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The Troms Line

An Economic Analysis

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Foreword

I would like to thank my supervisor, Karl Rolf Pedersen, for constructive input and suggestions in the writing process, as well as introducing a “rookie” into the world of economic analysis. I would also like to thank Jernbaneverket, for input and the sharing of their spreadsheet Märklin, which proved to be invaluable in performing the necessary calculations. I would also like to thank Statens Vegvesen for help retrieving historical data from counting stations. Lastly, I would like to thank my lovely girlfriend Maren, for keeping up with me in stressful closing stages and for her indispensable grammatical flair.

_____

Thomas Tjørve

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Abstract

The aim of this thesis is to bring the old assessments regarding the Troms Line back to life again, and examine whether it would be a good idea, from an economic point of view, to revive the project.

When examining the regional conditions, it is evident that there is one factor that has changed, and is expected to change more in the coming years. This is the mined volumes of minerals, especially in Sweden, but also in Finland. The most notable of course being iron ore. In conjunction with withdrawing ice, and the gradual opening of the Northeast Passage, the connection of the largest city in the region – Tromsø – to the rail network would, in some aspects, seem reasonable.

The thesis bases its analysis on the guide provided by the National Rail Administration and the values it provides, and derives numbers regarding the current traffic in the region from the National Public Roads Administration and published statistics by Statistics Norway.

The shortage of potential passengers in the region is acknowledged as the main cause for the project being found to be very unprofitable. There were two separate route alternatives being examined, both following the same route from Narvik to Andselv. From Andselv, one alternative is primarily based on bridge-building and crosses Malangen on its way to Tromsø. The second alternative passes through Nordkjosbotn and follows the Balsfjord on its way to Tromsø. The first alternative was found to be the most profitable, but even with very beneficial scenarios examined in the performed sensitivity analyses, there seems to be no basis to recommend such a considerable investment.

The thesis therefore concludes with a recommendation of not pursuing the project, with one exception: If the increasing demand for shipping cannot be covered by the port in Narvik, or other bottlenecks, the willingness-to-pay by foreign interest could be assumed to be quite high, as alternatives are scarce and significantly more costly. A co-funding of some kind, by private or/and public foreign interests could render an otherwise unprofitable project to become profitable.

Norsk Sammendrag

Målet med denne oppgaven er å bringe de gamle utredningene vedrørende Tromsbanen og diskusjonen om dens eksistens tilbake fra «de døde», og undersøke om de samfunnsøkonomiske betingelsene har endret seg i retning av en utbyggingsanbefaling.

Gjennom undersøkelser av de regionale forholdene, er det åpenbart at det er en faktor spesielt som har endret, og som kommer til å være i enorm utvikling under analyseperioden. Det er da snakk om volumet av mineraler som stammer fra gruvedrift i Sverige spesielt, men også i Finland. Sentralt i denne utvinningen står selvfølgelig jernmalm. I samband med forsvinnende ismasser og en gradvis åpning av den beryktede Nordøstpassasjen, kan det kanskje rettferdiggjøres at regionens største by og sentrum tilknyttes det norske, og europeiske, jernbanenettet.

Sentralt i analysen står Jernbaneverket metodehåndbok for samfunnsøkonomiske analyser i jernbaneprosjekter. Verdier fra Statens Vegvesen og statistiske publikasjoner fra Statistisk Sentralbyrå står like sentralt i utledningen av inngangsverdier til modell og modellering av trafikksituasjonen i regionen.

Den viktigste begrunnelsen for at prosjektet til slutt blir funnet å være svært ulønnsomt, er rett og slett at passasjergrunnlaget er for lite. Det var to forskjellige rutetraséer som ble undersøkt. Begge fulgte samme trasé til Andselv (fra Narvik), hvorav den ene deretter krysser Malangen og gjennom flere broer ankommer Tromsø – mens det andre alternativet passerer Nordkjosbotn og følger Balsfjorden mot Tromsø. Av disse alternativene ble det førstnevnte funnet å være mest lønnsomt. Selv med veldig gunstige hypotetiske scenarioer fra sensitivitetsanalysen, er det fortsatt ikke noe grunnlag for å anbefale en investering av en slik størrelse.

Oppgaven konkluderer derfor med en anbefaling om å ikke videreføre prosjekt – med et unntak: hvis den økende etterspørselen for utskipningskapasitet ikke kan dekkes av havnen i Narvik eller på grunn av andre flaskehalser. Betalingsvilligheten til utenlandske gruveinteressenter for å bidra til et slikt prosjekt kan da antas å være svært høy, da andre alternativer enn utskipning fra norske havner kan antas å være svært kostbare. En fordeling av kostnadene kan da forvandle et ellers ulønnsomt prosjekt til å bli lønnsomt.

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1. Introduction

1.1 Background for the Assessment

The Troms Line is a railroad project between the cities Narvik and Tromsø in Northern Norway. The line has previously been assessed individually and as a part of the Northern Norwegian Railroad.

Figure 2 : Illustration of the Troms Line

The previous assessments in 1983and 1992-94 have both concluded with recommendations of not pursuing the project. Many things have changed since then, however, and the aim of this thesis is to bring the old assessments back to life, and see if the current situation in the region constitutes a better foundation for realising the project.

The region is believed to experience increasing volumes of freight stemming from mining in Sweden, especially, and Finland. This has led to the Ofoten Line, already the most trafficked railroad stretch in Norway in terms of freight, being assessed for a double track solution as the only means for covering the increasing demand (Jernbaneverket, 2013).

Seen in conjunction with the Northeast Passage experiencing increasing traffic due to withdrawing ice, this increases the rationale of connecting the largest city in the region to the rail network.

Given these changes in strategic and technical conditions, the following research questions are defined:

- Is the Troms Line economically profitable?
- Which route alternative is most beneficial?

1.2 Structure of the Thesis

The thesis will firstly introduce the project in an historical context, thereafter outlining the current situation in the region and the prospects for the future in terms of key aspects regarding the population, transport and business prospects.

Then, the theoretical foundation of the thesis will be presented with a brief introduction of cost-benefit analyses and affiliated aspects. Following this, the various route alternatives will be examined and assessments of which that are most beneficial will be made.

Thereafter, the thesis will to a large extent follow the structure recommended by the National Railroad Administration (Jernbaneverket), with a deduction of the conditions, a traffic analysis and an assessment of the impacts the project will cause. Lastly, the results of the analysis will be presented and examined in terms of sensitivity and risk.

2. Background, Conditions and Prospects

2.1 The Troms Line in an Historical Context

2.1.1 General Overview

The question about railroads in the Northern parts of Norway has a long history. After the Nordland line to Bodø was finished in 1960, the parliament decided to suspend further construction northwards and instead focus on road development. When the country entered the oil age hopes were lit again, as many believed the income generated from the oil should be used for infrastructural projects (NSB, 1992:8).

The Northern Norwegian railroad has been subject to public assessment two times, in 1981 and 1992. The first assessment emphasized the importance the railroad would have from a regional perspective. The 8 man workgroup, called the RIBU committee, concluded that the number of new employment the project would generate, directly and indirectly, would be very moderate compared with the total need for jobs in the region. However, they noted that project could have a significant effect if it was coordinated with the development of industry and other business activity. Lastly, they concluded that the project would be of significant importance for the Armed Forces, both regarding preparedness and an eventual war (NSB, 1992:8).

The reasoning behind the new evaluation in 1992, were simply the fact that the material was outdated. The assessment made by NSB in 1992, found a cost-benefit relationship of 0.67 in the concept Fauske-Tromsø with a connection to Harstad. For the stretch Narvik-Tromsø, they found a relationship of 1.15 (NSB, 1992:7). However, the Norwegian Ministry of Transport and Communications performed an analysis of their own in 1993, which found a cost-benefit relationship of about 0.1 for the option of Narvik-Tromsø with connection to Harstad (Norwegian Ministry of Transport and Communications, 1993).

2.1.2 Die Polarbahn

In 1940, the Norwegian State Railways had finished construction of the Nordland line until Mosjøen. When German forces occupied Norway the same year, the *Reichskommisariat Norwegen* made the railroad a priority and wanted to construct a railroad all the way to Kirkenes (Ellingsve, 1995). The main motivation for the Third Reich was to secure supplies of iron ore from Sweden, a resource vital to the war efforts. This was shipped from the port in Narvik, and due to the harsh conditions on the Norwegian coast ships usually followed the route generally referred to as the *Norwegian Corridor* on sailing southwards. This predictability lead to German ships being an easy target for the British Navy which had a blockade strategy which involved mining and other disruptions of enemy supplies (Booth & Walton, 1998: 44-49).

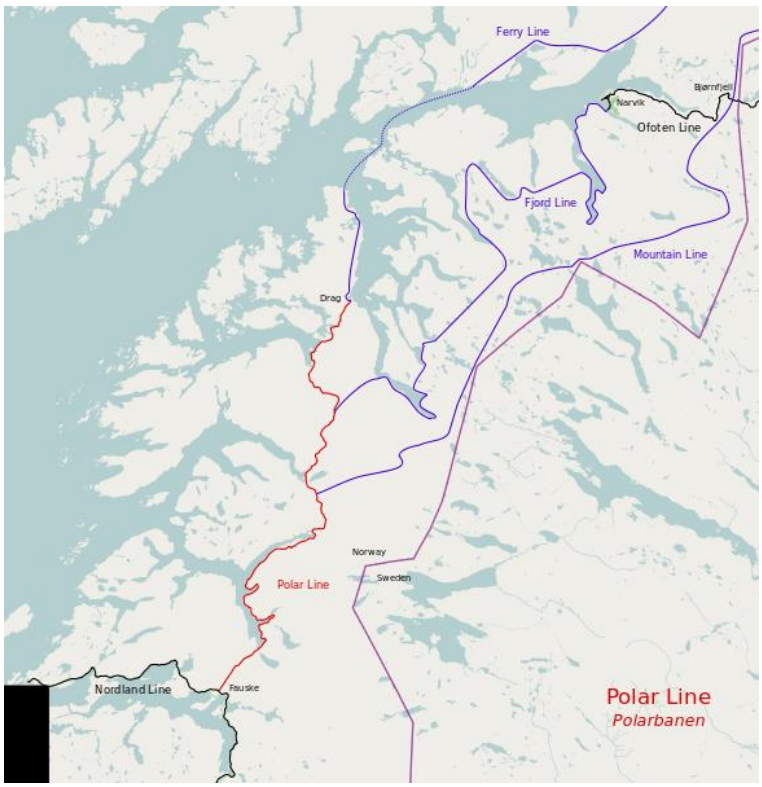

Figure 2: The Polar line (Wikimedia Commons, 2014)

The route to Fauske was built by the Norwegian State Railways, while the route northwards was headed by German authorities. A substantial workforce was put into this project, and this workforce consisted mainly of prisoners of war from the Soviet Union, Yugoslavia and Poland. The name *Polarbahn* was utilized to describe this stretch. In figure 2, the red line describes the section that was under construction, but abandoned after the liberation. While the stretch was never finished, several traces still remain from the work that was done, with prepared pathways and tunnels. Some of these tunnels are today utilized by roads.

The German desire to reach Kirkenes was also motivated by eastwards expansion and was meant to serve as a base for the invasion eastwards against the Soviet Union. A railroad supplying troops, material and equipment to the Soviet doorstep was regarded as vital, further explaining the amount of resources put into this project (Thjømøe, 2013).

2.1.3 The Troms Line

In 1877 the first regional railroad committee was formed in Tromsø. After an international railroad meeting between Finnish, Swedish and Norwegian interests there was an agreement upon combining the transport of iron ore and a local train line in Troms County (Sagland, 2014). In 1898, however, after Swedish pressure, a railroad connecting Norway and Sweden (The Ofoten line) was agreed as a compromise. Disappointed with this conclusion, the regional railroad committee in Troms was dissolved (Sagland, 2014).

Renewed interest arose some years later about connecting the Troms line the Ofoten line, and in 1913 the parliament decided to perform a site survey with an ambition of investigating the possibilities of connecting Tromsø to the Ofoten line. The conclusion was that a railroad through Troms would pass through a very favorable terrain and that constructional expenditures would be low (Nordland County railroad committee and Troms railroad committee, 1949).

The instability caused by World War 1 put the project temporarily on hold. However, in 1923, the Norwegian parliament passed a bill approving the start of the Troms line between Storsteinnes and Setermoen, which to this day has not been started (Senjens Blad, 1923).

2.2 Regional Conditions and Future Prospects

2.2.1 Impact Area

The project's area of influence is defined as the areas surrounding and between Narvik and Tromsø, as well as the Northwestern parts of Finland and Sweden. Finnmark County is exempted, since a railroad to Tromsø will still leave it unconnected to the Scandinavian rail network and the fastest way to Southern Norway and the continent will still be through Finland and Sweden.

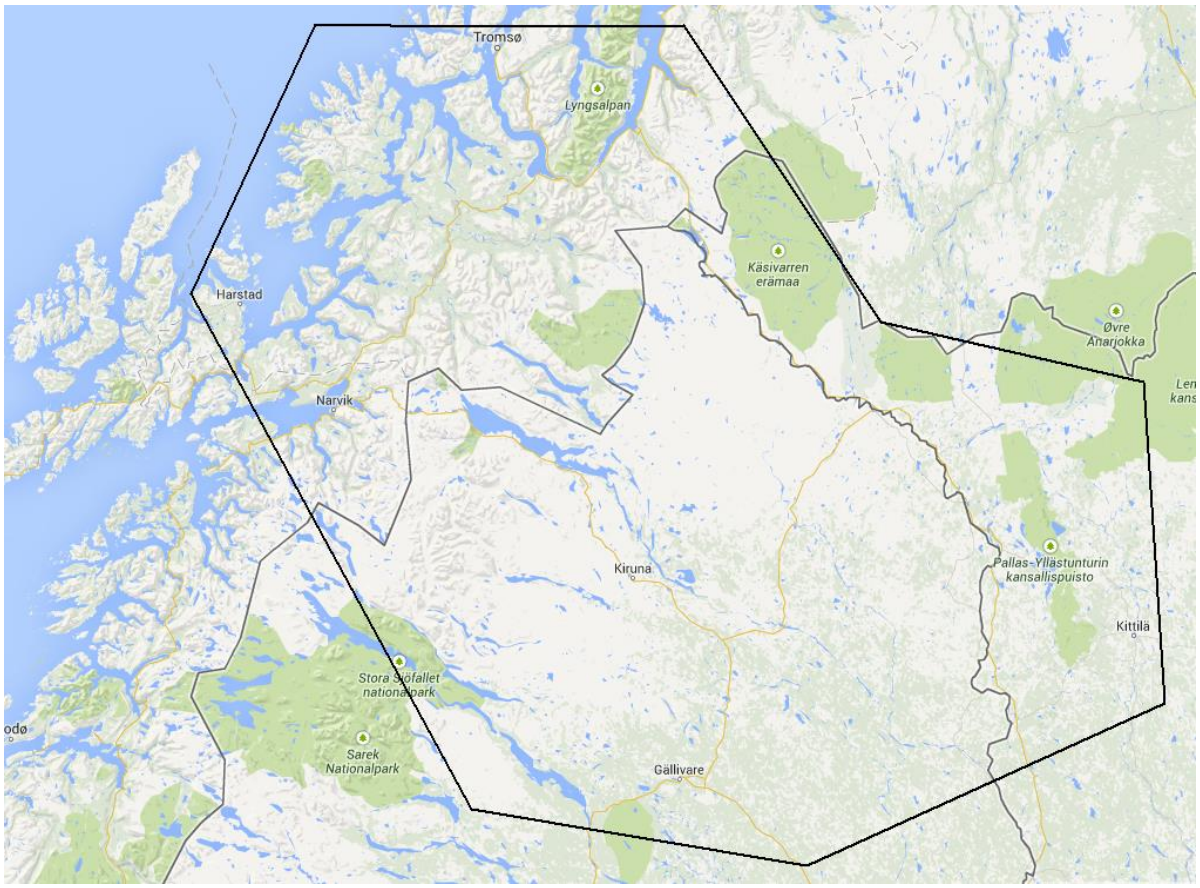

Figure 3: Approximate Representation of Impact Area

2.2.2 Population

As of January 1st 2014, the total population in the area of influence on the Norwegian side was 249,117 persons (Statistics Norway, 2014). How this population is distributed among the different municipalities in the area as of January 1st this year is shown in the figure below.

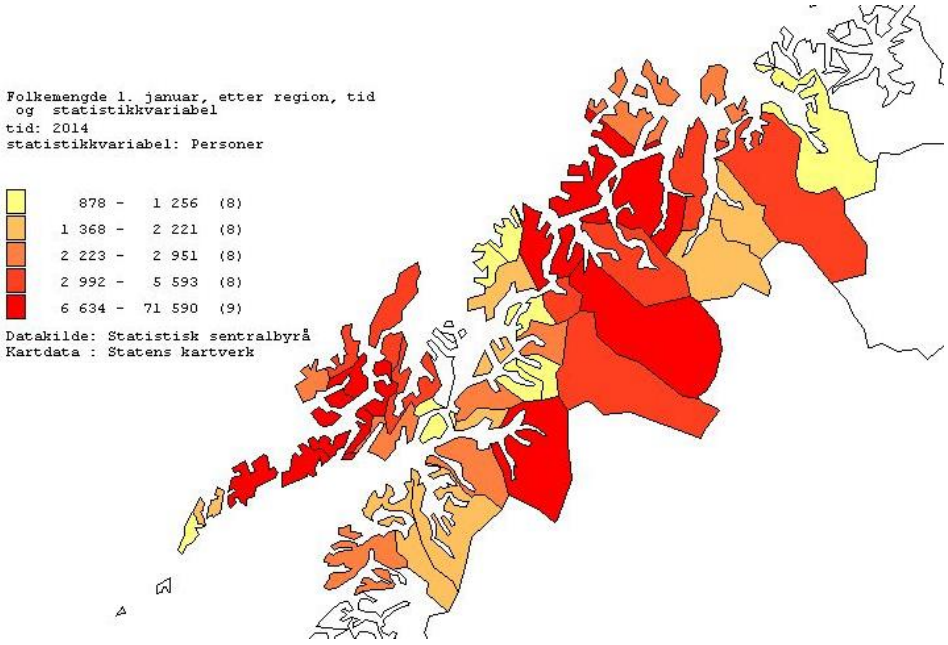

Figure 4: Population Distribution

As illustrated by the figure, many municipalities are sparsely populated. Only 9 of 41 municipalities have more than 6,634 inhabitants, and among those, the majority barely exceeds this amount. There are three cities in the area of influence on the Norwegian side: Narvik, Harstad and Tromsø. In order to estimate how the population will change during the period of analysis, the net population change in an historical context is a good place to start. The figure below shows how the net population has changed between 1951 and 2014:

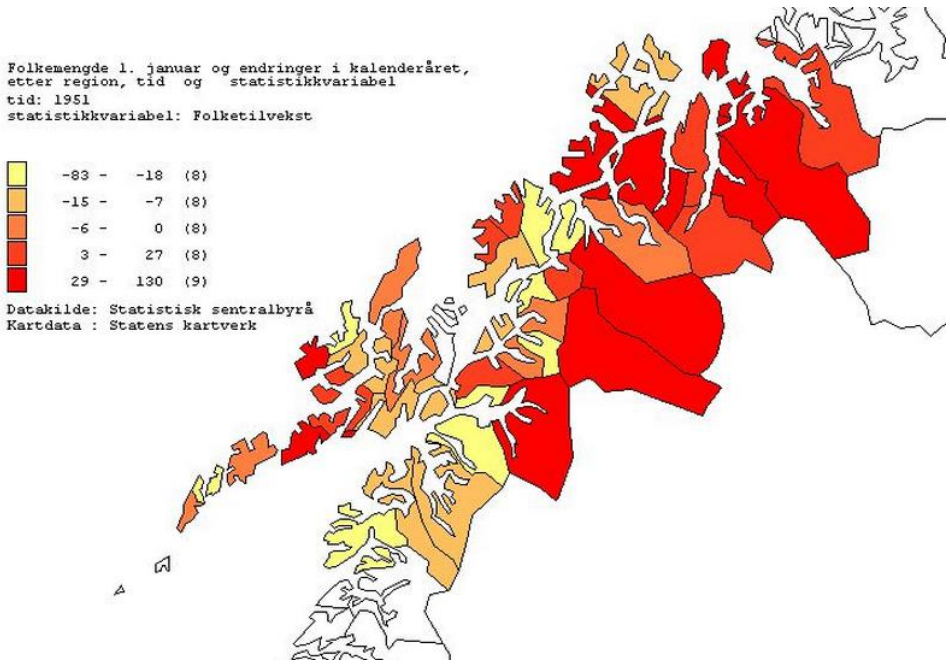

Figure 5: Net Population Change (Statistics Norway, 2014)

The figure illustrates that most municipalities in the region suffer from a decreasing population. Another conclusion is that urbanization is a trend in this region as the country as a whole, as the municipalities containing cities and towns of a certain size are those with the most positive numbers. For the area of influence as a whole, the population is slightly decreasing, with a net value of -1,966 persons since 1951.

The trend in the following 25 years is believed to be the similar. The population is assumed to remain quite stable, while the urbanization, especially around the two major cities Tromsø and Narvik, is assumed continued. Events that might change this are major investments in extraction of natural resources, which would have a positive impact on the population in the period of analysis with an influx of capital and manpower.

2.2.3 Infrastructure

Person transport in this region is dominated by road traffic, by car and bus. Due to large distances between urban centers, small-scale air traffic is also widespread. Transport of goods is dominated by sea transport, while road transport by trucks and railroad transport through the Ofoten Line accounts for the remainder.

Currently, the following travel durations car, bus and air, apply between the major cities in the area of influence (google navigation/177 Nordland/Tromskortet, 2014)

Table 1: Travelling distances between Cities in the area of influence

	Car (h:mm)	Bus(h:mm)	Air(h:mm)
Narvik – Harstad	1:41	2:10	Common airport
Narvik - Tromsø	3:29	4:15	0:35 (Evenes)

2.2.4 Commuting in the Region

Statistics Norway developed statistics in 2001 about the amount of commuters in percentage of the total workforce in the municipalities in Norway. Although dated, the trend is not believed to have weakened in recent years. The figure below illustrates the net amount of commuters as a percentage of the total workforce. As the figure below illustrates, the big municipalities – Tromsø and Narvik – have a workforce consisting of many commuters. The same could be said about Målselv municipality, but this is explained through the fact that the

army is based there with multiple camps in a junction of municipal borders (Statistics Norway, 2001).

Figure 6: Commuters as a Percentage of the Total Workforce

2.2.5 Road

The E6 corridor is of great importance for transport between Northern and Southern Norway and an efficient national corridor is a key factor for connecting Northern Norway to national and international markets. However, it has many limitations especially due to road width and tunnels and bridges of poor quality. The road has a high level of industrial freight, with some sections having a proportion of heavy vehicles of 25% (The Barents Euro-Arctic Region, 2013).

In the National Transport plan for the period 2014 – 2023, there are several road projects planned that may affect the travelling distances in the region. Figure 7 illustrates all the road projects that are envisaged in the period (Regjeringen, 2013).

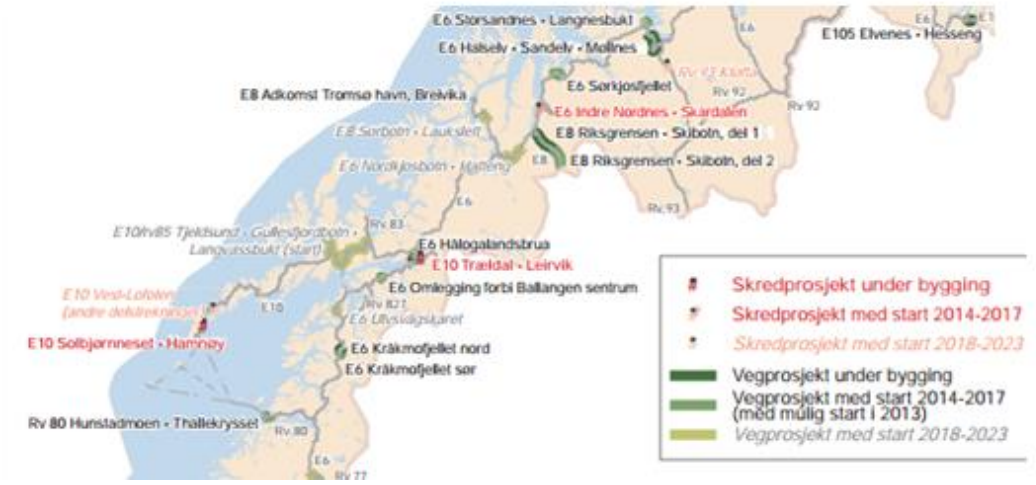

Figure 7: Planned Road Projects 2014-2023 (Regjeringen, 2013)

Between Narvik and Tromsø and Narvik and the region of Vesterålen, there is one project that will have a major effect on the travelling distance. This is the Hålogaland Bridge, which will reduce the distance from Narvik by 15 – 20 minutes. The bridge is expected to be finished and open in 2017 (Vegvesenet, 2014).

There are other minor projects planned in the period, located between Narvik and Tromsø. There will be a route change of both the E6 towards Tromsø and the E8 northwards at Nordkjosbotn, but this will mostly affect the E8. A more important project is that between Sørbotn and Laukslett, which is still in the planning phase but has the potential to affect the travelling distance and road safety between the two cities.

In the time period after 2023, it is believed that there will be a similar focus on road projects in the region, especially on the E6 corridor, thus reducing the travelling distance between the major cities in the area of influence further.

An interesting and relevant point of analysis is how the development is expected to be in the neighboring countries. In Sweden, there are some relevant projects planned in their national transport plan, and, most notably, the E10 from Kiruna towards Norway will be upgraded with a route change.

Figure 8: Planned Road Projects in Norbotten County (Trafikverket, 2011)

Another important corridor in the region is the "Northern Lights Corridor"; Haparanda/Tornio – Tromsø, illustrated by the figure below:

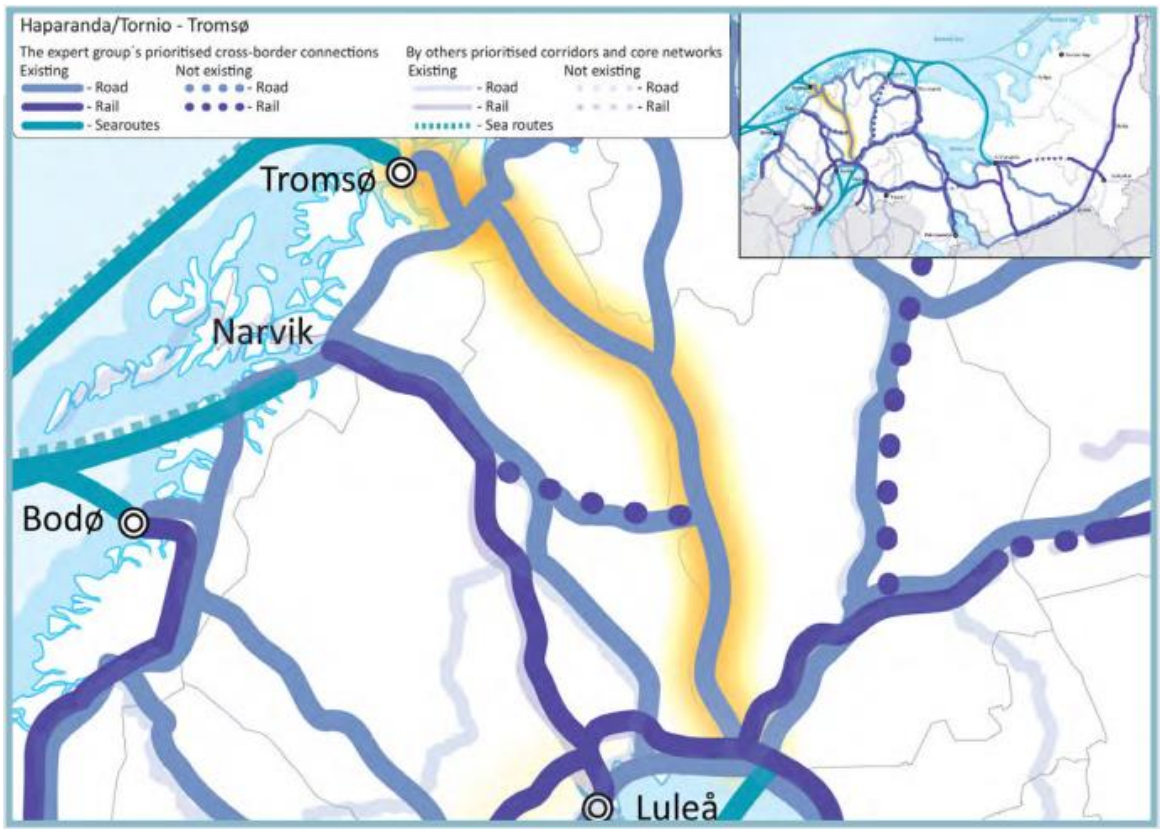

Figure 9: The Northern Lights Corridor (The Barents Euro-Arctic Region, 2013)

By road, this corridor is connecting Finland and Norway by the road E8, which crosses the Norwegian border close to Skibotn and then connects with the E6. The roads in this corridor are generally insufficiently wide and many stretches need improvements. The E8 is important both for cargo and private transport, and the lack of a railroad in the corridor gives the road an added importance. The main commodities being transported through the corridor are fish from Norway destined for Swedish and Finnish markets and from Finland timber and construction materials are transported to Norway (The Barents Euro-Arctic Region, 2013).

On the Norwegian side, the E8 has a high priority and vast investments are allocated in the national transport plan. The past five years have seen an increase of approximately 19% in the number of heavy goods vehicles crossing the border, and there are no indications that this growth will diminish in the future (The Barents Euro-Arctic Region, 2013).

Another element making this corridor interesting is that several mining projects in Finland are expected to start in the next decade. In the long-term, therefore, a new railroad might be put on the agenda, with Norwegian ports being a natural end-point for such a venture.

The diagram below shows which types of cargo and end destination of goods transported by road from Northern Norway. The typical cargo is dry bulk, and it is mostly transported to other destinations in Northern Europe (Sekretariatet for Nasjonal Transportplan, 2011).

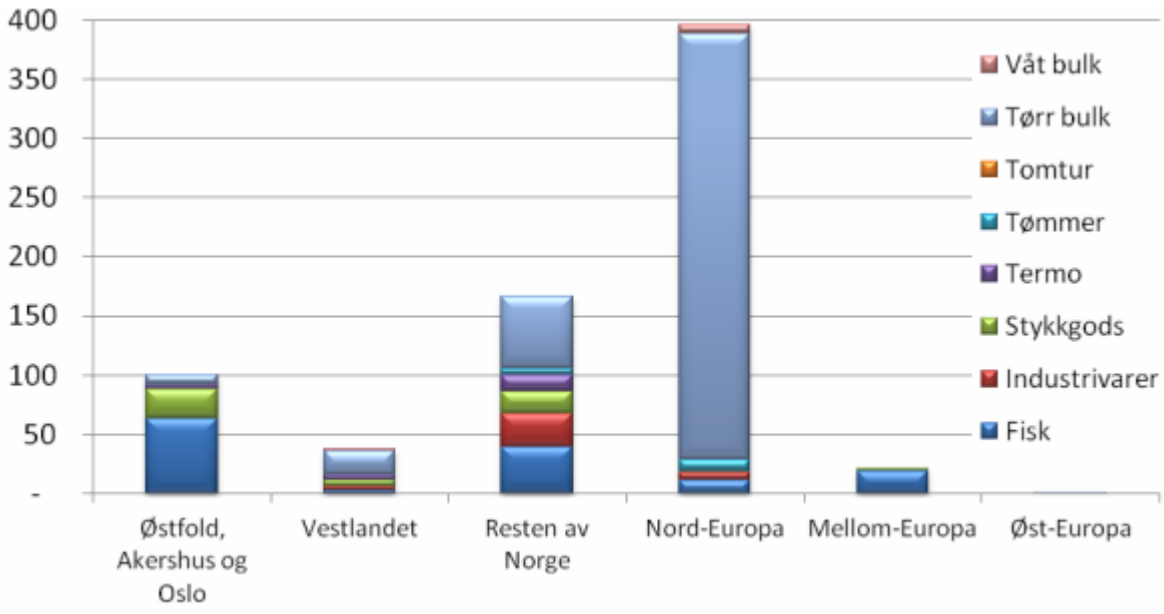

Figure 10: End Destinations of Goods Transported by Road from Northern Norway

2.2.6 Rail

Regarding railway projects, there is a planned upgrading of the Ofoten Line in the period, on both sides of the border. The reasoning behind the upgrade is mainly to increase the transport capacity, with more crossing tracks, strengthening of the electric supply and increased connectivity with Narvik harbor.

