

PREFACE

This Master Thesis is the final proof of competence for obtaining the degree of Master in Transportation Sciences, with a specialization in Mobility Management, from the University of Hasselt located in Belgium.

The conducted research in this Master Thesis was supervised by Veerle Cops, the researcher of Hasselt University, who supported and guided me during this work. I also would like to take the opportunity to express my gratitude to Professor Elke Hermans who put a significant effort in the research and promoted both theoretical and practical parts of the thesis. Above all, thanks to Toerisme Limburg for the willingness to provide all the information and consultation in the aspects related to the Limburg Recreational Cycle Network.

SUMMARY

In this Master Thesis 1) the potential of developing a Recreational Cycling Master Plan in the Limburg province of Belgium was investigated and 2) some long-distance recreational trails related to that were proposed.

In order to carry out the first objective the "state-of-the-art" of European practices were analyzed in terms of economic, environmental and social advantages. It was identified that the development of a long-distance bicycle trail in the Limburg Province is a feasible and beneficial project. Since the basic infrastructure facilities in this region are already constructed it is important to emphasize the customers' preferences when making improvements and creating trails. Customers of a network are mainly recreational cyclists. There are three main criteria influencing the choices of a possible destination for a cycle holiday. Firstly, the users want to cycle in safe conditions. In this context, paths have to be segregated, infrastructure should be appropriate for all experience levels of cyclists and clear signage is required. Secondly, services along the route such as accommodations, cafes and restaurants, information points, maintenance shops, availability of guidelines and maps, and resting points must be present. They may be basic, but adjusted to the cyclist's needs and located no further than 15-20km from each other. And last, but not least, recreational cyclists want to get an unforgettable experience from the network: they appreciate scenery, heritage, attractive towns, cultural points, museums and landscapes. To make a Master plan complete cycle supporting projects have to be established. Those are the projects which for example assess the network facilities, integrate other modes of transport, create a cycle-friendly environment and monitor the network in general.

The second objective was performed through the Limburg Recreational Cycle Network's (RCN) current state analysis and the implementation of the previously found information in order to develop three long-distance trails. The trails were designed based on duration (4, 5 and 8 days) and the target group "45-plussers". Features like the "favorite spots", the planned leverage projects, existing starting points on the Limburg RCN, a cycling distance of approximately 45-50km per day, options to rent a bicycle and to buy a map in advance, and the availability of minimum 3 cycle-friendly cafés, 1 accommodation, 1 picnic place and 2-3 activities on the route per day-trip were included. The suggested routes in this Master Thesis were constructed using the online tool Routeyou. Additional recommendations regarding improvements for the cycle tourism in the Limburg province were given: adjusting online purchasing, introducing a luggage-carriage service, negotiating developments with the authorities, co-operating with NMBS (train tickets promotion) and considering further extension for other target groups.

Moreover, the criteria of sustainability in recreational cycling were identified (optimal use of environmental resources, respect for the host community, social economic benefits etc.) and based on these criteria the Limburg RCN was defined as a sustainable network.

Key words: Recreational cycle network, Master Plan, Limburg, Fietsparadijs, Sustainable cycle tourism network, Long-distance trail.

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1. INTRODUCTION

1.1. Aims, objectives, methodology and focus of the research

The main goal of the Master Thesis is to investigate the opportunity to develop a cycle tourism Master Plan across the Limburg region which is part of Belgium and to propose a long-distance trail(s) as a part of it. A particular project in Limburg which is dealing with the cycle network calls "Limburg Fietsparadijs" (also Limburg Cycle Recreational Network) and exists already for 20 years. Despite of that Limburg does not have a general plan for long-distance touristic purposes yet. The current routes are intended for day or weekend trips, however "Toerisme Limburg", a non-profitable organization which is responsible for all kind of tourism activities in the region, would like to attract tourists for longer visits like one or two weeks. This implies that not only Belgian cyclists, but international tourists could benefit from the developed Master Plan which will connect existing routes to a long-distance trail in an efficient manner and will also be promoted outside of Belgium. Within the study, challenges and opportunities to develop the Master Plan were defined.

The **aim** of the thesis is to assess the potential benefits, define criteria for building a recreational cycle network and developing long-distance cycling routes for tourism purposes in Limburg, especially in relation to sustainable tourism development. In order to reach that aim three key objectives were identified:

- To determine the current scale and scope of cycle tourism in Belgium and the neighboring countries. The **current state** of cycle tourism in the Limburg provinceneeds to be investigated. This includes not only an evaluation of existing infrastructure, but identification of **cyclists' preferences** regarding recreational cycling. Thus, main focus was on the following countries: Belgium, Germany, the Netherlands and France.
- To evaluate the extent to which the cycling network of Limburg wasdeveloped as a **sustainable tourism network**. The focus of the first part of the Master thesis (section 1 and 2) is an evaluation based on best practices in European countries with similar conditions (e.g. the EuroVelo project). Further evaluation is conducted in the second part of the research (section 3) and founded on the real conditions of the existing network in the Limburg province.
- To develop a number of **higher level trails** that connect interesting local routes in Limburg (one story).Appropriate criteria of a "good" cycle tourism network will be defined and applied to Limburg and long distance trails suggested.

1.1.1. The research questions of the thesis

For the Master Thesis the **main research question** was defined as: How to develop a Master Plan for recreational cycling tourism in the Limburg region of Belgium.

Six **sub-questions** were listed to support the key question:

1. What are the key success factors in attracting cycle tourists? Those include not only network infrastructure, supportive points (accommodation, cafes, repair centers etc.) and possible sightseeing, but also the subjective opinion of potential network users (in general). How they feel themselves under one or another circumstance. Analysis was mainly conducted in European scope.
2. What are the opportunities, barriers and challenges in developing cycle tourism on a larger scale than currently? Those are factors which may intervene in the development of a Master Plan for Limburg. But it is also a big potential.
3. Which criteria should be considered in cycling Master Plan development?
4. What are the criteria of sustainable tourism and does the Limburg network matches these criteria?
5. What are the preferences of the people living in Belgium and the neighboring countries regarding cycle tourism in the Limburg province?
6. What are suggested long distance trails for the cycle network in Limburg?

1.1.2. Methodology

To answer the sub-questions from *section 1.1.1* particular research methods were used. Since the study is mostly qualitative a wide range of literature and theories was used to support the work.

1. What are the key success factors in attracting cycle tourists?

In order to disclose this topic the best worldwide practices for the same conditions were observed. Because geographical, meteorological and cultural traditions are to some extent similar within the European Union we tried primarily to receive benefits from practices implemented in European regions. Those practices are a German cycle tourism network with more than 70000km of cycle routes, a case in Switzerland integrating 68 local routes into 9 national trails, Scottish experience opening up the country's landscapes and a Slovenian practice. On the higher level, some European routes are combined in the project known as the EuroVelo network which includes 13 trails covering the whole continent. Some features of the Australian and Taiwan cases were presented as well. Regarding literature the European Cycle Network EuroVelo document written by the Directorate-General for Internal Policies of the European Parliament was mainly used (Directorate-General For internal Policies, 2009). To find out about case

studies numerous web sources were utilized, for instance www.myswitzerland.com (My Switzerland, 2015) or www.visitdenmark.dk (Visit Denmark, 2015).

It is not enough to investigate networks only. There are also services to support cycle tourists to reach their travel location. Aiming to that we were looking at the Dutch "Treinreiswinkel" project which offers train packages for travelers with bicycles. Monitoring and evaluation plays an important role as well. Therefore the "Bett & Bike" case was helpful to observe assessment procedures.

Cyclist preferences were investigated using studies from Taiwan (Chen & Chen, 2013) and Dublin (Deenihan & Caulfield, 2015).

2. What are the opportunities, barriers and challenges in developing cycle tourism in the Limburg province on a larger scale than previously?

Not all good practices and handbooks are suitable for the specific case of Limburg. Those factors which did not match the Limburg RCN were eliminated and possible obstacles were identified. There are also opportunities for the future which were taken into consideration in the study such as an integration of "Limburg fietsparadijs" into a higher level network (on Belgian or European level). For example, using the EUROVELO network Handbook to analyze to which extent it could be integrated at the EU level (Directorate-General For internal Policies, 2009).

3. Which criteria should be considered in cycling Master Plan development?

Existing successful recreational cycle networks were observed and their substantial characteristics were emphasized. Since Limburg is a part of Europe those general rules and conditions applied for example in Germany, Switzerland or in the Netherlands could be useful to investigate.

4. What are the criteria of sustainable tourism and does the Limburg network matches these criteria?

We have analyzed what makes a cycle tourism network sustainable. Among criteria proposed by the World Tourism Organization, Global Sustainable Tourism Council and the EUROVELO project the last one was chosen as more complete and appropriate. Afterwards, this list of measures was imposed on the Limburg network and examined whether it answers these criteria or not. Moreover, recommendations regarding improvements were given.

5. What are preferences of the people living in Belgium and the neighboring countries regarding cycle tourism in the Limburg province?

This question should have been answered using data from the study which was supposed to be conducted by "Toerisme Limburg" in the summer of 2015. Unfortunately the survey which implied interviewing the actual network users did not take place. Therefore, the information from previous studies of "Toerisme Limburg", the Flemish-Brabant province and Flanders was used. Additional interviews with some stakeholders were conducted.

6. What are suggested trails for the cycle network in Limburg?

Based on the information gathered from the literature and the previous studies and taking into account current characteristics of the Limburg cycle network a set of trails was developed and proposed using the Routeyou planner.

1.1.3 Structure of the thesis

In order to conduct the Master Thesis firstly the cycling tourism policies in Europe and in the Flanders region particularly were described and criteria of sustainable tourism were identified. Afterwards benefits and advantages of developing a Master Plan for recreational cycling were presented. In subsection 2.1 the current state of the cycle tourist market has been observed: we have identified the existing standards and requirements regarding a network construction. Further the profiles of the cycling network users were analyzed. Such criteria as social status, age, motivations, income etc. were emphasized (subsection 2.2). Subsection 2.3 gives examples of good cycle tourism practices and networks with similar conditions as the Limburg region. Concluding section 2 we defined the main and secondary requirements for a cycling tourism Master plan in general and for the selected area of Limburg in particular.

The thesis was composed of **two sub-studies**. The first one (section 1 and 2) was based on the existing good practices, handbooks and projects. Here, the general requirements for a network infrastructure and its elements were defined, state of the art of a Master Plan's characteristics were listed and the users' preferences were identified. In the second part (section 3) the Limburg Recreational Cycle Network was described, previously defined criteria were applied in order to develop a Master Plan for the particular cycle recreational network in Limburg and three trails were redesigned and evaluated.

In section 4 results and significant information which has been found within the study were summarized, limitations and further extensions were discussed and some recommendations were given.

1.2. Cycle tourism and sustainable tourism development

Transportation is an integral part of the tourism industry. Transportation can be discussed without taking into consideration tourism, but tourism cannot exist in

isolation from transport. It is due to the improving of transport (i.e. good road infrastructure, stable air transportation and reliable railroad and waterway connections) that tourism has expanded, leading to an increasing impact on the environment. In the light of that issue, it is important to review the role of transportation in the recreational planning context making accents on sustainability.

Cycling is known as **a sustainable mean of transportation**. Regarding to tourism this opportunity is not yet widely developed. However, the forecast for the tourism sector predicts a stable increase of the CO₂ emission level (Filimonau et al., 2013). Emission is mostly produced when people travel between origin and the tourism destination. In this context cycle tourists use the train more often than planes or cars. However, the situation can vary from country to country. Moreover, in some particular cases they reach the location with their own bicycle, without using any additional mode of transport. The average travel distance for the cyclists is shorter as well (what in the end creates less emission). Those tourists do not stay in their hotel the whole day and therefore do not use a lot of energy. The observed carbon footprint of Dutch holidaymakers developed since 2002 indicates that cycle tourists in the Netherlands produce 35% less CO₂ than other tourists while being on holiday (Pels et al., 2013).

The eco-efficiency of the bicycles should attract interest in developing cycling tourism, but information which could be found in this area is still limited. Recently, Denmark, Switzerland, the Netherlands, Belgium (particularly Flanders) and Germany are successfully designing recreational cycle paths and they implement cycle tourism policy within the countries. Relatively low costs of infrastructure constructions or redesign of existing routes can help to stimulate rural economies significantly. There are additional social benefits of recreational cycling. For instance, research in New Zealand emphasizes the following social advantages of tourism cycling: mental and physical health, learning, being together as a family, meeting likeminded people, bringing "new faces" into small rural communities and sense of pride and community identity (Faulks et al., 2007). The ability to provide **environmental, economic and social advantages** makes this tourism form considerably potential for the near future.

In this thesis we will consider cycle tourism as travelling from one location to another by bicycle for leisure purposes (Lumsdon, 2000). Although one can think that cycle tourists could be approached as one category because they are motivated by a common interest there is still a variety of groups and therefore multiple market activities for recreational cycling. Concerning the trip duration two types of cycle tourists are defined:

- **day trips** are home based cycle trips of more than three hours; such trips can comprise participation in cycle events or just a regular excursion;
- **cycle holidays** are more than one day trips implying staying away from home for at least one night by renting an accommodation or using own

sleeping facilities (tent, caravan, mobile home, etc.); a cycle holiday can be based on one location or on a tour implying a stay in different places; cycling is actually the main goal of the holiday.

In cycling holidays, cycling is not the only mean of transportation, but it is the main purpose of the holiday (Directorate-General for internal Policies, 2009). The journey and experience itself play a significant role. This Master Thesis mainly refers to cycling holidays and investigates cyclists' behavior and preferences in cycle holidays (which also equals the term "cycling tourism").

In order to insert cycling into the tourism market detailed research should be carried out. It is clear that first of all an infrastructure needs to be constructed in accordance with geographical and policy requirements. Afterwards built bikeways have to be organized in routes and trails giving an explanation how to use a network. While developing a trail it is important to keep in mind that cycle routes should pass through rural areas with attractive landscapes as well as through towns and large cities. Many European high populated and small cities offer safe and amusing cycling programmes. Among them are Amsterdam, Copenhagen, Budapest, Paris, Seville, Gent and so on. For instance, the path of 320 kilometers from Passau to Vienne is considered the most popular route in Europe. A lot of towns on this route currently benefit from the increased cycling demand. Approximately 70% of all visitors are related to cycling tourism. Additionally the route has connections with train, boat and bus services which support sustainable movements through the network. Numerous companies sell ready packages for those who have difficulty in developing travelling paths themselves.

Taking into account the growing demand, environmental, economic and social advantages recreational cycling can be unambiguously established as a sustainable kind of tourism and a promising field for investigating. As mentioned in the guidebook of the United Nations World Tourism Organization (UNWTO) "Sustainable tourism development meets the needs of present tourists and host regions while protecting and enhancing opportunity for the future. It is envisaged as leading to management of all resources in such a way that economic, social, and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity, and life support system" (United Nations World Tourism Organization, 2013). Different organizations propose distinct **criteria for sustainable tourism**. UNWTO defines the following important characteristics:

- enhancing the well-being of communities;
- supporting the protection of the natural and cultural environment;
- recognizing product quality and tourist satisfaction;
- applying adaptive management and monitoring(UNESCO, 2010).

The Global Sustainable Tourism Council organizes the criteria into four pillars (Global Sustainable Tourism Council, 2013):

- sustainable management;
- socio-economic impacts;
- cultural impacts;
- environmental impacts (including consumption of resources, reducing pollution, and conserving biodiversity and landscapes).

In order to evaluate the sustainability of a cycle network in particular this Master Thesis used parameters proposed by the EuroVelo project (EuroVelo, 2015):

- Optimal use of environmental resources;
- A respect for the socio-cultural authenticity of host communities;
- Social economic benefits to all stakeholders;
- Informed partnership of all stakeholders;
- Continuous monitoring of impacts;
- High levels of consumer satisfaction (Lumsdon & Page, 2004).

These criteria are not the maximum, but minimum which governments, businesses, and destinations should achieve to approach social, environmental and economic sustainability. Considering the fact that each tourism destination has its own culture, environment, customs, and laws, the criteria are designed to be adapted to local conditions and supplemented by additional criteria for the specific location and activity.

1.3. European and Belgian cycle and tourism policies

Having the highest diversity and density of tourist attractions, the European Union is the most popular tourist destination with more than ten percent of GDP generated by the tourism industry. According to the European Commission statistics there are 9.7 million people employed in this area and 1.8 million businesses operating (European Commission, 2015).

The Commission has defined **major challenges for sustainable tourism** (European Commission, 2010):

- preserving natural and cultural resources;
- limiting negative impacts at tourist destinations, including the use of natural resources and wasteproduction;
- promoting the wellbeing of the local community;
- reducing the seasonality of demand;
- limiting the environmental impact of tourism related transport;
- making tourism accessible to all;
- improving the quality of tourism jobs.

A wide number of sustainable tourism projects have been developed what leads to growth in the industry (eco-routes, sport products, bicycle paths etc.). Since recreational cycling is an excellent example of sustainable tourism the European

Commission promotes its importance and supports the development of cycle routes on European Union territory by funding promising projects and initiatives. For instance, the development of the Amber Trail project in central Europe has been partially funded by the Directorate-General for Environment programmes and the North Sea Cycle Route was funded through INTERREG programmes (European Commission, 2015). Additionally, cycle routes should be built according to the sustainable tourism framework proposed by the UNWTO and be endorsed by EU policy structures.

A base for tourism cycling is the disposal of a bicycle on a regular basis. Table 1 demonstrates the evolution of the cycling modal share by country in Europe.

