa ik a	Ta uk oai ka	Aj op äi- vät	Ki- lo me trit	ko- ko- nais aika	Aj oa ik a	Ta uk oai ka	Pal ve- luai ai- ka
11:4 3	FinnMedi 5 (3.krs)	biokatu 2, 33520 Tampe- re	00 :3 9	00: 00		10 7,5	02: 50	:0 2	00: 00	00: 48
12:3 0	Narvan laborato- rio	Kestintie 3, 37370 Narva	00 :1 9	00: 00	ti, pe					
12:5 7	Vesilahden labo- ratorio	Anttilantie 2, 37470 Vesi- lahti	00 :3 6	00: 00	ma ,to					
13:4 0	Hervannan labora- torio	Insinöörinkatu 38 33720 Tampere	00 :1 0	00: 00						
13:5	Vatialan terveys-	Junatie 1,	00	00:	ti					

9	asema	36240 Kan- gasala	:1 0	00						
14:1 6	Linnainmaan la- boratorio	Kirviälänkatu 2, 33580 Tam- pere	:0 8	00: 00						
14:3 3	FinnMedi 5 (3.krs)	biokatu 2, 33520 Tampe- re								

Reit-
ti 7

Aika	Paikka	Osoite	Aj oa ik a	Ta uk oai ka	Aj op äi- vät	Ki- lo me trit	ko- ko- nais aika	Aj oa ik a	Ta uk oai ka	Pal ve- luai ai- ka
		biokatu 2,	00					03		
9:47	FinnMedi 5 (3.krs)	33520 Tampe- re	:0 8	00: 00		21 6	05: 11	:5 8	00: 09	01: 04
		Kirviälänkatu	00							
9:55	Linnainmaan la- boratorio	2, 33580 Tam- pere	:1 0	00: 00						
10:1 4	Hervannan labora- torio	Insinöörinkatu 38 33720 Tam- pere	:3 8	00: 00						
		Aluesairaala, Salonkatu 24,	00							
11:0 0	Valkeakosken laboratorio	37600 Valkea- koski	:3 7	00: 00						
11:4 5	FinnMedi 5 (3.krs)	biokatu 2, 33520 Tampe-	01 :0	00: 00						

		re	0							
		Pereentie,	00							
13:00	Luopioisten laboratorio	36760 Luopioinen	:18	00:08	ke,					
	Kuhmalahden	Rautajärventie	00							
13:26	terveyskeskus + laboratorio	22, 36840 Pohja	:27	00:00	ti					
		Kurvis-Höllin	00							
14:01	Sahalahden terveyskeskus + lab.	tie 8, 36420 Kangasala	:20	00:00	ma					
		Herttualantie	00							
14:30	Kangasalan laboratorio	28, 36200 Kangasala	:19	00:01						
		biokatu 2,								
14:57	FinnMedi 5 (3.krs)	33520 Tampere								

Reitti 8

Aika	Paikka	Osoite	Ajokäytännön	Taustatiedot	Ajokäytännön	Kilometrit	ko-konaisaika	Ajokäytännön	Taustatiedot	Palvelu-aika
9:06	FinnMedi 5 (3.krs)	Biokatu 2, 33520 Tampere	00:30	00:00		38,25	06:46	05:42	00:00	01:04
9:36	Oriveden laboratorio	Sairaalantie 6, 35100 Orivesi	00:45	00:00						
10:2	Mäntän laborato-	Sairaalantie	01	00:						

9	rio	168, 35820 Mänttä- Vilppula	:1 3	00						
11:5 0	Kurun laboratorio	Kisatie 1, 34300 Kuru	:3 2	00: 00	ma ,ti, ke, to					
12:3 0	Ruoveden labora- torio	Ruovedentie 56, 34600 Ruovesi	:4 0	00: 00						
13:1 8	Virtain laboratorio	Sairaalantie 1, 34800 VIR- RAT	:2 9	00: 00						
13:5 5	Kihniön terveys- keskus	Kivinevantie 11-13, 39820 Kihniö	:2 1	00: 00	ma ,ke ,to					
14:2 4	Parkanon labora- torio +tk	Parkanontie 48, 39700 Par- kano	:5 4	00: 00						
15:2 6	Nokian laborato- rio	Maununkatu 16 37100 No- kia	:1 8	00: 00						
15:5 2	FinnMedi 5 (3.krs)	Biokatu 2, 33520 Tampe- re								