The Ofoten Line is a very heavily trafficked railway, mostly due to iron ore freight from Sweden being shipped out from Narvik harbor. It is estimated that the yearly freight of iron ore is 21.9 million metric tonnes (2012), in addition to 10 passenger trains per day (Jernbaneverket, 2013). The volume for non-ore commodities are not large compared to the ore volumes, but the railway serves as an important supply line for consumer goods, fish exports and other manufactured goods through the Swedish Rail Network (The Barents

Euro-Arctic Region, 2013). With the upgrades that are planned, it is assumed that the iron ore freight will increase to 40 tonnes yearly (Jernbaneverket, 2013).

In Northern Finland, as a consequence of increasing mining activity, there have been assessments of possible railroad solutions. One of these is a railroad between Kolari and Skibotn, using the latter as a harbor for shipping out extracted minerals (Jernbaneverket, 2011). On Norwegian side, Jernbaneverket has not found goods volumes that justify construction, but follows the development in Finland and participates in the assessment of transport and logistical solutions in the area (Jernbaneverket, 2011)

2.2.7 Sea

The Northern Maritime Corridor passes through the area of influence. The deep-water ports of this corridor, primarily Narvik and Murmansk, have a significant potential for growth and for shipment of cargo by sea from the Barents region throughout the world (The Barents Euro-Arctic Region, 2013). The ports in the region are used to export products from the metal, mining, petroleum and forest industries to the markets of Europe, America and Southeast Asia.

There is a significant market for container shipping from the countries of Southeast Asia to European market, and the ports in this region could support imports of goods both to the Barents region and other European countries (The Barents Euro-Arctic Region, 2013). This is especially relevant with the Northeast Passage becoming more and more suitable for ship traffic, opening up a huge potential towards the Asian market.

Another element favoring the development of the ports located in the corridor is the abundance of seafood in the Barents region, given the expected growth in worldwide demand for seafood (The Barents Euro-Arctic Region, 2013).

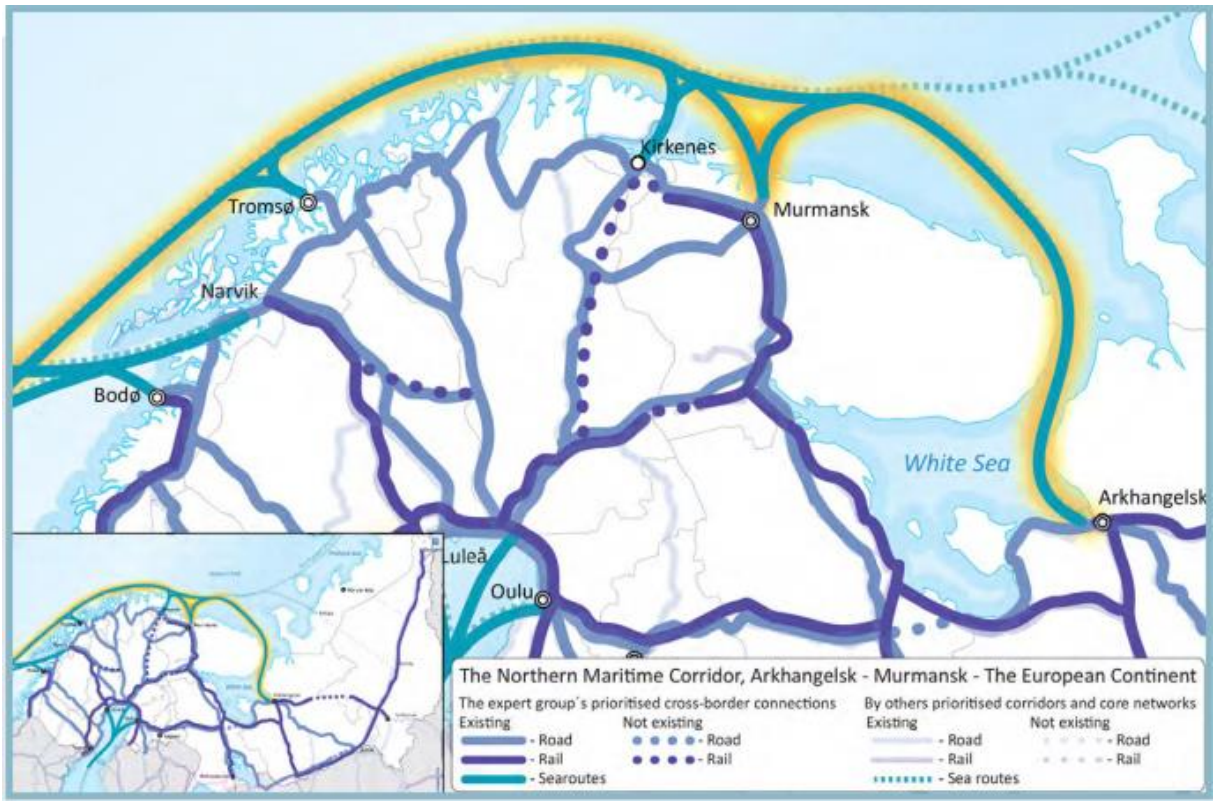

Figure 11: The Northern Maritime Corridor (The Barents Euro-Arctic Region, 2013)

The port in Narvik has an annual turnover of 19 million tonnes, making it by far the largest port in Northern Norway. The port of Tromsø is the largest cruise port in Northern Norway as well as one of Norway's largest fishing ports. It is a prioritized port by Norwegian authorities and an expansion is ongoing. (The Barents Euro-Arctic Region, 2013). The figure below illustrates the type cargo and volume of goods shipped out from Northern Norway.

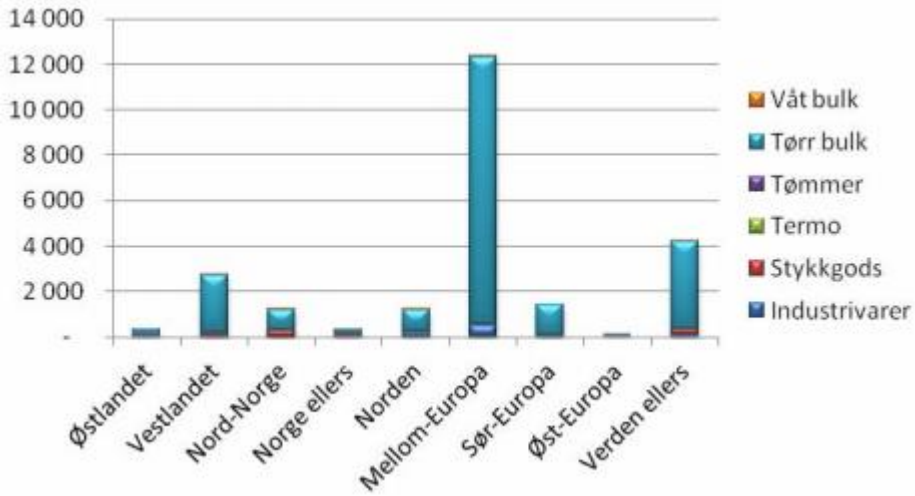

Figure 12: End Destinations and Classification of Shipped Goods

As shown, most of the cargo is dry bulk, which could be traced back to the vast amounts of minerals transported on the Ofoten Line. Furthermore, most of this is then exported out of the country and predominantly to Central Europe (Sekretariatet for Nasjonal Transportplan, 2011).

For the analysis period, the maritime traffic is expected to experience further growth in transport volume, with Narvik especially increasing in importance due to it being defined as a strategic important node in the EU TEN-T (The Barents Euro-Arctic Region, 2013).

2.2.8 Business and Industrial Status and Prospects

In the area of influence, the workforce is distributed on the following industries, in percentage:

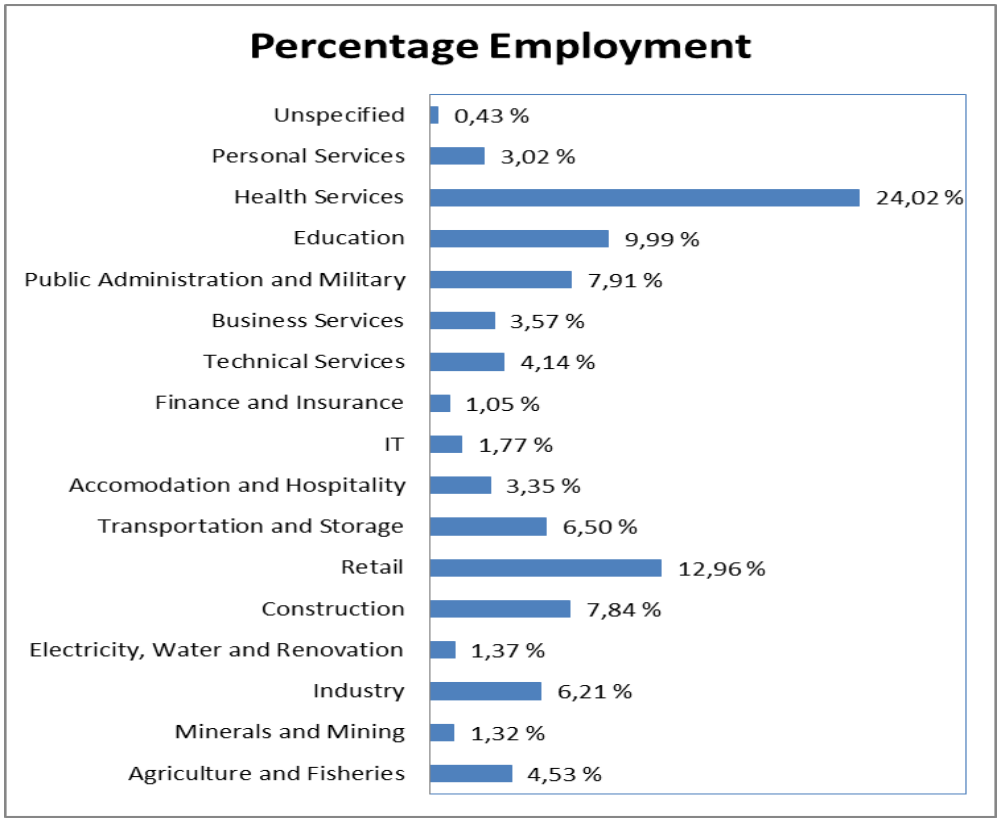

Figure 13: Distribution of Workforce (DERIVED FROM STATISTICS NORWAY, 2007)

The most dominant sectors in the region are the health and retail sectors. Although not accounting for a dominant position in terms of number of people working there, the fisheries sector is an important sector for the region as a whole. Norway is the world's second largest seafood exporter and seafood is Norway' third biggest export item (The Norwegian Seafood

Council, 2012). In volume, 38% of coastal fishing is attributed to Nordland and Troms, underlining its importance (Statistics Norway, 2014). Concerning aquaculture, numbers from 2011 show that approximately 30% of the amount produced of all species stem from Nordland and Troms (Statistics Norway, 2014).

The future prospects for business and industry in the area of influence are not believed to be subject to notable changes. However, one important factor that can change this is the introduction of the petroleum sector in the region. In a short-term perspective, it is deemed to be unlikely. However, in a longer perspective, an opening for extraction of oil and natural gas in the areas around Lofoten, Vesterålen and Senja is not unlikely. This will cause several ripple effects for other industries as well as the population patterns and distribution.

2.2.9 Unemployment

The number of persons unemployed for the area of influence is illustrated by the figure below:

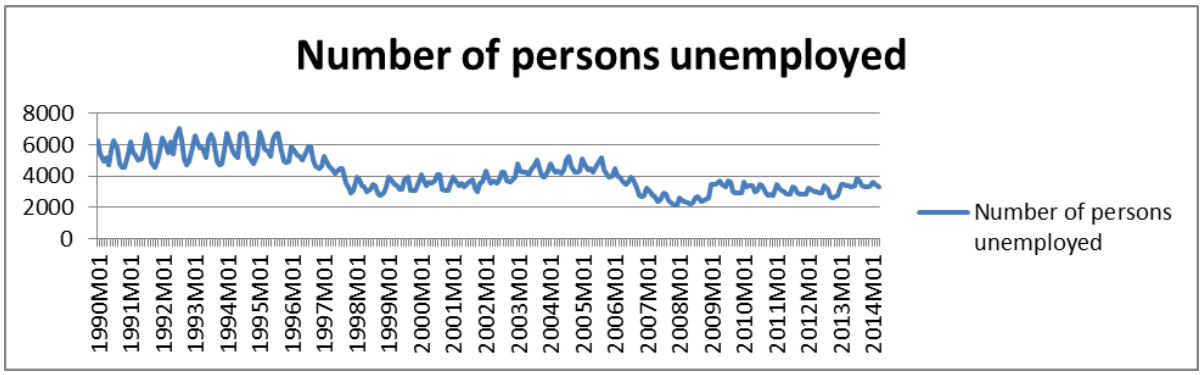

Figure 14: Unemployment Rate (Derived from Statistics Norway, 2014)

With a total population of 249,117 persons in the area of influence, the number is not regarded as high and in line with the national average. Seen in a future perspective, this situation is not believed to be subject to major changes in the time to come, although the numbers are subject to national and international economic conditions and cycles.

2.2.10 Tourism

Tourism has acquired an increasingly larger influence on the economy of the region. In 2011, tourism accounted for 7.3% of the employment in Northern Norway (TV2, 2012). The

potential is believed to be higher, and improved infrastructure is a crucial part in attracting tourists.

For the analysis period, tourism is expected to experience a small growth. The industry is very fragile to national and international economic fluctuations, and therefore is hard to estimate in such a long perspective.

2.2.11 Conclusion

For a period of 25, or 40 years, no major changes are expected. The investment in the region will mainly go to upgrading of roads, which are needed. The population and employment is expected to remain quite stable. An interesting thing that should be remarked is that several mining projects are planned in the next decade, which would increase the goods flow to Norwegian ports. The goods flow from Sweden on the Ofoten Line is also expected to grow significantly in the period of analysis.

The opening of the Northeast Passage and the region's connectivity with mainly the Asian market might prove to cause a significant increase in goods flow from Norwegian ports, which will cause ripple effects for the area of influence.

3. Theory

3.1 Economic Analysis

Economic analysis is a tool contributing to correct prioritization of public funds and to ensure the economic efficiency of projects (Jernbaneverket, 2011:12). The analysis examines the various consequences of the projects, and systemizing these consequences in order to give a thorough assessment of the economic profitability of the project. An important area of usage for economic analyses is public investment projects, such as infrastructure projects or capacity expansions in the health or education sectors (Norwegian Ministry of Finance, 2005).

The main rule when performing an economic analysis is to describe all relevant alternatives as well as possible, and then compare these with the reference alternative; the alternative in which the project is not conducted. There are three main types of economic analysis (Norwegian Ministry of Finance, 2005); cost-benefit analysis, cost-effect analysis and cost-efficiency analysis. This thesis will focus on cost-benefit analysis for examining the defined research questions.

3.2 Cost-Benefit Analyses

3.2.1 Introduction

A cost-benefit analysis is a process where the costs and benefits of a project, decision or government policy is compared. The analysis is utilized to determine if the project in question is profitable, or justifiable, and/or to compare a portfolio of projects against one another. The analysis is in the form of a systematic categorization of impacts as costs and benefits, before determining the net benefits of the proposal relative to the reference alternative (Broadman et al, 2006:2). In a cost-benefit analysis, all the effects should be valued in monetary terms as far as it is possible (Norwegian Ministry of Finance, 2005).

3.2.2 The Purpose and Use of Cost-Benefit Analyses

The broad purpose of cost-benefit analyses is to help social decision-making. More specifically, the objective is to facilitate a more efficient allocation of society's resources

(Broadman et al, 2006:3). This is done through clarifying and making the consequences of different possible alternatives visible. Altogether, this serves as a foundation for decision-making (NOU 2012:16).

A project is considered to be economically efficient if it is not possible to derive more benefits through a different allocation of society's resources. As a basis for conducting this evaluation, the Pareto criterion is often used. The term *Pareto optimality* describes a situation where it is not possible to change the resource allocation in a way where someone derives more benefits without someone being worse off. Equivalently, a *Pareto improvement* is a change that contributes to someone deriving benefits *without* someone being worse off. When an allocation is Pareto optimal, the allocation is also considered to be economically profitable (Jernbaneverket, 2011:12).

There are some limitations to the Pareto criterion, the most important one being that it prohibits any change that entails someone being worse off. It is hard to envisage projects in the transport sector which will not leave any individuals or groups worse off (Jernbaneverket, 2011:12). The Pareto criterion can be illustrated by the simplified model below. All possible solutions for individuals A and B are located within the quadrant and any move towards the frontier in any direction will involve a Pareto improvement. Additionally, any position on the frontier line means that the allocation is Pareto optimal– since no Pareto improvements can be made. This shows that even if an allocation is Pareto optimal it does not mean it is the best solution.

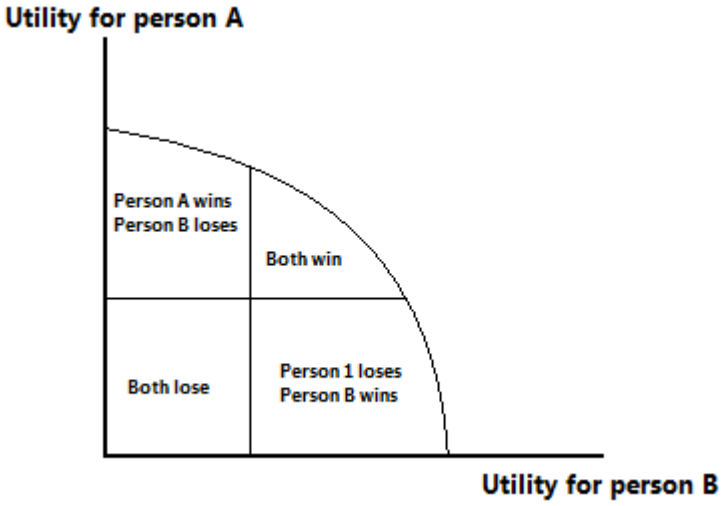

Figure 15: The Pareto Criterion

Due to the limitations of the Pareto criterion, the Caldor-Hicks criterion was created as a complement. The essence of this criterion is that a change is economically profitable if at least one individual is better off, while, at the same time, there is a hypothetical possibility to compensate the individuals that are worse off. The guiding principle derived from this criterion is therefore that a project is also economically profitable if the sum of benefits exceeds the sum of costs and negative effects (Jernbaneverket, 2011:13).

3.2.3 Achieving Comparability

The core of cost-benefit analysis is the comparison between two or more alternatives. To assess the economic profitability of a project, it needs to be compared with the situation if it is not conducted. This situation is defined as the reference alternative, or the null alternative. The reference alternative is regarded within the same period, and measures that are considered to be undertaken in the period needs to be included in the reference alternative (Jernbaneverket, 2011:19). This is also the case when assessing alternative projects, with the only exception being measures that are considered irrelevant as a consequence of the project.

The value of a benefit in a cost-benefit analysis valued based on what the individual is willing to pay for it. The same procedure is applicable for costs – what the individual is willing to pay to avoid it (Jernbaneverket, 2011:20). The cost of utilizing a resource is, as a rule, set to the value of the resource's best alternative utilization, defined as the opportunity cost.

Not all impacts of the project are quantifiable in monetary terms, but these may have an influence on the final decision, and, therefore needs to be included. Non-priced impacts are weighted based on their importance on a nine-fold scale, ranging from (++++) to (----).

3.2.4 Conversion to a Common Point in Time

A project will typically have impacts over a long period of time, with investment costs occurring early and concentrated while benefits arrive later and more distributed over a longer period (Jernbaneverket, 2011:21).

This needs to be accounted for in the analysis, and the value of an impact will vary with the time it occurs. This needs to be seen in relation with the fact that consumers prefer to drive

utility today rather than in the future and that resources that are utilized today might yield benefits when used in another fashion (Jernbaneverket, 2011:21).

The size of the discount rate therefore has a significant effect on the profitability of long-term measures. There are two different ways of regarding the discount rate. It can be interpreted as both the required return on investment, or, the minimum economic compensation per currency unit invested that is required for one to be willing to refrain consumption now in order to acquire a higher consumption later (NOU 2012:16).

The discount rate consists of two parts, the risk-free rate of return and the risk premium. The former indicates the cost for society to tie capital in risk-free investments. The latter is based on the innate risk aversion of society, and therefore projects with risk connected to them are charged with a risk premium (Jernbaneverket, 2011:39).

Economic profitability is based upon the principle of benefits exceeding costs at a given discount rate. The net present value reflects the profitability by either being positive or negative, and is based upon the following calculation:

$$\text{NPV} = \frac{-\Delta I_0 + \sum \Delta U_t}{(1+r)^t}$$

Where ΔI_0 denotes the change in investment costs, ΔU_t is the change in project profitability (sum of changes related to cost and benefits), t denotes the period (in years) and, lastly, r denotes the required rate of return (the discount rate).

Due to limitations in amount of available resources for investment in infrastructure, projects need to compete against other projects which also require public financing. Given the limited budget, the net present value per budget NOK is calculated to ensure comparability for the decision-making process, given that the project are profitable.

3.2.5 The Ramsey Condition

The Ramsey condition states that an investment is profitable if the future return, as evaluated by the present, is deemed to be more worth than the utility loss from foregoing consumption today (NOU 2012:16). A social discount rate is a measure used to help guide choices concerning social projects, in order to maximize the social welfare. It determines if a project produces enough benefits to fully compensate individuals for the forgone benefits of the

resources it displaces from alternative uses. Low discount rates are often used in environmental applications, especially when benefits accrue in the distant future (Harrison, 2010). The Ramsey condition is illustrated by the following equation:

$$\rho = \delta + \eta \cdot g$$

Where ρ is the social discount rate.

δ is the pure time preference rate, and it discounts utility. In a way, it measures impatience, since people in general prefer deriving utility today rather than tomorrow (Conceição et al, 2007). A value of zero means that the welfare of future generations is treated equally to the present generation.

η denotes the elasticity of marginal utility, also called the "elasticity of marginal well-being" (Dasgupta, 2007). In easier terms, it explains how much different people value the same proportionate increase in consumption. If this elasticity is one, it means that a specific increase in consumption is worth proportionally the same for everyone. In an inter-generational context, this means that a specific increase in consumption is worth the same today as it is in the future. If one considers future generations to be richer than the current, an increase in consumption would be less worth, and therefore the elasticity would be above one (Conceição et al, 2007).

The third, and last, factor the social discount rate is reliant upon is the growth rate in per capita consumption, g. With a low η and a positive growth rate, the (relatively) poor present generations would care less about inter-generational inequality caused by redistributing income across time from the present poor to the future rich (Conceição et al, 2007).

3.2.6 Residual Value

Residual value is introduced in cases where the period of analysis is shorter than the estimated lifetime of the project. The residual value is included as an income post in the analysis and is given by a linear depreciation associated with the investment costs:

$$\text{Residual value} = \frac{lifetime\ of\ the\ investment - period\ of\ analysis}{lifetime\ of\ the\ investment} \cdot investment\ costs$$

3.2.7 Distributional Effects

Distributional effects should be considered when there are conflicting interests concerning a measure. The positive and negative effects of the measure may affect different segments of the population in different ways and to a different degree. These are problems that need to be assessed when evaluating projects (Norwegian Ministry of Finance, 2005).

In some cases, the aim of the project may be redistribution among segments of the population. Furthermore, even though the project might have a positive influence on some, others may be affected negatively. This again raises the question if they are to be compensated and if compensation is desirable. Usually when performing these analyses, the population is divided into four segments, the users of the infrastructure (in this case passengers and rail customers), operators (i.e. NSB), public bodies, and, lastly, society in general (Norwegian Ministry of Finance, 2005).

3.2.8 Real Price Adjustment

In order to compile benefits and costs occurring both now and in future, one make assumptions on how the different calculation principles will evolve during the period of analysis. Determining how future prices will evolve relative to each other is a complicated task; therefore, a common simplification is to assume that all nominal prices grow with the same growth rate (NOU 2012:16).

The report by the expert committee appointed by the Norwegian State to review the framework for economic analyses concluded that real price adjustments should only be considered when there is a solid theoretical and empirical basis to estimate how the evolution of the valuation of a good will differ from the general price growth (NOU 2012:16). Furthermore, it was recommended that in cases with great uncertainty related to price evolution trajectories with great importance to the analysis, sensitivity analyses should be utilized.

3.2.9 Tax Cost and User Payment

Many public initiatives concerns common services that often are hard to finance in the market. In these cases the measures must be financed through taxes or user payment (NOU 2012:16). Taxes in general will lead to consumers and producers dealing with different

prices, and this will again alter the producer and consumer decisions in a way that leads to a loss in efficiency. For projects that are to be financed through a public budget, a tax financing cost should be calculated, which is the marginal cost of collecting one more currency unit through tax (NOU 2012:16). Currently the tax financing cost is 0.20 per 1 NOK.

However, the tax system is also characterised by taxes that correct externalities like environmental or health costs connected to consumption. When these are properly crafted, they do no lead to a loss in efficiency (NOU 2012:16). User payment, as opposed to taxation, will only affect the individuals that utilise the good or service in question. The economic effect of some forms of user payment could, however, in many cases have similar traits with the effects of taxation, namely when user costs are higher than the economic cost of usage. The difference between user payment and economic cost corresponds to the loss in efficiency that arises from taxation. When performing a trade-off between taxation and user payment, one therefore needs to compare the welfare loss from user payment with the welfare loss from taxation. Additionally, one needs to consider the costs of collecting user payment (NOU 2012:16).

3.2.10 Net Effects for Society in Infrastructure Projects

A cost-benefit analysis normally summarizes the effects for stakeholders directly affected by a measure, valued in monetary terms. The analysis is therefore often limited to examining the effects in the market where the project is done. The reality, however, is that some projects give ripple effects of significance in other markets as well. If these ripple effects give a contribution to the net value creation, and not just a redistribution of the total value creation, they should be examined with more diligence both in cost-benefit analyses and economic analyses (NOU 2012:16).

Specifically relevant considerations when examining this is if the project could lead to increased productivity, increased supply of employment and increased transportation possibilities (NOU 2012:16).

4. Problem, Objective and Alternatives

4.1 Needs and Purposes

The need and purpose of the project is explained first and foremost from five factors:

- Increasing goods volumes from mining in Sweden and Finland will increase the need for port capacity in Narvik, which might not be enough to satisfy the increasing demand. Connecting Tromsø Port will relieve the pressure on Narvik Port and provide an effective mean of satisfying the increasing demand.

- The opening and increased shipping volume through the Northeast Passage will increase shipping volumes to and from Asia. Northern ports connected to the European railroad network are a natural reference point and would see increased volumes in coming years.

- Commuting among workers to the cities Tromsø and Narvik is widespread, and a railroad network between these will reduce travelling time and increase employment possibilities in the region.

- Travelling distance, personal and goods transport between Narvik and Tromsø will be reduced and the means of travel will be safer and more environmental-friendly.

- Tromsø and the surrounding area will be connected to the Swedish rail network, which again is connected to Southern Norway, providing effective means of transport.

To perform a cost-benefit analysis of the project, there has to be a comparative basis, and this is done by comparing the project to an alternative where the project is not initiated – called the *reference* or *null alternative.*

4.2 The Reference Alternative

4.2.1 Overview

The reference alternative is considered as an alternative to the project and will cover the entire analysis period (SSØ, 2010). It might be difficult to convey, due to its nature of predicting future prospects without the project being initiated. In most cases, the status quo cannot be assumed, but instead there is a need to perform prognoses to predict future trends.

When developing the reference alternative, the thesis will firstly define what the impact area of the project is, and then what is expected to happen in this area in terms of population, other infrastructure projects, employment and tourism if the Troms Line is *not* constructed.

4.2.2 Definition of Reference Alternative

The main characteristics of the reference alternative are listed in the following table:

Table 2: The Reference Altnernative

Topic	Current status	Comment	Future Status
Population	The current population in the area of influence is 249,117	The population is believed to remain quite stable, with increased urbanization	250,000
Unemployment	The unemployment in the area of influence is approximately 4,000 people	The unemployment rate is also believed to remain quite stable in the reference alternative	4,000
Travelling distance Narvik – Tromsø	By car, a journey between Narvik and Tromsø takes 3h:29, by bus 4h:15 and by plane 35 minutes	Due to projects already planned, the travel duration by road is expected to be shortened by 20 minutes	Car: 3 h, 9 minutes Bus: 3 h, 55 minutes Plane: 35 minutes
Goods volume	Ofoten Line: 22 million tonnes Road: Yearly Average Traffic of lorries through Nordkjosbotn is 593 vehicles Sea: Annual turnover Tromsø: 1,439,776 tonnes Narvik: 19,415,779 tonnes	The goods volume passing through the area, especially from Sweden, is expected to grow significantly in the period	Estimated in chapter 6

4.3 Project Alternatives

4.3.1 General Overview

The alternatives considered for the stretch are largely based on the reports from 1992 and 1983. There are several different alternatives, which will be presented on the following pages. For explanatory purposes, the stretch will be split up in the following intervals: Narvik – Bjerkvik – Andselv – Tromsø. All the alternatives will not be considered, so the chapter will end with an exclusion of the least desirable alternatives and a statement of which alternatives that are to be considered in the analysis.

4.3.2 Narvik – Bjerkvik

Concerning the route Narvik – Bjerkvik, three different alternatives were presented in the 1992-report:

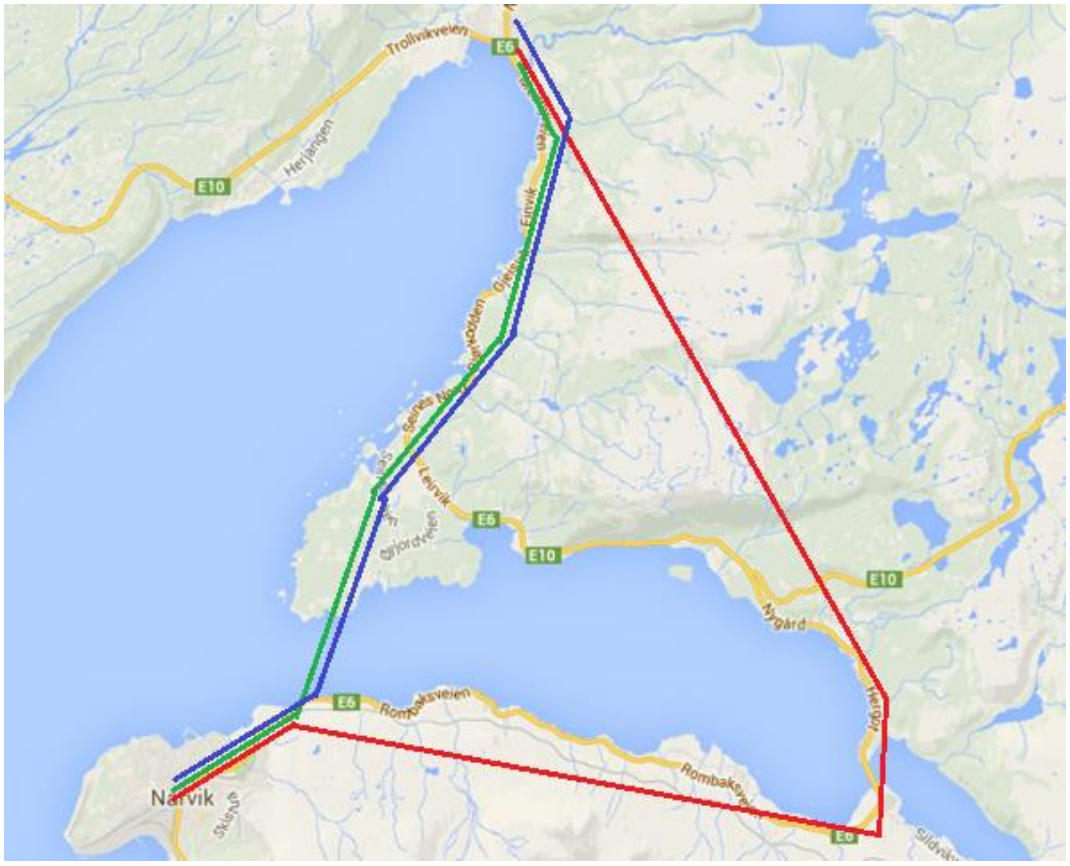

Figure 16: Narvik-Bjerkvik

Alternative 1: (RED)

An alternative from the 1983-report, it follows the current European route E6 around Rombaken and then directly to Bjerkvik.