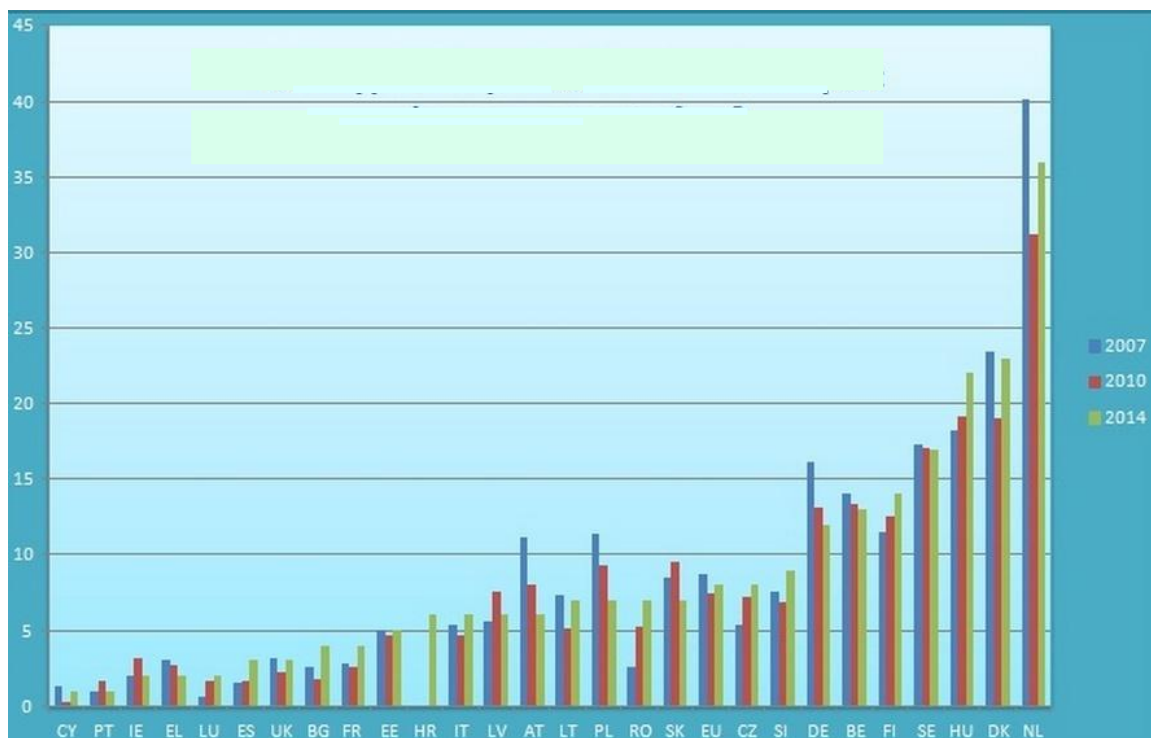


FIGURE 1 Percentage of bicycle modal share in EU countries by year.
Source: European Cycling Federation, 2015

The use of bicycles varies between countries, however the Netherlands and Denmark constantly remain at the top. Interestingly, in the countries with lower usage of bicycles the main purpose of cycling is recreation, while in the high-share cycling countries the bicycle is often used for everyday activities like shopping, travelling to work and to school.

In Belgium, with a population of approximately 11 million inhabitants, almost half of the population owns a bicycle (48%). Eight percent of all trips are made by bicycle. Each Belgian cyclist travels on average 0.9 kilometer per day (European Cyclists' Federation, 2015). The popularity of cycling in Belgium is higher than in most of the other countries (6th place in EU), however, it is still far below the set goal (see the Mobility Plan below). Moreover, there is a big difference between

Flanders (the northern part of Belgium) and Wallonia (the southern part). A National Household Survey was conducted in Belgium in 2001 which shows that only 6.4% of all cyclists live in Wallonia, while 91% live in Flanders (Belgian National Household Survey, 2001).

The Flemish research "**Onderzoek Verplaatsingsgedrag Vlaanderen**" conducted from September 2012 to September 2013 shows the situation of cycling in Flanders and in the Limburg province particularly. 13% of all trips in Flanders were made by bicycle, however, it is only 6% of all traveled kilometers in the region, while in Limburg almost 9% of the kilometers travelled were done by bicycle (considering trips less than 1000km). On average each Flemish person owns a bicycle and 15% of the population uses it for daily purposes, while 31% of the residents use the bicycle 1 to several times per week. Regarding to tourism 46% of trips in Flanders was devoted to recreational travelling (with a destination point in Flanders). At the same time in the Limburg province 60% of inhabitants use the bicycle for tourism related activities (with a destination point in Limburg).

Since 1950, when cars became more and more popular as mode of transport, the usage of bicycles has significantly decreased in Belgium. But in the 80s the regional authorities of Flanders understood the potential of cycling and started the implementation of policies in order to change the situation (construction and maintenance of cycling infrastructure, stimulating people to shift to bicycles). Despite that traffic legislation is similar in Belgium, in Flanders the cycling infrastructure is more accessible.

The Flemish government set **the global policy in the Mobility plan** which resulted in the Flemish Bicycle Plan aiming to increase the bicycle share up to 19% of all trips (Vandenbulcke et al., 2009). To reach this goal a set of measures should be implemented in different areas including tourism as well. Therefore, "Toerisme Vlaanderen", the Flemish government department responsible for tourism set various programmes regarding recreational cycling. One of them is "Ronde 100" established in May 2013 to promote recreational cycling in the provinces of Flanders. The project aims to integrate product development, tourist reception, infrastructure, cycling culture, heritages and other elements of the recreational cycling into one cohesive story with participation of numerous tourism partners. Consequently "Toerisme Vlaanderen" invested three million euro in 15 tourism projects which would expand Flanders (by promotion) as authentic cycling destination. "Ronde 100" should emphasize Flanders as the place to experience the cycling culture both active (on the bike) and passive (as a spectator or museum visitor) (Toerisme Vlaanderen, 2013). Moreover, every year "Toerisme Vlaanderen" subsidizes through the calls of the Impulsprogramme a wide range of projects that aim to improve the quality of the cycle and walking networks and strengthen touristic potential of the region for international tourists. For instance, in order to improve the quality of accommodations the labels "Cyclist-friendly accommodation" was presented (see section 2.2.4).

1.4. Importance of a Master Plan for the cycle tourism network

A Master Plan for a cycle network in general is a document describing the long-term planning for developing cycling infrastructure in a region or in a city. It intends to extend cycle networks, increase its quality and safety for users, and promote cycling as a sustainable mean of transportation (Wikipedia, 2015). It also develops a continuous trail, connecting routes into one "story". Numerous big cities have a Master Plan for cycling: London, New York, Los Angeles, Berlin and so on. Some countries like the Netherlands have a Master Plan for the whole country (Directoraat-General Personenvervoer, 1998).

A cycle Master Plan has **six main goals** which underline the importance of providing a continuous system of safe recreational bikeways that encourage more non-motorized trips over those currently being made (Fresno County Department of Public Works and Planning, 2013):

- Create a comprehensive and safe system of bikeways, bicycle facilities, and trails that focus on recreational areas in the region.
- Create a system of bicycle facilities that enables more multimodal trips with other forms of transportation by bicyclists.
- Increase bicycle ridership by implementing bicycle facility improvements.
- Promote bicycle safety and reducing the number of bicycle accidents, and increasing the recreational opportunities for the general public.
- Increase the number of people using the network.
- Implement the Plan.

In this thesis, a master plan for Limburg recreational cycle network is defined from a cycling tourism perspective. A Master Plan then connects by means of recreational safe cycle routes heritage, landscapes, accommodations and other tourism facilities, attractions and supportive points into one comprehensive trail in order to attract more tourists. Additionally, a Master Plan gives recommendations on how to support facilities for bikeway and trail users (i.e. signs, bike parking, repair centers, bike rentals etc.).

The long-distance trail(s) as the part of the Master Plan for Limburg will be build on existing completed infrastructure, while also exploring new opportunities. There are a wide range of facilities and local routes. The following action is to connect these facilities and routes on a higher level into a comprehensive recreational "story" which will lead cyclists from one location to another opening up a rich history of heritage and landscapes of the Limburg province. If modifications are required three main principles are taken into account by Toerisme Limburg, the tourist board of the Limburg province: build new facilities or establish new routes only if it can increase safety, quality or add experience.

2. THEORETICAL OBSERVATION OF CYCLE TOURISM

2.1 The cycle tourism market

Although there is no common database for cycle tourists in Europe, some sources try to estimate **the level of recreational cyclists**. For instance, according to Lumsdon and Page cycle holidays amount for between 2% and 4% of all European holidays (Lumsdon & Page, 2004). They also forecast growth in this area caused by increased interest in cycle tourism in such countries like Germany and Denmark, while other countries will perform a slow raise. Yet tour sellers offer cycle holidays in many member states, those include not only short trips, but long trails as well. Detailed investigation shows a wide market spread. Analysis conducted using Google search revealed that many international tour companies offer Belgium as one of the main travelling destinations for tourism cycling. Among them are Austria (Euro Bike, EuroCycle Rad&Reisen), France (Blue Marble Travel), Germany (Pedalo) and the Netherlands (Eurosail, HAT Tours). In some countries well-known tourism operators sell cycle packages under their brands. Forexample: TUI in Germany sells this kind of holiday under its activity holiday brand, the English operator Inghams offers tours to Danube Cycle Route. Despite these examples, EU countries mostly concentrate on local cycle destinations within the region or in the neighboring countries. Thus, the scale of cycle tourism still remains small. Exception from this rule is Denmark where international cyclists account for 66% of all tourists. Those tourists are mainly coming from Germany and the total of the cycle tourism Danish market is valued at approximately 1 billion euro (Koucky, 2007).

In this section firstly value and demand estimation of the cycle tourism market will be provided. Afterwards, good practices of recreational cycle networks will be given. Among them are the German Radnetz case, Swiss Veloland experience, EuroVelo network and some cycling supporting projects like "Treinreiswinkel", "Bett&Bike" and "Sustrans". Additionally, general user's profiles and preferences will be discussed. Based on that the requirements for a cycling master plan will be listed.

2.1.1 Value estimation of the cycle tourism market

It is very hard to estimate **the cycle market** because compared with traditional products and services it is complicated to identify the components and providers of cycle tourism. The local tourism industry, the owners of the infrastructure and the owners of additional facilities could be considered as a part of the supply. The income generated by cycling is also produced by different sectors like hotels, campsites, restaurants and cafés, bike rentals, shops and etc. Some estimated monetary numbers regarding to recreational cycling by EU member state can be found in the Eurostat data bases (Eurostat, 2008). Table 1 below illustrates that there are 2.8 billion cycle trips made in Europe per year, while the estimated income from those trips is considered to be about €54 billion (numbers are rounded until 2 digits). The income from the day trips is calculated by multiplying the number of trips by €16 (average expenditure per day trip, see Table 2), while the

income generated by overnight trips is calculated by multiplying the number of overnight trips by €353 (average expenditure per trip of 7 days).

Country	Number Daytrips (mln)	Number Overnight trips (mln)	Expenditure Daytrips (billionn€)	Expenditure Overnight trips (billion €)	Total expenditure (billion €)
Austria	77	0.6	1.26	0.20	1.46
Belgium	19	0.1	0.32	0.04	0.36
Bulgaria	12	0.1	0.20	0.05	0.25
Switzerland	68	0.5	1.11	0.18	1.29
Cyprus	0	0	0.01	0	0.01
Czech Republic	18	0.2	0.30	0.07	0.37
Germany	749	5.7	12.25	2.01	14.26
Denmark	52	0.4	0.85	0.14	0.99
Estonia	1	0	0.01	0	0.01
Spain	239	2.7	3.92	0.94	4.86
Finland	56	0.6	0.91	0.20	1.11
France	919	9.9	15.03	3.49	18.53
Greece	10	0.1	0.17	0.04	0.21
Hungary	16	0.2	0.27	0.06	0.33
Ireland	19	0.1	0.32	0.05	0.37
Italy	52	0.5	0.84	0.19	1.03
Lithuania	2	0	0.04	0.01	0.04
Luxembourg (Grand-Duché)	1	0	0.01	0	0.01
Latvia	3	0	0.05	0.01	0.06
Netherlands	138	1	2.26	0.36	2.61
Norway	34	0.3	0.56	0.11	0.67
Poland	25	0.3	0.41	0.09	0.51
Portugal	7	0.1	0.11	0.03	0/14
Romania	5	0.1	0.07	0.02	0.09
Sweden	165	1.5	2.7	0.52	3.22
Slovenia	3	0	0.05	0.01	0.06
Slovakia	4	0	0.07	0.01	0.08
United Kingdom	74	0.6	1.22	0.22	1.43
Total	2770	25.6	45.32	9.04	54.35

TABLE 1 Estimate of economic values of cycle tourism in EU countries
Source: Eurostat, 2008

Direct expenditures are one of the main advantages of cycle trail development. It explains how local economies can create jobs and generate businesses. The more

important it becomes for small villages in rural areas because often cycle tourism is the only way to attract tourists there.

The above estimation (TABLE 1) is still under discussion. Different authors use various approaches to evaluate turnover of cycle tourism which results in diverse numbers. The experience of the Veloland network in Switzerland indicates that the total spending during the year 2011 was estimated at €118 million: on average each holiday cyclist travelling more than two days spent €71 per day, of which €28 is on accommodation and €25 on food and beverages (My Switzerland, 2015).

Some difficulties in calculation appear through the differences in activities between day trips and overnight cyclists. Inconsistency between rural and urban areas and between Western and Eastern Europe (due to costs differentiation) also should be considered. Variety of expenditure also can fluctuate depending on the tourist's origin country. Nevertheless, similarities in expenditures were found. The latest method proposed by the Altermodal organization calculates the economic impacts using the following constants: €57 per day for holiday cyclists and between €10-20 for day excursions (Altermodal, 2007). TABLE 2 gives a detailed view on average expenditures per tourist type and per activity.

Expenditure of overnight cycle tourist:	
- per day	€57
- per trip	€399 (on average 7 days)
Distribution over different activities of overnight cycle tourist	€24 accommodation (40%)
	€16,5 food and beverage (30%)
	€16,5 other (30%)
Expenditure of day trip cyclist:	
	€15.39 total
	€10 food and beverage

TABLE 2 Average direct expenditure per type and per activity
Source: EuroVelo, 2012 (update for 2009 study)

Table 3 gives the same estimation for the Limburg Province. Numbers are slightly different: Limburg tourists, staying overnight, spend more money (€82 in comparison with €57 per day). Regarding the distribution of expenditure per activity proportions remain approximately the same as for European tourists in general (Toerisme Limburg, 2014).

	Estimated number of cyclists	Expenditure (indexed to 2014)	Total estimated expenditure
Short trip cyclist	1 142 828	€2,5 per short cycling trip	€2 865 887
Day trip cyclist	835 144	€16,3 per day	€13 612 961
Overnight cycling tourists	149 898	€82,8 per night	€12 404 710
Total	2 127 870		€28 883 558

TABLE 3 Average direct expenditure per cycle tourist type
Source: Toerisme Limburg, 2014 (indexed to 2014)

2.1.2 Demand estimation of the cycle tourism market

TABLE 4 shows that the demand between the countries is fluctuating significantly. Therefore the borders between those countries with different demand requirements should be recognized and proportions for each category need to be defined. The analysis conducted for the EuroVelo network identified six groups of demand in cycle tourism: low, low-medium, medium, medium-high, high and very high (See TABLE 4). In order to make this assessment experts' opinions were taken into account. According to this concept Belgium demonstrates a high demand level, as cycle holidays are accounting for 3% of all holidays (this number is the average of all countries in the 5th category).

	Low	Low-Medium	Medium	Medium-High	High	Very High
Share of population using cycle as main mode of transport	<2%	2-5%	6-8%	9-12%	13-20%	>20%
Share of cycle holidays of all holidays (%)	0.5	1	1.5	2	3	3.7
Countries attributed to corresponding demand level	Bulgaria Luxembourg Portugal Malta Cyprus Spain	Romania Lithuania Serbia Norway Croatia Macedonia Italy Estonia Ireland Greece UK	Latvia Czech R. Slovenia France	Slovakia Poland	Hungary Denmark Sweden Belgium Germany Finland Austria Switzerland	the Netherlands

TABLE 4 Gradation of cycle tourism demand between EU countries
Source: EuroVelo, 2012 (update of 2009 study)

In general cycle tourism is static in most countries, but the marginal growth is uneven across Europe. The German market is the biggest in the EU and is growing thanks to developing the Radnetz Network (Radnetz, 2015) (see section 2.2.). In France, Denmark, Austria, the Netherlands and Switzerland a slow increase in the cycle tourism demand is noticed. In some particular cases, for example, along the Danube river, the development is going faster and consequently the market is growing quicker there. In central Europe, Italy, UK and Scandinavia numbers are lower, however, a steady growth is visible and a changing trend towards promoting cycle tourism is obvious. Unfortunately, in other countries the interest in recreational cycling does not show a positive tendency. For instance, the situation in Bulgaria, Cyprus, Portugal and Greece remains unchanged (Directorate-General for internal Policies, 2009).

2.2 Good examples of recreational cycle networks

Prior to exploring the features of recreational cycling network requirements and investigation of users' preferences emphasis was made on the already implemented and successfully operated tourist trails. The German network Radnetz and Swiss cycle routes combined under the brand "Switzerland Mobility" are considered as state-of-the-art examples. Distinct characteristics of these networks give an explanation on what should (or should not) be included in a "superior" trail. Further, well-developed regional routes can be integrated in a wider trail connecting neighboring countries. A good illustration is the EuroVelo network which will be discussed in section 2.2.3. One should not forget that recreational cycle tourism is not just about the network itself, but it also contains services and projects to monitor and support cycling activities. Therefore, the analysis of several Dutch, German and English projects was conducted.

2.2.1 The new cycle network for Germany - Radnetz

Background

Historically, cycling is promoted in large German cities. Availability of landscapes and heritage in rural areas gave an opportunity to develop recreational cycling in the rural areas as well. It resulted in the national network known as Radnetz consisting of twelve long-distance routes (all in total 11700km) connecting all regions of Germany. The so-called Deutsche-routes (D-routes) are based on existing infrastructure. Paths are carefully selected in order to bind attractive destinations. Authorities promise "safe, comfortable and relaxing routes by combining several rivers or theme paths with one another and creating a wide-ranging offer and a whole new experience for cyclists" (Radnetz, 2015). Various accommodations and sites are presented along the routes. D-routes No. one to six stretch from west to east, D-routes No. seven to twelve from north to south. There are different kinds of attractions on the way: tourists can choose between natural

landscapes (lakes, forests, fields, hills), city trips, small towns and historical monuments (castles, open air museums etc.). Most of the paths are separated from the traffic and covered with asphalt. A GPS map can be downloaded from the official website. Moreover, there are third-party sources (mostly web) which help to organize a trip. Some parts of Radnetz are included in the European Velo network.

Features

Between 1.6 and 2.2 million Germans plan a cycle holiday over the next year and about 7 million often use the bicycle during their holiday (Trendscope, 2008). The German network is often visited by foreign tourists. The market research conducted by Trendscope agency shows that there are between 5 and 8% foreign cycle tourists in Germany, while the same indicator for conventional tourism reveals 15%.



Figure 2 Radnetz cycle network, Germany. Source: Radnetz, 2010

Regional economies benefit from the presence of paths running through their territory. In the region of Münsterland approximately 30% of the income is generated by cycling tourism (Fahradportal, 2009). The whole German network receives on average €9.16 billion gross revenues annually produced by 153 million day trips and 22 million overnight stays.