Reit-
ti 9

Aika	Paikka	Osoite	Aj oa ik	Ta uk oai	Aj op äi-	Ki- lo me	ko- ko- nais	Aj oa ik	Ta uk oai	Pal ve- luai
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			a	ka	vät	trit	aika	a	ka	ai- ka
		biokatu	2,	00					03	
12:00	FinnMedi 5 (3.krs)	33520 Tamperre	:13	00:00		260	06:01	:49	00:52	01:20
12:21	Kuljun laboratorio	Kukonkorventie 18, 37560 Lempäälä	:18	00:00						
12:47	Toijalan laboratorio	Akaantie 37800 Toijala	:14	00:00						
13:10	Kylmäkosken terveyskeskus	Koulutie 37910 Kylmäkoski	:12	00:00						to
13:30	Urjalan laboratorio	Sairaalantie, 31760 Urjala	:20	00:00						
13:58	Viialan laboratorio	Koivistontie 3, 37830 Viiala	:18	00:00						
14:24	Lempäälän laboratorio	Himminpolku 6, 37500 Lempäälä	:30	00:00						
15:02	Valkeakosken laboratorio	Aluesairaala, Salonkatu 24, 37600 Valkeakoski	:44	00:00						
15:54	Hämeenlinnan laboratorio / Kantakussairaala	Ahvenistontie 20, 13530 Hämeenlinna	:51	00:00						

Hatanpäänkatu 00
 17:4 Hatanpään labora- 24 33100 :0 00:
 5 torio Tampere 8 52

biokatu 2,
 18:0 FinnMedi 5 (33520 Tampe-
 1 3.krs) re

Reit-
 ti 10

Aika	Paikka	Osoite	Aj oa ik a	Ta uk oai ka	Aj op äi- vät	Ki- lo me trit	ko- ko- nais aika	Aj oa ik a	Ta uk oai ka	Pal ve- luai ai- ka
11:0 4	Hämeenlinnan laboratorio / Kan- ta-Hämeen kes- kussairaala	Ahvenistontie 00 20, 13500 Hä- meenlinna	:2 6	00: 00		19 2,9	03: 55	:2 5	00: 00	00: 30
11:3 0	Kalvolan terveys- asema	Nordstedtintie 00 6, 14500 Hä- meenlinna	:3 2	00: 00	,ti, ke, pe					
12:0 7	Rengon terveys- asema	Rengonraitti 00 28, 14300 Hä- meenlinna	:4 7	00: 00	ti,t o,p e					
13:0 0	Lopen terveys- asema	Harjutie 9, 12700 Loppi	:2 9	00: 00						
13:3 3	Riihimäen pääter- veysasema	Penttilänkatu 00 5, 11100 Rii- himäki	:2 1	00: 00						

		Kuusitie 10,	00		
13:5		12100 Haus-	:2	00:	
9	Oitin laboratorio	järvi	2	00	
		Kontiontie 77,	00		
14:2	Riihimäen alue-	11120 Riihi-	:2	00:	
7	sairaala	mäki	8	00	

15:00	Hämeenlinnan laboratorio / Kanta-Hämeen keskussairaala	Ahvenistontie 20, 13500 Hämeenlinna			
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Reitti 11

Aika	Paikka	Osoite	Aj oa ik a	Ta uk oai ka	Aj op äi- vät	Ki- lo me trit	ko- ko- nais aika	Aj oa ik a	Ta uk oai ka	Pal ve- luai ai- ka
8:49	Hämeenlinnan laboratorio / Kanta-Hämeen keskussairaala	Ahvenistontie 20, 13500 Hämeenlinna	00 :1 1	00: 00		19 9,1	05: 45	:2 3	00: 27	00: 55
9:00	Hämeenlinnan pääterveysasema	Viipurintie 1, 13200 Hämeenlinna	00 :1 1	00: 00						
9:16	Hämeenlinnan laboratorio / Kanta-Hämeen keskussairaala	Ahvenistontie 20, 13500 Hämeenlinna	00 :3 1	00: 00						
9:52	Riihimäen pääterveysasema	Penttilänkatu 5, 11100 Rii-	00 :0	00: 00						