Alternative 2: (GREEN)

This alternative crosses Rombaken over to Øyjord. This option could be coordinated with road traffic with a common bridge. This route would conflict areas of cultural heritage as well as a recreational area with many cabins.

Alternative 3: (BLUE)

This alternative crosses Rombaken, which follows approximately the same route as the previous alternative. This alternative is developed with the idea of avoiding tunnels, and has a station that is planned further north than the previous alternative.

Table 3: Summary of alternatives Narvik - Bjerkvik

	Length (km)	Tunnels (%)	Non-tunnels (%)	Large bridges	Duration (min)
Alt. 1	27	83	17	1	11
Alt. 2	13	58	42	1	8
Alt. 3	16	50	50	1	9

4.3.3 Narvik – Andselv

In order to consider other alternatives with connecting with the Ofoten Line, the stretch Narvik – Andselv will be examined separately:

Figure 17: Narvik-Andselv

Alternative 1: Narvik – Bjerkvik – Setermoen – Andselv (RED)

This alternative starts with a crossing at Øyjord on the way to Bjerkvik. Thereafter, the route follows Gratangseidet, links up with E6 and continues up Salangen Valley to Setermoen. The route then follows the Bardu River, passing west of Bardufoss Airport on its way to Andselv. The route will conflict with army training grounds, areas with reindeer grazing and agricultural areas (NSB, 1992:36).

Alternative 2: Narvik – Bjerkvik – Sjøvegan – Setermoen – Andselv (GREEN)

The second alternative was launched as an idea to connect Sjøvegan as a station. It was only submitted as an idea, and no feasibility study was performed on this alternative (NSB, 1992:36).

Alternative 3: Narvik – (Tornehamn) – Setermoen – Andselv (BLUE)

This alternative was considered very complicated from an environmental point of view. In a technical and cost perspective, however, it was considered beneficial. The route will follow

the Ofoten Line to Tornehamn, thereafter it will follow Sørdalen on its way to Setermoen (NSB, 1992:36). In 1992, the Norwegian Army was skeptical of this alternative, due to concerns regarding emergency preparedness. Additionally, constructing a line through Sørdalen will be in conflict with strong conservation interests, due to its wildlife (NSB, 1992:36).

Alternative 4: Narvik – (Bjørnefjell) – Setermoen – Andselv (PURPLE)

This is another alternative that will utilize the current Ofoten Line to Bjørnefjell. Therafter, it will pass through Stordalen before entering Salangsdalen, connecting with alternative 1 at Lund. This proposition is in serious conflict with the reindeer industry, on both sides of the border (NSB, 1992:37).

Alternative 5: Narvik – Bjerkvik – Setermoen – Andselv («RED»)

This proposition is roughly the same as alternative 1. The difference is that the attempt to avoid tunnels, which leads to this alternative having more bridges (NSB, 1992:37).

Table 4: Summary of alternatives Narvik - Andselv

	Length (km)	Tunnels (%)	Non-tunnels (%)	Large bridges	Duration (min)
Alt. 1	101	59	41	1	47
Alt. 2	95	63	37	1	48
Alt. 3	128	50	50	0	80
Alt. 4	-	44	56	0	-
Alt. 5	97	40	60	4	44

4.3.4 Andselv – Tromsø

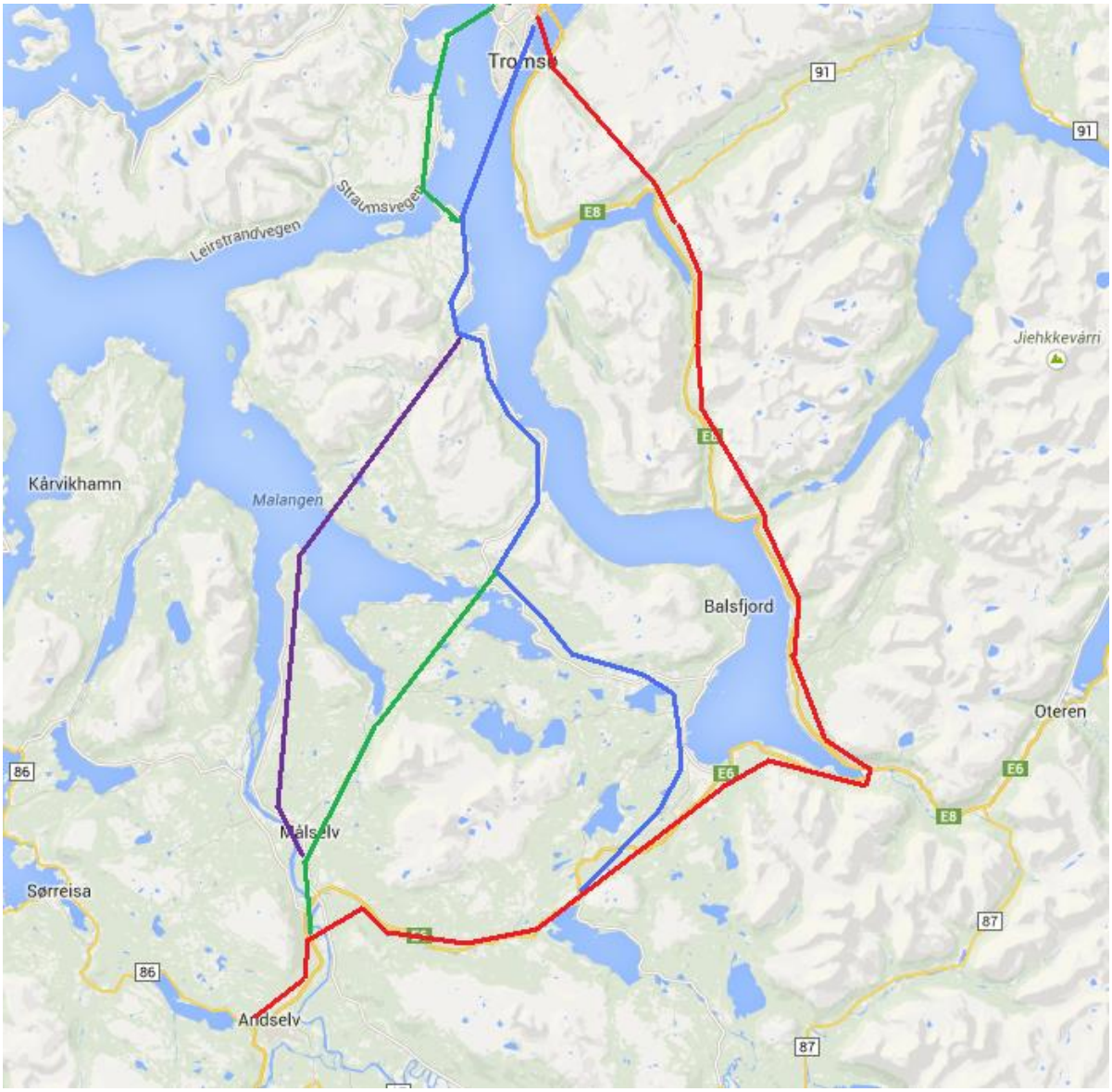

Figure 18: Andselv-Tromsø

Alternative 1: Andselv – Nordkjosbotn – Tromsø (RED)

This is an alternative originating from the 1983-report. The route will pass through a tunnel under Helgemauken, before continuing through Takelvdalen. It will pass through the North-West side of Takvatnet, before it passes through Nordkjosbotn and following the Balsfjord. It will pass through Lavangsdalen, continuing with a tunnel under Tromsdalstind before an underwater tunnel under Tromsøysund before entering Tromsø (NSB, 1992:37).

Alternative 2: Andselv – Storsteinnes – Tromsø (BLUE)

This alternative will follow the previous route until Takvatnet, before turning northwards to Storsteinnes. It will then follow the West side of Balsfjorden before crossing under Rystraumen and Sandnessundet to Troms Island (NSB, 1992: 37).

Alternative 3: Andselv – Tromsø (PURPLE)

This route will follow the west side of Målselva, before crossing the river and following the east side of the Målselv Fjord. Thereafter, it will cross Malangen by an underwater tunnel, cross the Malangen peninsula and connect with the previous alternative (NSB, 1992:37).

Alternative 4: Andselv – Tromsø (GREEN)

The final alternative is an attempt to avoid tunnels. The route will follow Målselva before heading to Aursfjordsbotn. There it will cross Nordfjorden by bridge and cross the Malangen peninsula. The route will end up west of Tromsø Airport after three notable bride-crossings. First, over Rystraumen to Kvaløya, then over to Håkøya before a final bridge over Sandnessundet (NSB, 1992:37).

Table 5: Summary of alternatives Andselv - Tromsø

	Length (km)	Tunnels (%)	Non-tunnels (%)	Large bridges+tunnels	Duration (min)
Alt. 1	114	45	55	2 + 1	44
Alt. 2	96	53	47	1 + 1	38
Alt. 3	75	75	25	1 + 2	28
Alt. 4	79	27	73	4	29

4.3.5 Summary and Assumptions

For the stretch Narvik – Bjerkvik, a central condition has changed, namely the construction of the Hålogoland Bridge over Rombaken. Two of the alternatives assumed a crossing of Rombaken, which will entail lost coordination gains of constructing these together. The consideration of the time aspect still weighs heavily, therefore alternative two is chosen as the most appropriate to further analyse.

Towards Andselv, alternative two including Sjøvegan is excluded due to a weigh-off between the time aspect and potential gains of including Sjøvegan to the rail network. Furthermore, the two alternatives including construction activity in Sweden are also

excluded due to their increased costs and environmental as well as security concerns. The natural alternative would be to follow E6, therefore alternative 2 will be further examined.

Onwards from Andselv to Tromsø, alternative 2 and 3 is firstly excluded to the vast costs of a 33 km underwater tunnel at a depth of 195 meters below sea level. The alternative through Nordkjosbotn would entail a much longer travelling time, but on the other hand would have an increased passenger basis. Additionally, a proposed future railway in Northern Finland ending in Skibotn could easily be connected with this alternative.

Therefore, two alternatives will be analysed, and these are illustrated below:

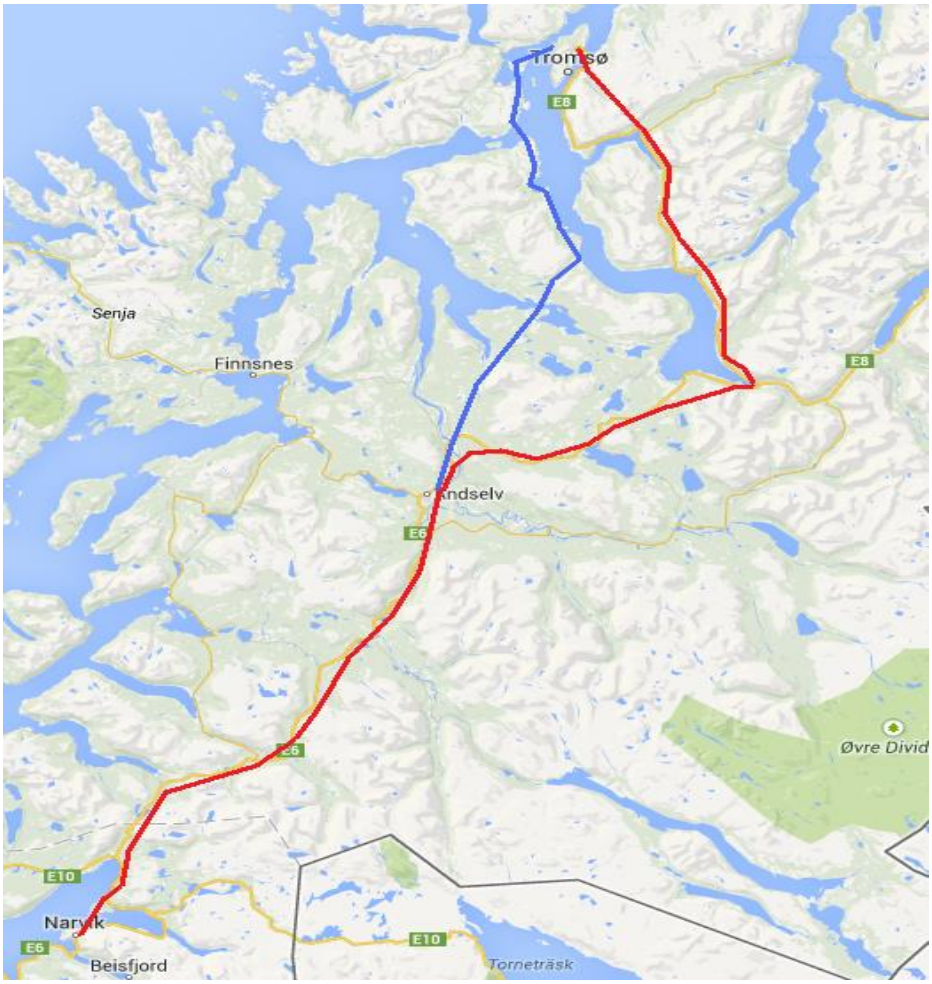

Figure 19: Recommended Alternatives

Table 6: Summary of chosen alternatives

	Length (km)	Tunnels (%)	Non-tunnels (%)	Large bridges+tunnels	Duration (min)
Alt. 1	180	45	55	5	76
Alt. 2	215	51.6	48.4	3+1	91

5. Determination of Assumptions

5.1 Discount Rate

The discount rate should represent the economic cost of tying capital in long-term investments with risk connected to it. The discount rate constitutes of two parts, the risk-free rate of return and the risk premium.

The Norwegian Ministry of Transport and Communications have recommended utilizing a rate of 4.5% when assessing projects within the transportation sector, consisting of a risk-free rate of return of 2% and a risk premium of 2.5% (Jernbaneverket, 2011:39), which will be utilized in the analysis.

As of the 30th of April this year, however, the recommended discount rate has been reduced to 4.0%, and the thesis will examine the results with both methods.

5.2 Time Horizon

Regarding the time horizon, the allocation year, project years, impact years, calculation years and total calculation period needs to be decided.

The allocation year denotes the year which one discounts the costs and benefits to. This is usually set to the first impact year. In this analysis, however, the allocation year is set to 2018 in order to give comparability with other project in the National Transportation Plan 2014-2023. The impact years will then span from the opening of the project in 2022

The project years describes the duration of the construction phase, which is set to five years, thus assuming a five year construction period in the years 2017, 2018, 2019, 2020 and 2021.

Lastly, regarding the time horizon, a dual calculation will be made. The initial conditions at the start of the process of writing the thesis was a lifetime of 25 years, but the thesis will also cater for the new regulations of 40 years and display how the results differ with these settings.

5.3 Price Estimations

The point of the cost-benefit analysis is to give a basis for assessing the use of limited resources, and a resource is best used when it cannot be put to better use elsewhere. The calculated prices in the analysis should therefore reflect the opportunity value for the society if used alternatively (Jernbaneverket, 2011:41).

When estimating the future prices, the thesis will utilize the common simplification to assume that all nominal prices grow with the same growth rate, thus no real price adjusting. This is in line with NOU 2012:16 and is done because of a lack of a solid theoretical and empirical basis to estimate how the prices will differ from the general price growth.

Prices relevant for the calculation will be updated to current values (2014) with either the wage index or the consumer price index, depending on its specifications in the guide provided by the NRA. The general price growth after 2014 is assumed to grow in line with the consumer price index.

5.4 Line and Train Standard

Due to the Ofoten Line being electrified, the Troms Line is also assumed to be electrified in the analysis.

Passenger trains on the Ofoten Line are currently operated by the state-owned Swedish rail company SJ. The Troms Line is assumed to be operated by NSB, and the train types are assumed to be of tilting train standard. A natural point of reference is the Stadler FLIRT trains recently purchased by NSB for local and regional stretches. These trains are designed for winter conditions, which is appropriate for the Troms Line (NSB, 2104). Specifically, the NSB classification Type 74 will be assumed.

The line standard should be dimensioned for speeds up to 200 km/h, in line with Jernbaneverket’s standards for new railway project (Regjeringen, 2009).

6. Traffic Estimations

6.1 Introduction and Requirements

The following chapter is made up of two parts, which are traffic estimations for people and goods respectively. In these sections, the thesis will firstly have a look on the current traffic in the area. Thereafter, assumptions will be made about three different aspects:

- How the traffic will develop in the period of analysis, seen from the current situation regarding infrastructure
- How much traffic that would be transferred over to the Troms Line if the project is conducted
- How much new traffic that will be generated by the project itself

Establishing these values is difficult, as predicting the future in such a long horizon will always entail possibilities for distortion and unforeseen events. The values that are derived are thought to reflect the actual traffic as good as possible. Eventual insecurities are perceived to be adjusted for in the risk premium of the discount rate. Sensitivity analyses regarding the amount of traffic will also be performed in chapter 11, thus displaying the effect the amount of traffic entails for the final result.

6.2 Assumptions

6.2.1 Reference Traffic on the Road Network

The Norwegian Public Roads Administration (Statens Vegvesen) has many automatic counting stations set up along the Norwegian road network. When analysing the current amount of traffic, the thesis has chosen four of these – situated at strategic locations in the area. The illustration on the following page shows the yearly average daily and the amount of which is considered heavy traffic – meaning vehicles which are longer than 5.5 meters. The values are supplied by the Norwegian Public Roads Administration and are current of the year 2013:

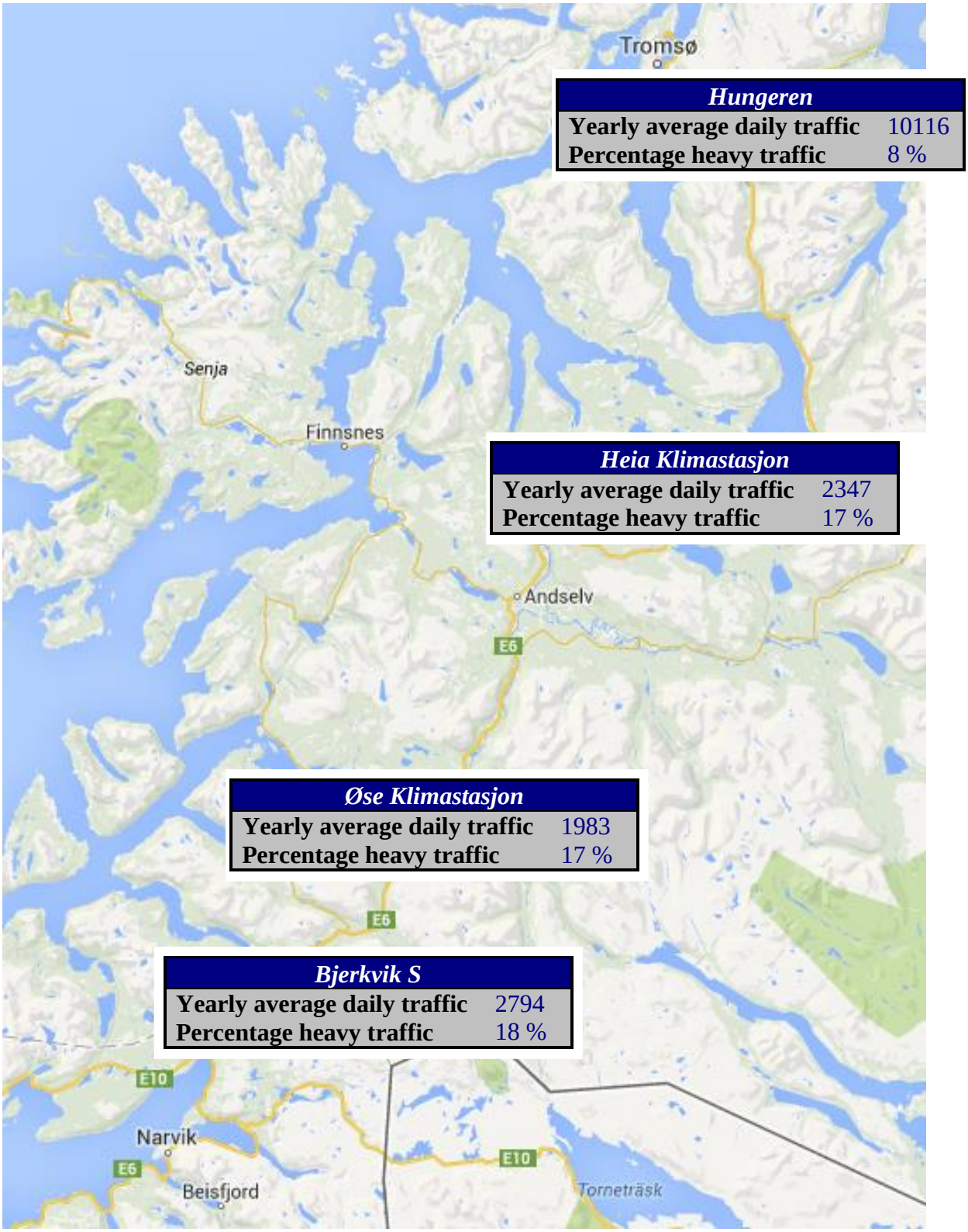

Figure 20: Results from Counting Stations

As seen from the figure, the amount of traffic at the point south of Bjerkvik is higher than at Øse Klimastasjon, which is due to a lot of traffic switching over to the E10 towards Lofoten

and Vesterålen. The traffic at Hungeren, which is situated along the E8 close to Tromsø, shows a much higher number being so close to the largest city in the region.

Another relevant aspect to analyse is the amount of cars actually present in the region. The diagram below shows the amount of registered personal vehicles in the two counties Nordland and Troms from 2003-2013 (Statistics Norway, 2014):

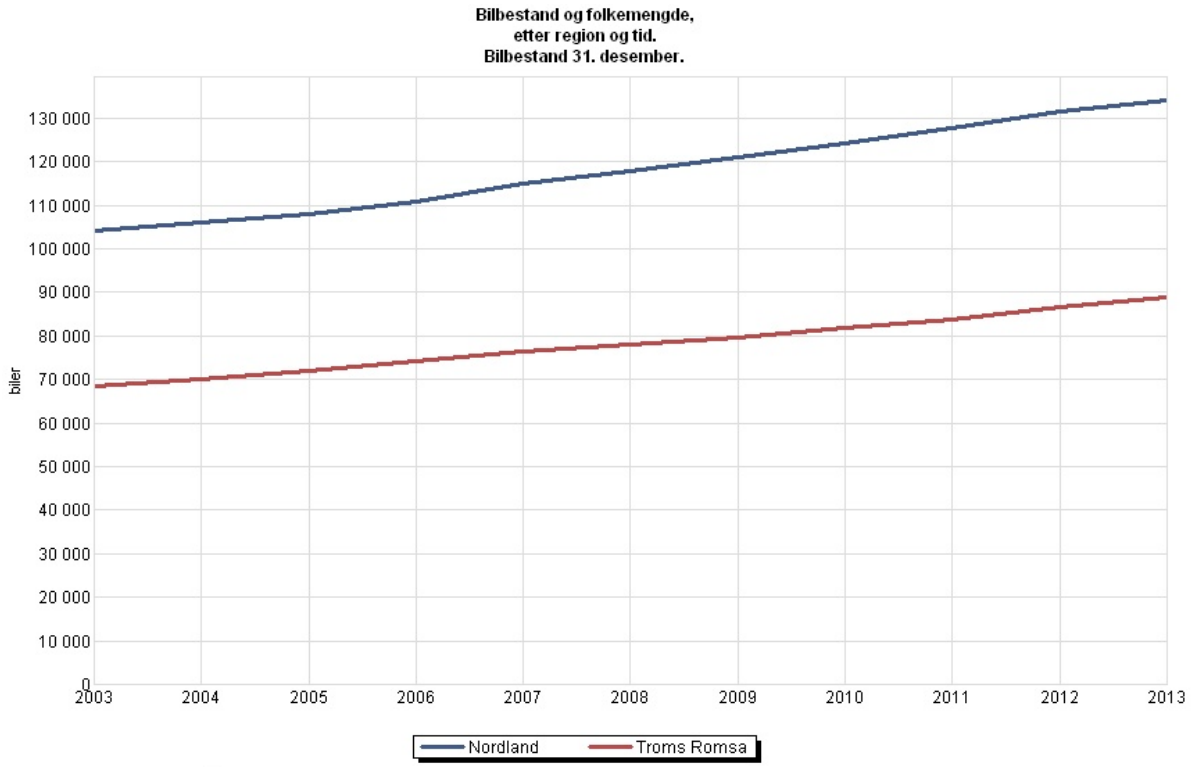

Figure 21: Amount of Registered Cars

The yearly average rise is 2.55% and 2.64% for Nordland and Troms, respectively. Counting points located between Narvik and Tromsø indicate a yearly average traffic growth ranging between 1.15 to 1.30 % (Average of three counting stations in the period 2005-2012). Both of these support an assumption of increased growth in traffic, also in future.

An assumption of a yearly average rise in road traffic of 1.15% is therefore made, based on these data.

Regarding the current traffic, the guidelines utilized when performing such an analysis separates between travels below and above 50 km. The following assumptions and justifications are therefore made about the current traffic in 2014:

Amount of travels below 50 km:

There is made an assumption of an average amount of 7000 travels per day throughout the year. The assumption can be regarded as an interpretation of the real situation, as the amount of travels around Narvik is not all captured by the counting station at Bjerkvik, while the counting station at Hungeren displays much higher numbers.

Amount of travels above 50 km:

The assumption of 1000 travels per day is made. The counting stations at Øse and Heia both display higher numbers than this, but because (1) the shorter travels need to be deducted and (2) that not all travels are displayed in these stations, an assumption of 1000 travels is considered as realistic.

6.2.2 Passengers Travelling by Air

Statistics Norway publishes statistics about the passenger travelling to and from the major airports in Norway. This allows retrieval of statistics for the travels to and from respectively Tromsø airport Langnes and Harstad/Narvik airport Evenes. The results are illustrated by the figure below (Statistics Norway, 2014):

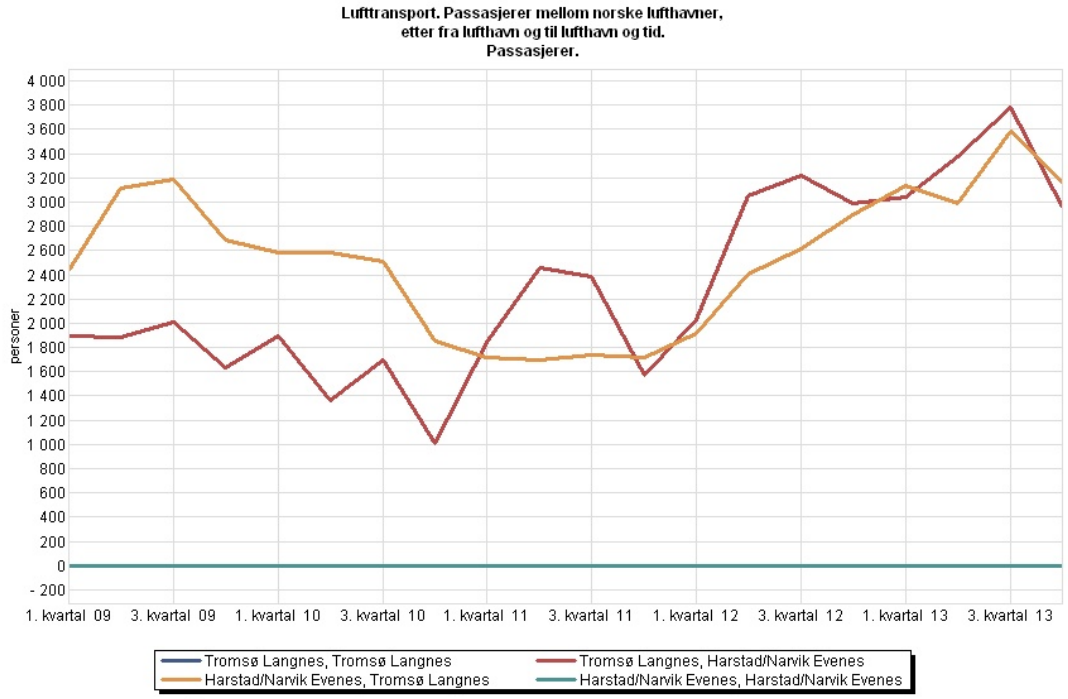

Figure 22: Amount of Passengers Travelling by Air

The figure displays a rising trend, with a total yearly amount (to and from) in 2013 as 26,024 persons, which will be assumed in the traffic simulation. There is a lack of historical data and the historical data that is available is very volatile; however, an assumption of a 1% yearly average rise is made. Seeing as this is the most time-efficient alternative, it is expected to be preferred for work-related travel between the two cities in the future as well.

6.2.3 Bus Travellers

Statistics Norway publishes statistics about the amount of passengers and passenger kilometres on regional routes. For Troms County, in 2012, 9,880,000 tickets where bought and a total of 78,357,000 passenger kilometres were travelled. These are very high numbers, displaying a county where bus travel is widespread for longer distances (Statistics Norway, 2013).

For the traffic simulation, we make a more conservative interpretation, since many travels are thought to be towards irrelevant destinations and in areas not relevant for the potential project. It is therefore assumed that 2,500,000 travels are made yearly in the area of influence, whereas 70% are below 50 km and 30% more than 50 km.

The high share of travels above 50 km is higher than the national average, but this is to cater for the fact that the distances among the most prominent settlements in this region often are more than 50 km. A final assumption is also that the bus traffic will grow in line with the car traffic, which is set as a yearly average of 1.15%.

6.2.4 Distribution of travels

The other element which is important, other than travels less than or more than 50 km, is the purpose of the journey. Usually this is split into three main purposes, as is the case in this analysis: commuting, leisure and business.

To estimate the share of each of these purposes constitute, the thesis will take use of the national travel survey published by the Norwegian Centre for Transport Research. The survey does not provide regional data, and the separation at ±50 km is not utilized, therefore some minor adjustments are made to give a more accurate representation of the perceived actual conditions. The distribution is summarized in the following table:

Table 7: Distribution of travels

	Short travels			Long travels		
	Commuting	Leisure	Business	Commuting	Leisure	Business
Car	30%	67%	3%	12%	68%	20%
Bus	10%	87%	3%	7%	85%	8%
Plane				0%	10%	90%

22 % of all daily travels where used for commuting purposes in 2009 (TØI, 2009), and the most chosen means of transport in that regard is the car. Therefore, a share of 30% is assumed for this area, also taking in to account a public transportation system in the cities which is not as developed as in many other larger, Norwegian cities. The share of business travel is 3% in total (TØI, 2009) and this is assumed for both bus and car travels.

For longer travels, business travels are adjusted upwards from 16% to 20%, to cater for the fact that fewer alternatives exist than other regions. Commuting is also adjusted slightly upwards, as distances between settlements are greater.

Concerning bus travel, the share is adjusted downwards regarding commuting as the car is the main transport method for this purpose, even more in this region, especially outside cities. For longer travels, leisure is the dominant purpose, in line with the national travel survey, and adjusted slightly upwards as bus travel are more used for leisure than car travel (TØI, 2009).

Air travel is only relevant for the longer travels, and it is only the route Evenes-Tromsø which is directly relevant. It is believed that this route is not utilized for leisure travel to a vast extent due to the high costs relative to other means of transport. Therefore, it is assumed that it is mostly used for business travellers, who value time more (see also chapter 9.2.1).