Holiday cyclists cycle longer than day trip tourists (65% against 5% spend cycling over 7 hours per day). If people go on day trips they mostly sit on the saddle from 1 to 4 hours (62%) (Trendscope, 2008). The Trendscope study also investigated how many days in total German cycle tourists go on holiday. The indicator is almost equal for three categories “2-4 days”, “5-7 days” and “8-14 days” (see TABLE 5). If the second and third group are combined, then it can be stated that the majority of cyclists (62%) go on holiday from 5 to 14 days, while only 8% prefer to cycle more than 15 days (Trendscope, 2008).

Duration	Cycle tourists (%)
2-4 days	30
5-7 days	30
8-14 days	32
15+ days	8
Total	100

TABLE 5 The amount of days spent by German tourist cyclists in a holiday
Source: Trendscope, 2008

Coming back to the issue about sustainable tourism the department of statistics provides some numbers about the share of transport mode when tourists travel to their holiday destination (or starting point). German cycle tourists use a train 3 times more often than conventional tourists. For those tourists the car index is 17% lower and the plane as mode of transport is used less (by 20%). 19% of cycle tourists reach their destinations by bicycle, while only 1% of traditional holiday makers use the bicycle to go on vacation (Fahradportal, 2009).

Regarding to bike hiring only 5% on average uses rental services; the majority owns their own bicycle.

2.2.2 VelolandSchweiz – cycling in Switzerland

Background

The network known as SwitzerlandMobility (or VelolandSchweiz) was established in 1998 and consists of 68 local and 55 regional routes integrated into 9 national trails, 20000km in total. The main feature proposed by authorities is Swiss landscapes of Alpines. Network's services include accommodations, bike and e-bike rentals, cycle services, recommendations for transportation (rail, bus, boat), guides, maps, an online application to set up your own trip and ready packages which include transfer of luggage, accommodation, guide book and bike rent. Currently SwitzerlandMobility (SSM) incorporates hiking, mountain biking, skating and canoeing as well. The organizations presenting those activities (plus transport, accommodations and additional support services) operate as partners with own responsibilities. All SSM routes are linked to the partners' services emphasizing team work aimed to successfully operate SwitzerlandMobility.



FIGURE 3 Part of the Veloland network
Source: SwitzerlandMobility, 2015

Features

Good government promotion led to network popularity from the early steps. The total number of users in 1999 was 3.3 million, it increased to 4.8 million by 2007 (Ickert & Rikus, 2008). Among them approximately 200,000 are overnight trips, the rest are day excursions. The total turnover in 2007 was ca. €88 million, while each overnight cyclist spent on average €71 per day (€25 was on food and beverages and €28 on accommodation) (Ickert & Rikus, 2008). The latest statistics indicate that the turnover in 2013 is equal to €316 million (My Switzerland, 2015).

The routes were chosen in cooperation with numerous organizations and experts. They possess all features of excellent paths with a good infrastructure, easy understandable and interpretable signage and the most attractive views. The Swiss cycle network actively focuses on non-motorized traffic and public transport in terms of infrastructure and communication, thus promoting combined mobility (My Switzerland, 2015). SSM highlights an importance of cooperation between all stakeholders to support a development program. Like in the German case some routes of the Swiss network are integrated on the higher level.

2.2.3 EuroVelo – connecting the continent

Background

The idea of creating a network which will connect the whole European continent appeared already in the mid 90s, however the opening ceremony of the first route (North Sea Cycle Route) was in 2001. EuroVelo is the European cycle route network consisting of 14 routes (15th is under development) and 45,000 km of bike paths (will be 70,000 when it is complete). It runs in Austria, Belgium, Bulgaria, Cyprus,

Czech Republic, Croatia, Denmark, Greece, Hungary, France, Germany, Iceland, Italy, Latvia, Lithuania, Luxemburg, Macedonia, Monaco, Norway, Poland, Romania, Serbia, Slovenia, Slovakia, Spain, Sweden, Switzerland, The Netherlands, Turkey and the UK. The main idea is to incorporate local existing routes into wide international trails in order to offer a sustainable TransEuropean network (European Cyclists Federation, 2015).

Features

The project is generally managed by the European Cyclists Federation (ECF) which coordinates implementation, operation and quality assurance. At the national level EuroVelo is controlled by National EuroVelo Coordination Centers and Coordinators (NECC/Cs). Besides, it is also supported by different partners. The international status contributes to gathering funds and to receive political support (EuroVelo, 2015). The project aims to bring three core themes of culture, heritage and nature to a new market. The network is used by long-distance cycle tourists as well as by local people making daily journeys. EuroVelo is developed in accordance with all standards (uniform signing, good quality infrastructure etc.).



FIGURE 4 EuroVelo network signs
Source: EuroVelo, 2015

According to the EuroVelo Guideline all routes should fulfill the following requirements:

- They must be based on existing or planned national or regional routes of the involved countries;
- At least two countries must be involved;
- Route length must be at least 1,000 km;
- Steep sections should be avoided wherever possible and for very steep sections (if unavoidable) alternative transport options (i.e. public transport or alternative routes) should be provided;

- Easy to communicate - internationally recognizable identity and name (marketing potential);
- Implementation plans in place (project plan, business plan, partners);
- Signing in accordance with the regulations of the respective nations and/or regions, continuous and in both directions;
- Signage supplemented by EuroVelo route information panels, in accordance with the recommendations of ECF's Signing of EuroVelo cycle routes manual as illustrated in FIGURE 4 (Directorate-General for internal Policies, 2009).

The network is planned to be completed by 2020. There are some estimated numbers to be produced by the end of the project:

- 12.5 million holidaymakers (82.5 million holiday cycle days);
- Total direct revenues from holidaymakers of €4.4 billion;
- 33.3 million day trips;
- €54 billion of direct revenues.

In order to calculate the turnover of the network the tool called "The Cycle Route Demand Forecast Model" (CDRFM) was developed. This program is based on Microsoft Excel and uses a user-friendly interface. The CRDFM helps planners of cycle routes and networks to estimate the demand (the number of day trips and cycle holidays) of the future network and assess potential gross revenue that a network can bring. The model is geographically based and therefore requires input about the distances of the considered region (Directorate-General for internal Policies, 2009).

2.2.4 Supporting and monitoring instruments

Developing a cycling network does not finish after designing routes and supporting facilities on the site. Authorities have to provide solutions for the cyclists to reach the travel destination, monitoring facilities, organizing promotion and so on. The following additional projects regarding these issues were observed.

"Treinreiswinkel" (Railway Travel Shop)

This Dutch company established in 2008 specializes on selling rail travel packages along Europe. Other public transport tickets are available as well, but the main emphasis is made on railway. It is possible to make bookings through the internet or visit selling points. On average the annual turnover is ca. €15 million (Treinreiswinkel, 2015).

The company offers short-distance train-bicycle trips as well as long-distance tours (for instance, packages to the Danube route). About 2% of the tickets sold are a combination of train and cycling. There are approximately 3 persons per booking that means that an average group of cyclists consists of three people. An average booking price is €450 (including bicycle carriage but without accommodation). From 2006 until 2008 turnover from bicycle packages grew almost three times. The table

below shows the turnover from train-bicycle packages for some destination countries.

Country	Turnover(€)
The Netherlands	50397
Italy	49092
France	47332
Germany	42000
Switzerland	36273
Norway	6655
Belgium	1351

TABLE 6Treinreiswinkel, Turnover per destination, 2008
Source: Treinreiswinkel, 2008

Treinreiswinkel proposes to make bicycle transport facilities more direct and on all long-distance trains more appropriate for bicycles.

There is a similar company “Fietsvakantiewinkel”, but they focus only on full bicycle packages including transportation, accommodation, maps, guidelines and other additional services. Those packages are developed for people who have difficulties to setup a trip on their own (Fietsvakantiewinkel, 2015).

Bett&Bike (cycle-friendly accommodations)

Bett&Bike is a German project aimed to define accommodations which are appropriate for cycle tourists. Today accreditation of accommodations exists in 9 countries including the Netherlands, Belgium, Switzerland, Denmark, Croatia, Luxemburg, Poland, Austria and Germany (Bett+Bike Deutschland, 2015). France, Switzerland, the Czech Republic and the UK have their own similar labeling systems.

Trendscope survey defined the following as important cyclists criteria of accommodations(Trendscope, 2008):

- Bicycle storage;
- Drying room;
- Repair room;
- Breakfast;
- Information material for cyclists.

Based on that Bett&Bike established the minimum characteristics for its members. Here is the information from the brochure:

- “Guests are welcome to stay for only one night.
- Bicycles are securely stored.

- It is possible to dry wet clothing and gear.
- The most important tools are available for simple bike repairs.
- In case of more major breakdowns, the nearest repair shop is ready to help.
- Informational materials, such as regional bike trails and schedules for bus and train, are available so you can find out more about attractive excursions in the area.
- In the morning, when you wake up, a hearty breakfast will be waiting for you” (Bett+Bike Deutschland, 2015).

Members of Bett&Bike are not only Hotels, Hostels or B&B’s, but also camping sites or some other accommodations which fit the characteristics described above. To receive a certificate the accommodation is tested by managers, other members and cyclists. Accreditation is given for one year and a distinguished sticker can be found on the doors of the accommodation (see Figure 5). There were almost 5000 accommodations registered in 2009, 240 of them in Flanders.



FIGURE 5 Bett&Bike sticker
Source: Bett&Bike, 2009

A GPS map can be downloaded from the official website, however it is only available in German. Besides that, a tool to find an appropriate accommodation in advance can be used through the internet or buying the paper-version of the guideline is also possible.

A similar system is present in the Flemish region of Belgium. In 2013, there were more than 500 officially recognized cycle-friendly accommodations. In order to meet the quality for recognition an accommodation has to match 10 compulsory and a number of additional criteria. For example, cycle-friendly accommodations must be located within 5 kilometers of a recreational trail, a cycle network or a National Cycle Route. In addition, there must be sufficient space to store the bikes,

a bicycle repair set, a first aid kit and available extensive cycle information. This initiative was initially developed in Limburg and afterwards copied by the rest of Flanders(Toerisme Flanderen, 2013).

Monitoring cycle routes in England

The project of a British charity to promote sustainable transport "Sustrans" aims to measure economic impacts on four National Cycle network routes in the North East of England: Coast & castle, C2C, Hadrian's Cycleway and Penine Cycleway. Information about cycle flows (using counters), characteristics of the users (through intercept survey) and expenditures (filling diaries) were gathered on the site. Data was captured on each route (Sustrans, 2007). The differentiation was found between rural and urban areas and between traffic-free and traffic-occupied areas. The study contributed to categorization of the routes.

This survey indicated an importance of monitoring procedures. It helps authorities to estimate changes in the demand and to evaluate economic, social and environmental impacts. Methods should be chosen with regard to the specific area, but usually there is not such a big variation among tools.

2.3 User's profile and preferences

In order to find out common user's preferences we will consider cycle tourists in general as a uniform group, thus, their preferences and profiles are rather common within different countries. In order to find out those similarities general trend surveys from Europe (Germany, Switzerland, Ireland, Austria, Denmark and the Netherlands), Australia and Asia (Taiwan case) were observed.

2.3.1 User's profile

Socio-Demographic data

A study conducted in Australia, based on 600 different types of surveys across the whole continent, showed that a cycle tourist is mostly female (60%) and between 40 and 54 years old (45%) (Faulks et al., 2007). Tourists using the recreational network in Ireland are mainly women as well in age from 45 to 64 years (the users under 18 years old are not taken into account)(Deenihan & Caulfield, 2015). Numerous studies from Germany, Switzerland and the Netherlands indicate approximately the same numbers (Ickert & Rikus, 2008; Trendscape, 2008; Pels et al., 2013).

Data from all sources emphasize that many cycle tourists are holders of university or postgraduate degrees (around 60%). They are professionally active and work mostly on a managerial position and have a middle or high income level. In Australia people with very-high income account for more than 30% of the cycle tourists (Faulks et al., 2007).

On average two-thirds of survey respondents are couples (married or living together de facto), half of them without kids or with kids living somewhere else and another half with kids living with them.

With regard to a holiday party 30% of recreational cyclists are travelling with a partner as a couple, another 25% goes on holiday with a friend or with a small group of friends, around 15-20% (varies between studies) cycle alone and the percentage of large groups of cyclists is very small (4%) (Stack & O’Boyle, 2013). Mostly people travel in groups of 2 persons (38%).

Socio-demographic characteristics are summarized in TABLE 7. These characteristics are related to holiday cyclists; the day trip cycle market is much broader and needs more careful investigation within the local area.

Age	40-55 years (45%)
Gender	female 60%, male 40%
Education	University/Postgraduate degree 60%
Work	Professional/Manager 63%
Income	€25,000-55,000 (per annum)
Family status	66% married or de-facto (half with kids living together, half without kids or with kids living somewhere else)
Cycling holiday party	Couple 30%, with friend/friends 25%
Group composition	2 persons 38%

TABLE 7 Socio-demographic characteristics of cycle tourists (summary is based on multiple studies analysis)

Motivations

More than half of the respondents define themselves as intermediate-skilled cyclists, about one third says that they have advanced skills. The network users are not novice in the “business” since they have been regularly cycling during the last 3-5 years (25%) (Faulks et al., 2007).

Cycle tourists in Australia indicated the factors which motivate them to go on cycle holiday (on a scale from 1 as least important to 5 as very important). Each category has 2 scales due to major and minor surveys. As can be seen in FIGURE 6 such reasons like sport, adventure, leisure, health and experience received high scores (Faulks et al., 2007). The German Trendscape study shows the same results. It was noticed by respondents that during the cycle holiday they perform activities not-related to cycling like eating at a restaurant (77%), visit parks (46%), shopping for non-essential items (43%), hiking or walking (42%), visit museums (35%) and swimming (31%).

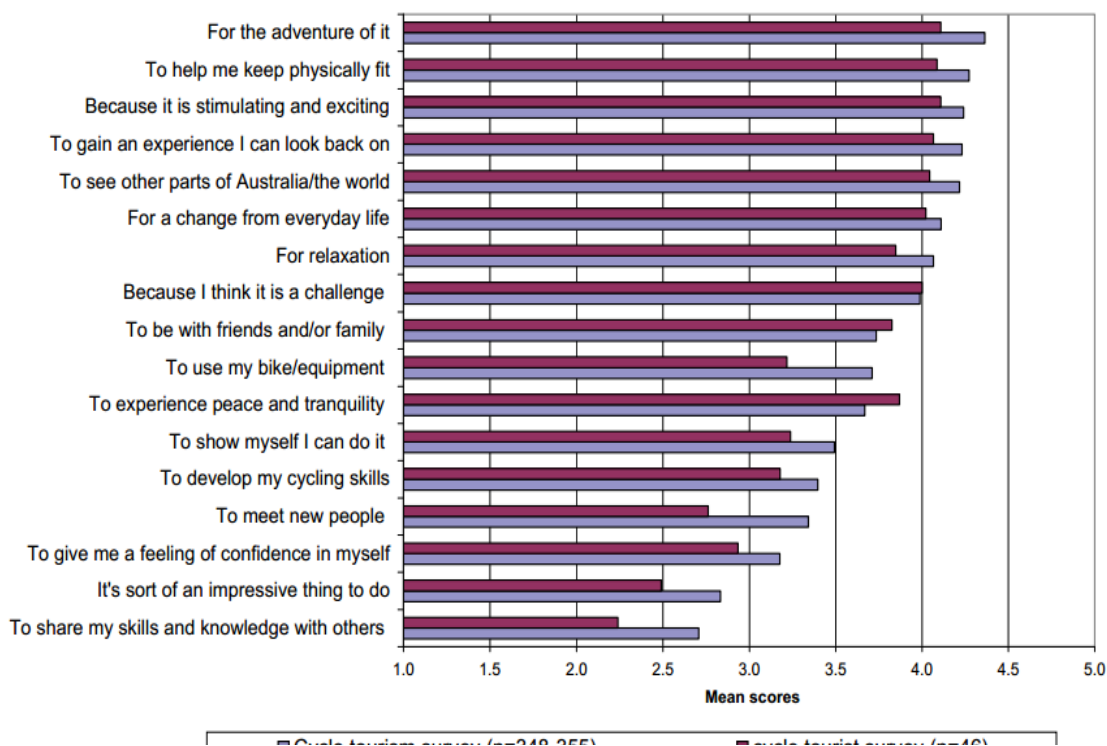


FIGURE 6 Evaluation of motivation factors for holiday cycling
Source: Cycle tourism in Australia, 2007

Regarding the organization of the holiday, tourists mostly act independently (55%), while 25% follow some special events (with a cycle community for instance) and 7% use the help of tour operators. The information source for the last holiday (if it took place) was in 53% the internet, 37% of respondents were informed by cycling clubs or organizations, 35% and 33% used own or friends' experience. TABLE 8 combines motivation factors for cycling and background.

Experience	Intermediate cycle skills 55%
Regular cycling	3-5 year 25%
Motivation factors	Sport, leasure, health, experience
Additional activities	Eating at restaurants, visit parks, shopping, walking/hiking
Way of organizing tour	Independently 55%
Information received from	Internet 53%

TABLE 8 Motivation factors for tourism cycling and background (summary is based on multiple studies analysis)

2.3.2 *User's Preferences*

In this subsection user's preferences regarding to network facilities will be discussed. The main points of concern are accommodation properties, seasonality, length of stay and destination and route attributes. At the end concluding remarks will be given.

Accommodation

Since the weather conditions vary along different countries cyclists show different preferences regarding to accommodation. European cyclists value standard hotels to the same extent as Australian tourists (approximately 40%), but when it comes to camping the demand in Australia remains the same as for hotels, while in Europe this indicator drops by 15% (about 25%). Guest Houses, B&B and Farm stays are the most popular type of accommodation in Europe (45%). Network users do not need luxury hotels, but they expect good basic facilities (Directorate-General for internal Policies, 2009).

Seasonality

Studies in Germany and Switzerland show that the recreational cycle season starts in May and lasts until September with 79% of the trips made during this period (Ickert & Rikus, 2008; Trendscape, 2008). There are some differences for day excursions. 45% of them take place in the summer, 28% in spring and 19% in the autumn months (Lumsdon & Page, 2004).

Length of stay

Estimation of the trip duration is based on the German case described in section 2.2.1 and it equals 5-14 days (for 62% of the cyclists tourists). The survey conducted in Ireland shows that international tourists coming to visit Irish attractions are cycling approximately 3 to 6 hours per day (60% of respondents), while domestic cyclists spend mostly 2 to 4 hours per day turning the pedals (47%) (Stack & O'Boyle, 2013).