		himäki	7							
10:04	Riihimäen alue-sairaala	Kontiontie 77, 11120 Riihi- mäki	00 :2 4	00: 00						
11:00	Ryttylän terveys- asema	Kulmatie 14, 12310 Haus- järvi	00 :3 2	00: 27	ke					
11:37	Hämeenlinnan pääterveysasema	Viipurintie 1, 13200 Hä- meenlinna	00 :0 8	00: 00						
11:50	Parolan terveys- asema	Parolantie 42, 13130 Hä- meenlinna	00 :0 7	00: 00						
12:02	Hämeenlinnan laboratorio / Kan- ta-Hämeen kes- kussairaala	Ahvenistontie 20, 13500 Hämeenlinna	00 :4 7	00: 00						
12:55	Hauhon terveys- asema	Vihniöntie 5, 14700 Hä- meenlinna	00 :3 2	00: 00						
13:32	Lammin terveys- asema	Evontie 33, 16900 Hä- meenlinna	00 :4 2	00: 00						
14:18	Hämeenlinnan pääterveysasema	Viipurintie 1, 13200 Hä- meenlinna	00 :1 0	00: 00						
14:34	Hämeenlinnan laboratorio / Kan- ta-Hämeen kes- kussairaala	Ahvenistontie 20, 13500 Hämeenlinna								

Appendix 2. The supply deliveries of ALPE.

TAMPEREEN ALUEELASTUSLAITOS
Joni Hakala

TARVIKETOIMITUKSET

	Kantoveritukset				Pohjoiset				Sivoukset				Sakkaritukset			
	Tilataan logistiikalta	Tilataan muualta	Noudetaan itse	Alpe kustantaa	Tilataan logistiikalta	Tilataan muualta	Sisältyy vuokraan	Alpe kustantaa	Tilataan logistiikalta	Tilataan muualta	Sisältyy palveluun	Alpe kustantaa	Tilataan logistiikalta	Tilataan muualta	Sisältyy vuokraan	Alpe kustantaa
POHJOINEN																
Ruovesi 25	X	X	X	X				X								
Parkano 25	X	X	X	X												
Virtti 25	X	X	X	X				X								
Oivesi 25	X	X	X	X				X								
Vilppula 25	X	X	X	X				X								
LANSI																
Nokia 20	X	X	X	X				X								
Ylöjärvi 25	X	X	X	X				X								
Vammala 25	X	X	X	X				X								
Pirkkala 25	X	X	X	X				X								
Hämeenkyrö 25	X	X	X	X				X								
Kasainen 25	X	X	X	X				X								
ITÄ																
Keskuspaikaseura 30	X	X	X	X				X								
Hervanta 30	X	X	X	X				X								
Ilmajoki 470	X	X	X	X				X								
Valkeskoski 470	X	X	X	X				X								
Leppäala 470	X	X	X	X				X								
Kangasala 470	X	X	X	X				X								

* Jollain tavalla määritelty

PIKI-YHTEISJÄRJESTELMÄKIRJASTOJEN JA PIRKANMAAN MAAKUNTAKIRJASTOALUEEN
LAINOJEN KULJETUSTEN HANKINTA

Lite 1

Reitti 1 Etelä
TISTAI

					Ajoaika	Lähtö	Lähtöaika
1	PIRKANKATU 2	Tampere	0,000 km	0,000 km	8:30		0
2	KONKKALANKUJA 3	Vattiala/ Kangasalan lähikirjasto	11,309 km	11,309 km	8:51		5
3	SUORAMANTIE 19	Suorama/ Kangasalan lähikirjasto	4,499 km	15,808 km	9:03		5
4	KURVIKSENKUJA 2	Sahalatti /Kangasalan lähikirjasto	20,080 km	35,888 km	9:33		5
5	KESKUSAUKIO 2	Kangasala	15,847 km	51,735 km	9:58		10
6	KAUPPILANKATU 2	Valkeakoski	31,731 km	83,466 km	10:51		5
7	LEMPÄÄLÄN ALEKSI 1	Lempäälä	20,939 km	104,405 km	11:23		20
8	TAPOLANTIE 3	Vesilahti	9,142 km	113,547 km	11:56		5
9	KÖYVÄRINTIE 1	Akaa	22,785 km	136,332 km	12:29		5
10	KOULUTIE 0	Kylmäkoski	13,073 km	149,405 km	12:57		5
11	TAMPEREENTIE 4	Urgala	12,312 km	161,717 km	13:13		5
12	URJALANTIE 27	Punkalaidun	24,984 km	186,701 km	13:48		5
13	SILLANKORVANKATU 1	Sastamala	32,121 km	218,822 km	14:32		40
14	VÄLIKATU 11	Nokia	38,839 km	257,661 km	15:51		5
15	SUUPANKUJA 2	Pirkkala	9,531 km	267,192 km	16:09		5
16	JAAKONTIE 3	Nuoliala /Pirkkalan lähikirjasto	2,905 km	270,097 km	16:19		5
17	PIRKANKATU 2	Tampere	8,073 km	278,170 km	16:37		5