6.2.5 Summary of Assumptions

The following personal traffic assumptions are made if the reference alternative is followed in the period of analysis:

Table 8: Summary of Assumptions concerning personal traffic

Source	Current	Yearly average rise	Comment
Road traffic	7000 per day <50 km 1000 per day >50 km	1.15%	Based on historical data from three counting stations and amount of registered cars yearly in Nordland and Troms.
Bus traffic	2,500,000 yearly	1.15%	Expected to grow in line with road traffic
Air traffic	26,204 yearly	1%	A calculation was made of the yearly average growth, but the results are believed to be unsatisfactory due to lack of data and high volatility. An upwards trend is assumed, and is estimated conservatively to be 1 %.
Sea traffic	-	-	No relevant commercial sea travel between and within the area that is likely to be affected by the project
Pedestrian/Cyclist traffic	-	-	Not considered in the thesis as systematic counting point for cyclists in the region are only located in Tromsø and these were introduced in the fall of 2013, entailing a lack of historical data (Vik, 2013)

6.3 Traffic in Terms of Goods

6.3.1 Reference Traffic

The Ofoten Line is the most trafficked railroad stretch in Norway, by far, when it comes to goods volumes. The most important element in this is of course the transport of iron ore, but vast amounts of fish are also exported from Norway. The iron ore traffic accounts for an average of 18 trains daily, and in 2012 approximately 22 million tonnes of iron ore was transported on the Ofoten Line (Norwegian Ministry of Transport and Communications, 2013)

Figure 20, displaying the yearly average daily traffic in the area, shows a percentage of heavy vehicles ranging from 17-18%, except right outside of Tromsø. This indicates an amount of vehicles ranging from about 120,000 to 180,000 yearly, including buses.

The ports in Narvik and Tromsø are predominantly used for exports out of the region, consisting mostly of iron ore from Narvik with fish exports also being an important export good. Statistics Norway has published the following values for the two ports (2012):

Narvik port: 19 415 779 ton

Tromsø port: 967 773 ton

Concerning goods transport by air, the following values for the airports in the area of influence form the basis (Statistics Norway, 2014):

Table 9: Goods volumes by air in the last five years

Airport	**Total Volume (t)**				
	2009	***2010***	***2011***	***2012***	***2013***
Tromsø Langnes	2932	2390	2629	2628	2544
Narvik Framnes	21	21	24	22	5
Bardufoss	3	6	40	52	56
Evenes	973	323	372	387	969

As seen from the table, the volumes are quite volatile. The volume at Framnes and Bardufoss is quite negligible, while the volume at Langnes is remaining quite stable, although showing a slightly decreasing trend. The values are perceived to be very varying from year to year, therefore no growth is assumed for the period of analysis.

6.3.2 Traffic Predictions for the Period of Analysis

The goods traffic on the Ofoten Line is expected to see a heavy rise in coming years, with estimates ranging from 30 to 43 million tonnes in 2020, which is a growth from 67 – 139 % from the level in 2011 (Jernbaneverket, 2011). After 2020, it is still believed to rise, although not with the same intensity.

The opening of the Northeast Passage to an increasing extent is also believed to affect the volume handled at the ports in Narvik and Tromsø, as well as affecting exports from Scandinavia to Asia – leading to a higher volume transported through the area.

If the reference alternative is continued, the volume of goods on all sources of transportation is believed to increase. Estimations, assumptions and justifications on how much they are believed to increase is provided in the table on the following page:

Table 10: Summary of Goods Volumes by Source

Source of Volume	Current value	Yearly Average Growth	Comment
Road	96,000 vehicles p.a.*	2%	Increased imports and exports from the ports and a minor population growth will increase the volume by approximately 2% yearly (Jernbaneverket, 2011)
Air	3,574 tons	0%	A constant yearly volume is assumed.
Sea	21,000,000 tons**	3%	An yearly average growth of 3 % is assumed, but there are insecurities about the amount of ships travelling through the Northeast Passage in the future.
Rail (Ofoten Line)	23,000,000 tons**	7%, 3%	Estimations based on the report "Jernbanens rolle i nord" (Jernbaneverket, 2011)

* 80% of 120,000 vehicles from section 6.3.1.

** Adjusted upwards for 2014

*** In 2012, 21.9 million tonnes of iron ore was transported with the Ofoten Line. Including other goods and an increase of the iron ore volume, an assumption of a volume of 23 million tonnes is made for the current situation

7. Evaluation of Costs

7.1 Introduction

When evaluating the costs, there are some difficulties that need to be brought up. There has been a lack of similar projects in recent years; therefore experiential costs are hard to retrieve. With such a lacking basis, some simplifications has to be made.

The costs are considered formed by the following elements (Jernbaneverket, 2012)

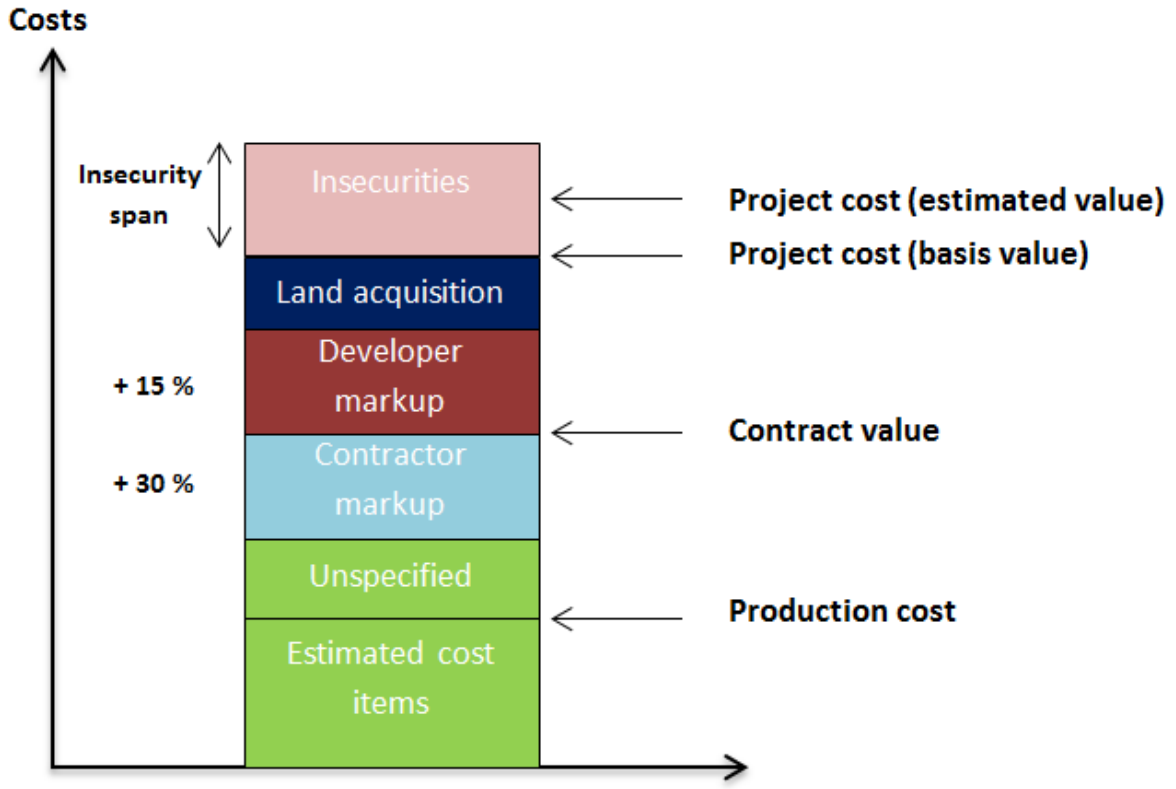

Figure 23: Cost Elements

Contractor mark-up consists of the costs of project management, site management, rigging and operation for the contractor. Developer mark-up consists of technical planning, studies, corporate governance and project management for the developer.

The following assumptions form the basis of the calculation, in line with the guidelines for cost estimations (Jernbaneverket, 2012):

- Unspecified costs are indicated by a 10 % premium

- Rigging and operating costs for the entrepreneur are indicated with a 30 % premium
- Construction client (contractor) costs constitute 15% of the construction costs and includes planning and design
- Costs of land acquisition is added to the calculation without a premium
- VAT is not included
- The price level is in 2014 prices

In 2008, a simplified answer from the Norwegian National Rail Organization (Jernbaneverket) stated the following approximate average costs for a single line railroad, based on their limited experience (St.Meld. Nr. 16(2008-2009):

- Single-track, free line 80,000 NOK/m
- Single-track, tunnel/bridge constructions 160,000 NOK/m
- Intersection track 70,000,000 NOK

Updated to 2014-prices, based on the building cost index for roads, the following prices are retrieved (rounded to the nearest 100 NOK) (Statistics Norway, 2014):

- Single-track, free line 97,400 NOK/m
- Single-track, tunnel/bridge constructions 195,000 NOK/m
- Intersection track 85,205,200 NOK

These overhead costs include all relevant costs illustrated in figure 23, as shown below:

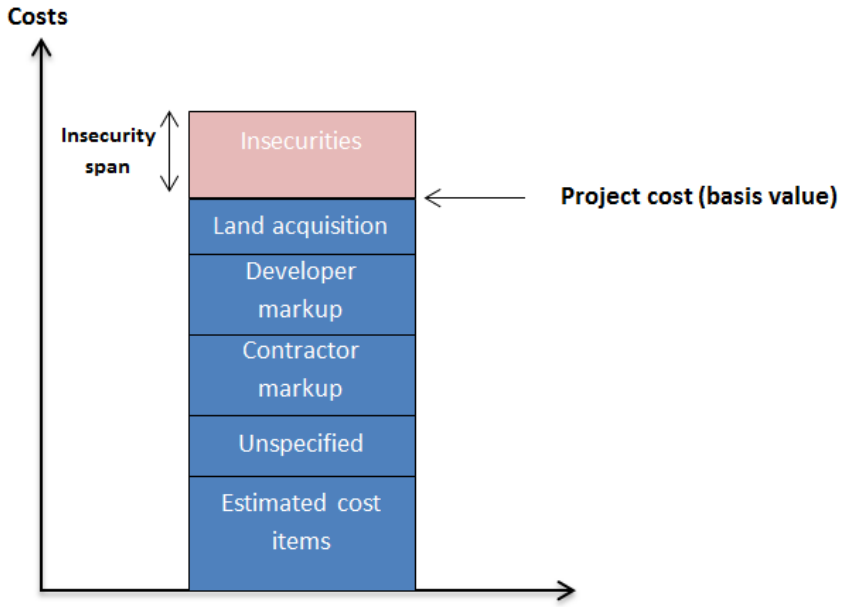

Figure 24: Cost estimation basis

7.2 Cost estimation

7.2.1 Assumptions

The following assumptions are made:

- The amount of intersection tracks are based on the amount of trains operating the line and the length. An estimation is found based on the amount of intersection tracks on the Nordland Line, which are 26 (Statistics Norway, 2012). This entails one intersection every 28 km on average. When estimating the value will be rounded upwards.

- There are several bridges in both of the alternatives, and an estimation of the total percentage of tracks that are bridged is made below:

Narvik – Andselv

There is one major bridge on this stretch, which over Rombaken where the Hålogoland Bridge is currently under construction. The road bridge has a length of 1,533 meters (Statens Vegvesen, 2014), and the same length is assumed for the railway bridge. Furthermore, there will be an array of smaller bridges, where the total length is uncertain and unknown. The

route needs to cross Storvatnet, Storelva, Spanselva, Salangselva as well as several minor crossing. A total of 500 meters is assumed, which is considered to be spacious.

Alternative 1

Alternative one has 4 large bridges from Andselv. These are crossing Nordfjorden, Rystraumen, Håkøya and Sandnessundet (NSB, 1992:38). A total of 2,200 meters is assumed as a good approximation for these four bridges, while another 200 meters are added for minor crossings.

Alternative 2

Alternative 2 has two large bridges from Andselv, which are both crossing the Balsfjord. These are approximated to a total of 1,000 meters, while 200 meters are added for minor crossings.

7.2.2 Estimation

Table 11: Cost estimation of the two alternatives

	Alt. 1	Cost (NOK)	Alt. 2	Cost (NOK)
Meters of single track, free line	94,567	9,113,425,800	100,827	9,820,549,800
Meters of single track, tunnel	81,000	15,795,000,000	110,940	21,633,300,000
Meters of single track, bridge	4,433	864,435,000	3233	630,435,000
Number of intersections	7	596,436,400	8	681,641,600
TOTAL	180,000	26,369,297,200	215,000	32,765,926,400

8. Assessment of Impacts

8.1 Introduction

The implementation of the project will of course affect many individuals and groups, with both positive and negative consequences. These consequences are separated by their possibility to be priced, and therefore a distinction between priced and non-priced consequences is made. Furthermore, the consequences are separated in terms of which entity of society that are affected by it. In the regulations, it is recommended to divide into four groups: transport users, operators, public bodies and society in general. A summary of the consequences that have been identified is presented in the table below:

Table 12: Consequences allocated to actors

Stakeholder	Consequence	Priced
Tranport Users	Passenger benefits	Yes
	Benefits for freight users	Yes
	Competition benefits and optionality	No
Operators	Change in demand for existing service providers	No
	Consequences for freight operators	No
	Costs for NSB	Yes
	Income for NSB	Yes
	Extra maintenance costs for Jernbaneverket	Yes
	Change in maintenance for other operators	Yes
Public Bodies	Changed tax	Yes
	Change in public procurement	Yes
Society in General	Changed cost of accidents	Yes
	Change in global emissions	Yes
	Changed cost of noise	Yes
	Natural and cultural heritage site intrusion	No
	Loss of recreational areas	No
	Health benefits	Yes
	Effects on the housing and labor markets	No
	Change in local emissions	Yes
	Increased tourism	No

8.2 Non-Priced Consequences

8.2.1 Introduction

When assessing non-priced consequences, verbal descriptions are used, combined with a scaling or sizing of the significance or extent of the consequence. The scaling is done after the following guidelines, as described by manual number 140 issued by the Norwegian Public Roads Administration (Statens Vegvesen, 2006:142):

Table 13: Explanation of non-priced consequences symbolic

Symbol	Description
++++	Very big positive consequence
+++	Big positive consequence
++	Medium positive consequence
+	Small positive consequence
0	Insignificant consequence
-	Small negative consequence
--	Medium negative consequence
---	Big negative consequence
----	Very big negative consequence

8.2.2 Natural and Cultural Heritage Intrusion

For large parts of the stretch, the railroad will follow the current E6, thus limiting its conflict with natural and cultural heritage interests. However, there are some issues that are worth mentioning.

The 1992-report mentions several conflicts on the stretch between Narvik and Andselv, as well as some conflicts further on from Andselv in Målselvdalen. Although this information is dated, many of these conflicts still apply. The following figure illustrates where the conflicts are located and in which interests they are conflicting:

1: Kvernmo/Fjelldal

Conflict with the population of elk, reindeer herding as well as Sami cultural heritage sites and cultivated land

2: Lapphaugen

The population of elk, reindeer herding, Sami cultural heritage sites and cabin sites

3: Salangsdalen

Areas of geological interest, as well as reindeer parturition areas and significant agricultural areas (1992).

4: Setermoen

Conflict with army sites

5: Skoelvdalen

Conflict with reindeer herding and agriculture

6: Nordheim

Reindeer herding and cultural heritage sites

7: Målselvdalen

Signifcant conflict with population of elk, as well as agriculture

8: Andslimoen

Cultural heritage sites and recreational areas

9: Takvatnet

Conflict with Sami cultural heritage sites

10:Between Nordkjosbotn and Laksvatnet

Conflict with reindeer herding and recreational areas

11: Laksvatnet

Cultural heritage sites and reindeer herding

12: Ramsfjorden

Areas with significant geological value

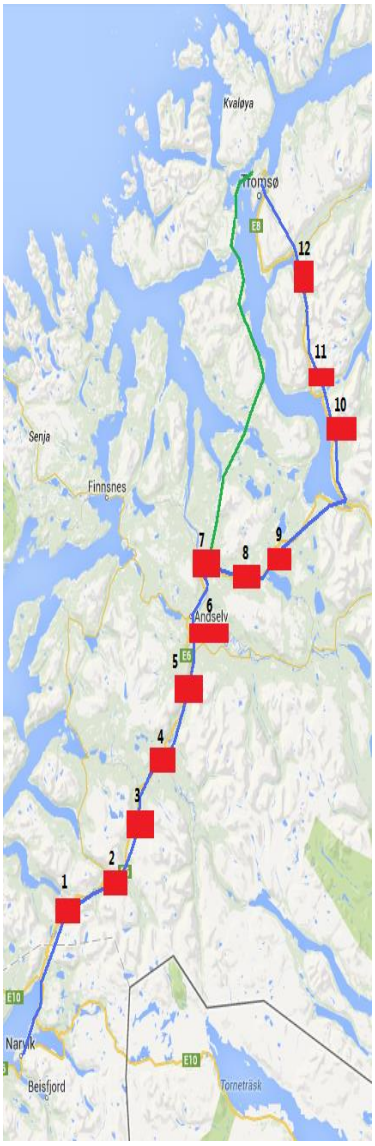

Figure 25: Conflict Areas

8.2.3 Tourism

To ensure a visually pleasing experience of the train ride, it is of great significance that the share of tunnels on the stretch is kept low. Since the line will be passing through rough, exotic terrain, it is perceived to generate income from tourism. The fact that Tromsø would be connected to the rail network could generate more tourism from Sweden as the accessibility will be improved. Therefore, tourism is considered to entail a benefit both for

the tourist industry in the area as well as for the tourists. Alternative 1 will affect this aspect more positively as it has a lower share of tunnels.

8.2.4 Loss of Recreational Areas

The line will pass through several recreational areas that are in use by the local population. A common way to value (in monetary terms) recreational areas is to utilize the so-called willingness-to-pay principle (Navrud, 2014). It consists of examining what the individuals are willing to pay for the good not to be utilized for this purpose.

In this specific situation, the substitution effect that is present would likely weigh heavily. The area is, relatively, sparsely populated, which again entails numerous green areas to utilize if some, to an extent, relinquishes. Therefore, the consequence is not considered to be very significant.

8.2.5 Effects on the Housing and Labor Markets

The project will affect the labour market with the manpower needed for the construction itself, the operation of the stretch and its stations and might affect. One could also argue that the project reduces the distance from the city to the rural areas, thus offering new possibilities for unemployed people living there.

From an economic perspective, however, this can only be considered a benefit if the project brings unemployed people into the workforce. The unemployment rate in the area, as displayed in 2.2.9, is in line with the national average; therefore one cannot expect significant decrease in unemployment, rather a redistribution of the current workforce.

The housing market can be affected by the same rationale; the project will enable people to settle in new areas and still maintain a satisfying commuting distance to their workplace. This might reduce the pressure on the housing market in the city, but, from an economic perspective, this is also a give-and-take situation, where private actors respectively gain and lose. In a long-term perspective, these are considered to outweigh each other.

8.2.6 Competition Benefits and Optionality

The project would also serve as a means of increasing competition among transport providers in the region as bus companies, airlines and boats, as well as competing with

personal car use. This would of course benefit the consumers, both financially and in terms of the optionality of choosing transport solutions best suited for their needs, as well as reducing queue costs due to more frequent departures.

8.2.7 Loss of Customers for other operators

For the aircraft and bus companies operating routes in the area, there will be a loss in terms of paying customers.

There are three airports in the area of influence which will be affected: Framnes, Evenes and Bardufoss. The closure of Narvik airport Framnes airport is already decided (Innst. 382 S, 2011-2012), while Bardufoss only operates routes to Oslo; therefore the main route that will be affected is that from Evenes to Tromsø. Today this is a daily route, which is subsidised by the state through state tenders and directly to the airport operation through Avinor.

Subsidies are also present for the bus companies, with the companies receiving subsidies to support their operation. Seeing the companies operation in a longer perspective, it is expected that the returns of the companies are reflecting the marginal costs they incur, therefore the profit of these companies are not considered to be affected, only the amount of routes offered. The amount of subsidies distributed by the state might be affected, however, but will not be priced due to lack of accurate information.

8.2.8 Consequences for Freight Operators

For the freight traffic the incomes are set equal to the costs for the operators. This is in line with the methodology of the Norwegian Rail Administration and is based on the premise that the overall transport demand is unaffected by a measure, and the eventual changes in cost are reflected in its entity in the price of the customers.

8.2.9 Summary

A summary of the consequences and their assessed significance is displayed in the table below:

Table 14: Summary of non-priced consequences

Actor	Consequence	Assessment
Society in general	Increased tourism	++
	Loss of recreational areas	-
	Natural and cultural heritage intrusion	--
	Effects on the housing and labour markets	0
Transport users	Competition benefits and optionality	+
Operators	Loss of customers	0
	Benefits for freight operators	0

9. Priced Consequences

9.1 Benefits for Transport Users

9.1.1 Passenger Benefits

Mathematically, the overall change in passenger benefits for the passenger can be expressed through the so-called “trapezoidal formula” (Jernbaneverket, 2011:66):

$$0.5 \cdot (GC_0 - GC_1) \cdot (X_0 + X_1)$$

Where GC_0 and GC_1 refer to the average generalised costs before and after the measure. X_0 and X_1 refers to the amount of passengers before and after the measure, respectively.

Since this is a new stretch, and therefore has no existing traffic, one can assume that the majority of the traffic is transferred from other sources. This introduces new sets of challenges, so to simplify further; we assume that all traffic is transferred from other sources. This enables us to calculate the consumer surplus for each relation.

Within the concept of generalised costs, one finds travel time and its value and travel costs. These aspects will be handled separately.

The concept of travel time consists of several factors. These are the actual time on-board, the time needed to access the means of transport, the waiting time, time used for transfers and time used for delays.

When calculating the time benefits for each relation, this analysis will take a somewhat simplified approach, and disregard time used for transfers. Transfers might be relevant for some travel combinations, but is not considered to be very predominant within these alternatives.

In efficient travel time, the following time values in minutes are utilized:

Table 15: Initial difference in travel time

Alternative	Time (minutes)
Current travelling time Narvik – Tromsø (car):	209
Travelling time by car (2022):	189
Travelling time by bus(2022):	255
Travelling time by air(2022)	80
Travelling time with the Troms Line (1):	76
Travelling time with the Troms Line (2)	91

The travelling time by car is retrieved from the google maps navigational software. Bus and air travelling times are retrieved by their relevant timetables. These have been adjusted to their expected time value in 2022, the opening year, where some infrastructure projects have reduced the travelling time. Most notable among these is the construction of the Hålogoland Bridge.

The other time components, accessing time, waiting time and delay time and their value relative to train travel are listed in the table below:

Table 16: Other time elements relative to train travel

	Long travels			Short travels		
	Accessing time	Waiting time	Delay time	Accessing time	Waiting time	Delay time
Car	-10	-10	-3	-10	-10	-3
Bus	0	0	0	0	0	0
Air	+40	+20	+10	Only relevant for long travels		

For cars, accessing time is considered to be very low, as the car is thought to be parked very close to the recipient. The train stations are considered to be located centrally, therefore an average accessing time relative to cars of 10 minutes is estimated. Waiting time for trains relative to cars is estimated at an average of 10minutes, as one rarely comes to the train

station a long time before departure. Trains are more prone to delays, therefore an average estimation of three minutes is assumed.

For air transport, an average accessing time of 40 minutes is estimated. This is estimated based on the distance of the airports Evenes and Langnes to their respective city centres. Waiting time is considered to be higher, as one usually tends to be at least 30 minutes before departure at the airport. Delay time is also considered to be higher in air travel, as departures are more vulnerable to weather conditions.

The Norwegian Rail Administration utilizes weighting on these travel components, which is multiplied with the amount of minutes relevant for each component:

Table 17: Weight of Travel Time Components (Jernbaneverket, 2011)

Travel time component	Weight	Accumulated
Accessing time short travels	1,0	
Accessing time long travels	1,0	
Waiting time, short travels		
0-15 minutes	2,0	2,0
15-30 minutes	1,0	3,0
Over 30 minutes	0,5	3,5
Waiting time, long travels		
0-15 minutes	1,04	1,04
15-30 minutes	0,54	1,58
Over 30 minutes	0,04	1,62
Delay time		
Short travels	2,8	
Long travels	2,1	

This gives the following efficient time differences between the various means of transport for a travel between Narvik and Tromsø:

Table 18: Net travelling difference relative to train

Time relative to train alternatives	Alternative 1	Alternative 2
By car	86,4	71,4
By bus(2022):	179	164
By air(2022)	96,6	81,6

The valuation of time savings is measured in hours, and differs by the purpose of the travel; if it is done for leisure, commuting or business purposes. Furthermore, there are different values for short and long travels, with 50 km as the threshold.

Table 19: Value of travel time (2009-NOK/hour)

Below 50 km:	**Commuting**	**Leisure**	**Business**
Train	56	44	380
Car	84	70	380
Bus	56	44	380
Above 50 km:	**Commuting**	**Leisure**	**Business**
Train	88	63	380
Car	151	130	380
Bus	56	52	380
Air	288	180	445

The other aspects within generalised costs for the passengers are the actual costs of travel. The analysis worksheet used by the Norwegian Rail Administration uses the following formula for calculating the costs for the passenger:

Ticket price = fixed price + (km cost interval 1 · km) + (km cost interval 2 · km)

Thereafter, the following values are utilized for the different components:

Table 20: Cost assumptions, passenger traffic trains (2009-NOK)

	Commuting	Leisure	Business
Fixed price component	14,10	19,13	24,17
Km cost, interval 1	0,45	1,06	1,34
Limit interval 1 (km)	150	150	150
Km cost interval 2	0,45	0,38	0,51

The spreadsheet also contains values for other means of transport, which are calculated in the same fashion, with an exception of car travel, which has a fixed value of 2.04 NOK for commuting and leisure purposes and 2.37 for business purposes per kilometre. For bus and air travel, the following values apply:

Table 21: Cost assumptions, bus and air travel (2009-NOK)

	Bus Travel			Air Travel		
	Comm.	**Leis.**	**Bus.**	**Comm.**	**Leis.**	**Bus.**
Fixed price component	14,10	19,13	24,17	840,53	630,39	945,59
Km cost, interval 1	0,45	1,06	1,34	0,84	0,53	1,05
Limit interval 1 (km)	150	150	150	100	100	100
Km cost interval 2	0,45	0,38	0,51	0,84	0,53	1,05

A final aspect to consider is the fact that the project might affect users of other means of transport. This could for instance be in the form that transferring of traffic from roads might give a better traffic flow. The Norwegian Rail Administration operates with rates for each transferred kilometre and the benefit they pose, and these are only relevant for kilometres transferred in urban areas:

Table 22: Benefit rates for other transport users given transferring of traffic (2009-NOK)

	NOK/km
Cars	1,20
Bus	2,41
Freight trucks	3,61

9.1.2 Benefits for Freight Customers

The same principles regarding generalised cost as in the previous section apply for freight customers. The thesis considers four possible sources where the freight traffic on the line can be transferred from: road, air and sea, in addition to freight transferred from the Ofoten Line to the Troms Line.

The benefits for the freight customers consist of the influence on three elements: the price paid to the operator, time costs and delay costs.

The price paid to the operator is assumed to be a function of terminal costs and transport costs, based on the inputs from the spreadsheet by the Norwegian Rail Administration, compared with the price paid to the operator with their previous means of transport. This is calculated as costs per km.

The time aspect, as mentioned, consists of the actual difference in transport time and the difference in average delay. The following benefit elements form the basis of the calculation, as per the guide provided by the National Rail Administration:

Table 23: Benefit elements in freight

Element	NOK
Delay costs (NOK per tonhour)	12,50
Time costs (NOK per tonhour)	0,65
Price elasticity generalised costs	-1,5
Freight transferred from road:	
Freight costs per wagon km	14,15
Tonn per load	11
Freight traffic transferred from sea:	
Freight costs per tonkilometer	0,26
Amount of tons per TEU	10

Freight traffic transferred from aircrafts is not valued in the guide provided by the NRA, and therefore will be disregarded in the analysis, since it only constitutes a very small amount.

9.2 Consequences for Public Bodies

It has been chosen to place the consequences for NSB as consequences for public bodies, given the fact that it is owned by the state, and that eventual profit will be redistributed back to state allocations.

9.2.1 Costs of Maintenenance for the Public

When assessing the maintenance costs for the public as a consequence of the project, one must view it from two angles: the increased cost of maintenance due to the new railroad line and the decreased cost of maintenance as an amount of traffic is transferred away from other sources.

The former is based on the amount of passenger trains and freight trains that operate the line. To calculate the maintenance cost, the thesis relies on the basis values provided from the spreadsheet used by the National Rail Administration. These are values per gross ton kilometre, and is given at 0.0175 2014-NOK, for both passenger trains and freight trains.

The transferring of traffic from other sources has transfer values given by the following table, also provided by the spreadsheet, denoted in 2014-NOK per driven kilometre:

Table 24: Wearing costs, transferred traffic (2009-NOK)

Source	Wearing costs
Traffic transferred from cars	0,010
Traffic transferred from bus	0,341
Traffic transferred from planes	3,980
Traffic transferred freight (road)	1,205

9.2.2 Consequences for NSB

The operators of the route, NSB, will as a result of the operation increase their incomes from ticket sales and service provision on the trains. To estimate these values, one must first define the market conditions and the operating conditions.

The market conditions consist of the amount of passengers and their individual travel length and travel purpose. The market conditions will follow from the traffic simulations based on the assumptions in the traffic estimations and the transfer values presented in the next chapter.

The operating conditions are the following:

Table 25: Operating conditions

	Alternative 1	Alternative 2	Comment
Number of travels yearly	2220	2220	3 times daily each way on workdays, 2 times remaining days
Length	180 km	215 km	
Time usage	76 minutes	91 minutes	
Number of kilometres per year	399600	477300	
Punctuality	90%	90%	Assumption from Märklin

The income from ticket sales is given from the formula presented in 9.1.1 and is based on the values in table 18. Furthermore, a 2% share of the income will be added to the total income to estimate the income from aspects such as sales in travel. This is a number used in the spreadsheet Märklin.

The thesis assumes three daily departures each way from Narvik and Tromsø respectively, while this is reduced to two on weekends and public holidays. Furthermore, the thesis assumes the following conditions regarding the train sets:

Table 26: Train data

	Value	Comment
Number of seats	264	Given from nsb.no
Total cost	91,560,000	Calculated based on purchase contract from 2009, adjusted with the consumer price index.
Lifetime (years)	25	
Energy usage KWh/km	6	Based on train data
Energy cost NOK/KWh	0,39	Given from the guide provided by the National Rail Administration
Maintenance cost per km	15,21	
Preparation cost	2300	

The cost of the operation will be given estimated per hour of operation. In that regard, the wages of the employees must be taken into account. These are assumed to be 800 NOK per hour for the engine driver and 766 for conductors, which are given from the guide from the Norwegian Rail Administration and will be adjusted in line with the wage index.

There are other cost assumptions that must be taken into account, given the fact that employees work more than just the duration of the journey:

Table 27: Additional time elements (Märklin)

Delay, average addition to turning time	20
Minimum turning time	10 minutes
Additional time, crew	30%

Furthermore, administration costs are added on as 10% of the sum of the income and the other costs. This post includes costs that are not directly linked to the operation, such as marketing.

9.2.3 Changes in Public Fees

There are certain special duties related to traffic that are affected by the project. This is above all connected to the fact that the project will entail decreasing road traffic, which again will reduce the income the state generates from these fees.

These fees are present to correct for negative externalities related to the environment, and therefore are directly linked to benefits redeemed from lower environmental costs. The difference between the loss in taxes and the attributed environmental benefits therefore represents the net economic effect. In the presentation these will be presented separately and the net economic effect will then appear automatically.

The Norwegian Railroad Administration operates with the following values in their spreadsheet Märklin to estimate the effects on the generated public fees when traffic is transferred from other sources to rail. This includes fees for elements such as CO_2, fuel, road use etc. The values are in NOK per driven kilometre, which enables the calculation of the difference in tax income:

Table 28: Traffic transfer values regarding tax (2009-NOK)

Source	Value
Transferred from cars	0,321
Transferred from buses	0,000
Transferred from planes	30,910
Transferred freight traffic (from road)	1,012

Furthermore, there is an additional relevant fee on freight, which is a fee paid to the state for operating heavy axle loads on the railroad. Today, this fee is only relevant for the Ofoten

Line(axle load above 25 tons), but it is included in this analysis as it is perceived that iron ore traffic will operate on the potential Troms Line as well.