Destination attributes

Destination and route attributes are probably the main points which define where holiday cyclists are going to travel. The analysis of data from Ireland, Taiwan and Australia provides a list of destination attributes prioritization (TABLE 9). Attractive scenery definitely plays a significant role in a cycling holiday when people spend most of their time outside. The following three criteria (suitable weather, routes through attractive towns and historical attractions) are also related to that (Stack & O'Boyle, 2013; Chen & Chen, 2013; Faulks et al., 2007). Some studies additionally indicate factors like presence of maps and brochures for cyclists, rental bikes, gentle gradients and importance of socializing with "like minded" people (EuroVelo, 2015).

Parameter	% ranked in top 5
Beautiful scenery	80
Suitable weather	68
Routes through attractive towns	47
Historical/cultural attractions	42
Easy access	41
Other outdoor activities	39
Dedicated cycle network	37
Cyclist friendly accommodations	36
Value for money	34
Routes for all abilities	29
Meet local people	26
Established cycle destination	20
Cycle friendly public transport	19
Online route information	15
Challenge/competition	14
Nightlife/Entertainment	13
Guided tours	12
Other	8

TABLE 9 Destination attributes indicated by cyclists

Source: Stack & O'Boyle, 2013; Chen & Chen, 2013; Faulks et al., 2007

Route characteristics

The network infrastructure is fundamental in insuring the safety of cyclists. This parameter will be discussed in detail in section 2.4.1, while here other route characteristics were opened up. As can be seen in TABLE 10 a lot of route features are relevant for tourism cyclists (Trendscope, 2008). Those can be integrated in wider categories. For instance, safety which includes traffic-free cycling and route surface quality; ease of use (signposting, information material, level of difficulty); leisure (food and beverage opportunities, cycle friendly accommodations, places to rest) and so on. Distance between possible stops should not be very large. It serves not only rest purposes, but also variability of route paths (alike route variety criteria).

Parameter	% ranked in top 5
Low traffic density or traffic free cycling	85
Signposts for cyclists	80
Route variety	77
Route surface quality	76

Cyclist friendly accommodation	66
Opportunity of food and beverage along a rout	63
Information material	60
Access to public transport	56
Route density	53
Places and huts for resting	50
On route cycle-maintenance shops	43
Frequency distance between stops	30
Level of difficulty	27
Bike transfers between towns	13
Other	4

TABLE 10 Route attributes indicated by cyclists
Source: Trendscape, 2008

The research conducted in Dublin gives an explanation of users' preferences regarding to segregation of paths (if segregated and not segregated routes are present). The cyclists would prefer to ride 75% of the time in segregated facilities, 18% on the road with cycle lanes and 7% without any cycle facilities (Stack & O'Boyle, 2013). Tourists are willing to increase the cycle time twice in order to use a segregated facility. Younger cyclists are more likely to choose roads without any facility. Females prefer separated cycle routes. Moreover, tourists are willing to pay 98% more for an option to use a fully segregated facility (if fees would be introduced) (Stack & O'Boyle, 2013).

Concluding remarks

Concluding all the above, three main criteria influencing the choice of a possible destination for a cycle holiday can be distinguished:

- Basic cycling (type of route, difficulty level, length, signage, infrastructure etc.),
- Services along the route (accommodations, maintenance shops, food and beverages, rest points, guidelines and maps) and
- Opportunity of experience by sightseeing (landscapes, heritage, museums, attractive towns, cultural points) (Černá et al., 2014).

Thus, these components should be considered in order to develop an attractivenetwork for recreational cycling.

2.4 A Master Plan requirements

Often a Master Plan does not imply construction of cycling infrastructure, so it is important to choose those existing routes which meet all standards (if such established in the region) and satisfy cyclists' requirements. This section describes

which properties pathways should have itself, which additional elements need to be installed or added on the way, which features cycling services should have and how a cycling friendly community can help to make a network more attractive.

2.4.1 Infrastructure requirements

The infrastructure of the routes is the basis for cycling tourism and for cycling in general. Even if there are handsome sightseeing, perfect guidelines and good accommodations tourists will not be able to enjoy these without safe and comfortable pathways. Good-planned, well-designed and continuously-maintained cycling paths make a significant contribution to the comfort and safety of the tourists. Additionally, cyclists who experienced high quality routes will promote them in the future. Design issues are not within the scope of this Master Thesis, but the main principles are pointed. Guidelines for an infrastructure design can be found in "Fresno County Regional Bicycle and Recreational Trails Master Plan" (Fresno County Department of Public Works and Planning, 2013) or "City of Des Moines Bicycle and Trail Master Plan" (Alta Planning Design, 2011).

The key principles for bicycle trail guidelines:

- **Safety:** environment should be safe. Bicycle routes and crossings should be designed to be free of dangers and with minimum noise, external traffic and interfering architectural elements.
- **Accessibility:** routes should be designed for all categories of cyclists. Since recreational cyclists are often older people and families with kids, routes should be accessible for people with different skills.
- **Continuous and holistic:** a network should continuously connect one attractive destination with another in a convenient manner and give users a "full picture".
- **Ease of use:** bicycle routes should be designed in a way that they can be easily found, the environment should be easily understandable. The presence of an appropriate signage is very important (see section 2.4.2).
- **Diverse experience:** a network should provide different scenarios on its way. Monotonous riding along the same conditions for a long time can lead to tedium.
- **Convenient:** it should be possible to enter the network from many neighborhoods (frequent access points).
- **Economic:** a network should bring the maximum benefit for its cost. The benefits include not only monetary values, but reduction in emissions and health advantages as well.
- **Scenic experience:** people go to cycle holidays to enjoy views while travelling, so taking advantage of attractive and scenic areas should be maximized.
- **Separate bicycles and pedestrian ways** in order to reduce conflicts (especially in the case when routes are heavily used) (Alta Planning Design, 2011).

- **Public lands:** a network should use public property. Some exceptions are possible if private lands' rules permit that(Černá et al., 2014, Rotar et al., 2012, Fresno County Department of Public Works and Planning, 2013, City of London, 2005).

As was discussed earlier cyclists prefer to ride 75% of their time on fully segregated facilities. There can be three kinds of bikeways distinguished (Fresno County Department of Public Works and Planning, 2013). Class I Bikeways are separated from motor vehicle traffic, these are mostly used by recreational cyclists. Facilities may be constructed along linear corridors like rivers or railroad lines, through parks or open space areas and adjacent to roads. Preferably surface is asphalt, but in the rural areas it can be granite or another aggregate material. If the path is going along a road a barrier has to be present.

Class II Bikeways use streets, but separate bike lanes are present. This is often the case when travelling in an urban area. In rural areas that kind of bikeway is supported by paved shoulders (without curbs and sidewalks). Class III Bikeways do not have any features except of cycling route signs. They go through the roadway and should be avoided. If this is not possible their usage should be limited to 7% (Fresno County Department of Public Works and Planning, 2013).

Sometimes it is not feasible to connect destinations using an appropriate recreational cycle path and relatively long-distances should be travelled to reach the next attractive point (i.e. travelling from one village to another, from rural to urban areas). Therefore that section of a trail has to be as direct as possible. There are some ways to approach this issue:

- **Cycling along a railroad.** Bikeways along not-used railroads are often used to complete cycle paths. Firstly, this is usually the shortest way. Secondly, it is a flat terrain what makes cycling faster.



FIGURE 7 Cycling along the old railway, Penicuik, United Kingdom
Source: Penicuik cycling trail, 2015

- **Cycling along waterway** corridors including rivers, channels, drainage ditches and beaches. They do not always provide a direct connection, but add attractiveness to a trail. FIGURE 8 illustrates the German trail passing through the Rhine corridor. The popularity of the Danube trail depends on this solution as appropriate for recreational cycling.



FIGURE 8 Cycling along the Rhine, Germany
Source: German Travel Destinations, 2014

2.4.2 *Standards for quality cycling services*

Currently there is no cycling strategy or common manual for recreational cycling in Europe (which fits for each country), however some member states are attempting to develop their own standardized list of requirements in order to improve and promote regional networks. According to Rotar if an area wants to attract people to use its cycle routes it has to fulfill the following **requirements**:

- Clear and easy understandable signage;
- Cycle information points;
- Cycle-friendly accommodations;
- Minimum three marked cycle routes;
- Cycle repair points along routes;
- Bicycle rental centers;
- Maps (or preferably panoramic maps) of cycle routes;
- Trained cycle guides (by request) (Rotar et al., 2012).

Signage

Presence of signs along routes plays a crucial role. It allows cyclists to follow the correct directions according to the established rules. Good quality signage aims to increase cyclists' comfort and accessibility. For tourists, wayfinding signage is the most important one. Those are typically placed at key locations leading to and along bicycle paths including junctions where multiple routes intersect each other.

Wayfinding signs show the number of a junction according to a route map (FIGURE 9, left side) or a destination and distance to it (FIGURE 9, right side). They should be installed at a height appropriate to the visibility of cyclists. Warning and regulatory signs are less used in recreational cycling, but they are still placed in order to explain rules of a region or create alertness about a coming hazard (Alta Planning Design, 2011).



FIGURE 9 Cycle network signs
Source: Fietsparadijs, 2015; Gresham, 2015

Cycle information points

Information points provide users with all the information needed on accommodations, routes, guidelines, repair points, bicycle rent, transport options and other relevant services. Skilled and helpful personnel and free WIFI is an added value. Opening hours should be adjusted to cycling demand in the region. Information points can be part of any other tourism facility like hotels, tourist centers, stores etc. (Rotal et al., 2012).

Cycle-friendly accommodations

As discussed before (in the Bett&Bike case) accommodations for cyclists differ from regular hotels, B&B, farms, campsites and so on. In addition to conventional services they should include an information point, bicycle repair tools, a safe parking, a place to clean your bicycle and dry your clothes. Food should be suitable for cyclists. In Slovenia cyclist-friendly accommodations have the "five-wheels" system. An accommodation is granted the five-wheels sign if it satisfies all conditions described above, while one wheel means only basic cycle facilities are provided (FIGURE 10).



FIGURE 10 Cycle friendly-accommodation sign in Slovenia
Source: Cycling Marketing Standards, Slovenia, 2015

Cycle-friendly restaurants and cafes

Like lodging accommodations restaurants and cafes should provide safe bicycle and luggage storage, information services, maps, cycle-friendly meals, packed lunches and tools for small repairs.

Parking

Short-term bicycle parking includes a rack which allows locking a bicycle frame and one wheel. It keeps the bike in a stable position without damaging it and should be free of charge. Normally a separate surface is allocated for those facilities, however an on-street bicycle parking is acceptable.

In general cycle services should not be further than 15-20km away from each other (less than 15km if possible). Moreover, there is a need of places to sit and rest: spots equipped with benches should be installed along a route (Stack & O'Boyle, 2013).

2.4.3 Cycle friendly environment

An important element of a recreational cycling plan development should be a **cycle-friendly community** which benefits from cycle tourism. People living in the region should understand cyclists' needs in order to improve provided services and to increase received benefits. It becomes a complicated task since people are more oriented towards motorized vehicles. The local community should be informed about plans and be able to participate in the development if they want to (by means of a consultation committee, votes, promotion). Some info-sessions can be conducted to inform the inhabitants about the potential and importance of cycle tourism for the local economy (Rotar et al., 2012). A good example of such community participation are "Fietspeters and -meters" in the Limburg Province. Those are volunteers living close to the network who continuously monitor the quality of the routes. At least once a month each "peter and meter" rides along a loop which belong to his/her "jurisdiction" and reports about anything that can

affect cycling like missing or dirty route boards, overhanging tree branches, defects on the road and so on. The distance can be between 15 and 40 kilometers and reports are sent directly to "Toerisme Limburg" via phone or email. The maintenance team receives about 500 reports per year half of which comes from "peters and meters". Currently there are 230 "Fietspeters and meters" in the Limburg province, however new members are always desired.

It is important to ensure that cyclists can easily reach a network. Therefore public transport should be supplemented with bicycle carriage facilities, roads leading to a network have to be clean and include additional guided signs. If users are coming by car suitable car parking should be organized in the neighborhood. Public sources such as water and toilets need to be accessible and easily reachable. Additionally these facilities must be appointed on maps and in guidelines. Moreover, each facility on a route should have its own distinguished logo which can be recognized on spot, for example, glued on the window or mentioned on a map.

2.4.4 Coordination and network expanding

Coordination processes should be conducted by one organization even if there are several responsible authorities operating (i.e. regional and local). All components of a master plan should be discussed and agreed prior to its implementation. A good example of such cooperation is the EuroVelo network with a project development mainly managed by ECF and controlled at the national level by Coordination Centers.

Developers of a master plan should experience the network themselves: ride through paths, visit places where cyclists are going, check accommodations and restaurants. Such rides should be made constantly resulting in improvements implemented immediately.

A trail should not be limited to one possible way exclusively. A variety of routes for different classes of cyclists would be a good opportunity for people with different skills and interests. It was discussed in the beginning that cycle tourists are uniform groups, nevertheless some deviations exist. For instance, families with kids would prefer riding on segregated paths through a flat terrain whereas younger experienced cyclists on some sections of a trail would like to climb an obstacle or don't mind to travel together with other traffic. Integration of different routes and paths into one holistic network is one of the goals of a master plan.

3. LONG-DISTANCE TRAILS DEVELOPMENT FOR THE LIMBURG RECREATIONAL CYCLE NETWORK

3.1 Overview of the Limburg Recreational Cycle Network (RCN)

3.1.1 Region

The Limburg province of Belgium has a territory of 2,414 km² which comprises **five regions (Maasland, Haspengouw, Voerstreek, Limburgse Kempen and Hasselt)** and 44 municipalities including the main capital Hasselt (Wikipedia, 2015). An important feature for cycling is that the center of the province is crossed from east to west by the Albert Canal. Cyclists often choose routes along water sites because of their landscapes. The Albert Canal covers most of the central part of Limburg. The eastern border of the province is located west of the river called Maas, which drainage covers almost all part of north east Limburg. The landscapes along the Maas river attracts a lot of tourists. Among other important water ways are the channels from Bocholt to Herentals.

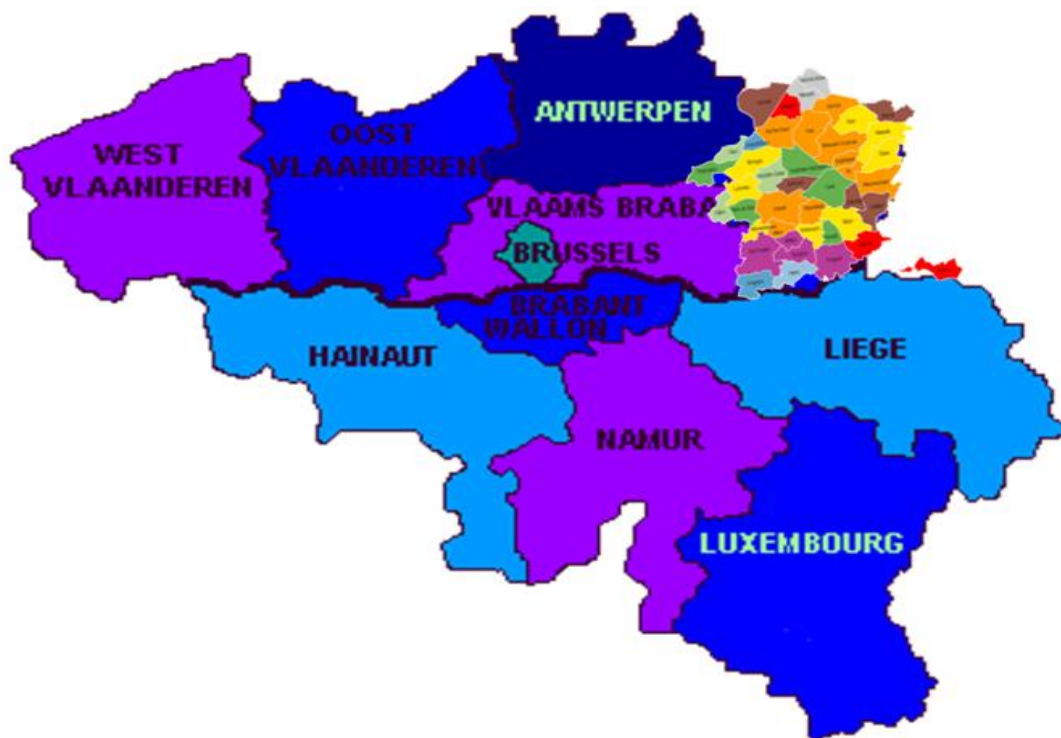


FIGURE 11 Map of Belgium, the Belgian provinces and the municipalities of the Limburg province

Source: Kaart-belgie.nl, 2015

The north and east side of the provinces have a common border with the Netherlands, the other sides are only connected with Belgium itself. The region in the south side of the province is called Haspengouw, known for its fertile soils and fruit gardens (with a bicycle trail along the former fruit industry rail road), and a

rich history with numerous castles and religious heritage. Although geographically Limburg is a flat area, there are some hills in the south-east in the region Voerstreek.

An interesting recreational area is the National Park Hoge Kempen, located on the north of the Albert Canal, with its sandy soils, forests and heathlands suitable for long walks, picnics and cycling (Nationaal Park Hoge Kempen, 2015). The park is located on the border of the regions Maasland and Limburgse Kempen. In the Limburgse Kempen the former coal-mines are situated. Lately they have been reconverted, often with an added value as a tourist attraction. The old mining industry rail road was also used in the development of the Recreational Cycling Network. The area in the west of the Limburgse Kempen, from Lummen municipality to Genk, is known as De Wijers, Land van 1001 vijvers, meaning the ponds area, the country of 1001 ponds (Toerisme Limburg, 2015).

The whole province in general has a wide variety of enjoyable countryside landscapes which attract nature-oriented people. Moreover, the province offers a lot of heritage, integrated in the Recreational Cycling Network, for instance, the Landcommanderij Alden Biesen in Bilzen, Roman archeology and Medieval architecture in Tongeren or Renaissance monuments in the Maasland, which are highly promoted by Toerisme Limburg.