Reitti 2 Pohjoinen
KESKIWIIKKO

					Ajoaika	Lähtöaika
1	PIRKANKATU 2	Metso	0,000 km	0,000 km	0:00	9:15

Appendix 3. Current routing schedule of PIKI.

2	KOIVUMÄENTIE 2	Viöjärvi	12.549 km	12.549 km	0:11	9:45
3	KYRÖNSARVENTIE 16	Hämeenkyrö	26.424 km	38.973 km	0:31	10:10
4	POPPELLIKATU 10	Ikaalinen	17.710 km	56.683 km	0:46	11:00
5	PARKANONTIE 57	Parkano	35.318 km	92.001 km	1:13	11:45
6	KIHNIÖNTIE 46	Kihniö	26.288 km	118.289 km	1:32	12:10
7	MÄKITTIE 2	Virrat	36.017 km	154.306 km	1:58	13:15
8	URHEILUTIE 4	Ruovesi	34.676 km	188.982 km	2:23	13:45
9	PIRKANKATU 2	Metso	77.623 km	266.605 km	3:20	14:45

Reitti 3

TORSTAI

			Ajoaika	Lähtöaika
1	PIRKANKATU 2	Metso	0,000 km	0:00
2	KESKUSTIE 23	Orivesi	45,066 km	0:33
3	SEPPÄLÄN PUISTOTIE 16	Mänttä-Vilppula	48,392 km	1:10
4	KIRKKOTIE 1	Juupajoki	36,287 km	1:38
6	RAUTAJÄRVENTIE 26	Kuhmalahdi	17,881 km	2:22
7	KEHÄTIE 4	Pälkäne	39,118 km	2:54
8	PIRKANKATU 2	Metso	38,709 km	3:22

Reitti 4

PERJANTAI

			Ajoaika	Lähtöaika
1	PIRKANKATU 2	Metso	0,000 km	0:00
2	KONKKALANKUJA 3	Vatjala / Kangasalan lähikirjasto	13,682 km	0:15
3	SUORAMANTIE 19	Suorama / Kangasalan lähikirjasto	4,499 km	0:21
4	KURVISENKUJA 2	Sahalahdi / Kangasalan lähikirjasto	4,999 km	0:26
5	KESKUSAUKIO 2	Kangasala / Paäkijasto	15,240 km	0:39
6	KAUPPILANKATU 2	Valkeakoski	47,255 km	1:20
7	KÖYVÄRINTIE 1	Akaa	22,013 km	1:40
8	TAMPERENTIE 4	Urijala	24,991 km	2:01
9	TAPOLANTIE 3	Vesilähti	32,718 km	2:28
10	ALEKSI 1	Lempäälä	9,468 km	2:37
11	SUUPANKUJA 2	Pirkkala	30,180 km	2:59

12	VÄLIKATU 11	Nokia	↙	9.627 km	214.672 km	3:09	14:00
13	KOIVUMÄENTIE 2	Migärvä	↙	14.623 km	229.295 km	3:23	14:20
14	KYRÖNSARVENTIE 16	Hämeenkyrö	↙	26.424 km	255.719 km	3:43	14:50
15	POPPELIKATU 10	Ikaalinen	↙	17.706 km	273.425 km	3:58	15:10
16	PIRKANKATU 2	Metso		53.588 km	327.013 km	4:38	16:15

Appendix 4. Discussion topics with the organizations
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Organization	Time	Topic
PIKI	1h 45min (2 meetings)	Current situation, transportation routes & future needs.
Fimlab	1h 30min (1 meeting)	Current situation, transportation routes & future needs.
Alpe	2h 15min (2 meetings)	Current situation, transportation routes, possible equipment maintenance & future needs.
Pirko	1h 30min (1 meeting)	Current situation, transportation routes & future needs.