This fee is currently 0.0313 NOK per gross ton kilometre, and is adjusted by the consumer price index.

9.2.4 Changes in Public Procurement

The level of government procurement is decided yearly after negotiations between the train company and the Ministry of Transport and Communications. A project can in principle affect the level of government procurement in two ways: If a change of quality or/and scale of the provision affects the ministry's willingness to pay, or, if the projects financial consequences for the operator enable the reduction of the need for ,or demand an increase of, government procurement.

As a general rule and practical approach, the level of government procurement is assumed to depend upon the operator's financial result. Changes in the financial result is in other words assumed to give an equal, opposite, impact in the level of government procurement (Jernbaneverket, 2011:78).

9.3 Consequences for Society in General

9.3.1 Cost of Accidents

Railways are regarded as more safe means of transport in terms of accidents compared to, especially, road traffic. Accidents have consequences for transport users, operators, relatives and public bodies, and the distribution among these vary with different types of accidents. It is perceived, however, that the actor that is most affected is the society in general and therefore it is grouped under external effects (Jernbaneverket, 2011: 79).

When estimating the costs and the extent they are internalised in the behaviour of the actors, the thesis relies on a report from the Norwegian Centre for Transport Research (TØI), where the following assumptions are made (TØI report 464/1999):

- Self-inflicted accident costs are considered as internalised
- Damages which are inflicted on other are considered external

- Accidents within the same category of vehicles are considered internalised
- Accidents for employees in operating firms are considered internalised, with the exception of damages inflicted the next of kin or the public by injuries or fatalities
- Accident costs for passengers are internalised, with the exception of damages inflicted the next of kin or the public by injuries or fatalities
- Material damages are considered internalised through insurance costs

The difference in accident costs when traffic is transferred from other sources of traffic to rail is based on an average of the rates presented by respectively TØI, UNITE and SIKA and only includes the accident costs which are considered external. The costs are denoted as NOK per driven kilometre:

Table 29: Reduction in accident costs with traffic transfer (2009-NOK)

Means of transport	NOK per driven kilometre
Personal car	0,59
Bus	0,60
Pedestrians/Bicycles	0,00
Airplanes	1,77
Trucks	0,31

9.3.2 Effects on Local Emissions

Transferring traffic, both personal and goods, from road to railroad entails an environmental gain in terms of reduced emissions of several substances. The most prominent substances in this regard are NO_x and particulates. The table below shows the cost of a one kilogram emission of NO_x and large particulates (PM_{10}) in different degrees of settlements, and it is based on a study performed by TØI (TØI report 1053/2010):

Table 30: Cost of local emissions per kg (2009-NOK)

	City	Other densely populated areas	Rural areas
NO_x	200	100	50
PM_{10}	3600	440	0

These rates are multiplied with calculated emission factors to give the emissions per kilometre of each means of transport. These factors are gathered from the Norwegian Environment Agency (Klif) and are displayed in the table below:

Table 31: Emission Factors, locally (2009-prices)

	City	Other densely populated areas	Rural areas
Personal car	0,058	0,017	0,006
Bus	0,820	0,376	0,183
Plane	1,379	1,379	1,379
Truck	0,354	0,186	0,089
Personal trains (diesel)	0,601	0,214	0,104
Freight trains (diesel)	2,084	0,740	0,360

The traffic simulation will give the amount of kilometres transferred from each source, and given an assumed distribution of cities, towns and rural areas of respectively 10%, 20% and 70%, the relevant calculations can be made.

9.3.3 Effects on Global Emissions

In transportation projects one also needs to take into account air pollution in a global perspective, thus its contribution to global warming. When estimating the difference between the reference alternative and the two project alternatives, one needs relevant transfer values.

The thesis will use values originating from the spreadsheet used by the National Rail Administration, which define the following transfer values:

Table 32: Transfer Values CO_2 (2009-NOK)

Source	Value
Traffic transferred from cars	0,180
Traffic transferred from buses	0,710
Traffic transferred from planes	15,62
Transferred freight traffic	0,75

The values are denoted as the amount of kilograms CO_2 per driven kilometre. Furthermore, one needs a valuation for CO_2 emissions. The thesis will follow the guidelines of the National Rail Administration and value the emissions at 320 (2009)-NOK between 2020 and 2030 (opening year 2022) and 800 NOK with a yearly growth of 1.4% from 2030.

9.3.4 The Cost of Noise

Based on Econ report 2003-054, the following values are utilized for valuing the benefits of transferring traffic from other means of transport to railroads in terms of noise (NOK per driven kilometre)

Table 33: Transfer values in terms of noise reduction

	City	Other densely populated areas	Rural areas
Personal car	0,38	0,38	0,00
Bus	3,57	3,57	0,00
Plane	0,00	0,00	0,00
Truck	3,91	3,91	0,00
Personal trains (diesel)	0,601	0,214	0,104
Freight trains (diesel)	2,084	0,740	0,360

9.3.5 Health Benefits

The distribution of different means of transportation has a profound effect on the degree of physical activity. Train travel often generates more pedestrian or bicycle activity in order to access train stations. This will again better the general health of the population affected by the project, in terms of reducing risk for many types of disease.

This is relevant in the analysis in the form of transferred car travels to train travels. A valuation study in 2010 defined the current assumptions to value health benefits were recommended and will be utilized in the calculations (Jernbaneverket, 2011: 84):

Average walking/bicycle length per transferred car travel: 1.0 km

Rate per km: 19.20 (2009-NOK)

9.3.6 Tax Financing Costs

The project is assumed to be financed by the public. Public financing of projects entail, ultimately, an increased tax level. Taxes and fees that are not introduced to correct negative externalities, contribute to the fact that society's resources are guided away from the best economic adaption.

This loss in efficiency, together with the marginal administration cost linked with tax collecting, entails that public financing of projects have an economic cost. As a consequence, a tax financing cost of 20% is charged to the net present value of public disbursements.

10. Cost-Benefit Analysis

10.1 Valuation of Benefits for Passengers

To estimate the transferred traffic from each relationship, one needs to examine how the effect of price difference and time difference affects the demand for train travel versus the transport user's previous choice of transport. In other words, one has to examine how the total costs (the sum of time costs and payable costs related to the travel) differ among the different modes of transport and the project alternatives.

The thesis will use the procedure from the spreadsheet provided by the National Rail Administration and estimate the transferred traffic based on elasticity calculations. The NRA utilizes an elasticity of -1.2 for short travels and -1.5 for long travels. This entails that for each percentage cost reduction (compared to the initial mode of transport); the demand for train travel will increase by 1.2/1.5 %.

First, we define average distances for each mode of transport, for short and long travels. Then, we calculate the difference in total cost between the initial mode of transport (car, bus or plane) and a hypothetical cost of what the same journey would cost if undertaken by train. This enables us to calculate the amount of traffic transferred from each source by the following formula:

$$\varepsilon \cdot \%p = \%transferred$$

Where ε denotes the elasticity (-1.2 for short travels and -1.5 for long travels), %p denotes the percentage difference in total cost and %transferred denotes the percentage transferred to train from the other mode of transport. The average distances are defined as the following:

Table 34: Average driven distances

	<50 km	>50 km
Car (km)	10	70
Bus (km)	20	80
Air (km)		160

Then, the total change in user benefits are calculated as the sum of time costs (refer to table 19 in chapter 9.1.1) and payable costs (refer to table 20 and 21). The thesis makes a simplified assumption that the time saving between Narvik and Tromsø is linearly distributed, which enables the calculation of a value for time saved per kilometre relative to mode of transport. This calculation shows the following:

Table 35: Time savings per kilometre (minutes)

	Alternative 1	**Alternative 2**
Train relative to car	0,480	0,332
Train relative to bus	0,994	0,763
Train relative to air	0,5367	0,3795

Furthermore, one can then calculate the change in time cost per minute based on the distribution of car travels among commuting, business and leisure and their valuation (refer to tables 7 and 19)

Table 36: Change in time cost per minute

	<50 km	**>50 km**
Car	1,39	3,04
Bus	0,92	1,31
Train	0,92	1,85
Air		6,98

This leaves us with enough information to estimate the amount of traffic that is transferred from each source of transport. The calculations are presented on the following page, separated between the two alternatives:

Table 37: Estimation of transfer values, alternative 1

	Time difference vs train	Time cost vs train	Payable cost vs train	%p	ε	%transferred
Car 10 km	4,8	9,351	-6,16	9,1%	-1,2	10,92%
Bus 20 km	19,88	18,29	0	27,0%	-1,2	32,4%
Car 70 km	33,6	149,625	54,71	55,1%	-1,5	82,65%
Bus 80 km	79,52	79,652	0	29,8%	-1,5	44,7%
Air 160 km	85,87	1070,93	841,03	83,1%	-1,5	124,65%

Table 38: Estimation of transfer values, alternative 2

	Time difference vs train	Time cost vs train	Payable cost vs train	%p	ε	%transferred
Car 10 km	3,32	8,615	-6,16	7,0%	-1,2	8,4%
Bus 20 km	15,26	16,836	0	24,8%	-1,2	29,76%
Car 70 km	23,24	139,265	54,71	52,3%	-1,5	78,45%
Bus 80 km	61,04	67,812	0	25,4%	-1,5	38,1%
Air 160 km	60,72	1047,248	841,03	82,1%	-1,5	123,15%

As displayed by the two tables, as expected, these calculations give some unrepresentative answers. Although simplified, the calculations give an important indication towards which values to expect. To cater for local variations and as an attempt to give the most accurate representation possible, values will be adjusted manually to some degree:

Table 39: Assumed transfer values

	Alternative 1		Alternative 2	
	<50 km	>50 km	<50 km	>50 km
Transferred from car	5%	55%	5%	60%
Transferred from bus	10%	50%	10%	55%
Transferred from air		80%		90%

The reason why car journeys less than 50 km are adjusted downwards is that for the areas around the city centres, the only relevant journey is Bjerkvik – Narvik. Journeys between Andselv and Setermoen also falls within this limit and some traffic can be transferred to trains there as well. For the majority, and in line with the National Travel Survey, car travel is preferred for these short travels. Regarding longer car journeys, the train will accommodate all the larger settlements in the region, and more traffic is assumed to be transferred to trains due to their time advantage; therefore, the results from the elasticity test will be somewhat maintained.

Concerning bus travel, the same argument as above is relevant for bus journey less than 50 km. For bus travels more than 50 km, the train will have a major time advantage and will be preferred between the main hubs in the area. The bus, however, caters many smaller places not covered by rail; therefore the share will not be adjusted to more than 55% for alternative 2, which covers more populated areas than alternative 1.

Air travel will lose an important share of its customers due to both a time advantage and cost advantage. The time advantage is lessened for those living west of Evenes; therefore a small share is assumed to be maintained.

This information enables the performing of a traffic simulation, which is displayed in appendix 2.

10.2 Benefits for Freight Users

The benefits for the freight users are calculated as described in chapter XX. In addition, similar to passengers, one needs to make assumptions based on the traffic that will occupy the line. The thesis makes an initial assumption that all volume transported on the Troms Line is believed to be transferred from other means of transport in the reference alternative, in line with the NRA (Jernbaneverket, 2011:71).

The transfer rates of which the volume is transferred to the Troms Line are the following, based on the same methodology as in the previous chapter, and are constant with the growth of the individual goods flows:

Table 40: Transfer rates of freight volumes

	Alternative 1	**Alternative 2**
Car to train	45%	50%
Sea to train	0%	0%
Air to train	90%	90%
Ofoten Line*	20%	20%

*Goods that are currently travelling on the Ofoten Line but are transported onwards to Tromsø

The line connects the major hubs in the area, also with the rest of Norway through the Swedish ARE-network; therefore a large share of the road traffic will be transferred to rail. Furthermore, the thesis assumes that no freight traffic currently shipped by sea will be transferred, due to the regional conditions where the ports are mainly used for exports to distant locations. Finally, we assume that 20% of traffic on the Ofoten Line will transfer to the new Troms Line to relieve the pressure on the port in Narvik.

This enables a traffic simulation that can be regarded in detail in appendix 2.

10.3 Residual Value

The development of this thesis has been done in the midst of new national regulations implemented the 30th of April. The former regulations stated that the residual value after 25 years is found through the use of straight-line depreciation, with the assumptions regarding the lifetime of the various elements as outlined in 3.2.11. This was a purely technical value, and therefore did not take into account benefits occurring after 25 years.

The new regulations calculate the residual value after 40 years, thus prolonging the period of analysis and minimizing the size of the residual value, in an attempt to improve the representability of the analysis.

The thesis will present the results with both regulations, but before that it will make the following assumption regarding the share each of the elements constitutes of the total investment:

Table 41: Share of investment

Element	Share
Substructure	59%
Superstructure	24%
Wiring facilities	7%
Signal facilities	3%
Electric facilities	7%

Furthermore, the thesis makes an assumption that elements with a lifespan shorter than 40 years will be reinvested, since a non-functioning railroad will have no value.

10.4 Presentation

Appendix 11 shows a thorough overview of the results of the cost-benefit analysis for the two alternatives with the old and new regulations, and the individual calculations for each element can also be found in appendix 3-10. A summary of the results is shown in the table below:

Table 42: Results from the Cost-Benefit Analysis

	Alternative 1		Alternative 2	
	Old regulations	**New regulations**	**Old regulations**	**New regulations**
Benefits for users	1 768 556 569	2 660 446 098	1 433 643 154	2 156 644 652
Benefits for operators	0	0	0	0
Benefits for public bodies	97 671 503	156 299 450	259 406 779	421 012 067
Benefits for society in general	4 178 704 436	6 550 416 015	4 601 646 918	7 216 075 757
Residual value	4 443 721 425	2 641 479 151	5 521 673 484	3 282 245 665
Tax financing costs	-5 468 464 981	-5 456 739 392	-6 767 389 525	-6 735 068 467
Gross present value	5 208 267 382	6 478 548 576	5 207 012 889	6 340 909 674
Investment costs	27 439 996 407	27 439 996 407	34 096 354 403	34 096 354 403
Net present value	-22 231 729 025	-20 888 095 085	-28 889 341 515	-27 755 444 729
Benefit/Cost-ratio	0,18	0,24	0,15	0,19

As seen from the table, all calculations show a negative net present value, thus none of the alternatives can be seen as economically profitable. Of these, alternative 1 is regarded as the most beneficial. Operators are not generating benefits for themselves, as the eventual benefits are transferred to either the users through cheaper fares or back to the state through state purchase.

The largest benefits are attributed to society in general, where reductions in emissions, accidents, and noise in particular, are quite high due to transferring of traffic, especially from road to railroad.

The fact that area is sparsely populated does not give large incentives for conducting such an investment in terms of passenger traffic. The quantity of freight traffic that is expected to circulate in the area in the period might give more incentives for examining the project further, however, but the fact is that the benefits from this will mostly accrue foreign interests, in addition to being very dependent on elements such as the actual future output from mining in Sweden and Finland and the capacity of the Ofoten Line and the port in Narvik. These issues will be discussed more in detail in chapter 12.5.

11. Risk and Uncertainty

The analysis is built on a number of uncertain assumptions. Therefore, it is important to examine the robustness of the results in relation to a change in these assumptions. The thesis will examine the effect of a change in the discount rate, the traffic and the costs, as these are the most critical conditions.

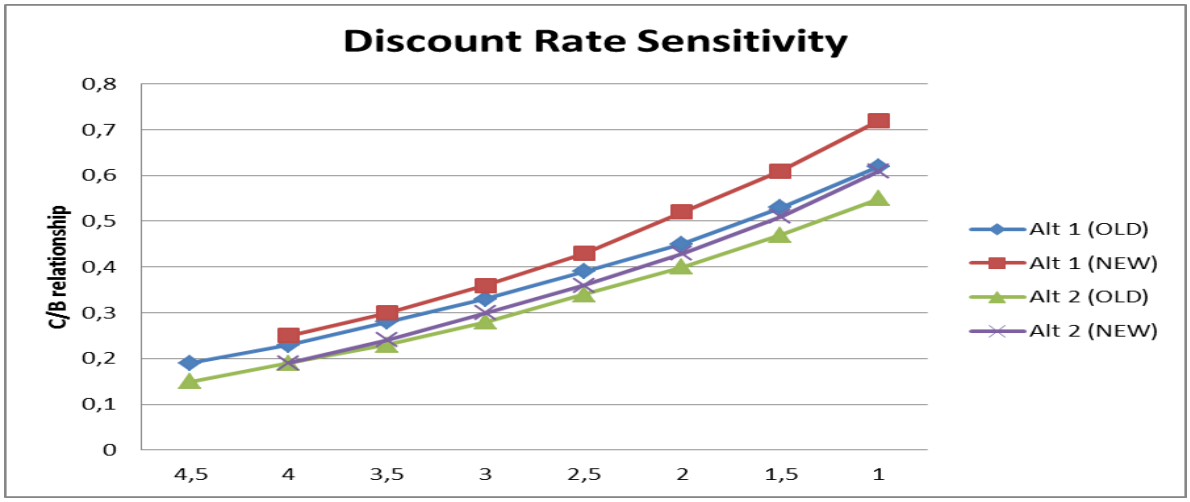

Figure 26: Discount Rate Sensitivity

The figure above shows graphs with slopes increasing the cost-benefit ratio by approximately 0,04-0,08 per 0,5% discount rate decrease.

Then, the thesis will consider scenarios in the interval between a +20% and -20% increase/reduction. The figure below show the results on the net present value from these calculations:

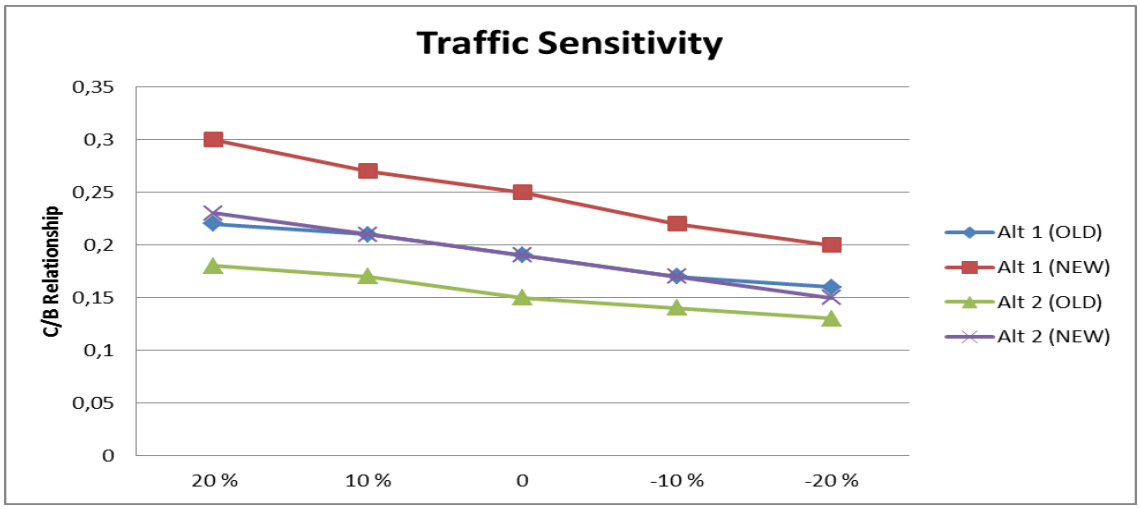

Figure 27: Traffic Sensitivity

Lastly, the thesis will examine the sensitivity concerning the construction costs. These numbers can be considered to be very little robust; therefore, this examination is of increased importance. The principle is the same as in the former analysis; the interval ranging from +20% and -20% will be considered and is displayed below:

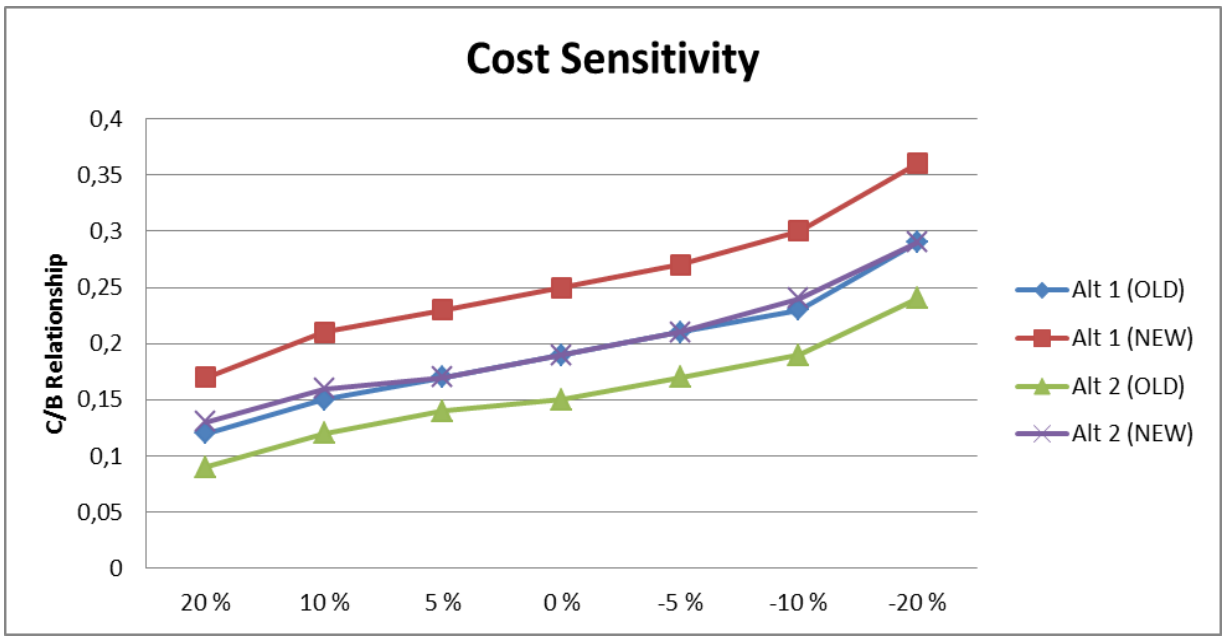

Figure 28: Cost Sensitivity

As shown by the graphs, the influence of the construction costs on the profitablity of the projects is considerable. It is noteworthy that that a 20% reduction of the construction costs, still leaves all alternatives very unprofitable.

12. Discussion

12.1 Residual Value

The public assessment program regarding economic analyses includes official Norwegian reports (NOU), the guide provided by the Norwegian ministry of Finance and also several sectorial guides; like the guides provided by the Norwegian public roads administration (Statens Vegvesen) and the Norwegian national rail administration.

The traditional conditions, which the analysis was based on, involved a period of analysis spanning 25 years and a lifetime of the project of 40 years. After 25 years a technical residual value is calculated, equalling 15/40 of the investment cost with a discount rate of 4.5%.

This raised the question of whether a technically calculated residual value was a good indicator for remaining benefits. Given the fact that this was changed as of 30th of April, one should think that many people agree that it was not.

The ideal for economic analyses is that all cost and benefit effects of the project are to be included in the analysis. In practice, this would entail that the period of analysis is as long as the lifetime of the project. The different elements of the project have different lifetimes (see 3.2.11) and in a practical analysis one needs to take into account the fact that some elements need replacing when the initial ones are exhausted. If one cannot use find a timespan that complies with all the individual lifespans, one could be left with a residual that could have a very low alternative value. Railroad tracks, e.g., are difficult to use as something else than just railroad tracks.

One could therefore argue that if one chooses a lifespan of a project where the residual is large, with a very low alternative value, one has a project with a built-in waste of resources. To mitigate this, a natural point of reference would be to attempt to keep the residual post as low as possible in the analysis, hence increasing the lifespan of the project in the analysis.

An orientation by the Norwegian Ministry of Finance from April this year updated the guidelines and entered into force the 30th of April addressed these issues. The methods of performing analyses were changed, with the period of analysis being extended to 40 years.

This is motivated by a desire to have the period of analysis as close to the actual lifetime of the investment as possible.

This mitigates some of the regular points of criticism, but there are still questions concerning if 40 years is a representable description of the real technical lifetime of the investment. If one investigates a portfolio railroad projects built before 1974 (see appendix 12), and some long before, these have for the most part only seen minor upgrades since then, indicating that 40 years is not a good representation of the actual lifetime.

A potential solution could be to adjust the lifespan of the project according to the most predominant elements of the investment. In a railroad project, this is typically the substructure. The substructure is currently assessed to have a lifespan of 75 years, and this should perhaps serve as a natural point of reference?

12.2 Discount Rate

The discount rate reflects the risk-free interest and the risk in the project, and thereby indicates the alternative value of the project.

The main thought behind these regulations is that the required rate of return of a public project should be the same as a project with the same degree of risk in the private sector. If the rate of return was to be lower for public projects, then society would benefit from reducing public investment in favour of private investment, and vice versa. If one uses the same required rates of return, and initiates the profitable projects and not the unprofitable, one would have the optimal economic allocation of investments between the two sectors.

The discount rate today is built upon these principles, and empirical investigations of the private rate of return and how it varies with risk. The advocates for the discount rate to remain at its current level argue the fact that a reduction in the discount rate can, logically, only happen if one gives less priority to other areas like financial savings for the country as a whole, public spending, public maintenance or investment and spending in the private sector. The question they therefore pose is if a higher level of investment in the public should be prioritized above the aforementioned elements.

The Official Norwegian Report (NOU) 2009:16 regarding global environmental challenges and Norwegian policy gives an analysis of insecurity and discounting. In this analysis the

existence of good arguments for a lower discount rate in projects with long-term climate benefits was pointed out. This was mainly centred on two arguments; the insecurity if one takes into account the welfare of future generations when using a high discount rate and the doubt surrounding the relevance of observable market interest rates in a long-term perspective.

It seems natural to assume, however, that if the supply, or availability of environmental goods become scarcer over time, their value will rise. This increased valuation could outweigh the effect of the discount rate and make projects economically profitable even if the benefits accrue in the distant future.

12.3 Real-Price Adjustment

In such economic analyses, one needs to make assumptions on how the development of the future prices is to evolve. A common simplification is to keep all prices, in reality, unchanged through the period of analysis, as is the case in this analysis. In other words, one assumes that all nominal prices grow at the same growth rate – in this case the consumer price index and thereafter the government's predictions for future growth.

There are two elements where the arguments for them to be real price adjusted are especially strong; and these are the valuation of time savings and the valuation of environmental goods. The principle of time valuation is that saved time alternatively could be used for purposes that one misses – if the saving does not take place (NOU 2012:16). Time usage is usually divided into two categories: working time and leisure time. The most common method to value time savings is estimating an elasticity for the willingness to pay with respect to the real income. Studies indicate that such an elasticity is likely to be between 0.8 and 1.0 (NOU 2012:16). The time savings made possible by this project is significant, and with a real price adjustment of the prices, this should have a perceptible effect on its profitability.

The same case could be argued for environmental goods. As mentioned in 12. 2, it is a natural assumption to expect that if a good becomes scarcer over time, its value will rise. This advocates for the fact that environmental goods should be real price adjusted. It is also a common assumption that the population's willingness to pay for these goods rises with rising salaries – and that an elasticity of this relationship could be derived. This is also a measure

that could be seen as having the potential to have a perceptible effect on the profitability of the project.

12.4 Other Countries

Sweden is a natural country to compare with, as it has many similar conditions as Norway. The latest report from ASEK (the Swedish work group for economic analysis within transport), applicable from April 1st 2014, has the following general guidelines concerning lifespan and residual value and discount rate.

Regarding the lifespan they recommend utilizing a period of analysis of 60 years on a railroad project. Their motivation behind this choice was to secure that the period of analysis was as similar to the economic lifetime of the investment as possible (ASEK, 2014). This entails that the residual value method is no longer in use, and in the report this is explained by the method penalizing large projects with a good traffic development and a long economic lifetime.

The discount rate on railroad projects is set to 3.5% for the initial 30 years, while it is reduced to 3.0% for the following years. This number is a reduction from the previous value of 4.0%, and the change is attributed to calculations based on the Ramsey equation (ASEK, 2014).

A calculation was made with these two general elements integrated (with Norwegian factors elsewhere) and the following results were retrieved:

Table 43: Analysis with Swedish Conditions

	Alternative 1	**Alternative 2**
User benefits	4,114,699,038	3,335,521,029
Operator benefits	2,577,753,940	2,993,816,772
Public benefits	-2,328,871,261	-2,310,817,750
Benefits for society in general	10,435,795,393	11,499,241,281
Tax financing costs	-5,537,775,817	-6,995,870,685
Net present value	-18,178,395,114	-25,534,463,756
Benefit/Cost ratio	0,34	0,26

12.5 International Interests

The analysis has maintained the principle of examining the project from a Norwegian perspective. The fact is, however, that many benefits will accrue entities on the Swedish side of the border, as well as possible Finnish interests. The mining industry in Sweden has announced an escalation in the amount of iron ore, with a wish to ship this out from the port in Narvik, which is ice-free all year and the most cost-efficient effective. The possibility of constructing double tracks on the Ofoten Line, the most trafficked line by far in Norway regarding goods, is being examined and seen as the only possibility of covering the increasing demand (Jernbaneverket, 2013).

If the increasing demand cannot be covered by the port in Narvik, or by other bottlenecks, the willingness-to-pay by foreign interest could be assumed to be quite high, as alternatives are scarce and significantly more costly. Questions therefore arise if the project could or should be co-funded by these interests to some extent, both for their own hedging purposes and on grounds of equitability. If the most optimistic scenarios regarding the mining sector in Northern Sweden / Finland come true, in conjunction with more activity in the Northeast Passage, then co-funding by foreign interests could be a win-win situation for all parties involved and the factor that tips the profitability of the project into the positive.

13. Conclusion and Recommendations

With the current principles regarding economic analysis, the Troms Line is to be considered as unprofitable even in very positive scenarios (see sensitivity analysis).

Benefits related to time saving usually constitute a large share of the total benefits in such projects, and, the time savings on this project are also considerable. The lack of people that will benefit from these time savings is, however, a determining factor in the lack of profitability.

Some of the input values lack the robustness to form a proper basis for decision-making. This is particularly relevant for the cost calculations, but, also for the assumptions regarding traffic. A proper traffic analysis is needed to form a quality assured basis for decision-making, as well as an in-depth study of the costs.

Of the two alternatives, alternative 1 is the most promising – although still quite unprofitable. If a realisation of the project is possible, it is likely to be driven by increasing demand for port capacity by foreign interests. If the increasing demand cannot be covered by the port in Narvik, or by other bottlenecks, the willingness-to-pay by foreign interest could be assumed to be quite high, as alternatives are scarce and significantly more costly. A co-funding of some kind, by private or/and public foreign interests could render an otherwise unprofitable project to become profitable.