FIGURE 12 Landcommanderij Alden Biesen, Bilzen
Source: Bilzen.be, 2015

3.1.2 History, evolution and properties of the Limburg RCN

The development of the Limburg RCN began in 1995 in the Limburg province of Belgium (Flanders region) based on a proposal of the mining engineer Hugo Bollen. Currently the network includes **2000 kilometers** of high quality cycle routes which are used by around 2 million recreational cyclists per year (Vanswijgenhoven, 2015). The network already earned trust of the local people and was copied worldwide. One of the well-recognized features of the so-called Fietsparadijs are

blue signs along the routes which denote the number of a junction (Figure 9). The whole network is actually based on **390 junctions**. Each junction has a unique number which leads a user to the next numbered junction and so on. In total there are about **20000 signs** serving to indicate the correct direction (Toerisme Limburg, 2015). Signs are installed on a height which is appropriate for the cyclist's vision. Additionally paper maps, a web-site planner and a smart phone application are designed to help the users. Each year about 20000 maps are sold. Regarding **the mobile phone application**, there are still some changes and improvements which will be made, however the first version of the application can already be downloaded from Google or the Apple store. From 25th June 2015 until October 2015 the app was downloaded more than 15000 times (Toerisme Limburg, 2015).

The following table describes some features which were developed and implemented during the different periods.

Feature	Year	Description
Cycle friendly labels.	2001 -	Labels were developed for cycle-friendly accommodations and cafes. Currently there are 160 cafes and 185 accommodations labeled.
Bike rental.	2002 -	There are about 18 locations next to the network which offer bicycles for rent.
Bad weather Guarantee. (SWG)	2003 - 2006	If it is rainy weather and a cyclist is staying in an accommodation which uses SWG then he/she gets a voucher for a free visit to one of the 50 indoor attractions, for example a museum, theatre, indoor skiing or an indoor water park.
Storyteller.	2004 -	It is a device which can be rented at tourist offices and installed on your own or rental bike. The device tells a cyclist a short story about the location which he is passing. Recently the stories can also be downloaded and recorded onto a smart phone which is then used during the trip.
Fietsonthaal- and servicepunt (cycle reception and service point).	2004 -	There are nine points where cyclists can start their trip. Those places have a parking for cars, a picnic area, a cycle-friendly café, repair instruments, sanitation, bicycle rentals, an info desk, a Wi-Fi spot and maps.
Cycle network map.	2005-	The general cycle route map can be purchased at tourism offices and on the official website of Toerisme Limburg. On the map are denoted all junctions, heritage, cycle-friendly accommodations and cafes, places to rest and other important objects for cyclists. The map comes with a book where all information is

Thematic routes maps.	2005-2015	clarified in details. There are about 20000 maps sold per year. In addition thematic route maps are for sale (see section 3.1.5).
Picnic places.	2008 -	Comfortable places for a picnic, often with a nice view. After the research conducted by Toerisme Limburg in 2003 it became clear that the network was missing good-quality picnic places.
Spotters.	2010 -	Devices (look like a pole) which are installed along the route. When looking at an object in the environment (like a monument or a historical place) through the device a short movie about this particular object is displayed.
Charge poles for electrical bicycles.	2011 -	Charging stations placed along a route in order to charge electrical bicycles. They also can be found at 40 cycle-friendly cafes and restaurants.
Velodromer.	2013 -	An offline application for 10 thematic routes of Fietsparadijs. It can be downloaded and used during cycling, in offline mode.
Favorite places.	2014	During a survey which was conducted among the inhabitants of the Limburg province they were asked to choose their most favorite places in their municipality (a part of the cycle network). Afterwards the most common chosen places were put on the cycling map.
Fietsparadijs application.	2015 -	Online application including all numbered junctions, cycle-friendly accommodations and cafes, route and locations description.

TABLE 11 Fietparadijs' development
Source: Toerisme Limburg, 2015

Limburg Fietsparadijs is accessible for people with a physical disability which often need adjustment to make their cycling experience more smoothly. Rental centers offer **bicycles for disabled people** for a fair price. Those bicycles can be picked up at the reception and service points (see table 11). The choice can be made between a co-pilot tandem (see Figure 13), a tricycle, a hand-bike, an O-Pair bike and a twin-bike plus (Visit Flanders, 2015).



FIGURE 13 A co-pilot tandem wheelchair bicycle
Source: www.indemedical.com, 2015

3.1.3 Working principles, maintenance and network regulation

Network reliability is based on **the ABC principles**. "A" stands for "autoluw" what means "low-traffic" routes. 60% of the network routes are low-traffic, while 40% of them are fully car-free. Still every year the province invests in the construction of crossing bridges for cyclists. That is why the owners of the network consider it friendly both for kids and elderly. "B" stands for "belevingsvolle" - experience providing. Each route and the attractions and landscapes along the route (heritages, museums, towns etcetera) should bring some new knowledge, feeling and memories. And, finally, "C" means comfort and safe network (good quality surface and so on). Therefore a construction of a new route is considered only if those three principles are met: "Geen extra kilometers maar betere kilometers Fietsroutenetwerk" (More qualitative kilometers rather than quantity of kilometers) (Toerisme Limburg, 2015).

Users spend €29 million per year when cycling in the Fietsparadijs (Toerisme Limburg, 2013). In order to keep their satisfaction and the network on a high level 19 people are permanently working to control the quality, 260 volunteers continuously examine the routes (see section 2.4.3) and all 44 municipalities are working in cooperation with each other. Moreover, each user can at any time notify about problems on the network using the website or via phone. From 2007 to 2014 the province of Limburg and Toerisme Vlaanderen invested directly and through different programs approximately €3.5 million (€450 000 per year). For the following period, from 2014 to 2018 the Flemish government reserved for Limburg RCN an additional €1,5 million, €375 000 of which will be invested in maintenance. Money

will come through **SALK funding** (Strategisch Actieplan voor Limburg in het Kwadraat,2014).

It is defined that the province and Toerisme Limburg play **a general coordinating role**. This is done via the "route office". The service of Mobility and Route networks of the Limburg province is responsible for the first line maintenance: installation of junctions and other signs, grass and tree cutting, notifications about detours (if a route is closed), minor repairs on the road surface etcetera. The province deploys five permanent maintenance crews, two of which through the social-economical projects the Wroeter and the Biehal. Through the office of Mobility and Route networks the Limburg province also provides further support to the municipalities, especially in route and trails developments, their realization and infrastructure design. The Limburg municipalities are committed to the second line care like brushing bicycle paths, verges trimming, main repairs on the routes, picnic sites and benches maintenance. The role of Toerisme Limburg is to conduct marketing and promotion of the network: development of trails, maps, labels, signs, application and so on (Toerisme Limburg, 2013).

3.1.4 Users' profiles and preferences in the Limburg province

Information provided below is based on two surveys: The research on Flemish regions (**Het Vlaamsregio'onderzoek**) conducted by Toerisme Vlaanderen in 2011 and the Cycling survey (**Fietsonderzoek**) conducted by Toerisme Limburg in 2003-2004. Although in the first steps of writing this Master thesis it was assumed that Toerisme Limburg would conduct a new survey during the summer of 2015 unfortunately it was cancelled due to internal reasons. That is why the data from the previous survey (2003-2004) was used which was still reliable, but needed some recalculation according to the increased number of users and the annual inflation rate. Thus, the quantity of users (actual numbers) is calculated using the counters currently installed on the network. Other percentages are taken from the survey 2003-2004. In order to fulfill some information gaps the survey conducted in the neighboring province **Flemish Brabant** in 2014 was utilized. This province has a similar landscape and cycle route network .

The Flemish survey shows that among all 5 regions of the Limburg province **Maasland** was chosen as the most "cycle-interesting and comfortable" location. Next goes Haspengouw and Hasselt (with surroundings) (Visit Flanders, 2011). Significance of these criteria (cycle-interesting and comfortable) increases when we consider "45-plussers". Eight out of ten cyclists coming to Limburg are actually **older than 45** (Toerisme Vlaanderen, 2012). An interview with the Belgian tour-operator "VOS travel", selling bicycle packages to the Limburg province, proves this statement: people purchasing tours are mostly older than 55 and maximum 75 years.

The reasons why people prefer to cycle in the Limburg province are the comprehensive opportunities for recreational cycling, beautiful landscapes and nature. Mostly people are utilizing their own bicycles. "45plussers" often travel in couples and pass the night in an accommodation spending on average **€80.4 per person per night** (24 hours). They are also almost sure that they are going to return during the next three years to spend another vacation in Limburg (Toerisme Vlaanderen, 2012).

Since the long-distance trail will focus on tourists coming for several days, only data regarding "vacation" cyclists were used, i.e. people staying overnight. The survey of Toerisme Limburg indicates that three quarters of the network users are **Flemish citizens** (23% from Antwerp and 18% from East-Flanders), while one quarter is originating from the Netherlands (7% North-Holland, 6% Dutch Limburg and 6% North-Brabant). The interview with the "VOS travel" representative shows that the share of Dutch people's presence varies from year to year with an average of 30% (from 2010 to 2015). The majority (55%) is **travelling in couples**, 25% are coming with large groups (attending some events, for example) and 11% are family cyclists. Thus, on average there are **2,7 persons per trip**. The mean age of the "vacation" cyclists is 48. Presence of "45plussers" is very strong. Two quarters of the couples do not have kids, have kids who already moved out of the house or have kids older than 18. This makes it easier to go on vacation as a couple. Half of the recreational cyclists have a University degree. Moreover 4/5th is still professionally active (a lot are employees in the educational system). Regarding to the previous experience 75% already had been on a cycling vacation during the last three years and half of them in Limburg. Furthermore, 40% is planning to repeat the holiday and come back again. "45plussers" express their feelings about recreational cycling as a **"relaxed activity"** (percentages are extracted from the survey 2003-2004) (Toerisme Limburg, 2005).

Users travel on average **50 kilometers per day** and prefer to stay in one cycle region (9 out of 10 cyclists): one municipality (i.e. Maasland, Hasselt, Limburgse Kempen etc.) or one short route from the map. 46% spends from **3 to 6 hours per day** turning pedals (Flemish Brabant survey). Those criteria should be taken into account when developing a trail. In Limburg 10% of the cycling tourists rents a bicycle, while the percentage in the Flemish-Brabant province is equal to only 1%. Half of the tourists visit cities and towns (Toerisme Vlaams-Brabant, 2014).

When it comes to **overnight stays** the results show that most people stay for three nights. But large groups of cyclists from the Netherlands often stay 5 or more nights. 80% prefers to stay every night at the same place, therefore it can be assumed that they make loops and come back every evening to the same spot. The majority of accommodations chosen by users are cycle-friendly labeled, but only 40% of people are informed about this fact. There is a difference between Dutch and Belgian tourists: 55% of the Dutch prefer camping, while this is not a popular

kind of accommodation among the Belgians (10%). Both nationalities are satisfied by the quality of the lodging accommodations (55%)(Toerisme Limburg, 2005).

Talking about **a general rating** for the Limburg cycle network the survey of Toerisme Limburg shows that the users expressed the following opinion (grades with a maximum of 10)(Toerisme Limburg, 2005):

- Signalization (signs system) – 9;
- The network quality – 8;
- Quantity of cycle routes – 8,5;
- Activities on the routes – 8,5;
- Places to rest (along the routes) – 7.

When the users were asked why they chose the Limburg province 36% indicated the cycle network, 27% referred to surrounding landscapes. Seven out of ten decide in advance which routes they are going to cycle and the decision to go on that kind of holiday is taken more than one month in advance. 90% books an accommodation themselves, which shows the non significant role of the tourism agent(Toerisme Limburg, 2005).

The Flemish-Brabant research shows that 37% of the cyclists use the cycle maps and 18% employs the online route planner (web site). Two third think that the description of the routes in words is significant as well. Moreover, the majority (75%) mentioned that the information about the sightseeing along a route is very important. The users defined which **features along the routes** are considered to be essential: Horeca objects - 61% thinks that the presence of hotels, restaurants and cafes is very important for cyclists, benches (61%), public accessible toilets (63%), picnic places (67%) and sightseeing (70%). Regarding the road surface 40% gave their preferences to asphalt and 29% is in favor of concrete. When the respondents were asked for what reason they stop during the trip the most popular answer was "visit a café or a restaurant" (38%), the second most popular was "for rest benches" (15%), 12% made stops to visit a city or a village, family visit and picnic places both deserved the attention of 10% of the cyclists, sightseeing and info boards amount for 8% and 7% respectively (Toerisme Vlaams-Brabant, 2014).

Considering **the seasonality** the most active months for cycling are July and August, though the whole period from April until September seems to be highly occupied (Toerisme Vlaams-Brabant, 2014).

3.1.5 Thematic routes and packages

Up to today there are more than **50 thematic routes** in Limburg with an average of 35 kilometers each. They are devoted to different topics like vegetables, mills, Maas River, kids-friendly tours, mountain biking, cycling in the parks etc. Most of those routes are divided into **categories**, each of them includes 3 to 7 routes (lus). They are also known as thematic routes:

1. Het Snoer van Maasdorpjes (Maasland, Maas villages) – 4 routes;
2. De Wijvers (Limburgse Kempen, the ponds) – 5 routes;
3. The national Park Hoge Kempen (Limburgse Kempen)– 3 routes;
4. Proef en beleef (Limburgse Kempen: Bree municipality)– 5 routes;
5. Van bloesem tot oogst (Haspengouw, fruit gardens)– 6 routes;
6. Rijk verleden (Haspengouw, old cities) – 7 routes;
7. Bosland (Limburgse Kempen, forests) – 2 routes;
8. Voerstreek (villages) – 2 routes;
9. Mijnsites: van verleden naar heden (Limburgse Kempen, mine sites) – 3 routes.

Maps and a description of each route can be purchased through Toerisme Limburg or in a particular municipality. Purchasing the map through the internet webshop of Toerisme Limburg did not always succeed. In some particular cases the municipality's website refers to the Toerisme Limburg webshop. The situation with **the online route planner** is more convenient: it is possible to choose locations while an external program (Routeyou) connects them to each other. However, another problem appears here: unfamiliar users do not know which locations they "must see" and therefore do not know what to choose. From the planning perspective it is very complicated to define suitable routes among the variety of choices. Moreover, looking at the distances of those routes and considering that average cyclists travel 45-50 km per day it becomes clear that the options are designed for a one day trip at the maximum. When another language is chosen on the website (French, English or German) descriptions of the routes are still presented in Dutch.



FIGURE 14 Maps: thematic routes in the Limburg province
Source: Toerisme Limburg, 2014

The analysis of other sources which could provide long distance trails shows that there are not a lot of travel agencies which sell **cycle vacations to the Limburg province**. For instance, "Vos travel" offers a 4-days "one hotel-based" (in Genk) package which includes the accommodation arrangement, cycling on the network according to a defined plan and the opportunity to rent a bicycle (see Figure 15).

Tourists can visit the National Park Hoge Kempen, the mine sites in Genk, and the cities Hasselt (Herkenrode), Bilzen and Maastricht (the Netherlands) (Vos travel, 2015).

The "Zuiderhuis" agency provides a 3-days tour based on two hotels in Genk and Tongeren with included luggage transportation (see Figure 15). Cyclists are following the route through the Maasland, Haspengouw and the National Park Hoge Kempen and additionally visit Hasselt, Genk mines and Tongeren (Zuiderhuis, 2015).

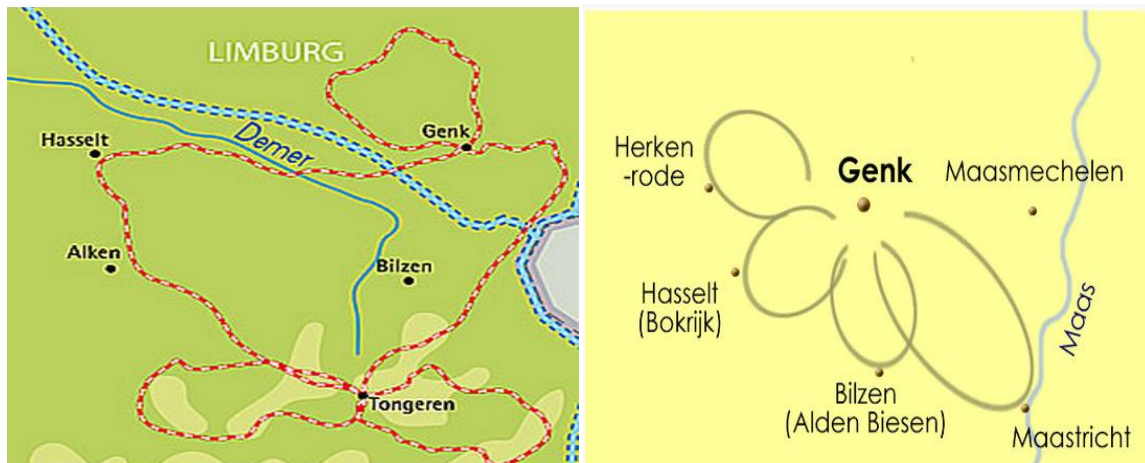


FIGURE 15 Cycling travel routes: "Limburg in style" (left) and "Vos travel: Fietsparadijs" (right)

Source: Zuiderhuis, 2015; Vos travel, 2015

There are also offers of other companies which include Fietsparadijs routes as a part of international trails, mostly between the Netherlands and Belgium, for example, the route from Eindhoven to Hasselt.

3.1.6 Marketing strategy of Toerisme Limburg regarding Fietsparadijs

Toerisme Limburg considers marketing as **an extension for the cycle network**. The niche market of Fietsparadijs focuses on the main target group which are the 45-plussers who are travelling in couples (without kids). Those people have a middle or high income and are ready to cycle an average of 45-50 kilometers per day. While currently this category is mostly represented by the citizens of the Limburg province itself, Toerisme Limburg would like to increase the flow of users from all Belgian provinces and invite more "guests" from the neighboring countries (the Netherlands, Germany, France, Luxemburg) to spend their vacation in their cycling paradise. The successful realization of this concept is based on the network's advantages (Fietsparadijs opens up unique nature, landscapes and attractions and enables a safe, comfortable and active experience of the landscape in a sustainable manner), an excellent location in the EU region and the present cycle craftsmanship. Yet additional assets are needed in order to reach these

market targets and to distinguish themselves from other networks (Toerisme Limburg, 2013).

Planned actions:

The aim is to develop innovative cycling products that enhance the leading position and make it possible to actively discover the unique landscapes of Limburg and get an experience by cycling. There is the ambition to develop a unique, distinctive and attractive cycle product. These cycle products can range from infrastructure, services, digital products to cycle events. For economic values the cycle products must be developed to suit the tourism entrepreneurs, to build up the service and reception for the cyclist, for instance, a luggage carrying service, a cycle repair service or bicycle rental online. The products should be developed in collaboration with private partners in the Limburg province.

To respond successfully to current cycling trends an extension of the niche policy is required. The main target group of the Cycling Paradise Limburg remains recreational cyclists. Developing tailored cycle products should result in offering a wide, but specific cycling experience for recreational, sport and professional cycling. During the promotion of destinations the Limburg province is being positioned as the top cycle vacation destination in Europe. Limburg has all requisites for cycle vacations both inside the province and using cross-border routes (Toerisme Limburg, 2013).

Expected results 2014-2018:

- The Limburg province as top of mind cycle vacation destination in Europe;
- Increase the perceived value of the cycle route network;
- Development of cycle services and reception (see table 11);
- Development of cycle products tailored for niche markets and target groups;
- Development of cycle products in favor of cycle tourism;
- Collaboration with Limburg private and public partners;
- To extend the image of Fietsparadijs through local initiatives like cycling events and cycle shows.

Toerisme Limburg also suggests to take into account and to develop **Customer Relationship Management**. Currently more and more people use smartphones to prepare their trips, therefore it is important to provide up-to-date information about destinations, attractions and accommodations, especially when decisions are taken last minute. A "Mobile strategy" is a must for tour agencies and other tourism actors, mobile applications with tour guides become a common fact. Social media is obviously also an additional information source for those "mobile-dependent" users. Thus Customer Relationship Management (whereby a potential tourist approaches his vacation behavior) becomes an important point for efficient communication and marketing action (Toerisme Limburg, 2013).

3.1.7 Limburg Recreational Cycle Network in relation with sustainability

In section 1.2 **the criteria of a sustainable recreational cycle network** proposed by the EuroVelo project were emphasized. We will now check whether Limburg "Fietsparadijs" answers those parameters and fits within the "frame" of sustainability.

- 1. Optimal use of environmental resources.** The Limburg RCN is based on existing infrastructure and does not require additional significant constructions (except of some minor changes). Current infrastructure is often based on historical trails along agricultural facilities, waterways, an old Roman route (in Haspengouw) or old rail roads (fruit rail road, mining rail road). Since cyclists use bicycles they produce less CO₂. Additionally, spending almost the whole day cycling they do not use a lot of energy in their lodging accommodation. In case of the Limburg province tourists mostly come by own cars and that still has an impact on the environment (Toerisme Vlaanderen, 2012). Although the Belgian rail company NMBS offers an opportunity to carry bicycles on its coaches, people prefer to take a car because distances are relatively short. A whole day entry for bike transportation within Belgium will cost €8 (only bicycle carriage), while for a single-trip €5 should be paid (NMBS, 2015). On top, the cyclists still have to pay for their own ticket and find an appropriate train station close by. Recreational cyclists are often travelling in off-peak hours or during weekends; then it makes car usage more convenient in comparison with a train due to free roads. Maybe an increase of promotion of cycle-train tickets and cycle-packages from NMBS could arouse the interest of users. For instance, by mean of collaboration with tourism agencies and cycle communities. The bicycle load and unload places should also be better equipped and be at the same priority level as regular travelers. Thus, Toerisme Limburg should work in co-operation with MNBS in order to develop more convenient options to carry bicycles on a train.
- 2. Respect for the socio-cultural authenticity of host communities.** The socio-cultural aspects of the communities where the network passes through are fully respected. Heritage, landscapes and attractions in the area are accessible for tourists. Presence of the network does not interfere with the usual way of residents' life. Moreover, people often use the cycling network themselves. Communities also play an active role in the hospitality towards tourists and in the network quality control, for example "fietspeters en fietsmeters" (see section 2.4.3).
- 3. Social economic benefits to all stakeholders.** The users spend €29 mln when cycling on the network significantly supporting the local economy, especially in the rural areas. The LRC network creates new working places and increases the welfare of the society.
- 4. Informed partnership of all stakeholders.** Information about the network and activities which are related to the network development are constantly

available for all stakeholders by means of social media, official documents accessible online (on the websites), guidebooks etc. Cycle-friendly labels for cafes and accommodations are a good example of informed partnerships that also bring benefits to the stakeholders (bullet 3).

- 5. Continuous monitoring of impacts.** The impacts are not monitored continuously, but some actions were taken in this direction. In 2006 a survey was organized which investigated the economic impact (Toerisme Limburg, 2013). There are also plans to monitor the quality of the cycle paths more actively. Therefore all cycle paths are inventoried in a digital database that will make it easier to monitor the situation on the network and to identify problems. Eventually, when the problems are more visible it will help to force the communities to invest in the cycling network. Besides that, the permanent maintenance team and even regular users daily check the quality of the network.
- 6. High levels of consumer satisfaction.** As was described in section 3.2 users of the Limburg network expressed a high level of satisfaction considering five performance characteristics (signalization, the network quality, quantity of cycle routes, activities on the routes, places to rest).

3.2. Preconditions to develop trails

In order to develop a Master Plan the conditions and features were defined which have to be taken into account during the design of long distance trails. Further we will give an explanation of two initiatives conducted by Toerisme Limburg and present the attributes of a good Master Plan which were described earlier in this Master Thesis. Those are crucial to reach the aim which was set in section 1.1.

Favorite spots

Although the Limburg RCN is located in a relatively small territory it offers a wide range of places to visit. Thus, it becomes a complicated task for people who are not familiar with the network to choose a route. In order to define the most distinguished spots Toerisme Limburg took an initiative "Favorieteplekjes" (favorite spots). Inhabitants were asked to identify the best places in their municipality by voting. There were 260 pictures of spots submitted and more than 10500 votes received. Eventually, one spot in each of the 44 municipalities was awarded with the title "Favorieteplekje" (Toerisme Limburg, 2015). Further those spots were indicated on the cycling map (Figure 16, some examples). The full list of favorite places is provided in Annex 1.



FIGURE 16 Favorite spots: Borgloon (left-up), Halen (right-up), Leopoldsburg (left-bottom), Riemst (right-bottom)
Source: Toerisme Limburg, 2015

Four leverage projects

Besides the favorite spots, four places were defined which will be developed into special attraction spots with additional experience. This will give a new impulse to the network designing new variations of cycling (see Figure 17) (Het Belang van Limburg, 2015):

- **cycling through the water** in Bokrijk (De Wijers): the idea is to dig a cycle path between two ponds, so users will have a feeling that they are riding on the water;
- **cycling between the trees** in Hechtel-Eksel (Bosland): to build a cycle path between the treetops;
- **cycling through the heath** in the National Park "Hoge Kempen";
- **cycling under the ground** (or through the caves) in Riemst: modify the marl caves to be able to cycle inside.



FIGURE 17 Simulation pictures: cycling through the water (left-up), cycling between the trees (right-up), cycling through the heather (left-bottom), cycling under the ground (right-bottom)
Source: Toerisme Limburg, 2015

Those projects are subsidized with SALK funding and expected to be realized during 2016. Cycling through the water will already be possible in April 2016.

Approaching trails' development

Aiming to develop a Master Plan we defined features which will be included and used during the trail creation. Firstly, it was determined that the **4 leverage projects** described above have to be definitely included in the long distance routes. Additionally, as many **favorite spots** as possible should be part of them as well.

Secondly, since it was discovered that recreational cyclists travel on average **45-50 kilometers per day** and spend 4 to 6 hours turning pedals, those facts have to be considered. There should be a minimum of 3 cycle-friendly cafés per day with a distance of approximately 15 kilometers between each other (see section 2.4). The trails are going to be based on multiple accommodations, therefore a minimum of **one cycle friendly-accommodation** has to be located at the end of each day route (in order to spend the night somewhere). At least one picnic place is required, placed in the middle of the day route. Regarding attractions (things to do) like heritage, museums, parks, visiting towns etc. the average appropriate amount per day would be **2-4 stops**, however it still depends on the duration of the activities and on the intensiveness of a day trip.

Thirdly, it was discussed in section 2.3.2 that cyclists would prefer to cycle 75% of their time in fully-segregated facilities. This fact should be taken into account and mostly **car-free paths** should be integrated.

Fourthly, **the target group** was chosen based on the positioning of Toerisme Limburg and the profile of a recreational cycle tourist defined in section 2.3.1. Those are people above 45 years travelling in couple, without kids and having a middle- or high-level income. Considering the nationality they are mostly Belgians (other provinces than Limburg) and Dutch, plus potential tourists from Germany and France. Respectively the description of trails has to be in three languages and; ideally, will be translated in English as well.

Currently there are diverse thematic routes on the network, making it complex for unfamiliar users to define a plan for a vacation and to make a choice between them. Therefore the trails have to be as simple as possible and limited to a maximum of **3 routes according to the duration**: four days (app. 180 km), five days (app. 200 km) and eight days (app. 370 km). An opportunity to rent a bicycle and to buy a map should be provided at the beginning of each trail and in advance. Since the trails will involve multiple accommodations, a service of luggage carriage can be introduced. It can be done through cycle reception and service points or through bicycle rentals for an additional fee.

Finally, in order to physically draw the long distance trails for this Master Thesis, **the "Routeyou" tool** was used. This online route planner helps to create your own path for cycling, hiking or motor-biking or choose one which was already posted by other users (2015b). The tool provides all junctions of the LRC network which makes it feasible to use it for the above described purposes.

3.3. Routes development

3.3.1 Trail 1 – 5 days (South Limburg)

Start of the trail should be as comfortable as possible, that is why it is better to begin a route from a cycle reception and service point (see Table 11). The one which is located in Pietersheim (Neerharenweg 12, Lanaken) and is close to the Dutch and German borders (from the east side) was chosen.

The full map of the 5-days 200 kilometers trail is presented below. The stars indicate the places where the new projects will be implemented, the houses show the location of an overnight accommodation (end and start of the day-tip) and the arrows the points where the trail can be started:



FIGURE 18 5-days trail, the route map
Source: Routeyou , 2015

By means of a **junction scheme** the sequence of junctions for each day-trip is presented. The black triangle indicates the starting point. The numbers in the squares are the numbers of junctions which users have to pass. Those junctions are the same which are used in the Toerisme Limburg general map. Between the squares the distance between the junctions (below number) and the distance from the beginning until each point (above number) is shown.

Day 1: Lanaken – Tongeren, 48.7 kilometers in total, 6 picnic places on the route, 3 cycle-friendly cafes, 4 favorite spots, 2 cycle-friendly accommodations next to the last junction (see junctions scheme Figure 19).

▲	0 km 0.0	131	0.0 1.0	54	1.0 3.6	10	4.6 0.4
10	5.0 5.4	11	10.4 0.3	11	10.7 2.5	88	13.1 1.1
557	14.2 3.2	401	17.4 0.5	402	18.0 6.7	80	24.7 3.0
540	27.8 3.9	81	31.7 0.7	89	32.3 2.1	68	34.5 3.9
108	38.4 0.0	108	38.4 4.4	109	42.8 0.5	110	43.3 2.9
107	46.2 2.6	111	48.7				

FIGURE 19 5-days trail, day 1, junctions scheme
Source: Routeyou, 2015

The route starts at Domein Pietersheim (Figure 20), one of the favorite spots. It is a recreational park with a stronghold, museum and walking paths (Domein Pietersheim, 2015).



FIGURE 20 Domein Pietersheim
Source: Domein Pietersheim, 2015

Further the route goes along the Maas River and crosses the Dutch cycle network (junction 10). Then users have to follow the Albert channel. There is an opportunity to visit Maastricht: next to junction 11 turn in the direction of the Netherlands (junction 3) and then come back to the Limburg RCN (direction junction 401). This is an optional route which can be proposed for people who are interested in visiting several countries. Next to junction 402 one of the new leverage projects is located **“Cycling through the caves”**, in Riemst. Afterwards the route leads to the Landcommanderij Alden Biesen in Bilzen (see Figure 12) and finishes in Tongeren where the Roman culture can be explored. The path is mostly traffic-free and includes four favorite places. At the end of the day cyclists can choose between two cycle-friendly hotels based in Tongeren.

Day 2: Tongeren – Sint-Truiden, 43.7 kilometers in total, 7 picnic places on the route, 4 cycle-friendly cafes, 3 favorite spots, 2 cycle-friendly accommodations next to the last junction (see junctions scheme Figure 21).

Starting point (= ▲) 107							
▲	0 km	129	2.1	130	5.7	120	9.1
	2.1		3.6		3.4		2.6
137	11.7	136	12.3	136	12.3	152	17.1
	0.6		0.0		4.8		0.5
154	17.6	154	17.7	155	20.5	155	20.5
	0.1		2.8		0.0		2.4
151	22.9	154	24.3	152	24.8	153	26.0
	1.4		0.5		1.2		3.0
148	29.0	149	29.9	171	35.3	189	42.1
	0.9		5.3		6.8		0.0
189	42.1	135	43.7		43.7		
	1.6		0.1				

FIGURE 21 5-days trail, day 2, junctions scheme
Source: Routeyou, 2015

Since tourists are coming from different locations the trail can also be started from the cycle reception point in Alden Biesen (only 8km from Tongeren). Then day two switches to day one, day three will become day two and so on.

Tourists start in Tongeren and cycle to Borgloon passing numerous fruit gardens and the fruit sirop factory. Next to Borgloon one of the favorite places is located (see Figure 16). There are 3 of them along the second day route. Furthermore, cyclists pass Castle Rullingen and can have lunch at the picnic place with a panoramic view next to Wellen. The route finishes in Sint-Truiden, the city is full of history, architectural monuments and heritage (Figure 22).



FIGURE 22 Sint-Truiden, the city center
Source: Het Belang van Limburg, 2015

Day 3: Sint-Truiden – Zonhoven, 43.4 kilometers in total, 5 picnic places on the route (one with a panoramic view), 7 cycle-friendly cafes, 3 favorite spots, 2 cycle-friendly accommodations next to the last junction (see junctions scheme Figure 23).

There is a cycle reception and service point in Sint-Truiden next to the train station (Stationsplein 65, Sint-Truiden). This starting point would be more convenient for people coming from Wallonia, for instance.

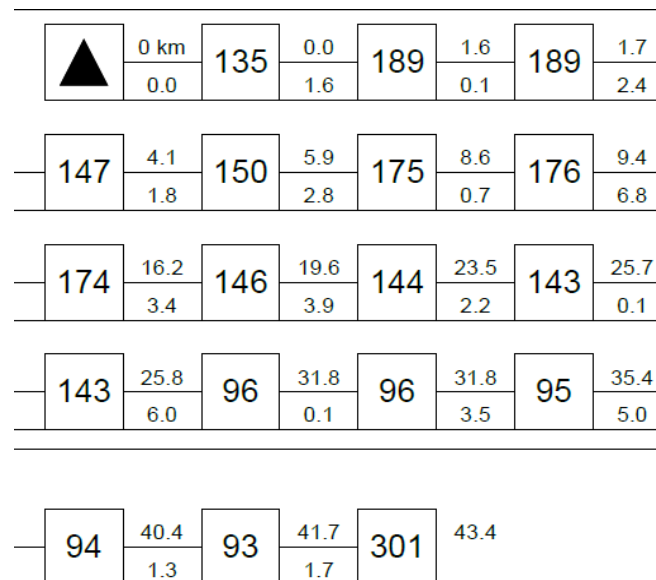


FIGURE 23 5-days trail, day 3, junctions scheme
Source: Routeyou, 2015

Potential users begin their day cycling through the Provincial Domain Nieuwenhoven: a park with a walking area and a castle (Kasteelnieuwenhoven, 2015). Then the route guides them to two favorite places, the first one is in the Wijer city and the second is next to Alken (between the junctions 144 and 143). In the afternoon cyclists arrive in Hasselt where a small city trip could be done. The following stop point is not so far from Hasselt and is called the Abbey Herkenrode. The excursion introduces eight hundred-years history of the abbey. The route finishes after crossing the Albert channel, in the municipality Zonhoven next to the ponds where two cycle-friendly accommodations are available.

Day 4: Zonhoven - As, 48.7 kilometers in total, 1 picnic place on the route, 4 cycle-friendly cafes, 3 favorite spots, 1 cycle-friendly accommodation next to the last junction (see junctions scheme Figure 24).

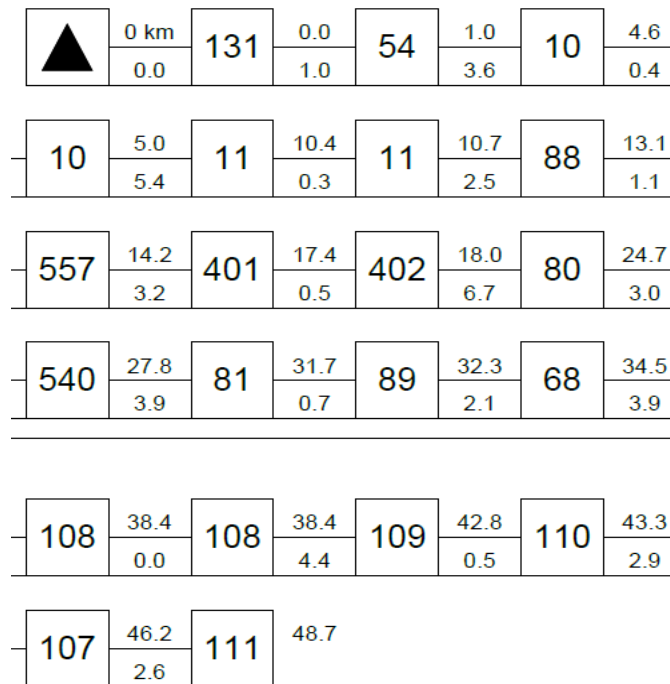


FIGURE 24 5-days trail, day 4, junction scheme
Source: Routeyou, 2015

The route passes through the ponds known as "De Wijers" area, thereafter it turns to the Zonhoven municipality and reaches Bokrijk. As it was described earlier one of the new projects "Cycling through the water" will be realized here. Moreover, an open-air museum is located in Bokrijk. Afterwards the trail passes old mine sites that can be observed including C-Mine. In As the day trip finishes. Next to that location users find the watermills and may experience the touristic train. One of the cycle-friendly hotels is placed here as well.

Day 5: As - Lanaken, 17,2 kilometers in total, 3 picnic places on the route, 3 cycle-friendly cafes, 2 favorite spots (see junctions scheme Figure 25).