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APPENDIX

Appendix 1: Traffic Simulation Assumptions

Assumptions

(1) Current travelling time Narvik-Tromsø

Alternative 1		Alternative 2	
Means	**Time (minutes)**	**Means**	**Time (minutes)**
Distance (km)	**180**	**Distance (km)**	**215**
Car	189,1	Car	189,1
Bus	281,7	Bus	281,7
Train	102,7	Train	117,7
Air	199,3	Air	199,3

(2) Time differences in travelling time

Alternative 1		Alternative 2	
Means	**Time (minutes)**	**Means**	**Time (minutes)**
Train	0	Air	81,6
Air	96,6	Train	0
Car	86,4	Car	71,4
Bus	179	Bus	164

(3) Reference traffic in 2022

Reference traffic in 2022<50 KM	Commute	Leisure	Business	SUM
Cars	863 457	1 995 976	86 346	2 945 779
Buses	197 136	1 715 085	59 141	1 971 362
Aircrafts	0	0	0	0

Reference traffic in 2022 <50 KM	Commute	Leisure	Business	SUM
Cars	49 340	279 595	82 234	411 169
Buses	59 141	718 139	67 590	844 870
Aircrafts	0	2 951	26 567	26 024

(4) Annual average growth rates

Growth rates (Average yearly growth)	
Cars	1,15 %
Buses	1,15 %
Aircrafts	1,00 %

(5) Transferred traffic

Traffic transferred from other sources to rail (alternative 1)		
	<50 km	>50 km
Cars	5 %	55 %
Buses	10 %	50 %
Aircrafts		80 %

Traffic transferred from other sources to rail (alternative 2)		
	<50 km	>50 km
Cars	5 %	60 %
Buses	10 %	55 %
Aircrafts		80 %

(6) Average travel distance

Average distance (km) travels <50 km	
Cars	10
Buses	20

Average distance (km) travels > 50 km		
Cars	70	
Buses	80	
Aircrafts	160	Linear distance Evenes-Tromsø

(7) Time savings per kilometer (minutes)

	Alt 1	Alt 2
Car to train	0,4800	0,3321
Bus to train	0,9944	0,7628
Air to train	0,5367	0,3795

(8) Value of time

Time costs, passenger travel under 50 km

Value of travel time (NOK/hour)	Commuting	Leisure	Business
Train	66,95	52,61	454,30
Car	100,42	83,69	454,30
Bus	66,95	52,61	454,30

Time costs, passenger travel over 50 km

Value of travel time (NOK/hour)	Commuting	Leisure	Business
Train	105,21	75,31	454,30
Car	180,52	155,42	454,30
Bus	66,95	62,17	454,30
Air	344,31	215,20	532,01

*Adjusted for 2022

Assumptions

(1) Reference traffic (tonnes, 2014)

Ofoten Line	23 000 000	
Car	11 520 000	* Assumed 96,000 journeys with an average of 12 tonnes per car
Sea	21 000 000	* Sum of Narvik and Tromsø Ports in 2012, adjusted upwards
Air	3 574	* Based on SSB (continued value)

(2) Growth rates

Ofoten Line	3,75 %	*Yearly weighted estimated average, based on predictions
Car	2,35 %	*Based on TØI's predictions, weighted
Sea	1,85 %	*Based on TØI's predictions, weighted+added 1 % because of Northeast Passa
Air	0,00 %	

(3) Transfer rates

	Alternative 1	**Alternative 2**	
Car to train	45,00 %	50,00 %	
Sea to train	0,00 %	0,00 %	*Assumed to be included in transferred road traffic
Air to train	90,00 %	90,00 %	
Ofoten Line	20,00 %	20,00 %	*Continuation to Tromsø

(4) Relationship unloading / loading in ports 6,35 %

Appendix 2: Traffic Simulations

Traffic Simulation (>50 km)

	Reference alternative												Alternative 1												Alternative 2											
	Car			Bus			Air			Train			Car			Bus			Air			Train			Car			Bus			Air			Train		
	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business
2022	49 340	279 595	82 234	59 141	718 139	67 590	0	2 951	26 567	0	0	0	19 736	111 838	37 005	29 571	359 070	33 795	0	590	5 313	59 175	529 187	100 277	19 736	111 838	32 894	26 613	323 163	30 416	0	590	5 313	62 132	565 094	107 769
2023	49 907	282 810	83 180	59 821	726 398	68 367	0	2 981	26 833	0	0	0	19 963	113 124	37 431	29 911	363 199	34 184	0	596	5 367	59 855	535 269	101 399	19 963	113 124	33 272	26 920	326 879	30 765	0	596	5 367	62 846	571 589	108 976
2024	50 481	286 063	84 136	60 509	734 751	69 154	0	3 010	27 101	0	0	0	20 193	114 425	37 861	30 255	367 376	34 577	0	602	5 420	60 543	541 421	102 532	20 193	114 425	33 655	27 229	330 638	31 119	0	602	5 420	63 569	578 159	110 197
2025	51 062	289 352	85 104	61 205	743 201	69 949	0	3 040	27 372	0	0	0	20 425	115 741	38 297	30 602	371 600	34 974	0	608	5 474	61 240	547 644	103 679	20 425	115 741	34 042	27 542	334 440	31 477	0	608	5 474	64 300	584 804	111 432
2026	51 649	292 680	86 083	61 909	751 748	70 753	0	3 071	27 646	0	0	0	20 660	117 072	38 737	30 954	375 874	35 377	0	614	5 529	61 944	553 938	104 839	20 660	117 072	34 433	27 859	338 286	31 839	0	614	5 529	65 039	591 526	112 680
2027	52 243	296 046	87 072	62 621	760 393	71 567	0	3 102	27 922	0	0	0	20 897	118 418	39 183	31 310	380 196	35 783	0	620	5 584	62 656	560 305	106 011	20 897	118 418	34 829	28 179	342 177	32 205	0	620	5 584	65 787	598 325	113 943
2028	52 844	299 450	88 074	63 341	769 137	72 390	0	3 133	28 201	0	0	0	21 138	119 780	39 633	31 670	384 569	36 195	0	627	5 640	63 377	566 745	107 197	21 138	119 780	35 230	28 503	346 112	32 575	0	627	5 640	66 544	605 202	115 220
2029	53 452	302 894	89 087	64 069	777 982	73 222	0	3 164	28 483	0	0	0	21 381	121 158	40 089	32 035	388 991	36 611	0	633	5 697	64 106	573 259	108 396	21 381	121 158	35 635	28 831	350 092	32 950	0	633	5 697	67 309	612 158	116 511
2030	54 066	306 377	90 111	64 806	786 929	74 064	0	3 196	28 768	0	0	0	21 626	122 551	40 550	32 403	393 465	37 032	0	639	5 754	64 843	579 847	109 608	21 626	122 551	36 044	29 163	354 118	33 329	0	639	5 754	68 083	619 194	117 817
2031	54 688	309 901	91 147	65 551	795 979	74 916	0	3 227	29 056	0	0	0	21 875	123 960	41 016	32 776	397 989	37 458	0	645	5 811	65 588	586 512	110 834	21 875	123 960	36 459	29 498	358 190	33 712	0	645	5 811	68 866	626 311	119 137
2032	55 317	313 464	92 196	66 305	805 133	75 778	0	3 260	29 346	0	0	0	22 127	125 386	41 488	33 153	402 566	37 889	0	652	5 869	66 343	593 253	112 074	22 127	125 386	36 878	29 837	362 310	34 100	0	652	5 869	69 658	633 509	120 472
2033	55 953	317 069	93 256	67 068	814 392	76 649	0	3 292	29 640	0	0	0	22 381	126 828	41 965	33 534	407 196	38 325	0	658	5 928	67 106	600 071	113 327	22 381	126 828	37 302	30 180	366 476	34 492	0	658	5 928	70 459	640 791	121 823
2034	56 597	320 716	94 328	67 839	823 757	77 531	0	3 325	29 936	0	0	0	22 639	128 286	42 448	33 919	411 879	38 765	0	665	5 987	67 877	606 968	114 595	22 639	128 286	37 731	30 528	370 691	34 889	0	665	5 987	71 269	648 156	123 188
2035	57 247	324 404	95 413	68 619	833 230	78 422	0	3 359	30 236	0	0	0	22 899	129 762	42 936	34 310	416 615	39 211	0	672	6 047	68 658	613 944	115 877	22 899	129 762	38 165	30 879	374 954	35 290	0	672	6 047	72 089	655 606	124 569
2036	57 906	328 134	96 510	69 408	842 812	79 324	0	3 392	30 538	0	0	0	23 162	131 254	43 430	34 704	421 406	39 662	0	678	6 108	69 448	621 001	117 173	23 162	131 254	38 604	31 234	379 266	35 696	0	678	6 108	72 918	663 141	125 965
2037	58 572	331 908	97 620	70 206	852 505	80 236	0	3 426	30 843	0	0	0	23 429	132 763	43 929	35 103	426 252	40 118	0	685	6 169	70 246	628 138	118 484	23 429	132 763	39 048	31 593	383 627	36 106	0	685	6 169	73 757	670 763	127 377
2038	59 245	335 725	98 743	71 014	862 309	81 159	0	3 460	31 152	0	0	0	23 698	134 290	44 434	35 507	431 154	40 579	0	692	6 230	71 054	635 357	119 810	23 698	134 290	39 497	31 956	388 039	36 522	0	692	6 230	74 605	678 473	128 805
2039	59 927	339 586	99 878	71 830	872 225	82 092	0	3 495	31 463	0	0	0	23 971	135 834	44 945	35 915	436 113	41 046	0	699	6 293	71 871	642 660	121 150	23 971	135 834	39 951	32 324	392 501	36 942	0	699	6 293	75 463	686 271	130 249
2040	60 616	343 491	101 027	72 657	882 256	83 036	0	3 530	31 778	0	0	0	24 246	137 396	45 462	36 328	441 128	41 518	0	706	6 356	72 698	650 046	122 505	24 246	137 396	40 411	32 695	397 015	37 366	0	706	6 356	76 331	694 159	131 709
2041	61 313	347 441	102 189	73 492	892 402	83 991	0	3 565	32 096	0	0	0	24 525	138 976	45 985	36 746	446 201	41 996	0	713	6 419	73 534	657 518	123 876	24 525	138 976	40 876	33 071	401 581	37 796	0	713	6 419	77 208	702 138	133 185
2042	62 018	351 437	103 364	74 337	902 664	84 957	0	3 601	32 417	0	0	0	24 807	140 575	46 514	37 169	451 332	42 479	0	720	6 483	74 379	665 075	125 262	24 807	140 575	41 346	33 452	406 199	38 231	0	720	6 483	78 096	710 208	134 678
2043	62 731	355 478	104 553	75 192	913 045	85 934	0	3 637	32 741	0	0	0	25 092	142 191	47 049	37 596	456 522	42 967	0	727	6 548	75 235	672 719	126 664	25 092	142 191	41 821	33 836	410 870	38 670	0	727	6 548	78 994	718 371	136 188
2044	63 452	359 566	105 755	76 057	923 545	86 922	0	3 673	33 068	0	0	0	25 381	143 826	47 590	38 028	461 772	43 461	0	735	6 614	76 100	680 451	128 081	25 381	143 826	42 302	34 226	415 595	39 115	0	735	6 614	79 903	726 628	137 715
2045	64 182	363 701	106 971	76 931	934 166	87 922	0	3 710	33 399	0	0	0	25 673	145 481	48 137	38 466	467 083	43 961	0	742	6 680	76 975	688 272	129 514	25 673	145 481	42 788	34 619	420 375	39 565	0	742	6 680	80 822	734 980	139 259
2046	64 920	367 884	108 201	77 816	944 909	88 933	0	3 747	33 733	0	0	0	25 968	147 154	48 691	38 908	472 454	44 467	0	749	6 747	77 860	696 182	130 964	25 968	147 154	43 281	35 017	425 209	40 020	0	749	6 747	81 751	743 428	140 820

Traffic Simulation (<50 km)

	Reference alternative									Alternative 1									Alternative 2								
	Car			Bus			Train			Car			Bus			Train			Car			Bus			Train		
	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business	Commute	Leisure	Business
2022	863 457	1 995 976	86 346	197 136	1 715 085	59 141	0	0	0	820 284	1 896 177	82 029	177 422	1 543 577	53 227	62 886	271 307	10 231	820 284	1 896 177	82 029	177 422	1 543 577	53 227	62 886	271 307	10 231
2023	873 387	2 018 930	87 339	199 403	1 734 808	59 821	0	0	0	829 717	1 917 983	82 972	179 463	1 561 328	53 839	63 610	274 427	10 349	829 717	1 917 983	82 972	179 463	1 561 328	53 839	63 610	274 427	10 349
2024	883 431	2 042 147	88 343	201 696	1 754 759	60 509	0	0	0	839 259	1 940 040	83 926	181 527	1 579 283	54 458	64 341	277 583	10 468	839 259	1 940 040	83 926	181 527	1 579 283	54 458	64 341	277 583	10 468
2025	893 590	2 065 632	89 359	204 016	1 774 939	61 205	0	0	0	848 911	1 962 351	84 891	183 614	1 597 445	55 084	65 081	280 775	10 588	848 911	1 962 351	84 891	183 614	1 597 445	55 084	65 081	280 775	10 588
2026	903 866	2 089 387	90 387	206 362	1 795 350	61 909	0	0	0	858 673	1 984 918	85 868	185 726	1 615 815	55 718	65 830	284 004	10 710	858 673	1 984 918	85 868	185 726	1 615 815	55 718	65 830	284 004	10 710
2027	914 261	2 113 415	91 426	208 735	1 815 997	62 621	0	0	0	868 548	2 007 744	86 855	187 862	1 634 397	56 359	66 587	287 270	10 833	868 548	2 007 744	86 855	187 862	1 634 397	56 359	66 587	287 270	10 833
2028	924 775	2 137 719	92 478	211 136	1 836 881	63 341	0	0	0	878 536	2 030 833	87 854	190 022	1 653 193	57 007	67 352	290 574	10 958	878 536	2 030 833	87 854	190 022	1 653 193	57 007	67 352	290 574	10 958
2029	935 410	2 162 303	93 541	213 564	1 858 005	64 069	0	0	0	888 639	2 054 188	88 864	192 207	1 672 204	57 662	68 127	293 916	11 084	888 639	2 054 188	88 864	192 207	1 672 204	57 662	68 127	293 916	11 084
2030	946 167	2 187 169	94 617	216 020	1 879 372	64 806	0	0	0	898 859	2 077 811	89 886	194 418	1 691 435	58 325	68 910	297 296	11 211	898 859	2 077 811	89 886	194 418	1 691 435	58 325	68 910	297 296	11 211
2031	957 048	2 212 322	95 705	218 504	1 900 985	65 551	0	0	0	909 196	2 101 706	90 920	196 653	1 710 886	58 996	69 703	300 715	11 340	909 196	2 101 706	90 920	196 653	1 710 886	58 996	69 703	300 715	11 340
2032	968 054	2 237 764	96 806	221 017	1 922 846	66 305	0	0	0	919 651	2 125 875	91 965	198 915	1 730 561	59 675	70 504	304 173	11 471	919 651	2 125 875	91 965	198 915	1 730 561	59 675	70 504	304 173	11 471
2033	979 187	2 263 498	97 919	223 558	1 944 959	67 068	0	0	0	930 227	2 150 323	93 023	201 202	1 750 463	60 361	71 315	307 671	11 603	930 227	2 150 323	93 023	201 202	1 750 463	60 361	71 315	307 671	11 603
2034	990 447	2 289 528	99 045	226 129	1 967 326	67 839	0	0	0	940 925	2 175 052	94 093	203 516	1 770 593	61 055	72 135	311 209	11 736	940 925	2 175 052	94 093	203 516	1 770 593	61 055	72 135	311 209	11 736
2035	1 001 837	2 315 858	100 184	228 730	1 989 950	68 619	0	0	0	951 746	2 200 065	95 175	205 857	1 790 955	61 757	72 965	314 788	11 871	951 746	2 200 065	95 175	205 857	1 790 955	61 757	72 965	314 788	11 871
2036	1 013 359	2 342 490	101 336	231 360	2 012 835	69 408	0	0	0	962 691	2 225 365	96 269	208 224	1 811 551	62 467	73 804	318 408	12 008	962 691	2 225 365	96 269	208 224	1 811 551	62 467	73 804	318 408	12 008
2037	1 025 012	2 369 429	102 502	234 021	2 035 982	70 206	0	0	0	973 762	2 250 957	97 376	210 619	1 832 384	63 186	74 653	322 070	12 146	973 762	2 250 957	97 376	210 619	1 832 384	63 186	74 653	322 070	12 146
2038	1 036 800	2 396 677	103 680	236 712	2 059 396	71 014	0	0	0	984 960	2 276 843	98 496	213 041	1 853 456	63 912	75 511	325 773	12 285	984 960	2 276 843	98 496	213 041	1 853 456	63 912	75 511	325 773	12 285
2039	1 048 723	2 424 239	104 873	239 434	2 083 079	71 830	0	0	0	996 287	2 303 027	99 629	215 491	1 874 771	64 647	76 380	329 520	12 427	996 287	2 303 027	99 629	215 491	1 874 771	64 647	76 380	329 520	12 427
2040	1 060 783	2 452 118	106 079	242 188	2 107 034	72 657	0	0	0	1 007 744	2 329 512	100 775	217 969	1 896 331	65 391	77 258	333 309	12 570	1 007 744	2 329 512	100 775	217 969	1 896 331	65 391	77 258	333 309	12 570
2041	1 072 982	2 480 317	107 299	244 973	2 131 265	73 492	0	0	0	1 019 333	2 356 301	101 934	220 475	1 918 139	66 143	78 146	337 142	12 714	1 019 333	2 356 301	101 934	220 475	1 918 139	66 143	78 146	337 142	12 714
2042	1 085 322	2 508 841	108 533	247 790	2 155 775	74 337	0	0	0	1 031 056	2 383 399	103 106	223 011	1 940 197	66 904	79 045	341 020	12 860	1 031 056	2 383 399	103 106	223 011	1 940 197	66 904	79 045	341 020	12 860
2043	1 097 803	2 537 692	109 781	250 640	2 180 566	75 192	0	0	0	1 042 913	2 410 808	104 292	225 576	1 962 510	67 673	79 954	344 941	13 008	1 042 913	2 410 808	104 292	225 576	1 962 510	67 673	79 954	344 941	13 008
2044	1 110 428	2 566 876	111 043	253 522	2 205 643	76 057	0	0	0	1 054 906	2 438 532	105 491	228 170	1 985 078	68 451	80 874	348 908	13 158	1 054 906	2 438 532	105 491	228 170	1 985 078	68 451	80 874	348 908	13 158
2045	1 123 197	2 596 395	112 320	256 437	2 231 008	76 931	0	0	0	1 067 038	2 466 575	106 704	230 794	2 007 907	69 238	81 804	352 920	13 309	1 067 038	2 466 575	106 704	230 794	2 007 907	69 238	81 804	352 920	13 309
2046	1 136 114	2 626 253	113 612	259 386	2 256 664	77 816	0	0	0	1 079 309	2 494 941	107 931	233 448	2 030 998	70 035	82 744	356 979	13 462	1 079 309	2 494 941	107 931	233 448	2 030 998	70 035	82 744	356 979	13 462

Appendix 3: Valuation of time savings

Alternative 1

Amount of travels transferred to trains <50 km							Amount of kilometers transferred to trains <50 km							Total time saved <50 km (minutes)							Value of time savings <50 km						
Commuters			Leisure		Business		Commuters			Leisure		Business		Commuters			Leisure		Business		Commuters			Leisure		Business	
	Car	Bus	Car	Bus	Car	Bus		Car	Bus	Car	Bus	Car	Bus		Car	Bus	Car	Bus	Car	Bus		Car	Bus	Car	Bus	Car	Bus
2022	43 173	19 714	99 799	171 509	4 317	5 914	2022	431 729	394 272	997 988	3 430 170	43 173	118 282	2022	207 230	392 082	479 034	3 411 114	20 723	117 625	2022	231 247	437 523	420 019	2 990 877	156 908	890 614
2023	43 669	19 940	100 946	173 481	4 367	5 982	2023	436 693	398 806	1 009 465	3 469 617	43 669	119 642	2023	209 613	396 591	484 543	3 450 341	20 961	118 978	2023	236 714	447 866	429 947	3 061 576	160 617	911 666
2024	44 172	20 170	102 107	175 476	4 417	6 051	2024	441 715	403 392	1 021 074	3 509 518	44 172	121 018	2024	212 023	401 151	490 115	3 490 020	21 202	120 346	2024	242 309	458 452	440 111	3 133 945	164 413	933 216
2025	44 680	20 402	103 282	177 494	4 468	6 120	2025	446 795	408 031	1 032 816	3 549 877	44 680	122 410	2025	214 462	405 765	495 752	3 530 155	21 446	121 730	2025	248 037	469 289	450 514	3 208 025	168 300	955 276
2026	45 193	20 636	104 469	179 535	4 519	6 191	2026	451 933	412 724	1 044 693	3 590 701	45 193	123 818	2026	216 928	410 431	501 453	3 570 752	21 693	123 130	2026	253 900	480 382	461 163	3 283 857	172 278	977 856
2027	45 713	20 874	105 671	181 600	4 571	6 262	2027	457 130	417 470	1 056 707	3 631 994	45 713	125 241	2027	219 423	415 151	507 220	3 611 816	21 942	124 546	2027	259 901	491 737	472 064	3 361 480	176 350	1 000 971
2028	46 239	21 114	106 886	183 688	4 624	6 334	2028	462 387	422 271	1 068 860	3 673 762	46 239	126 682	2028	221 946	419 925	513 053	3 653 352	22 195	125 978	2028	266 045	503 361	483 223	3 440 939	180 519	1 024 632
2029	46 770	21 356	108 115	185 800	4 677	6 407	2029	467 705	427 127	1 081 151	3 716 010	46 771	128 139	2029	224 498	424 754	518 953	3 695 365	22 450	127 427	2029	272 334	515 260	494 645	3 522 276	184 786	1 048 852
2030	47 308	21 602	109 358	187 937	4 731	6 481	2030	473 084	432 039	1 093 585	3 758 744	47 309	129 612	2030	227 080	429 639	524 921	3 737 862	22 708	128 892	2030	278 771	527 439	506 338	3 605 536	189 154	1 073 645
2031	47 852	21 850	110 616	190 098	4 785	6 555	2031	478 524	437 008	1 106 161	3 801 969	47 853	131 103	2031	229 692	434 580	530 957	3 780 847	22 969	130 374	2031	285 361	539 907	518 306	3 690 763	193 625	1 099 024
2032	48 403	22 102	111 888	192 285	4 840	6 631	2032	484 027	442 033	1 118 882	3 845 692	48 403	132 610	2032	232 333	439 577	537 063	3 824 327	23 233	131 874	2032	292 106	552 669	530 558	3 778 006	198 202	1 125 003
2033	48 959	22 356	113 175	194 496	4 896	6 707	2033	489 593	447 116	1 131 749	3 889 918	48 960	134 135	2033	235 005	444 633	543 239	3 868 307	23 501	133 390	2033	299 011	565 733	543 099	3 867 310	202 887	1 151 595
2034	49 522	22 613	114 476	196 733	4 952	6 784	2034	495 224	452 258	1 144 764	3 934 652	49 523	135 678	2034	237 707	449 746	549 487	3 912 792	23 771	134 924	2034	306 079	579 106	555 937	3 958 725	207 683	1 178 817
2035	50 092	22 873	115 793	198 995	5 009	6 862	2035	500 919	457 459	1 157 929	3 979 900	50 092	137 238	2035	240 441	454 918	555 806	3 957 790	24 044	136 476	2035	313 314	592 795	569 078	4 052 302	212 592	1 206 682
2036	50 668	23 136	117 124	201 283	5 067	6 941	2036	506 679	462 720	1 171 245	4 025 669	50 668	138 816	2036	243 206	460 149	562 198	4 003 304	24 321	138 045	2036	320 720	606 807	582 530	4 148 090	217 617	1 235 205
2037	51 251	23 402	118 471	203 598	5 125	7 021	2037	512 506	468 041	1 184 714	4 071 964	51 251	140 413	2037	246 003	465 441	568 663	4 049 342	24 600	139 633	2037	328 301	621 151	596 300	4 246 143	222 761	1 264 403
2038	51 840	23 671	119 834	205 940	5 184	7 101	2038	518 400	473 424	1 198 339	4 118 792	51 840	142 028	2038	248 832	470 794	575 202	4 095 910	24 883	141 239	2038	336 062	635 834	610 396	4 346 513	228 027	1 294 291
2039	52 436	23 943	121 212	208 308	5 244	7 183	2039	524 362	478 868	1 212 119	4 166 158	52 436	143 661	2039	251 694	476 208	581 817	4 143 013	25 169	142 863	2039	344 006	650 864	624 824	4 449 256	233 417	1 324 885
2040	53 039	24 219	122 606	210 703	5 304	7 266	2040	530 392	484 375	1 226 059	4 214 069	53 039	145 313	2040	254 588	481 684	588 508	4 190 657	25 459	144 506	2040	352 137	666 249	639 594	4 554 427	238 935	1 356 203
2041	53 649	24 497	124 016	213 127	5 365	7 349	2041	536 491	489 946	1 240 158	4 262 530	53 649	146 984	2041	257 516	487 224	595 276	4 238 850	25 752	146 168	2041	360 461	681 998	654 712	4 662 085	244 582	1 388 261
2042	54 266	24 779	125 442	215 577	5 427	7 434	2042	542 661	495 580	1 254 420	4 311 550	54 266	148 674	2042	260 477	492 827	602 122	4 287 597	26 048	147 849	2042	368 982	698 119	670 188	4 772 287	250 364	1 421 077
2043	54 890	25 064	126 885	218 057	5 489	7 519	2043	548 901	501 279	1 268 846	4 361 132	54 890	150 384	2043	263 473	498 494	609 046	4 336 904	26 347	149 549	2043	377 704	714 621	686 030	4 885 095	256 282	1 454 668
2044	55 521	25 352	128 344	220 564	5 552	7 606	2044	555 214	507 044	1 283 438	4 411 285	55 522	152 114	2044	266 503	504 227	616 050	4 386 778	26 650	151 269	2044	386 632	731 513	702 247	5 000 569	262 340	1 489 053
2045	56 160	25 644	129 820	223 101	5 616	7 693	2045	561 599	512 875	1 298 197	4 462 015	56 160	153 863	2045	269 567	510 025	623 135	4 437 226	26 957	153 008	2045	395 771	748 805	718 847	5 118 772	268 541	1 524 252
2046	56 806	25 939	131 313	225 666	5 681	7 782	2046	568 057	518 773	1 313 127	4 513 328	56 806	155 632	2046	272 667	515 891	630 301	4 488 254	27 267	154 768	2046	405 126	766 505	735 839	5 239 769	274 889	1 560 282

Amount of travels transferred to train >50 km

	Commuters			Leisure			Business		
	Car	Bus	Air	Car	Bus	Air	Car	Bus	Air
2022	29 604	29 571	0	167 757	359 070	2 361	45 229	33 795	21 254
2023	29 944	29 911	0	169 686	363 199	2 384	45 749	34 184	21 466
2024	30 289	30 255	0	171 638	367 376	2 408	46 275	34 577	21 681
2025	30 637	30 602	0	173 611	371 600	2 432	46 807	34 974	21 898
2026	30 989	30 954	0	175 608	375 874	2 457	47 345	35 377	22 117
2027	31 346	31 310	0	177 627	380 196	2 481	47 890	35 783	22 338
2028	31 706	31 670	0	179 670	384 569	2 506	48 441	36 195	22 561
2029	32 071	32 035	0	181 736	388 991	2 531	48 998	36 611	22 787
2030	32 440	32 403	0	183 826	393 465	2 556	49 561	37 032	23 015
2031	32 813	32 776	0	185 940	397 989	2 582	50 131	37 458	23 245
2032	33 190	33 153	0	188 079	402 566	2 608	50 708	37 889	23 477
2033	33 572	33 534	0	190 242	407 196	2 634	51 291	38 325	23 712
2034	33 958	33 919	0	192 429	411 879	2 660	51 881	38 765	23 949
2035	34 348	34 310	0	194 642	416 615	2 687	52 477	39 211	24 189
2036	34 743	34 704	0	196 881	421 406	2 714	53 081	39 662	24 430
2037	35 143	35 103	0	199 145	426 252	2 741	53 691	40 118	24 675
2038	35 547	35 507	0	201 435	431 154	2 768	54 309	40 579	24 922
2039	35 956	35 915	0	203 751	436 113	2 796	54 933	41 046	25 171
2040	36 369	36 328	0	206 095	441 128	2 824	55 565	41 518	25 422
2041	36 788	36 746	0	208 465	446 201	2 852	56 204	41 996	25 677
2042	37 211	37 169	0	210 862	451 332	2 881	56 850	42 479	25 933
2043	37 639	37 596	0	213 287	456 522	2 909	57 504	42 967	26 193
2044	38 071	38 028	0	215 740	461 772	2 939	58 165	43 461	26 455
2045	38 509	38 466	0	218 221	467 083	2 968	58 834	43 961	26 719
2046	38 952	38 908	0	220 730	472 454	2 998	59 511	44 467	26 986

Amount of kilometers transferred to train >50 km

	Commuters			Leisure			Business		
	Car	Bus	Air	Car	Bus	Air	Car	Bus	Air
2022	2 072 280	2 365 640	0	11 742 990	28 725 560	377 728	3 166 009	2 703 600	3 400 576
2023	2 096 111	2 392 845	0	11 878 034	29 055 904	381 505	3 202 418	2 734 691	3 434 582
2024	2 120 216	2 420 363	0	12 014 632	29 390 047	385 320	3 239 246	2 766 140	3 468 928
2025	2 144 599	2 448 197	0	12 152 800	29 728 032	389 174	3 276 497	2 797 951	3 503 617
2026	2 169 262	2 476 351	0	12 292 557	30 069 905	393 065	3 314 177	2 830 127	3 538 653
2027	2 194 208	2 504 829	0	12 433 922	30 415 709	396 996	3 352 290	2 862 674	3 574 040
2028	2 219 442	2 533 635	0	12 576 912	30 765 489	400 966	3 390 841	2 895 595	3 609 780
2029	2 244 965	2 562 771	0	12 721 546	31 119 292	404 976	3 429 836	2 928 894	3 645 878
2030	2 270 782	2 592 243	0	12 867 844	31 477 164	409 025	3 469 279	2 962 576	3 682 337
2031	2 296 896	2 622 054	0	13 015 824	31 839 152	413 116	3 509 176	2 996 646	3 719 160
2032	2 323 311	2 652 208	0	13 165 506	32 205 302	417 247	3 549 531	3 031 107	3 756 351
2033	2 350 029	2 682 708	0	13 316 910	32 575 663	421 419	3 590 351	3 065 965	3 793 915
2034	2 377 054	2 713 559	0	13 470 054	32 950 283	425 633	3 631 640	3 101 224	3 831 854
2035	2 404 390	2 744 765	0	13 624 960	33 329 211	429 890	3 673 404	3 136 888	3 870 173
2036	2 432 041	2 776 330	0	13 781 647	33 712 497	434 189	3 715 648	3 172 962	3 908 874
2037	2 460 009	2 808 258	0	13 940 136	34 100 191	438 530	3 758 378	3 209 451	3 947 963
2038	2 488 299	2 840 553	0	14 100 447	34 492 343	442 916	3 801 599	3 246 360	3 987 443
2039	2 516 915	2 873 219	0	14 262 602	34 889 005	447 345	3 845 318	3 283 693	4 027 317
2040	2 545 859	2 906 261	0	14 426 622	35 290 229	451 818	3 889 539	3 321 455	4 067 590
2041	2 575 137	2 939 683	0	14 592 528	35 696 066	456 337	3 934 269	3 359 652	4 108 266
2042	2 604 751	2 973 489	0	14 760 342	36 106 571	460 900	3 979 513	3 398 288	4 149 349
2043	2 634 705	3 007 685	0	14 930 086	36 521 797	465 509	4 025 277	3 437 368	4 190 842
2044	2 665 005	3 042 273	0	15 101 782	36 941 797	470 164	4 071 568	3 476 898	4 232 751
2045	2 695 652	3 077 259	0	15 275 453	37 366 628	474 866	4 118 391	3 516 882	4 275 078
2046	2 726 652	3 112 648	0	15 451 121	37 796 344	479 614	4 165 752	3 557 327	4 317 829

Total time saved >50 km (minutes)