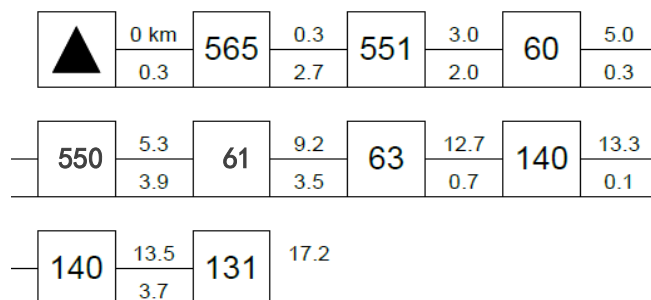


FIGURE 25 5-days trail, day 5, junctions scheme
Source: Routeyou, 2015

Starting from the As town the route enters The National Park Hoge Kempen where the leverage project "Cycling through the Heath" will be realized. The park

occupies a territory of 57.5 km² and has a wide range of opportunities both for cycling and walking. The distance for this day is shorter due to the fact that it is the last day. Besides, there is a variety of things to do in the National Park. The day trip finishes where cyclists started the trail i.e. at Domein Pietersheim.

Considering **the name for the trail** it should point out its main features, for example, "5 days through the heritage of cycle paradise". In order to present and promote the 5-days trail an attractive description of the travel offer for the potential users written.

Description: "This is a wonderful holiday for the lovers of nature and heritage. Belgium's most integrated with nature route, the 5-days Cycle paradise trip takes the traveler through an incredible variety of landscapes and a rich heritage of different historical periods: from Roman culture to coal mining in the 60s. Fruit gardens, beautiful ponds, the National Park, the Maas River, magnificent castles, relaxing domains, quiet countryside and distinctive towns: these are some of the hallmarks of our tour. Moreover, you have an extraordinary opportunity to cycle on the water, under the ground and through the heath. Try it and explore the mix of nature, culture and history on one of the most comfortable cycle networks in Europe!"

Highlights:

- Excellent cycling
- History, culture and nature
- Clean and comfortable lodging
- And all kind of services on the route that cyclists need

Plan (by day):"

Translation of this description to Dutch and German is given in Annex 2.

3.3.2 Trail 2 – 4 days (North Limburg)

The distinguishing feature of this route is its relation to nature, it follows a couple of waterways and passes through the forest. The trail begins at the cycle reception and service point "Maascentrum de Wissen" in Dilsen-Stokkem (Negenoordlaan 2). This location is easily accessible by car and like all reception points has a parking. The full map of the trail is presented below (Figure 26).



FIGURE 26 4-days trail, the route map
Source: Routeyou (constructed), 2015

Day 1: Dilsen-Stokkem – Bocholt, 46.9 kilometers in total, 6 picnic places on the route (one with panoramic view), 4 cycle-friendly cafes, 2 favorite spots, 2 cycle-friendly accommodations next to the last junction (see junctions scheme Figure 27).

▲	0 km	49	0.0	46	0.7	46	0.8
	0.0		0.7		0.1		5.4
26	6.2	24	8.1	25	11.7	22	13.6
	1.9		3.6		1.9		0.0
22	13.6	21	18.3	20	20.1	19	22.1
	4.6		1.8		2.1		1.5
18	23.7	14	30.2	15	31.7	16	32.8
	6.6		1.4		1.2		2.7
89	35.6	87	38.2	9	41.3	9	41.5
	2.6		3.1		0.2		2.7
7	44.3	211	46.9	▲	46.9		
	2.6		0.0				

FIGURE 27 4-days trail, day 1, junctions scheme
Source: Routeyou, 2015

The route follows the Maas River passing through the Maas villages with their peculiar landscapes. After visiting the favorite place in Kessenich the trail turns to the West and comes out next to the Zuid-Willemsvaart Channel. In Bocholt the

first cycling day finishes, where tourists can visit the Brewery museum and try fresh Belgian beer. In the area are plenty of eating places offering local gastronomy. Two farm-houses offer lodging accommodation bringing their guests closer to nature.

Day 2: Bocholt – Beringen, 44.6 kilometers in total, 7 picnic places on the route (one panoramic view), 7 cycle-friendly cafes, 4 favorite spots, 2 cycle-friendly accommodations next to the last junction (see junctions scheme Figure 28).

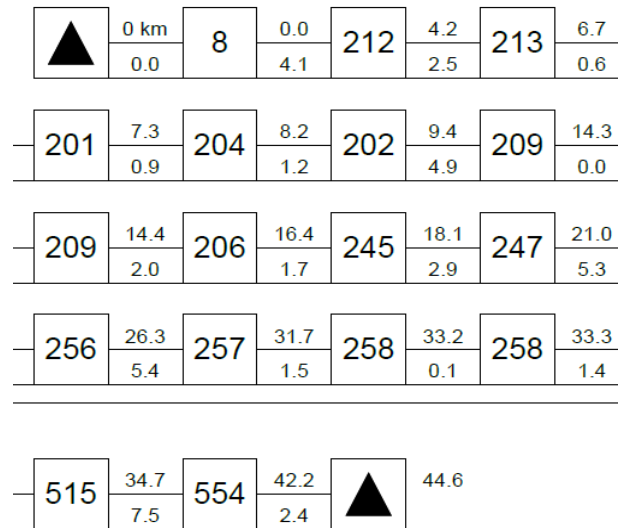


FIGURE 28 4-days trail, day 2, junctions scheme
Source: Routeyou, 2015

Users have to follow the channel Bocholt-Herentals and then turn in the direction of Bosland. This area is emphasized by numerous windmills and four favorite places (mostly related to the landscapes). As was mentioned before in Bosland the project **“Cycling between the trees”** will be realized. It could be an advantageous point to attract potential users to choose this trail. Finally, the day finishes between Leopoldsburg and Beringen. Beringen is famous for its mine site “Be-mine” and mine museum. In general the route is mostly traffic-free.

Day 3: Beringen - As, 47.9 kilometers in total, 8 picnic places on the route, 8 cycle-friendly cafes, 4 favorite spots, 1 cycle-friendly accommodation next to the last junction (see junctions scheme Figure 29).

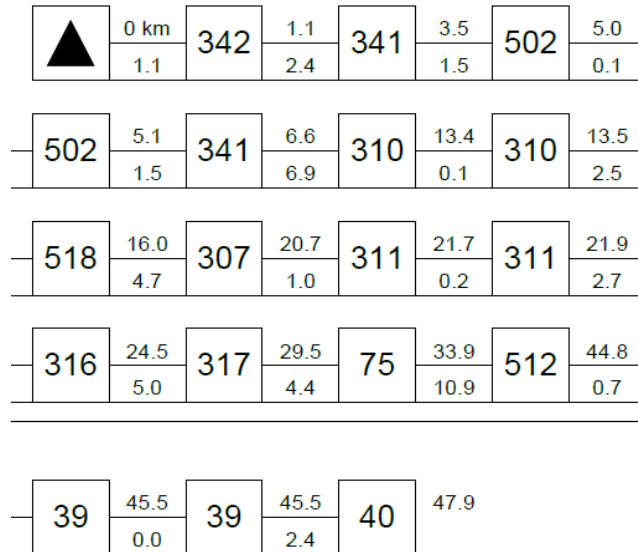


FIGURE 29 4-days trail, day 3, junctions scheme
Source: Routeyou, 2015

There is an option to start the 4-daystrail from Beringen. Reception service is located at Koolmijnlaan 23 in Beringen.

The route passes through some mine terrains: in Beringen, Heusden-Zolder, Houthalen-Helchteren, Zwartberg and Zevenhuizen. It also includes small parks, forest sites and three favorite places. Next to Houthalen it is possible to visit a sheep’s farm and to hike on the hill. On the last point (in As) the 4-days trail crosses the 5-days trail, thus they can be combined here into an even longer route consisting of 8 days (see section 3.3.3).

Day 4: As – Dilsen - Stokkem, 33.2 kilometers in total, 2 picnic places on the route (one panoramic view), 9 cycle-friendly cafes, 2 favorite spots and 7 cycle-friendly accommodations next to the last junction (see junctions scheme Figure 30).

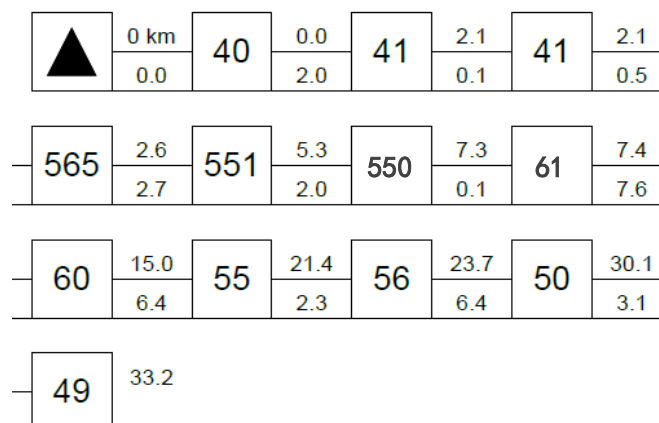


FIGURE 30 4-days trail, day 4, junctions scheme
Source: Routeyou, 2015

The day-trip starts from As where the watermill and touristic train are located, afterwards it goes through the National Park Hoge Kempen (see section 3.3.2 day 5), but unlike the first trail this one turns back to Dilsen-Stokkem through the Maas River, Maasmechelen and its mine site. After passing a small castle in the Maas village Leut the route finishes at its starting point.

Since the tour is mostly related to nature the name and description should be based on this feature:

Name: "4 days experiencing the beauty of nature in the cycle paradise".

Description: "This is a wonderful holiday for lovers of nature! Taking this bike tour you will cycle along the biggest waterways in Limburg with breath-taking panoramas of the Maas River and water-worlds of the channels, cycle in the woods and recreational parks. You will explore the history of mining and visit various castles and museums. Lodging accommodation is offered in small but outstanding farm-hotels where you can taste the unique kitchen and beers of the local community.

And last but not least you will have an extraordinary opportunity to cycle between the trees and through the heath. Try it and experience the mix of nature, gastronomy and history on one of the most comfortable cycle networks in Europe!"

Highlights:

- Excellent cycling along the waterways
- Clean and comfortable lodging
- A nature and gastronomy emphasis
- And all kind of services on the route that cyclists need

Plan (by day):"

Translation of this description to Dutch and German is given in Annex 3.

3.3.3 Trail 3 – 8 days

The 8-days trail is a combination of the first and second routes. First the trail goes through the 5-days option and then (next to the National Park Hoge Kempen) continues following the 4-days option. In total, the trail consists of 8 days because the last days of both routes are short and will be integrated into a one-day trip. The 8-days trail can be entered from 5 spots, which are Lanaken, Alden Biesen, Sint-Truiden, Beringen and Dilsen-Stokkem. Unfortunately, there is no reception service on the north side of the province, however it would be useful for the tourists coming from that direction. **The map** of the full trail is presented below (Figure 31) and the junctions scheme can be found in Annex 4.

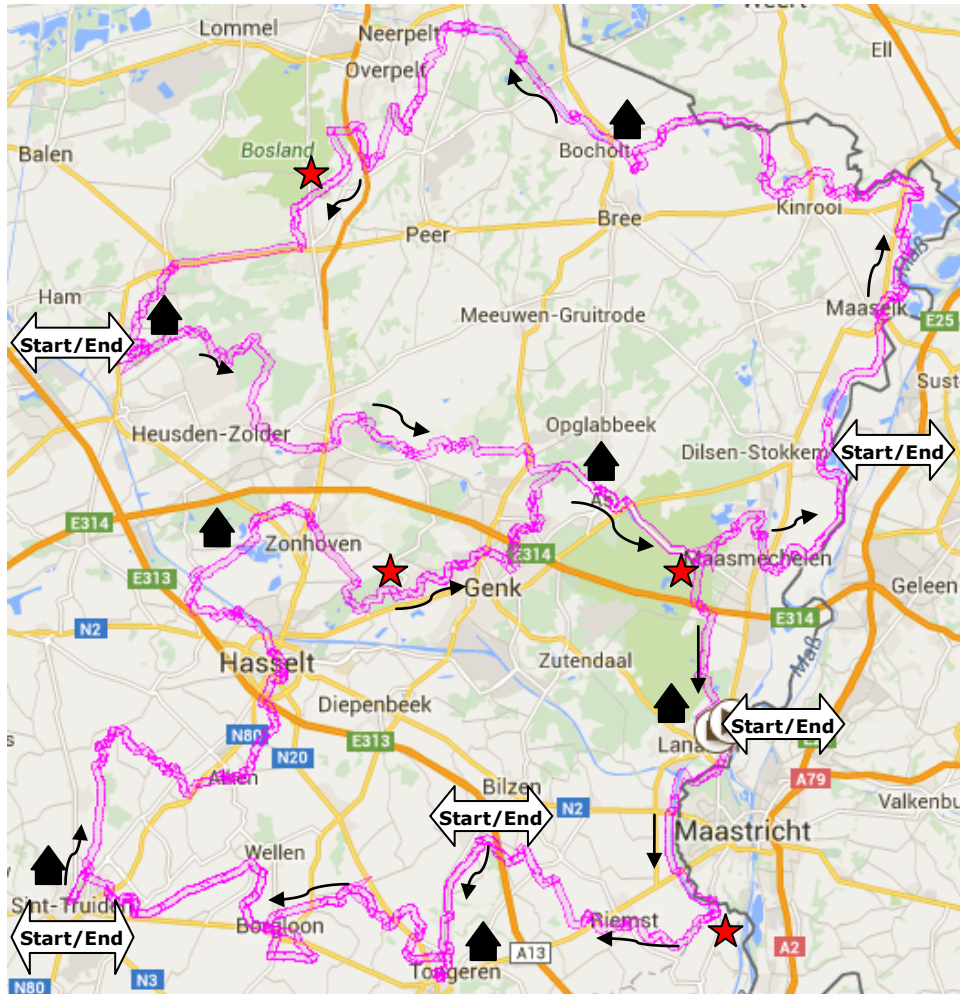


FIGURE 31 8-days trail, the route map
Source: Routeyou (constructed), 2015

4. CONCLUSIONS, DISCUSSIONS, LIMITATIONS, RECOMMENDATIONS AND FURTHER EXTENTION

In order to reach the aim and answer the main question and sub-questions of this Master thesis the theoretical background and multiple projects were studied and three trails proposed for the Limburg cycling master plan. In the first part of the study (introduction and section 1 and section 2) emphasis was on an assessment of the potential benefits and definition of criteria for developing a recreational cycle network. Those characteristics were mainly considered in scope of European tourism and cycle networks implemented within Europe. The second part (section 3) concentrated on the Limburg Recreational Cycle network investigating its features and proposing three long-distance trails. Below the answers to **the questions** which were set up in the beginning will be summarized.

1. What are the key success factors in attracting cycle tourists?

There is a combination of factors which can pull people to experience a cycling network. In this Master Thesis information regarding the European cycle networks was considered. Prior to implement a development strategy it is important to be aware who the users are. Analysis has shown that they are mainly 45-plussers, 60% of them are females and 40% males. Both genders are often owners of a university or postgraduate diploma (60%) with a middle or high income and working on professional/managers positions (63%). 66% of the recreational cyclists are married and are going on holiday in a group of two people (38%). The main reasons why they choose this kind of vacation are because of the adventure, experience, physical training, challenge and the opportunity to be with family. 55% of the cyclists are intermediately skilled and have been cycling on a regular basis for the past 2-5 years. Besides turning pedals and observing views they also consider eating in restaurants and cafes, visit parks, walking and shopping as an important part of the holiday. 55% of the tourists organize their trip independently using internet resources (53%). European cyclists prefer to spend the night in hotels, B&B, Guest Houses or at Farms (85%). An accommodation should just be simple, but the basics need to be good. The period from May to September is the most popular time for cycling in Europe. Duration of the trips lasts for 5-14 days (62%), while daily travelling accounts for 3-6 hours per day (60%).

Regarding the destination users emphasized such attributes like beautiful scenery (80%), suitable weather (68%), routes through attractive towns (47%), historical/cultural attractions (42%) and easy access (41%). In general tourism cyclists are interested in local sights and what makes a certain area different from others (Stack and O'Boyle, 2013, Faulks et al., 2007, Chen and Chen, 2013).

With regard to the route 10 main criteria were defined (percentage mentioned by the majority of the respondents): low traffic density or traffic free cycling, signposts for cyclists, route variety, route surface quality, cyclist friendly

accommodations, the opportunity of food and beverages along a route, information material, access to public transport, route density and places for resting (Trendscope, 2008).

Besides the network itself supporting services are also appreciated by cyclists. Third-party agencies which assist in the organization of a trip or provide transportation tickets for travelers with a bicycle can operate in order to help users to reach their destination. Instruments monitoring the network and its facilities (like "Bett&Bike" and "Sustrans" initiatives) are important to keep a good quality of existing objects and ensuring that cyclists are satisfied about the network.

Infrastructure, ensuring safety and comfort, is the basis of the network. Since in the Limburg province the basic network is already constructed there are no design recommendations, however, the main principles found in the literature, documents and guidelines are the following: safety, accessibility, continuity, ease of use, diverse experience, convenient, scenic experience, separate bicycle paths, pedestrian ways and usage of public lands. An important point is that the cyclists would prefer to ride 75% of the time in segregated facilities, 18% on the road with cycle lanes and 7% without any cycle facilities, therefore the trail should be developed keeping this in mind. Pathways should be covered with asphalt or other aggregate material (Fresno County Department of Public Works and Planning, 2013)..

Destinations have to be connected using paths with maximum panoramic views or sceneries. If this cannot be done then long-distance connections can be established along railroads or waterway corridors (channels, rivers, beaches).

2. What are the opportunities, barriers and challenges in developing cycle tourism on a larger scale than previously?

The main reason to consider cycle tourism is an opportunity to move towards more sustainable transportation and tourism. Network users are consumers who can bring economic benefits to the region. Even those people who bring almost all equipment and food with them sometimes have to stop and replenish for new supplies (spend money). Current estimated expenditures of tourists in Limburg are equal to ca. €29 millions which can rise due to the additional flow of tourists (Toerisme Limburg, 2015).

European cycling projects (Radnetz, Veloland and EuroVelo) demonstrate the successful experience of recreational cycling leading to environmental, economic and social advantages. The cycling demand level in Belgium is pretty high (13-20% of population), thus, a further development of recreational cycling seems to be realistic (see Table 4).

Some challenges can be listed. It is not enough to copy a good, existing network. It is important to consider the specific characteristics of a

region and the preferences of the cyclists visiting this area. There are still questions on how long a trail should be in order to meet expectations of different groups of cyclists.

3. Which criteria should be considered in cycling Master Plan development?

A number of valuable recommendations for developing a recreational cycle Master Plan were found:

- Clear and easy understandable signage should be presented (separate for cyclists), the most crucial ones are wayfinding signs;
- Cycle information points are important (information on accommodations, routes, repair points, bicycle rentals, transport options, with internet access and skilled personnel). They can be a part of any other cycle facility, for instance at a reception point or at a cycle friendly accommodation or café;
- Cycle-friendly accommodations and cycle-friendly restaurants and cafes need to be on a route. They must include an information point, bicycle repair tools, safe parking, a room to clean the bicycle and dry clothes, have suitable food for cyclists with an opportunity to take it "to go";
- Minimum three marked cycle routes should be introduced;
- Detach cycle repair points (not integrated in any other facility like an accommodation or café) along routes don't seem to be very important, but preferable;
- Bicycle rental centers with an opportunity to drop-off bicycles in different starting points are strongly recommended;
- Maps (or preferably panoramic maps) of cycle routes are crucial;
- Trained cycle guides are not often needed, but would be an advantage for some categories of people;
- Separate, free of charge, bicycle parking equipped with a rack (next to each facility which implies long stops) have to be accessible;
- Places to sit and rest are essential;
- The area where a cycle network will be developed has to be attractive for tourists (landscapes, culture, heritage, activities along the routes etc.).

The general rule is that cycle facilities should not be further than 15-20km away from each other.

A cycle friendly environment along the network and in the connected areas is a significant contributing factor. The local community should be informed and ready to help if it is required (recommendations, cyclists support etc.). Basic public facilities should be available for users (toilets, water). Public transport in the neighborhood needs to be suitable for cyclists as well. Additional car parking is demanded for those who reach the network by motorized vehicles.

Moreover, adjacent to the network roads must have signs leading to the cycle path.

Participation of all stakeholders (developers, community, municipalities, potential user's representatives, owners of cycle-friendly facilities and so on) is crucial. It guarantees that the network will be developed considering different perspectives (economic and environmental benefits) and the interests of all people will be taken into account (social benefits). Regarding to coordination there should be only one authority being responsible for the network development, quality control and improvements.

4. What are the criteria of sustainable tourism and does the Limburg network matches these criteria?

In general, recreational cycling is considered a sustainable form of tourism. Its users produce less CO₂ than regular tourists, costs of an infrastructure construction are relatively low, it can help to stimulate rural economies and it can provide users with social advantages like mental and physical health, new knowledge being together as a family, meeting likeminded people etcetera. A combination of those benefits makes the Limburg network sustainable both in short and in long terms.

The minimum set of sustainability criteria from the EuroVelo project was identified. Afterwards it was checked whether the Limburg RCN fulfills them. It includes the following parameters:

- Optimal use of environmental resources. Based on existing good quality cycle infrastructure the Limburg network does not need further construction or additional territories (no extra kilometers). Users travel to and from the network mostly by motorized transport which is not eco-efficient.
- Respect for the socio-cultural authenticity of the Limburg host communities. The Limburg RCN fully matches this criterion: the network and its users do not interfere with the local community life and presents heritage and landscapes in an appropriate way. Moreover, locals use the network themselves both for recreational and daily purposes.
- Social economic benefits to all stakeholders. The network supports local economies by creating new working places and increasing welfare of the local communities.
- Informed partnership of all stakeholders. Information about the network is constantly provided to all stakeholders.
- Continuous monitoring of impacts (social, environmental and economic including information about the users, their preferences and satisfaction level). Regarding this point not a lot of work is done, but plans to fulfill this criterion are set (Toerisme Limburg, 2015).

- High levels of consumer satisfaction. Research shows that the users are satisfied with the network in the Limburg province (Toerisme Limburg, 2005).

5. What are the preferences of Belgian residents and those in neighboring countries regarding cycle tourism in the Limburg province?

Users mainly prefer to come to Limburg because of its beautiful landscapes. Maasland was chosen as the most popular destination. People are ready to spend on average €80 per 24 hours. The majority of cyclists are older than 45, three quarters of them are Belgians and one quarter is Dutch, more than half is cycling in couples. Users want to travel about 50 kilometers per day turning pedals 3-6 hours. The majority use their own bicycle and half of them prefer to visit cities and towns during a trip. When going on a cycle holiday most users prefer to spend 3-5 nights on the network. Dutch people mostly choose a campsite and Belgians a hotel or B&B, but in any case it is a cycle-friendly accommodation. The satisfaction assessment shows that cyclists are pleased with the network however the rest places (benches) could be improved (Toerisme Limburg, 2005; Toerisme Vlaanderen, 2012).

People define in advance where they are going to cycle, therefore information should be provided in advance. Tourists make use of maps and an online route planner, but expect to receive a written description and information about the activities along the route as well. Presence of horeca, benches, toilets, picnic places and sightseeing are considered to be important (Toerisme Limburg, 2005; Toerisme Vlaanderen, 2012; Toerisme Vlaams-Brabant, 2014).

6. What are suggested trails for the cycle network in Limburg?

Based on the previously gathered information 3 long-distance trails with descriptions were proposed. Duration and geographical area were chosen as the main criteria. That resulted in a 4-days trail (South Limburg), a 5-days trail (North Limburg) and a 8-days trail (the whole province). The trails are set in such a way that they pass through the most attractive landscapes, heritage and sightseeing spots, they include as much as possible the favorite spots of the local people and places where the new leverage projects will be realized. There is an option to start a trip from different locations what makes the trails convenient for people coming from different directions. Facilities like cycle-friendly accommodations, cafes and restaurants, picnic and rest places are presented in each day of each trail. A short description of the routes is given both in junction numbers and in text form. Moreover, it is translated to multiple languages according to the origin country of potential users. The proposed trails do not require additional constructions except finishing the planned leverage projects (cycling on the water, between the trees, under the ground and through the heath).

Recommendations

In order **to improve cycle tourism in Limburg** some features and services have to be introduced, added or updated. There should be an opportunity to buy a map for people living in the neighboring countries. Users need to have information in advance which is now available only for the citizens of the Limburg province. More options for the potential tourists could be opened through the Fietsparadijs application, the Routeyou planner and services of the local tourism organization which could sell the map in advance.

Further, opening a cycle reception service in the north-east of the province is recommended. When following 4-days or 8-days trails there is no convenient way to start the trail from the north-east of Limburg (for people coming from Dutch Brabant or Dutch North Limburg, for example). An additional charged service like luggage carriage can be introduced, especially for potential users of 8-days trail because people coming for a longer vacation normally need more luggage which cannot be carried on a bicycle. Regarding sustainable tourism the usage of motorized transport could be decreased by convincing tourists to come by train (to Limburg). Therefore the cooperation between Toerisme Limburg and NMBS is significant in order to promote rail transport for cyclists. And lastly, an introduction of guided tours by Toerisme Limburg could be considered.

Limitations

Although long-distance trails are proposed the question is whether they can be put in practice. Firstly, such decisions have to be taken on a high authorities' level (heads of the province and municipalities, Toerisme Limburg and Toerisme Vlaanderen). Plans need to be approved by the heads of the municipalities. Those municipalities which were not included in the trails probably will feel excluded. Moreover, the local communities should be involved and agreements regarding particular aspects (for instance, which objects is better to include on a route) should be reached.

The trails were developed based on reliable facts from diverse projects and studies and on consultation of experts (Toerisme Limburg representatives, tourism agencies employee), but subjective opinion of the author has an influence on the results, for example why one destination should be included in the trail while others were not. Thirdly, the new leverage projects are not realized yet. How successful their implementation will be is not known yet. Finally, do these proposed trails match the preferences and planned activities of Toerisme Limburg, i.e. will they consider the proposal during further development?

Further research

If the recommendations from this thesis satisfy all conditions and are finally implemented, the marketing strategy for its promotion has to be conducted for each potential user's origin (country). Furthermore, other opportunities can be investigated, for instance, long-distance trails for families with kids including more

activities for kids, or trails for higher-level cyclists with longer distances or more complicated routes. Accommodations should vary regarding the type of users: more options to lodge in campsites for Dutch visitors (for short periods), specific accommodations for people looking for a trip full of experience (e.g. sleeping in a boat) and exiting lodging for cyclists searching an extreme experience (e.g. sleeping in a tree) are needed. Gradually additional "new experience" points have to be developed, like the current leverage projects which aim to attract cyclists to experience the network in a fresh manner. That will encourage people who already have used the network to return and to invite new visitors.

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6. ANNEXES

Annex 1. Favorite places on Limburg RCN

Alken

Junction: 144-143



As

Junction: 40-39



Beringen

Junction: 345-502



Bilzen

Junction: 68-85



Bocholt

Junction: 9-87



Borgloon

Junction: 154-155



Bree

Junction: 11-36



Diepenbeek

Junction: 100-142



Dilsen-Stokkem

Junction: 50-49



Gingelom

Junction: 510-511



Genk

Junction: 92-71



Halen

Junction: 355-351



Ham

Junction: 38



Hamont-Achel

Junction: 562-513



Hasselt

Junction: 94-95



Hechtel-Eksel

Junction: 515-258



Heers

Junction: 158-536



Herk-de-Stad

Junction: 313-314



Herstappe

Junction: 549-118



Heusden-Zolder

Junction: 307-518



Hoeselt

Junction: 109-119



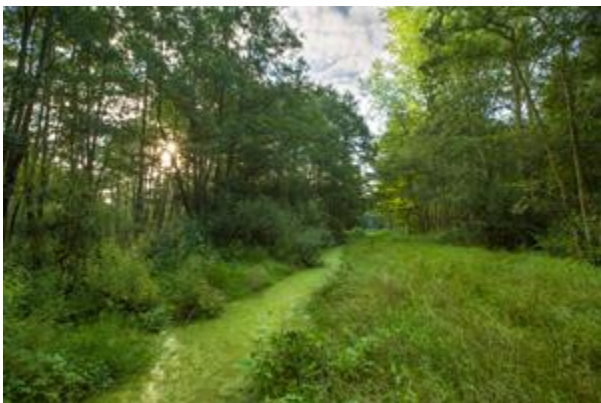
Houthalen-Helchteren

Junction: 75-74



Kinrooi

Junction: 21-22



Kortesseem

Junction: 145-138



Lanaken

Junction:131-140



Leopoldsburg

Junction:277-275



Lommel

Junction:226-227



Lummen

Junction:314-313



Maaseik

Junction:43-37



Maasmechelen

Junction:61-550



Meeuwen-Gruitrode

Junction: 33-4



Neerpelt

Junction: 204-203



Nieuwerkerken

Junction: 176-174



Opglabbeek

Junction: 70-33



Overpelt

Junction: 245-206



Peer

Junction: 5-309



Riemst

Junction: 402-80



Sint-Truiden

Junction: 171-180



Tessenderlo

Junction: 334-25



Tongeren

Junction: 112-113



Voeren

Junction: 425-426



Wellen

Junction: 149 1



Zonhoven

Junction: 79-305



Zutendaal

Junction: 64-534



Annex 2. Translation of the 5-days trail description

Dutch:

Dit is een mooie vakantie voor de liefhebbers van natuur en erfgoed. België is het meest geïntegreerd met de routes door de natuur, deze 5 daagse fiets tour neemt de reiziger mee door een ongelooflijke verscheidenheid van landschappen en een rijk aan erfgoed van verschillende historische periodes: van de Romeinse cultuur tot de oude kolen mijnen van de zestiger jaren. Fruitgaarden, adembenemende vijvers, het nationale park, rivier de Maas, betoverende kastelen, ontspannende domeinen, rustige platteland en karakteristieke stadjes: dit zijn een van de hoogtepunten van de Tour. Bovendien heeft u ook nog de mogelijkheid tot fietsen op het water, onder de grond en door de heide. Probeer het en beleef de mix van natuur, cultuur en geschiedenis op een van de meest betrouwbare fietsroute netwerk van Europa.

German:

Diesen wunderschönen Urlaub is für Liebhabers von Natur und Kulturerbe. Belgien ist als meiste integriert mit Routen durch der Natur, die 5 Tagen Fahrrad Paradies Trip nimmt der Reisende mit durch einen unglaublichen Auswahl von Landschaften und ein reiches Kulturerbe von verschiedene historische Perioden: von der Römerzeit bis zum Kohlenbergwerke in die Sechziger Jahren. Obstgärten, schönen Teichen, der Nationalpark, die Maas Fluss, bezaubernde Schlösser, entspannende nachlas, ruhige Landschaften und charakteristischen Städte: Dies sind einige der Höhepunkte unserer Tour. Außerdem haben sie außergewöhnlichen Möglichkeit um Fahrrad zu fahren auf das Wasser, unter die Erde und durch die Heide. Versuchen sie es und explore die Mischung von die Natur, Kultur und Historie auf einer der meist zuverlässigste Fahrrad Netzwerk von Europa.

Annex 3. Translation of the 4-days tail description

Dutch:

Dit is een mooie vakantie voor de liefhebbers van de natuur! Als u kiest voor deze fietstocht zult u fietsen langs de grootste rivieren van Limburg met een van de meest adembenemende panoramische uitzichten van rivier de Maas en water werelden van de kanalen, fietsen door het bos en recreatie parken. U zult de history van de mijnen ontdekken, kastelen en museums bezoeken. Pluspunt is de optie tot het verblijven in een van de boerderij hotels, de smaak van de unieke Bourgondische keuken en natuurlijke de locale bieren.

En natuurlijk niet te vergeten zult u een uitzonderlijke mogelijkheid hebben om te fietsen tussen de bomen en door de heide. Probeer het en beleef de mix van natuur, cultuur en geschiedenis op een van de meest betrouwbare fietsroute netwerk van Europa.

German:

Diesen wunderschönen Urlaub is für Liebhabers von die Natur! Wenn Sie diesen Fahrrad Tour nehmen werden sie entlang die größte Wasserwegen von Limburg fahren mit atemberaubendem Panoramen von die Maas Fluss und Wasserwelten von die Kanäle, Fahrrad fahren durch das Wald und Freizeitparks. Sie werden die History von Kohlenbergwerke explorieren und verschiedene Schlösser und Museums besuchen. Ein zusätzliches Pluspunkt ist einer Option zu übernachten in kleine hervorragende Bauernhof-Hotel und probieren Sie die einzigartige Küche und Bieren von die lokale Gemeinden. Schließlich werden sie eine außergewöhnlichen Gelegenheit haben zum Fahrrad fahren zwischen die Bäumen und durch die Heide. Probieren Sie es und erleben Sie die Mischung von Natur, Gastronomie und Historie auf ein von der meist zuverlässige Fahrrad Netzwerken in Europa.

Annex 4. Junctions scheme, the 8-days trail

Starting point (= ▲)

▲	0 km	54	0.0	131	1.0	131	1.2
	0.0		1.0		0.3		1.0

54	2.2	10	5.8	10	6.1	11	11.2
	3.6		0.3		5.2		0.2

11	11.4	88	13.9	557	15.0	401	18.2
	2.5		1.1		3.2		0.5

402	18.7	80	25.5	540	28.5	540	28.7
	6.7		3.0		0.2		3.9

81	32.7	89	33.3	68	35.4	108	39.3
	0.7		2.1		3.9		4.4

109	43.7	110	44.2	110	44.4	107	47.2
	0.5		0.1		2.9		4.2

107	51.4	129	53.5	129	53.5	130	57.2
	2.1		0.0		3.6		3.4

120	60.5	137	63.1	136	63.8	136	64.1
	2.6		0.6		0.3		4.8

152	68.9	152	69.0	154	69.5	154	69.5
	0.0		0.5		0.1		2.8

155	72.3	155	72.6	151	74.9	151	75.2
	0.2		2.4		0.2		1.4

154	76.6	152	77.1	153	78.3	148	81.3
	0.5		1.2		3.0		0.3

148	81.6	149	82.5	171	87.9	189	94.7
	0.9		5.4		6.8		1.6

135	98.3 0.0	135	98.4 1.8	189	97.9 2.4	147	100.3 1.8
150	102.1 2.8	175	104.8 0.1	175	104.9 0.7	176	105.8 0.0
176	105.7 8.8	174	112.5 0.0	174	112.5 3.4	146	115.9 3.9
144	119.8 0.3	144	120.1 2.2	143	122.3 5.9	96	128.3 0.1
96	128.4 3.8	95	132.0 0.1	95	132.1 5.0	94	137.1 1.3
93	138.4 5.2	301	143.6 1.8	300	145.2 1.1	305	146.3 4.8
92	151.0 0.1	92	151.2 0.8	91	151.9 9.7	72	161.7 0.1
72	161.8 1.3	73	163.1 2.3	509	165.4 0.5	509	165.8 8.5
508	172.3 2.7	512	175.1 0.7	39	175.7 2.4	40	178.1 0.1
40	178.3 2.0	41	180.3 0.5	41	180.8 0.5	565	181.3 2.7
551	183.9 2.0	60	188.0 6.4	55	192.4 2.3	56	194.7 8.4
50	201.0 4.8	49	205.8 0.7	46	208.5 0.1	46	208.8 5.4
26	212.0 1.9	24	213.9 3.8	25	217.5 1.9	22	219.4 0.0
22	219.5 4.8	21	224.1 0.3	21	224.4 1.8	20	228.2 2.1
19	228.3 1.5	18	229.8 8.8	14	238.4 1.4	15	237.8 1.2
16	239.0 0.4	16	239.3 2.7	89	242.1 2.8	87	244.7 3.1

9	247.8 0.2	9	248.0 2.7	7	250.7 0.3	7	251.1 2.7
211	253.8 1.9	8	255.7 4.7	203	260.4 0.1	203	260.6 0.8
212	261.3 2.5	213	263.9 0.6	201	264.4 2.8	201	267.2 0.9
204	268.1 1.2	202	269.3 4.9	209	274.2 2.0	206	276.2 0.1
206	276.4 1.7	245	278.1 2.9	247	281.0 5.3	256	286.3 5.4
257	291.7 1.5	258	293.2 1.4	515	294.5 0.0	515	294.6 7.5
554	302.1 0.1	554	302.2 3.5	342	305.6 2.4	341	308.0 1.5
502	309.5 0.7	502	310.2 1.5	341	311.7 6.9	310	318.6 2.5
518	321.1 4.7	307	325.8 1.0	311	326.8 2.7	316	329.4 5.0
317	334.4 4.4	75	338.8 10.9	512	349.7 0.7	39	350.4 2.4
40	352.8 0.5	40	353.2 2.0	41	355.3 0.5	565	355.7 2.7
551	358.4 2.0	60	360.4 3.9	61	364.3 3.4	63	367.8 0.7
140	368.4 4.5	131	372.9				

Source: Routeyou, 2015

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Richting: **Master of Transportation Sciences-Mobility Management**

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Datum: **11/01/2016**