	Commuters			Leisure			Business		
	Car	Bus	Air	Car	Bus	Air	Car	Bus	Air
2022	994 694	2 352 498	0	5 636 635	28 565 974	202 714	1 519 684	2 688 580	1 824 976
2023	1 006 133	2 379 551	0	5 701 457	28 894 482	204 741	1 537 161	2 719 499	1 843 226
2024	1 017 704	2 406 916	0	5 767 023	29 226 769	206 789	1 554 838	2 750 773	1 861 658
2025	1 029 408	2 434 596	0	5 833 344	29 562 877	208 856	1 572 719	2 782 407	1 880 274
2026	1 041 246	2 462 594	0	5 900 427	29 902 850	210 945	1 590 805	2 814 404	1 899 077
2027	1 053 220	2 490 913	0	5 968 282	30 246 732	213 054	1 609 099	2 846 770	1 918 068
2028	1 065 332	2 519 559	0	6 036 918	30 594 570	215 185	1 627 604	2 879 508	1 937 249
2029	1 077 583	2 548 534	0	6 106 342	30 946 407	217 337	1 646 321	2 912 622	1 956 621
2030	1 089 976	2 577 842	0	6 176 565	31 302 291	219 510	1 665 254	2 946 117	1 976 187
2031	1 102 510	2 607 487	0	6 247 596	31 662 268	221 705	1 684 404	2 979 998	1 995 949
2032	1 115 189	2 637 473	0	6 319 443	32 026 384	223 922	1 703 775	3 014 268	2 015 909
2033	1 128 014	2 667 804	0	6 392 117	32 394 687	226 162	1 723 368	3 048 932	2 036 068
2034	1 140 986	2 698 484	0	6 465 626	32 767 226	228 423	1 743 187	3 083 995	2 056 428
2035	1 154 107	2 729 516	0	6 539 981	33 144 049	230 707	1 763 234	3 119 461	2 076 993
2036	1 167 380	2 760 906	0	6 615 190	33 525 206	233 015	1 783 511	3 155 334	2 097 763
2037	1 180 804	2 792 656	0	6 691 265	33 910 745	235 345	1 804 021	3 191 621	2 118 740
2038	1 194 384	2 824 772	0	6 768 215	34 300 719	237 698	1 824 768	3 228 324	2 139 928
2039	1 208 119	2 857 257	0	6 846 049	34 695 177	240 075	1 845 752	3 265 450	2 161 327
2040	1 222 012	2 890 115	0	6 924 779	35 094 172	242 476	1 866 979	3 303 003	2 182 940
2041	1 236 066	2 923 351	0	7 004 414	35 497 755	244 901	1 888 449	3 340 987	2 204 770
2042	1 250 280	2 956 970	0	7 084 964	35 905 979	247 350	1 910 166	3 379 409	2 226 817
2043	1 264 659	2 990 975	0	7 166 441	36 318 898	249 823	1 932 133	3 418 272	2 249 085
2044	1 279 202	3 025 371	0	7 248 856	36 736 565	252 321	1 954 353	3 457 582	2 271 576
2045	1 293 913	3 060 163	0	7 332 217	37 159 036	254 845	1 976 828	3 497 344	2 294 292
2046	1 308 793	3 095 355	0	7 416 538	37 586 364	257 393	1 999 561	3 537 564	2 317 235

Value of time savings >50 km

	Commuters			Leisure			Business		
	Car	Bus	Air	Car	Bus	Air	Car	Bus	Air
2022	1 744 121	4 124 926	0	7 075 378	35 857 398	254 456	11 506 512	20 356 977	13 818 071
2023	1 785 349	4 222 431	0	7 242 626	36 704 995	260 085	11 778 503	20 838 175	14 123 727
2024	1 827 551	4 322 241	0	7 413 827	37 572 628	265 838	12 056 923	21 330 748	14 436 144
2025	1 870 751	4 424 410	0	7 589 075	38 460 770	271 718	12 341 925	21 834 964	14 755 471
2026	1 914 971	4 528 994	0	7 768 466	39 369 906	277 729	12 633 663	22 351 099	15 081 862
2027	1 960 237	4 636 051	0	7 952 097	40 300 531	283 872	12 932 298	22 879 434	15 415 473
2028	2 006 574	4 745 638	0	8 140 069	41 253 155	290 152	13 237 992	23 420 258	15 756 463
2029	2 054 005	4 857 815	0	8 332 484	42 228 297	296 570	13 550 911	23 973 866	16 104 996
2030	2 102 557	4 972 644	0	8 529 447	43 226 490	303 130	13 871 228	24 540 561	16 461 239
2031	2 152 258	5 090 188	0	8 731 066	44 248 278	309 835	14 199 116	25 120 650	16 825 361
2032	2 203 133	5 210 509	0	8 937 451	45 294 218	316 689	14 534 754	25 714 452	17 197 538
2033	2 255 210	5 333 675	0	9 148 714	46 364 883	323 694	14 878 327	26 322 291	17 577 948
2034	2 308 519	5 459 753	0	9 364 972	47 460 856	330 854	15 230 021	26 944 497	17 966 772
2035	2 363 088	5 588 810	0	9 586 341	48 582 736	338 172	15 590 028	27 581 411	18 364 197
2036	2 418 947	5 720 919	0	9 812 943	49 731 135	345 653	15 958 545	28 233 380	18 770 413
2037	2 476 126	5 856 150	0	10 044 901	50 906 679	353 299	16 335 773	28 900 761	19 185 615
2038	2 534 656	5 994 578	0	10 282 343	52 110 011	361 114	16 721 918	29 583 917	19 610 001
2039	2 594 570	6 136 277	0	10 525 397	53 341 788	369 101	17 117 191	30 283 222	20 043 774
2040	2 655 901	6 281 327	0	10 774 196	54 602 681	377 266	17 521 807	30 999 057	20 487 142
2041	2 718 681	6 429 805	0	11 028 876	55 893 379	385 611	17 935 988	31 731 812	20 940 318
2042	2 782 945	6 581 792	0	11 289 577	57 214 587	394 141	18 359 958	32 481 889	21 403 518
2043	2 848 729	6 737 373	0	11 556 440	58 567 025	402 859	18 793 951	33 249 696	21 876 963
2044	2 916 067	6 896 631	0	11 829 611	59 951 433	411 770	19 238 203	34 035 652	22 360 882
2045	2 984 997	7 059 653	0	12 109 239	61 368 565	420 879	19 692 955	34 840 187	22 855 504
2046	3 055 556	7 226 529	0	12 395 478	62 819 195	430 189	20 158 457	35 663 739	23 361 068

Alternative 2

Amount of travels transferred to trains <50 km

	Commuters		Leisure		Business	
	Car	Bus	Car	Bus	Car	Bus
2022	43 173	19 714	99 799	171 509	4 317	5 914
2023	43 669	19 940	100 946	173 481	4 367	5 982
2024	44 172	20 170	102 107	175 476	4 417	6 051
2025	44 680	20 402	103 282	177 494	4 468	6 120
2026	45 193	20 636	104 469	179 535	4 519	6 191
2027	45 713	20 874	105 671	181 600	4 571	6 262
2028	46 239	21 114	106 886	183 688	4 624	6 334
2029	46 770	21 356	108 115	185 800	4 677	6 407
2030	47 308	21 602	109 358	187 937	4 731	6 481
2031	47 852	21 850	110 616	190 098	4 785	6 555
2032	48 403	22 102	111 888	192 285	4 840	6 631
2033	48 959	22 356	113 175	194 496	4 896	6 707
2034	49 522	22 613	114 476	196 733	4 952	6 784
2035	50 092	22 873	115 793	198 995	5 009	6 862
2036	50 668	23 136	117 124	201 283	5 067	6 941
2037	51 251	23 402	118 471	203 598	5 125	7 021
2038	51 840	23 671	119 834	205 940	5 184	7 101
2039	52 436	23 943	121 212	208 308	5 244	7 183
2040	53 039	24 219	122 606	210 703	5 304	7 266
2041	53 649	24 497	124 016	213 127	5 365	7 349
2042	54 266	24 779	125 442	215 577	5 427	7 434
2043	54 890	25 064	126 885	218 057	5 489	7 519
2044	55 521	25 352	128 344	220 564	5 552	7 606
2045	56 160	25 644	129 820	223 101	5 616	7 693
2046	56 806	25 939	131 313	225 666	5 681	7 782

Amount of kilometers transferred to trains <50 km

	Commuters		Leisure		Business	
	Car	Bus	Car	Bus	Car	Bus
2022	431 729	394 272	997 988	3 430 170	43 173	118 282
2023	436 693	398 806	1 009 465	3 469 617	43 669	119 642
2024	441 715	403 392	1 021 074	3 509 518	44 172	121 018
2025	446 795	408 031	1 032 816	3 549 877	44 680	122 410
2026	451 933	412 724	1 044 693	3 590 701	45 193	123 818
2027	457 130	417 470	1 056 707	3 631 994	45 713	125 241
2028	462 387	422 271	1 068 860	3 673 762	46 239	126 682
2029	467 705	427 127	1 081 151	3 716 010	46 771	128 139
2030	473 084	432 039	1 093 585	3 758 744	47 309	129 612
2031	478 524	437 008	1 106 161	3 801 969	47 853	131 103
2032	484 027	442 033	1 118 882	3 845 692	48 403	132 610
2033	489 593	447 116	1 131 749	3 889 918	48 960	134 135
2034	495 224	452 258	1 144 764	3 934 652	49 523	135 678
2035	500 919	457 459	1 157 929	3 979 900	50 092	137 238
2036	506 679	462 720	1 171 245	4 025 669	50 668	138 816
2037	512 506	468 041	1 184 714	4 071 964	51 251	140 413
2038	518 400	473 424	1 198 339	4 118 792	51 840	142 028
2039	524 362	478 868	1 212 119	4 166 158	52 436	143 661
2040	530 392	484 375	1 226 059	4 214 069	53 039	145 313
2041	536 491	489 946	1 240 158	4 262 530	53 649	146 984
2042	542 661	495 580	1 254 420	4 311 550	54 266	148 674
2043	548 901	501 279	1 268 846	4 361 132	54 890	150 384
2044	555 214	507 044	1 283 438	4 411 285	55 522	152 114
2045	561 599	512 875	1 298 197	4 462 015	56 160	153 863
2046	568 057	518 773	1 313 127	4 513 328	56 806	155 632

Total time saved <50 km (minutes)

	Commuters		Leisure		Business	
	Car	Bus	Car	Bus	Car	Bus
2022	143 374	300 747	331 425	2 616 502	14 337	90 224
2023	145 023	304 206	335 236	2 646 592	14 502	91 262
2024	146 691	307 704	339 091	2 677 027	14 669	92 312
2025	148 378	311 243	342 991	2 707 813	14 838	93 373
2026	150 084	314 822	346 935	2 738 953	15 008	94 447
2027	151 810	318 442	350 925	2 770 451	15 181	95 533
2028	153 556	322 104	354 961	2 802 311	15 356	96 632
2029	155 322	325 809	359 043	2 834 538	15 532	97 743
2030	157 108	329 555	363 172	2 867 135	15 711	98 867
2031	158 914	333 345	367 348	2 900 107	15 892	100 004
2032	160 742	337 179	371 573	2 933 458	16 074	101 154
2033	162 591	341 056	375 846	2 967 193	16 259	102 317
2034	164 460	344 978	380 168	3 001 316	16 446	103 494
2035	166 352	348 946	384 540	3 035 831	16 635	104 684
2036	168 265	352 959	388 962	3 070 743	16 827	105 888
2037	170 200	357 018	393 435	3 106 056	17 020	107 106
2038	172 157	361 123	397 960	3 141 776	17 216	108 337
2039	174 137	365 276	402 536	3 177 906	17 414	109 583
2040	176 139	369 477	407 166	3 214 452	17 614	110 843
2041	178 165	373 726	411 848	3 251 419	17 817	112 118
2042	180 214	378 024	416 584	3 288 810	18 021	113 408
2043	182 286	382 371	421 375	3 326 631	18 229	114 712
2044	184 383	386 768	426 221	3 364 887	18 438	116 031
2045	186 503	391 216	431 122	3 403 584	18 650	117 365
2046	188 648	395 715	436 080	3 442 725	18 865	118 715

Value of time savings <50 km

	Commuters		Leisure		Business	
	Car	Bus	Car	Bus	Car	Bus
2022	159 991	335 603	290 595	2 294 159	108 558	683 147
2023	163 773	343 536	297 464	2 348 388	111 124	699 296
2024	167 644	351 657	304 495	2 403 899	113 751	715 826
2025	171 607	359 969	311 693	2 460 723	116 440	732 746
2026	175 663	368 478	319 061	2 518 889	119 192	750 067
2027	179 816	377 188	326 602	2 578 431	122 010	767 797
2028	184 066	386 104	334 323	2 639 380	124 894	785 946
2029	188 417	395 231	342 225	2 701 769	127 846	804 524
2030	192 871	404 573	350 315	2 765 634	130 868	823 542
2031	197 430	414 137	358 596	2 831 008	133 961	843 009
2032	202 097	423 926	367 072	2 897 927	137 128	862 936
2033	206 874	433 947	375 749	2 966 428	140 369	883 334
2034	211 764	444 204	384 631	3 036 549	143 688	904 214
2035	216 770	454 705	393 723	3 108 327	147 084	925 588
2036	221 894	465 453	403 030	3 181 801	150 561	947 467
2037	227 139	476 455	412 557	3 257 013	154 120	969 863
2038	232 508	487 718	422 309	3 334 002	157 763	992 789
2039	238 004	499 246	432 291	3 412 811	161 492	1 016 256
2040	243 630	511 048	442 510	3 493 483	165 309	1 040 278
2041	249 389	523 128	452 970	3 576 062	169 217	1 064 868
2042	255 284	535 493	463 677	3 660 593	173 217	1 090 040
2043	261 318	548 151	474 637	3 747 122	177 311	1 115 806
2044	267 495	561 109	485 857	3 835 697	181 503	1 142 182
2045	273 818	574 372	497 341	3 926 365	185 793	1 169 180
2046	280 291	587 949	509 098	4 019 176	190 185	1 196 818

Amount of travels transferred to train >50 km

	Commuters			Leisure			Business		
	Car	Bus	Air	Car	Bus	Air	Car	Bus	Air
2022	29 604	32 528	0	167 757	394 976	2 361	49 340	37 175	21 254
2023	29 944	32 902	0	169 686	399 519	2 384	49 908	37 602	21 466
2024	30 289	33 280	0	171 638	404 113	2 408	50 482	38 034	21 681
2025	30 637	33 663	0	173 611	408 760	2 432	51 062	38 472	21 898
2026	30 989	34 050	0	175 608	413 461	2 457	51 650	38 914	22 117
2027	31 346	34 441	0	177 627	418 216	2 481	52 243	39 362	22 338
2028	31 706	34 837	0	179 670	423 025	2 506	52 844	39 814	22 561
2029	32 071	35 238	0	181 736	427 890	2 531	53 452	40 272	22 787
2030	32 440	35 643	0	183 826	432 811	2 556	54 067	40 735	23 015
2031	32 813	36 053	0	185 940	437 788	2 582	54 688	41 204	23 245
2032	33 190	36 468	0	188 079	442 823	2 608	55 317	41 678	23 477
2033	33 572	36 887	0	190 242	447 915	2 634	55 954	42 157	23 712
2034	33 958	37 311	0	192 429	453 066	2 660	56 597	42 642	23 949
2035	34 348	37 741	0	194 642	458 277	2 687	57 248	43 132	24 189
2036	34 743	38 175	0	196 881	463 547	2 714	57 906	43 628	24 430
2037	35 143	38 614	0	199 145	468 878	2 741	58 572	44 130	24 675
2038	35 547	39 058	0	201 435	474 270	2 768	59 246	44 637	24 922
2039	35 956	39 507	0	203 751	479 724	2 796	59 927	45 151	25 171
2040	36 369	39 961	0	206 095	485 241	2 824	60 616	45 670	25 422
2041	36 788	40 421	0	208 465	490 821	2 852	61 313	46 195	25 677
2042	37 211	40 885	0	210 862	496 465	2 881	62 018	46 726	25 933
2043	37 639	41 356	0	213 287	502 175	2 909	62 732	47 264	26 193
2044	38 071	41 831	0	215 740	507 950	2 939	63 453	47 807	26 455
2045	38 509	42 312	0	218 221	513 791	2 968	64 183	48 357	26 719
2046	38 952	42 799	0	220 730	519 700	2 998	64 921	48 913	26 986

Amount of kilometers transferred to train >50 km

	Commuters			Leisure			Business		
	Car	Bus	Air	Car	Bus	Air	Car	Bus	Air
2022	2 072 280	2 602 204	0	11 742 990	31 598 116	377 728	3 453 828	2 973 960	3 400 576
2023	2 096 111	2 632 129	0	11 878 034	31 961 494	381 505	3 493 547	3 008 161	3 434 582
2024	2 120 216	2 662 399	0	12 014 632	32 329 052	385 320	3 533 723	3 042 754	3 468 928
2025	2 144 599	2 693 016	0	12 152 800	32 700 836	389 174	3 574 361	3 077 746	3 503 617
2026	2 169 262	2 723 986	0	12 292 557	33 076 895	393 065	3 615 466	3 113 140	3 538 653
2027	2 194 208	2 755 312	0	12 433 922	33 457 280	396 996	3 657 044	3 148 941	3 574 040
2028	2 219 442	2 786 998	0	12 576 912	33 842 038	400 966	3 699 100	3 185 154	3 609 780
2029	2 244 965	2 819 049	0	12 721 546	34 231 222	404 976	3 741 639	3 221 783	3 645 878
2030	2 270 782	2 851 468	0	12 867 844	34 624 881	409 025	3 784 668	3 258 834	3 682 337
2031	2 296 896	2 884 259	0	13 015 824	35 023 067	413 116	3 828 192	3 296 310	3 719 160
2032	2 323 311	2 917 428	0	13 165 506	35 425 832	417 247	3 872 216	3 334 218	3 756 351
2033	2 350 029	2 950 979	0	13 316 910	35 833 229	421 419	3 916 747	3 372 562	3 793 915
2034	2 377 054	2 984 915	0	13 470 054	36 245 311	425 633	3 961 789	3 411 346	3 831 854
2035	2 404 390	3 019 242	0	13 624 960	36 662 132	429 890	4 007 350	3 450 576	3 870 173
2036	2 432 041	3 053 963	0	13 781 647	37 083 747	434 189	4 053 434	3 490 258	3 908 874
2037	2 460 009	3 089 083	0	13 940 136	37 510 210	438 530	4 100 049	3 530 396	3 947 963
2038	2 488 299	3 124 608	0	14 100 447	37 941 577	442 916	4 147 199	3 570 996	3 987 443
2039	2 516 915	3 160 541	0	14 262 602	38 377 906	447 345	4 194 892	3 612 062	4 027 317
2040	2 545 859	3 196 887	0	14 426 622	38 819 251	451 818	4 243 133	3 653 601	4 067 590
2041	2 575 137	3 233 651	0	14 592 528	39 265 673	456 337	4 291 929	3 695 617	4 108 266
2042	2 604 751	3 270 838	0	14 760 342	39 717 228	460 900	4 341 287	3 738 117	4 149 349
2043	2 634 705	3 308 453	0	14 930 086	40 173 976	465 509	4 391 211	3 781 105	4 190 842
2044	2 665 005	3 346 500	0	15 101 782	40 635 977	470 164	4 441 710	3 824 588	4 232 751
2045	2 695 652	3 384 985	0	15 275 453	41 103 291	474 866	4 492 790	3 868 571	4 275 078
2046	2 726 652	3 423 912	0	15 451 121	41 575 979	479 614	4 544 457	3 913 059	4 317 829

Total time saved >50 km (minutes)

	Commuters			Leisure			Business		
	Car	Bus	Air	Car	Bus	Air	Car	Bus	Air
2022	688 190	1 984 937	0	3 899 765	24 102 749	143 361	1 146 992	2 268 509	1 290 637
2023	696 104	2 007 764	0	3 944 612	24 379 931	144 795	1 160 183	2 294 597	1 303 544
2024	704 109	2 030 853	0	3 989 975	24 660 300	146 243	1 173 525	2 320 985	1 316 579
2025	712 206	2 054 208	0	4 035 860	24 943 893	147 705	1 187 020	2 347 676	1 329 745
2026	720 397	2 077 831	0	4 082 272	25 230 748	149 182	1 200 671	2 374 674	1 343 042
2027	728 681	2 101 726	0	4 129 219	25 520 902	150 674	1 214 479	2 401 983	1 356 473
2028	737 061	2 125 896	0	4 176 705	25 814 392	152 181	1 228 445	2 429 606	1 370 037
2029	745 537	2 150 344	0	4 224 737	26 111 257	153 702	1 242 572	2 457 546	1 383 738
2030	754 111	2 175 073	0	4 273 321	26 411 537	155 239	1 256 862	2 485 808	1 397 575
2031	762 783	2 200 086	0	4 322 464	26 715 270	156 792	1 271 316	2 514 395	1 411 551
2032	771 555	2 225 387	0	4 372 173	27 022 495	158 360	1 285 936	2 543 310	1 425 666
2033	780 428	2 250 979	0	4 422 453	27 333 254	159 943	1 300 724	2 572 559	1 439 923
2034	789 403	2 276 865	0	4 473 311	27 647 586	161 543	1 315 683	2 602 143	1 454 322
2035	798 481	2 303 049	0	4 524 754	27 965 534	163 158	1 330 813	2 632 068	1 468 866
2036	807 664	2 329 535	0	4 576 789	28 287 137	164 790	1 346 117	2 662 336	1 483 554
2037	816 952	2 356 324	0	4 629 422	28 612 439	166 438	1 361 598	2 692 953	1 498 390
2038	826 347	2 383 422	0	4 682 660	28 941 482	168 102	1 377 256	2 723 922	1 513 374
2039	835 850	2 410 831	0	4 736 511	29 274 309	169 783	1 393 094	2 755 247	1 528 507
2040	845 462	2 438 556	0	4 790 981	29 610 964	171 481	1 409 115	2 786 933	1 543 792
2041	855 185	2 466 599	0	4 846 077	29 951 490	173 196	1 425 320	2 818 982	1 559 230
2042	865 020	2 494 965	0	4 901 807	30 295 932	174 928	1 441 711	2 851 401	1 574 823
2043	874 967	2 523 657	0	4 958 178	30 644 335	176 677	1 458 291	2 884 192	1 590 571
2044	885 029	2 552 679	0	5 015 197	30 996 745	178 444	1 475 061	2 917 360	1 606 477
2045	895 207	2 582 035	0	5 072 871	31 353 208	180 228	1 492 024	2 950 910	1 622 541
2046	905 502	2 611 728	0	5 131 209	31 713 770	182 030	1 509 182	2 984 845	1 638 767

Value of time savings >50 km

	Commuters			Leisure			Business		
	Car	Bus	Air	Car	Bus	Air	Car	Bus	Air
2022	1 206 689	3 480 437	0	4 895 175	30 254 942	179 954	8 684 619	17 176 348	9 772 249
2023	1 235 212	3 562 707	0	5 010 887	30 970 108	183 934	8 889 906	17 582 363	9 988 411
2024	1 264 410	3 646 922	0	5 129 334	31 702 180	188 003	9 100 046	17 997 974	10 209 354
2025	1 294 298	3 733 128	0	5 250 581	32 451 556	192 161	9 315 153	18 423 411	10 435 185
2026	1 324 893	3 821 372	0	5 374 695	33 218 646	196 412	9 535 344	18 858 903	10 666 012
2027	1 356 211	3 911 702	0	5 501 742	34 003 868	200 757	9 760 741	19 304 690	10 901 944
2028	1 388 269	4 004 167	0	5 631 792	34 807 651	205 197	9 991 465	19 761 014	11 143 095
2029	1 421 085	4 098 817	0	5 764 916	35 630 435	209 736	10 227 643	20 228 125	11 389 580
2030	1 454 676	4 195 705	0	5 901 187	36 472 667	214 376	10 469 404	20 706 277	11 641 517
2031	1 489 062	4 294 883	0	6 040 679	37 334 808	219 118	10 716 880	21 195 732	11 899 028
2032	1 524 260	4 396 405	0	6 183 469	38 217 328	223 965	10 970 206	21 696 757	12 162 234
2033	1 560 291	4 500 328	0	6 329 634	39 120 709	228 919	11 229 520	22 209 625	12 431 263
2034	1 597 173	4 606 706	0	6 479 254	40 045 444	233 982	11 494 963	22 734 616	12 706 243
2035	1 634 927	4 715 600	0	6 632 410	40 992 039	239 158	11 766 681	23 272 017	12 987 305
2036	1 673 573	4 827 067	0	6 789 187	41 961 008	244 448	12 044 822	23 822 121	13 274 584
2037	1 713 133	4 941 169	0	6 949 670	42 952 883	249 856	12 329 537	24 385 228	13 568 218
2038	1 753 628	5 057 969	0	7 113 946	43 968 203	255 382	12 620 983	24 961 646	13 868 347
2039	1 795 081	5 177 529	0	7 282 106	45 007 523	261 031	12 919 317	25 551 690	14 175 114
2040	1 837 513	5 299 915	0	7 454 240	46 071 411	266 805	13 224 704	26 155 681	14 488 668
2041	1 880 948	5 425 195	0	7 630 443	47 160 447	272 707	13 537 310	26 773 949	14 809 157
2042	1 925 410	5 553 435	0	7 810 812	48 275 226	278 739	13 857 305	27 406 831	15 136 736
2043	1 970 923	5 684 708	0	7 995 444	49 416 356	284 905	14 184 864	28 054 674	15 471 560
2044	2 017 511	5 819 083	0	8 184 440	50 584 459	291 207	14 520 166	28 717 830	15 813 791
2045	2 065 201	5 956 634	0	8 377 904	51 780 175	297 649	14 863 393	29 396 662	16 163 592
2046	2 114 018	6 097 437	0	8 575 941	53 004 155	304 233	15 214 734	30 091 541	16 521 131

Freight Volumes (Tonnes) Alternative 1

	Ofoten Line	Freight (car)	Freight (Sea)	Freight (Air)	
2014	23 000 000	11 520 000	21 000 000	3 574	
2015	23 862 500	11 790 720	21 388 500	3 574	
2016	24 757 344	12 067 802	21 784 187	3 574	
2017	25 685 744	12 351 395	22 187 195	3 574	
2018	26 648 960	12 641 653	22 597 658	3 574	
2019	27 648 296	12 938 732	23 015 714	3 574	
2020	28 685 107	13 242 792	23 441 505	3 574	
2021	29 760 798	13 553 998	23 875 173	3 574	**Troms Line**
2022	30 876 828	7 629 884	24 316 864	357	12 421 215
2023	32 034 709	7 809 186	24 766 726	357	12 799 493
2024	33 236 011	7 992 702	25 224 910	357	13 189 902
2025	34 482 361	8 180 531	25 691 571	357	13 592 850
2026	35 775 450	8 372 773	26 166 865	357	14 008 757
2027	37 117 029	8 569 533	26 650 952	357	14 438 059
2028	38 508 918	8 770 918	27 143 995	357	14 881 205
2029	39 953 002	8 977 034	27 646 159	357	15 338 663
2030	41 451 240	9 187 994	28 157 613	357	15 810 914
2031	43 005 661	9 403 912	28 678 528	357	16 298 459
2032	44 618 373	9 624 904	29 209 081	357	16 801 813
2033	46 291 562	9 851 089	29 749 449	357	17 321 511
2034	48 027 496	10 082 590	30 299 814	357	17 858 108
2035	49 828 527	10 319 531	30 860 360	357	18 412 175
2036	51 697 097	10 562 040	31 431 277	357	18 984 305
2037	53 635 738	10 810 248	32 012 756	357	19 575 112
2038	55 647 078	11 064 289	32 604 992	357	20 185 232
2039	57 733 843	11 324 299	33 208 184	357	20 815 321
2040	59 898 863	11 590 420	33 822 536	357	21 466 060
2041	62 145 070	11 862 795	34 448 252	357	22 138 154
2042	64 475 510	12 141 571	35 085 545	357	22 832 331
2043	66 893 342	12 426 898	35 734 628	357	23 549 347
2044	69 401 842	12 718 930	36 395 718	357	24 289 982
2045	72 004 411	13 017 825	37 069 039	357	25 055 046
2046	74 704 577	13 323 744	37 754 816	357	25 845 377

Freight Volumes (Tonnes) Alternative 2

	Ofoten Line	Freight (car)	Freight (Sea)	Freight (Air)	
2014	23 000 000	11 520 000	21 000 000	3 574	
2015	23 862 500	11 790 720	21 388 500	3 574	
2016	24 757 344	12 067 802	21 784 187	3 574	
2017	25 685 744	12 351 395	22 187 195	3 574	
2018	26 648 960	12 641 653	22 597 658	3 574	
2019	27 648 296	12 938 732	23 015 714	3 574	
2020	28 685 107	13 242 792	23 441 505	3 574	
2021	29 760 798	13 553 998	23 875 173	3 574	**Troms Line**
2022	30 876 828	6 936 258	24 316 864	357	13 114 841
2023	32 034 709	7 099 260	24 766 726	357	13 509 419
2024	33 236 011	7 266 093	25 224 910	357	13 916 512
2025	34 482 361	7 436 846	25 691 571	357	14 336 535
2026	35 775 450	7 611 612	26 166 865	357	14 769 919
2027	37 117 029	7 790 485	26 650 952	357	15 217 107
2028	38 508 918	7 973 561	27 143 995	357	15 678 561
2029	39 953 002	8 160 940	27 646 159	357	16 154 757
2030	41 451 240	8 352 722	28 157 613	357	16 646 187
2031	43 005 661	8 549 011	28 678 528	357	17 153 360
2032	44 618 373	8 749 913	29 209 081	357	17 676 804
2033	46 291 562	8 955 536	29 749 449	357	18 217 065
2034	48 027 496	9 165 991	30 299 814	357	18 774 707
2035	49 828 527	9 381 392	30 860 360	357	19 350 314
2036	51 697 097	9 601 854	31 431 277	357	19 944 490
2037	53 635 738	9 827 498	32 012 756	357	20 557 862
2038	55 647 078	10 058 444	32 604 992	357	21 191 076
2039	57 733 843	10 294 818	33 208 184	357	21 844 803
2040	59 898 863	10 536 746	33 822 536	357	22 519 735
2041	62 145 070	10 784 359	34 448 252	357	23 216 590
2042	64 475 510	11 037 792	35 085 545	357	23 936 110
2043	66 893 342	11 297 180	35 734 628	357	24 679 065
2044	69 401 842	11 562 664	36 395 718	357	25 446 249
2045	72 004 411	11 834 386	37 069 039	357	26 238 485
2046	74 704 577	12 112 494	37 754 816	357	27 056 626

Appendix 4: Global Emissions, assumptions and calculation

Assumptions

Converstion rates (Kg CO2 per driven kilometer)

Traffic transferred from personal cars	0,180
Traffic transferred from buses	0,710
Traffic transferred from air planes	15,620
Transferred freight (from road):	0,750

Climate benefits, NOK per ton	2012	2015	2020	2030	Yearly growth after 2030
NOK per tonn CO2	144	208	320	800	1,4 %

Amount of people travelling in each means of transport

Car	1,4	Conservative assumption
Bus	12	Average from 2005 (Vestlandsforskning)
Airplane	16	Assuming a Dash 8 with 40 % coverage

Average driven length freight (km) 12,42167

*Statistics Norway: Average driven length per ton = 66,3 (domestic transport)

*Statistics Norway: Average driven length per ton = 480,1 (international transport)

*Assuming a weight of 80 % national transport and 20 % international road transport in the area

(0,8 x 66,3) + (0,2 x 480,1) = 149,06 kilometers per tonn

Amount of tonnes per car 12

Alternative 1			
	Kilometers transferred from cars	Kilometers transferred from buses	Kilometers transferred from planes
2022	13 181 549	3 144 794	236 144
2023	13 333 137	3 180 959	238 505
2024	13 486 468	3 217 540	240 890
2025	13 641 562	3 254 542	243 299
2026	13 798 440	3 291 969	245 732
2027	13 957 122	3 329 826	248 190
2028	14 117 629	3 368 119	250 672
2029	14 279 982	3 406 853	253 178
2030	14 444 202	3 446 032	255 710
2031	14 610 310	3 485 661	258 267
2032	14 778 329	3 525 746	260 850
2033	14 948 279	3 566 292	263 458
2034	15 120 185	3 607 304	266 093
2035	15 294 067	3 648 788	268 754
2036	15 469 948	3 690 750	271 441
2037	15 647 853	3 733 193	274 156
2038	15 827 803	3 776 125	276 897
2039	16 009 823	3 819 550	279 666
2040	16 193 936	3 863 475	282 463
2041	16 380 166	3 907 905	285 288
2042	16 568 538	3 952 846	288 141
2043	16 759 076	3 998 304	291 022
2044	16 951 806	4 044 284	293 932
2045	17 146 751	4 090 794	296 872
2046	17 343 939	4 137 838	299 840

Amount of CO2 Alternative 1					
	CO2 reduction from cars	CO2 transferred from buses	CO2 transferred from planes	SUM	Valuation (NOK)
2022	2 372 679	2 232 804	3 688 569	8 294 052	2 654 097
2023	2 399 965	2 258 481	3 725 455	8 383 900	2 682 848
2024	2 427 564	2 284 453	3 762 710	8 474 727	2 711 913
2025	2 455 481	2 310 724	3 800 337	8 566 542	2 741 294
2026	2 483 719	2 337 298	3 838 340	8 659 357	2 770 994
2027	2 512 282	2 364 177	3 876 723	8 753 182	2 801 018
2028	2 541 173	2 391 365	3 915 491	8 848 029	2 831 369
2029	2 570 397	2 418 865	3 954 646	8 943 908	2 862 050
2030	2 599 956	2 446 682	3 994 192	9 040 831	2 933 569
2031	2 629 856	2 474 819	4 034 134	9 138 809	3 006 876
2032	2 660 099	2 503 280	4 074 475	9 237 854	3 082 016
2033	2 690 690	2 532 067	4 115 220	9 337 978	3 159 036
2034	2 721 633	2 561 186	4 156 372	9 439 192	3 237 983
2035	2 752 932	2 590 640	4 197 936	9 541 508	3 318 904
2036	2 784 591	2 620 432	4 239 915	9 644 938	3 401 850
2037	2 816 614	2 650 567	4 282 314	9 749 495	3 486 870
2038	2 849 005	2 681 049	4 325 138	9 855 191	3 574 017
2039	2 881 768	2 711 881	4 368 389	9 962 038	3 663 344
2040	2 914 908	2 743 067	4 412 073	10 070 049	3 754 906
2041	2 948 430	2 774 613	4 456 194	10 179 236	3 848 758
2042	2 982 337	2 806 521	4 500 755	10 289 613	3 944 958
2043	3 016 634	2 838 796	4 545 763	10 401 192	4 043 565
2044	3 051 325	2 871 442	4 591 221	10 513 988	4 144 639
2045	3 086 415	2 904 463	4 637 133	10 628 012	4 248 242
2046	3 121 909	2 937 865	4 683 504	10 743 278	4 354 437

Alternative 2			
	Kilometers transferred from cars	Kilometers transferred from buses	Kilometers transferred from planes
2022	13 387 134	3 426 417	236 144
2023	13 541 086	3 465 821	238 505
2024	13 696 808	3 505 678	240 890
2025	13 854 322	3 545 993	243 299
2026	14 013 646	3 586 772	245 732
2027	14 174 803	3 628 020	248 190
2028	14 337 814	3 669 742	250 672
2029	14 502 698	3 711 944	253 178
2030	14 669 480	3 754 631	255 710
2031	14 838 179	3 797 810	258 267
2032	15 008 818	3 841 485	260 850
2033	15 181 419	3 885 662	263 458
2034	15 356 005	3 930 347	266 093
2035	15 532 599	3 975 546	268 754
2036	15 711 224	4 021 264	271 441
2037	15 891 903	4 067 509	274 156
2038	16 074 660	4 114 285	276 897
2039	16 259 519	4 161 600	279 666
2040	16 446 503	4 209 458	282 463
2041	16 635 638	4 257 867	285 288
2042	16 826 948	4 306 832	288 141
2043	17 020 458	4 356 361	291 022
2044	17 216 193	4 406 459	293 932
2045	17 414 179	4 457 133	296 872
2046	17 614 442	4 508 390	299 840

Amount of CO2 Alternative 2					
	CO2 transferred from cars	CO2 transferred from buses	CO2 transferred from planes	SUM	Valuation (NOK)
2022	2 409 684	2 432 756	3 688 569	8 531 009	2 729 923
2023	2 437 395	2 460 733	3 725 455	8 623 583	2 759 547
2024	2 465 426	2 489 031	3 762 710	8 717 166	2 789 493
2025	2 493 778	2 517 655	3 800 337	8 811 770	2 819 766
2026	2 522 456	2 546 608	3 838 340	8 907 404	2 850 369
2027	2 551 465	2 575 894	3 876 723	9 004 082	2 881 306
2028	2 580 806	2 605 517	3 915 491	9 101 814	2 912 580
2029	2 610 486	2 635 480	3 954 646	9 200 612	2 944 196
2030	2 640 506	2 665 788	3 994 192	9 300 487	3 017 822
2031	2 670 872	2 696 445	4 034 134	9 401 451	3 093 291
2032	2 701 587	2 727 454	4 074 475	9 503 516	3 170 649
2033	2 732 655	2 758 820	4 115 220	9 606 695	3 249 943
2034	2 764 081	2 790 546	4 156 372	9 710 999	3 331 223
2035	2 795 868	2 822 637	4 197 936	9 816 441	3 414 537
2036	2 828 020	2 855 098	4 239 915	9 923 033	3 499 936
2037	2 860 543	2 887 931	4 282 314	10 030 788	3 587 473
2038	2 893 439	2 921 143	4 325 138	10 139 719	3 677 202
2039	2 926 713	2 954 736	4 368 389	10 249 838	3 769 177
2040	2 960 371	2 988 715	4 412 073	10 361 159	3 863 455
2041	2 994 415	3 023 085	4 456 194	10 473 694	3 960 092
2042	3 028 851	3 057 851	4 500 755	10 587 457	4 059 150
2043	3 063 682	3 093 016	4 545 763	10 702 462	4 160 687
2044	3 098 915	3 128 586	4 591 221	10 818 721	4 264 766
2045	3 134 552	3 164 565	4 637 133	10 936 250	4 371 452
2046	3 170 600	3 200 957	4 683 504	11 055 061	4 480 808

Freight

	Alternative 1			Alternative 2		
	Kilometers transferred from cars	Amount of CO2 (kg)	Value	Kilometers transferred f	Amount of CO2 (kg)	Value
2022	77 543 900	58 157 925	18 610 536	86 159 889	64 619 917	20 678 373
2023	79 366 182	59 524 636	19 047 884	88 184 646	66 138 485	21 164 315
2024	81 231 287	60 923 465	19 495 509	90 256 985	67 692 739	21 661 677
2025	83 140 222	62 355 167	19 953 653	92 378 025	69 283 518	22 170 726
2026	85 094 017	63 820 513	20 422 564	94 548 908	70 911 681	22 691 738
2027	87 093 727	65 320 295	20 902 494	96 770 808	72 578 106	23 224 994
2028	89 140 429	66 855 322	21 393 703	99 044 922	74 283 691	23 770 781
2029	91 235 229	68 426 422	21 896 455	101 372 477	76 029 358	24 329 395
2030	93 379 257	70 034 443	22 724 776	103 754 730	77 816 048	25 249 751
2031	95 573 670	71 680 252	23 584 432	106 192 967	79 644 725	26 204 924
2032	97 819 651	73 364 738	24 476 607	108 688 501	81 516 376	27 196 230
2033	100 118 413	75 088 810	25 402 533	111 242 681	83 432 011	28 225 036
2034	102 471 196	76 853 397	26 363 485	113 856 884	85 392 663	29 292 761
2035	104 879 269	78 659 452	27 360 789	116 532 521	87 399 391	30 400 877
2036	107 343 932	80 507 949	28 395 821	119 271 035	89 453 276	31 550 912
2037	109 866 514	82 399 885	29 470 006	122 073 904	91 555 428	32 744 451
2038	112 448 377	84 336 283	30 584 827	124 942 641	93 706 981	33 983 141
2039	115 090 914	86 318 185	31 741 820	127 878 793	95 909 095	35 268 689
2040	117 795 550	88 346 663	32 942 582	130 883 945	98 162 959	36 602 869
2041	120 563 746	90 422 809	34 188 767	133 959 718	100 469 788	37 987 519
2042	123 396 994	92 547 745	35 482 094	137 107 771	102 830 828	39 424 548
2043	126 296 823	94 722 617	36 824 346	140 329 804	105 247 353	40 915 940
2044	129 264 799	96 948 599	38 217 374	143 627 554	107 720 665	42 463 749
2045	132 302 521	99 226 891	39 663 099	147 002 801	110 252 101	44 070 110
2046	135 411 631	101 558 723	41 163 514	150 457 367	112 843 025	45 737 238

Appendix 5: Local Emissions, assumptions and calculation

Assumptions

Local emissions, gases, dust and particles

NOK per driven kilometer	Cities	Towns	Rural	
Passenger trains, electrical	0,000	0,000	0,000	
Passenger trains, diesel	0,601	0,214	0,104	
Freight trains, electrical	0,000	0,000	0,000	
Freight trains, diesel	2,084	0,740	0,360	
Traffic transferred from cars	0,066	0,022	0,077	
Traffic transferred from bus	0,979	0,451	0,220	
Trafikk transferred from planes	1,650	1,650	1,650	
Traffic transferred from pedestrian/cyclists	0,000	0,000	0,000	
Transferred freight traffic (road)	0,418	0,220	0,110	

Distribution of Cities, Towns and Rural

Type	%
Cities	10,00 %
Towns	20,00 %
Rural	70,00 %

Amount of people travelling in each means of transport

Car	1,4	Conservative assumption
Bus	12	Average from 2005 (Vestlandsforskning)
Airplane	16	Assuming a Dash 8 with 40 % coverage

Value of emissions Alternative 1

	Kilometers transferred from cars			Kilometers transferred from buses			Kilometers transferred from planes			SUM
	Cities	Towns	Rural	Cities	Towns	Rural	Cities	Towns	Rural	
2022	87 009	58 006	710 570	307 912	283 694	484 356	38 968	77 937	272 779	2 321 229
2023	89 065	59 377	727 366	315 190	290 400	495 805	39 830	79 661	278 812	2 375 506
2024	91 171	60 780	744 560	322 641	297 264	507 525	40 711	81 423	284 980	2 431 054
2025	93 326	62 217	762 159	330 267	304 291	519 521	41 612	83 224	291 284	2 487 901
2026	95 532	63 688	780 175	338 074	311 484	531 802	42 532	85 065	297 727	2 546 079
2027	97 790	65 193	798 617	346 065	318 847	544 373	43 473	86 946	304 312	2 605 617
2028	100 101	66 734	817 495	354 246	326 384	557 241	44 435	88 870	311 044	2 666 549
2029	102 468	68 312	836 819	362 619	334 099	570 413	45 418	90 835	317 924	2 728 906
2030	104 890	69 926	856 600	371 191	341 996	583 896	46 422	92 845	324 957	2 792 723
2031	107 369	71 579	876 848	379 965	350 080	597 698	47 449	94 898	332 145	2 858 032
2032	109 907	73 271	897 575	388 947	358 356	611 827	48 499	96 998	339 492	2 924 870
2033	112 505	75 003	918 792	398 141	366 826	626 289	49 572	99 143	347 001	2 993 272
2034	115 164	76 776	940 510	407 552	375 497	641 093	50 668	101 336	354 677	3 063 275
2035	117 887	78 591	962 742	417 186	384 373	656 247	51 789	103 578	362 522	3 134 915
2036	120 673	80 449	985 499	427 047	393 459	671 760	52 934	105 869	370 541	3 208 232
2037	123 526	82 351	1 008 794	437 142	402 760	687 639	54 105	108 211	378 738	3 283 265
2038	126 446	84 297	1 032 640	447 475	412 280	703 893	55 302	110 604	387 115	3 360 053
2039	129 435	86 290	1 057 050	458 052	422 026	720 532	56 525	113 051	395 678	3 438 639
2040	132 494	88 329	1 082 036	468 880	432 002	737 564	57 776	115 552	404 431	3 519 063
2041	135 626	90 417	1 107 613	479 963	442 213	754 998	59 054	118 108	413 377	3 601 370
2042	138 832	92 555	1 133 795	491 308	452 666	772 845	60 360	120 720	422 521	3 685 603
2043	142 114	94 743	1 160 596	502 922	463 366	791 113	61 695	123 391	431 867	3 771 807
2044	145 473	96 982	1 188 030	514 810	474 319	809 814	63 060	126 120	441 420	3 860 028
2045	148 912	99 275	1 216 113	526 979	485 531	828 956	64 455	128 910	451 184	3 950 314
2046	152 432	101 621	1 244 859	539 436	497 008	848 551	65 881	131 761	461 164	4 042 713

Value of emissions, Alternative 2

	Kilometers transferred from cars			Kilometers transferred from buses			Kilometers transferred from planes			SUM
	Cities	Towns	Rural	Cities	Towns	Rural	Cities	Towns	Rural	
2022	88 366	58 910	721 652	335 486	309 099	527 731	38 968	77 937	272 779	2 430 928
2023	90 454	60 303	738 710	343 416	316 406	540 205	39 830	79 661	278 812	2 487 798
2024	92 592	61 728	756 172	351 534	323 885	552 975	40 711	81 423	284 980	2 546 000
2025	94 781	63 187	774 046	359 843	331 541	566 046	41 612	83 224	291 284	2 605 565
2026	97 022	64 681	792 343	368 349	339 378	579 426	42 532	85 065	297 727	2 666 523
2027	99 315	66 210	811 073	377 056	347 400	593 122	43 473	86 946	304 312	2 728 909
2028	101 663	67 775	830 245	385 969	355 612	607 143	44 435	88 870	311 044	2 792 755
2029	104 066	69 377	849 870	395 093	364 018	621 494	45 418	90 835	317 924	2 858 096
2030	106 526	71 017	869 959	404 432	372 623	636 185	46 422	92 845	324 957	2 924 966
2031	109 044	72 696	890 524	413 992	381 431	651 223	47 449	94 898	332 145	2 993 401
2032	111 621	74 414	911 574	423 778	390 447	666 617	48 499	96 998	339 492	3 063 439
2033	114 260	76 173	933 121	433 795	399 676	682 374	49 572	99 143	347 001	3 135 117
2034	116 961	77 974	955 179	444 049	409 124	698 504	50 668	101 336	354 677	3 208 472
2035	119 725	79 817	977 757	454 546	418 795	715 016	51 789	103 578	362 522	3 283 545
2036	122 555	81 704	1 000 869	465 290	428 694	731 917	52 934	105 869	370 541	3 360 375
2037	125 452	83 635	1 024 528	476 289	438 828	749 218	54 105	108 211	378 738	3 439 004
2038	128 418	85 612	1 048 746	487 547	449 201	766 928	55 302	110 604	387 115	3 519 474
2039	131 453	87 636	1 073 536	499 072	459 819	785 057	56 525	113 051	395 678	3 601 828
2040	134 561	89 707	1 098 912	510 869	470 688	803 614	57 776	115 552	404 431	3 686 110
2041	137 741	91 828	1 124 888	522 945	481 814	822 610	59 054	118 108	413 377	3 772 365
2042	140 997	93 998	1 151 478	535 306	493 204	842 055	60 360	120 720	422 521	3 860 640
2043	144 330	96 220	1 178 697	547 960	504 862	861 959	61 695	123 391	431 867	3 950 981
2044	147 742	98 495	1 206 559	560 912	516 796	882 334	63 060	126 120	441 420	4 043 438
2045	151 234	100 823	1 235 080	574 171	529 012	903 191	64 455	128 910	451 184	4 138 059
2046	154 809	103 206	1 264 275	587 744	541 517	924 541	65 881	131 761	461 164	4 234 896

Freight

	Alternative 1				Alternative 2			
	City	Town	Rural	Value	City	Town	Rural	Value
2022	7 754 390	15 508 780	54 280 730	12 625 642	8 615 989	17 231 978	60 311 922	14 028 491
2023	7 936 618	15 873 236	55 556 327	13 077 412	8 818 465	17 636 929	61 729 252	14 530 458
2024	8 123 129	16 246 257	56 861 901	13 545 348	9 025 699	18 051 397	63 179 890	15 050 387
2025	8 314 022	16 628 044	58 198 156	14 030 028	9 237 802	18 475 605	64 664 617	15 588 920
2026	8 509 402	17 018 803	59 565 812	14 532 050	9 454 891	18 909 782	66 184 236	16 146 723
2027	8 709 373	17 418 745	60 965 609	15 052 036	9 677 081	19 354 162	67 739 565	16 724 485
2028	8 914 043	17 828 086	62 398 301	15 590 628	9 904 492	19 808 984	69 331 445	17 322 920
2029	9 123 523	18 247 046	63 864 661	16 148 492	10 137 248	20 274 495	70 960 734	17 942 769
2030	9 337 926	18 675 851	65 365 480	16 726 317	10 375 473	20 750 946	72 628 311	18 584 797
2031	9 557 367	19 114 734	66 901 569	17 324 818	10 619 297	21 238 593	74 335 077	19 249 798
2032	9 781 965	19 563 930	68 473 756	17 944 735	10 868 850	21 737 700	76 081 951	19 938 594
2033	10 011 841	20 023 683	70 082 889	18 586 834	11 124 268	22 248 536	77 869 877	20 652 037
2034	10 247 120	20 494 239	71 729 837	19 251 908	11 385 688	22 771 377	79 699 819	21 391 008
2035	10 487 927	20 975 854	73 415 488	19 940 779	11 653 252	23 306 504	81 572 765	22 156 422
2036	10 734 393	21 468 786	75 140 752	20 654 300	11 927 104	23 854 207	83 489 725	22 949 223
2037	10 986 651	21 973 303	76 906 560	21 393 353	12 207 390	24 414 781	85 451 733	23 770 392
2038	11 244 838	22 489 675	78 713 864	22 158 849	12 494 264	24 988 528	87 459 849	24 620 944
2039	11 509 091	23 018 183	80 563 640	22 951 737	12 787 879	25 575 759	89 515 155	25 501 930
2040	11 779 555	23 559 110	82 456 885	23 772 996	13 088 394	26 176 789	91 618 761	26 414 441
2041	12 056 375	24 112 749	84 394 622	24 623 642	13 395 972	26 791 944	93 771 802	27 359 602
2042	12 339 699	24 679 399	86 377 896	25 504 725	13 710 777	27 421 554	95 975 440	28 338 583
2043	12 629 682	25 259 365	88 407 776	26 417 335	14 032 980	28 065 961	98 230 862	29 352 595
2044	12 926 480	25 852 960	90 485 359	27 362 600	14 362 755	28 725 511	100 539 288	30 402 889
2045	13 230 252	26 460 504	92 611 765	28 341 689	14 700 280	29 400 560	102 901 961	31 490 765
2046	13 541 163	27 082 326	94 788 141	29 355 811	15 045 737	30 091 473	105 320 157	32 617 568

Appendix 6: Noise, assumptions and calculation

Assumptions

(1) Tranfer values for traffic noise

(NOK/driven kilometer)	Cities	Towns	Rural	
Transferred from car	0,451	0,451	0,000	
Transferred from bus	4,269	4,269	0,000	*Adjusted to 2022
Transferred from plane	0,000	0,000	0,000	
Freight traffic transferred (from road)	4,676	4,676	0,000	

(2) Amount of people travelling in each means of transport

Car	1,4	Conservative assumption
Bus	12	Average from 2005 (Vestlandsforskning)
Airplane	16	Assuming a Dash 8 with 40 % coverage

(3) Distribution of Cities, Towns and Rural

Type	%
Cities	10,00 %
Towns	20,00 %
Rural	70,00 %

Valuation, alternative 1

	Kilometers transferred from cars			Kilometers transferred from buses			Kilometers transferred from planes			SUM
	Cities	Towns	Rural	Cities	Towns	Rural	Cities	Towns	Rural	
2022	594 558	1 189 116	0	1 342 357	2 684 714	0	0	0	0	5 810 745
2023	608 612	1 217 225	0	1 374 087	2 748 175	0	0	0	0	5 948 100
2024	622 999	1 245 998	0	1 406 568	2 813 136	0	0	0	0	6 088 701
2025	637 725	1 275 450	0	1 439 817	2 879 633	0	0	0	0	6 232 626
2026	652 800	1 305 600	0	1 473 851	2 947 702	0	0	0	0	6 379 952
2027	668 231	1 336 461	0	1 508 690	3 017 380	0	0	0	0	6 530 762
2028	684 026	1 368 053	0	1 544 352	3 088 705	0	0	0	0	6 685 136
2029	700 195	1 400 391	0	1 580 858	3 161 715	0	0	0	0	6 843 159
2030	716 747	1 433 493	0	1 618 226	3 236 452	0	0	0	0	7 004 918
2031	733 689	1 467 378	0	1 656 478	3 312 955	0	0	0	0	7 170 500
2032	751 032	1 502 064	0	1 695 633	3 391 267	0	0	0	0	7 339 996
2033	768 785	1 537 570	0	1 735 715	3 471 430	0	0	0	0	7 513 499
2034	786 957	1 573 915	0	1 776 744	3 553 487	0	0	0	0	7 691 103
2035	805 559	1 611 119	0	1 818 742	3 637 485	0	0	0	0	7 872 905
2036	824 601	1 649 203	0	1 861 734	3 723 468	0	0	0	0	8 059 005
2037	844 093	1 688 186	0	1 905 741	3 811 483	0	0	0	0	8 249 504
2038	864 046	1 728 092	0	1 950 789	3 901 579	0	0	0	0	8 444 506
2039	884 470	1 768 940	0	1 996 902	3 993 804	0	0	0	0	8 644 117
2040	905 377	1 810 755	0	2 044 105	4 088 210	0	0	0	0	8 848 447
2041	926 779	1 853 557	0	2 092 423	4 184 847	0	0	0	0	9 057 606
2042	948 686	1 897 372	0	2 141 884	4 283 768	0	0	0	0	9 271 710
2043	971 111	1 942 222	0	2 192 514	4 385 028	0	0	0	0	9 490 874
2044	994 066	1 988 132	0	2 244 341	4 488 681	0	0	0	0	9 715 220
2045	1 017 564	2 035 127	0	2 297 392	4 594 785	0	0	0	0	9 944 868
2046	1 041 617	2 083 234	0	2 351 698	4 703 396	0	0	0	0	10 179 945

Valuation, alternative 2

	Kilometers transferred from cars			Kilometers transferred from buses			Kilometers transferred from planes			SUM
	Cities	Towns	Rural	Cities	Towns	Rural	Cities	Towns	Rural	
2022	603 831	1 207 662	0	1 462 568	2 925 136	0	0	0	0	6 199 197
2023	618 105	1 236 209	0	1 497 140	2 994 280	0	0	0	0	6 345 734
2024	632 715	1 265 431	0	1 532 529	3 065 059	0	0	0	0	6 495 734
2025	647 671	1 295 343	0	1 568 755	3 137 511	0	0	0	0	6 649 281
2026	662 981	1 325 962	0	1 605 838	3 211 675	0	0	0	0	6 806 456
2027	678 653	1 357 305	0	1 643 796	3 287 593	0	0	0	0	6 967 347
2028	694 695	1 389 389	0	1 682 653	3 365 305	0	0	0	0	7 132 042
2029	711 116	1 422 232	0	1 722 427	3 444 854	0	0	0	0	7 300 629
2030	727 925	1 455 850	0	1 763 142	3 526 284	0	0	0	0	7 473 201
2031	745 132	1 490 264	0	1 804 819	3 609 638	0	0	0	0	7 649 853
2032	762 745	1 525 491	0	1 847 481	3 694 962	0	0	0	0	7 830 680
2033	780 775	1 561 550	0	1 891 152	3 782 304	0	0	0	0	8 015 781
2034	799 231	1 598 462	0	1 935 855	3 871 710	0	0	0	0	8 205 258
2035	818 123	1 636 247	0	1 981 615	3 963 230	0	0	0	0	8 399 214
2036	837 462	1 674 924	0	2 028 456	4 056 912	0	0	0	0	8 597 755
2037	857 258	1 714 516	0	2 076 405	4 152 810	0	0	0	0	8 800 989
2038	877 522	1 755 044	0	2 125 487	4 250 974	0	0	0	0	9 009 026
2039	898 265	1 796 530	0	2 175 729	4 351 458	0	0	0	0	9 221 982
2040	919 498	1 838 996	0	2 227 159	4 454 318	0	0	0	0	9 439 971
2041	941 233	1 882 466	0	2 279 805	4 559 609	0	0	0	0	9 663 113
2042	963 482	1 926 964	0	2 333 695	4 667 389	0	0	0	0	9 891 530
2043	986 257	1 972 513	0	2 388 859	4 777 717	0	0	0	0	10 125 346
2044	1 009 570	2 019 140	0	2 445 326	4 890 653	0	0	0	0	10 364 689
2045	1 033 434	2 066 868	0	2 503 129	5 006 258	0	0	0	0	10 609 689
2046	1 057 862	2 115 725	0	2 562 298	5 124 596	0	0	0	0	10 860 481

Freight

	Alternative 1				Alternative 2			
	Cities	Towns	Rural	Value	Cities	Towns	Rural	Value
2022	7 754 390	15 508 780	54 280 730	108 768 196	8 615 989	17 231 978	60 311 922	120 853 551
2023	7 936 618	15 873 236	55 556 327	112 660 139	8 818 465	17 636 929	61 729 252	125 177 933
2024	8 123 129	16 246 257	56 861 901	116 691 344	9 025 699	18 051 397	63 179 890	129 657 049
2025	8 314 022	16 628 044	58 198 156	120 866 794	9 237 802	18 475 605	64 664 617	134 296 438
2026	8 509 402	17 018 803	59 565 812	125 191 650	9 454 891	18 909 782	66 184 236	139 101 833
2027	8 709 373	17 418 745	60 965 609	129 671 257	9 677 081	19 354 162	67 739 565	144 079 175
2028	8 914 043	17 828 086	62 398 301	134 311 154	9 904 492	19 808 984	69 331 445	149 234 616
2029	9 123 523	18 247 046	63 864 661	139 117 076	10 137 248	20 274 495	70 960 734	154 574 529
2030	9 337 926	18 675 851	65 365 480	144 094 963	10 375 473	20 750 946	72 628 311	160 105 515
2031	9 557 367	19 114 734	66 901 569	149 250 969	10 619 297	21 238 593	74 335 077	165 834 410
2032	9 781 965	19 563 930	68 473 756	154 591 467	10 868 850	21 737 700	76 081 951	171 768 297
2033	10 011 841	20 023 683	70 082 889	160 123 059	11 124 268	22 248 536	77 869 877	177 914 510
2034	10 247 120	20 494 239	71 729 837	165 852 583	11 385 688	22 771 377	79 699 819	184 280 647
2035	10 487 927	20 975 854	73 415 488	171 787 120	11 653 252	23 306 504	81 572 765	190 874 577
2036	10 734 393	21 468 786	75 140 752	177 934 006	11 927 104	23 854 207	83 489 725	197 704 452
2037	10 986 651	21 973 303	76 906 560	184 300 841	12 207 390	24 414 781	85 451 733	204 778 712
2038	11 244 838	22 489 675	78 713 864	190 895 494	12 494 264	24 988 528	87 459 849	212 106 104
2039	11 509 091	23 018 183	80 563 640	197 726 116	12 787 879	25 575 759	89 515 155	219 695 685
2040	11 779 555	23 559 110	82 456 885	204 801 152	13 088 394	26 176 789	91 618 761	227 556 836
2041	12 056 375	24 112 749	84 394 622	212 129 347	13 395 972	26 791 944	93 771 802	235 699 274
2042	12 339 699	24 679 399	86 377 896	219 719 759	13 710 777	27 421 554	95 975 440	244 133 066
2043	12 629 682	25 259 365	88 407 776	227 581 772	14 032 980	28 065 961	98 230 862	252 868 635
2044	12 926 480	25 852 960	90 485 359	235 725 103	14 362 755	28 725 511	100 539 288	261 916 781
2045	13 230 252	26 460 504	92 611 765	244 159 818	14 700 280	29 400 560	102 901 961	271 288 687
2046	13 541 163	27 082 326	94 788 141	252 896 345	15 045 737	30 091 473	105 320 157	280 995 939

Appendix 7: Health benefits, assumptions and calculation

Assumptions

Health Benefits, traffic transferred from cars	< 50 km	> 50 km
Average walking/bicycle distance per transferred car travel (km)	1,0	1,0
Valuation of health benefits (NOK/km):	22,95	22,95

Valuation (Alternative 1)

	<50	>50	Total walking/bicycle distance	Valuation
2022	147 289	242 590	389 879	8 947 215
2023	148 983	245 379	394 362	9 158 709
2024	150 696	248 201	398 897	9 375 202
2025	152 429	251 056	403 485	9 596 814
2026	154 182	253 943	408 125	9 823 663
2027	155 955	256 863	412 818	10 055 875
2028	157 749	259 817	417 566	10 293 576
2029	159 563	262 805	422 368	10 536 895
2030	161 398	265 827	427 225	10 785 966
2031	163 254	268 884	432 138	11 040 925
2032	165 131	271 976	437 108	11 301 910
2033	167 030	275 104	442 134	11 569 065
2034	168 951	278 268	447 219	11 842 534
2035	170 894	281 468	452 362	12 122 468
2036	172 859	284 705	457 564	12 409 019
2037	174 847	287 979	462 826	12 702 343
2038	176 858	291 291	468 149	13 002 601
2039	178 892	294 640	473 532	13 309 957
2040	180 949	298 029	478 978	13 624 578
2041	183 030	301 456	484 486	13 946 635
2042	185 135	304 923	490 058	14 276 306
2043	187 264	308 430	495 693	14 613 769
2044	189 417	311 976	501 394	14 959 210
2045	191 596	315 564	507 160	15 312 815
2046	193 799	319 193	512 992	15 674 780

Valuation (Alternative 2)				
	<50	**>50**	**Total walking/bicycle distance**	**Valuation**
2022	147 289	246 701	393 990	9 041 573
2023	148 983	249 538	398 521	9 255 298
2024	150 696	252 408	403 104	9 474 074
2025	152 429	255 311	407 740	9 698 023
2026	154 182	258 247	412 429	9 927 264
2027	155 955	261 217	417 172	10 161 925
2028	157 749	264 221	421 969	10 402 133
2029	159 563	267 259	426 822	10 648 018
2030	161 398	270 333	431 730	10 899 716
2031	163 254	273 442	436 695	11 157 364
2032	165 131	276 586	441 717	11 421 101
2033	167 030	279 767	446 797	11 691 073
2034	168 951	282 984	451 935	11 967 427
2035	170 894	286 239	457 133	12 250 313
2036	172 859	289 530	462 390	12 539 886
2037	174 847	292 860	467 707	12 836 304
2038	176 858	296 228	473 086	13 139 728
2039	178 892	299 634	478 526	13 450 325
2040	180 949	303 080	484 029	13 768 264
2041	183 030	306 566	489 596	14 093 718
2042	185 135	310 091	495 226	14 426 865
2043	187 264	313 657	500 921	14 767 888
2044	189 417	317 264	506 682	15 116 971
2045	191 596	320 913	512 508	15 474 306
2046	193 799	324 603	518 402	15 840 088

Appendix 8: Accidents, assumptions and calculation

Assumptions						
Transfer values regarding accidents (NOK/per driven kilometer)						
Car to train	0,704					
Bus to train	0,715					
Plane to train	2,145	*Adjusted to 2022-NOK				
Amount of people travelling in each means of transport						
Car	1,4	Conservative assumption				
Bus	12	Average from 2005 (Vestlandsforskning)				
Airplane	16	Assuming a Dash 8 with 40 % coverage				

Valuation, alternative 1

	Kilometers transferred from cars	Kilometers transferred from buses	Kilometers transferred from planes	SUM
2022	9 280 909	2 248 794	506 589	12 036 292
2023	9 500 291	2 301 951	517 795	12 320 037
2024	9 724 859	2 356 364	529 248	12 610 472
2025	9 954 735	2 412 064	540 955	12 907 754
2026	10 190 045	2 469 080	552 921	13 212 047
2027	10 430 918	2 527 444	565 152	13 523 514
2028	10 677 484	2 587 188	577 653	13 842 325
2029	10 929 878	2 648 344	590 431	14 168 653
2030	11 188 239	2 710 946	603 491	14 502 675
2031	11 452 706	2 775 027	616 840	14 844 573
2032	11 723 425	2 840 623	630 485	15 194 533
2033	12 000 544	2 907 770	644 431	15 552 744
2034	12 284 212	2 976 504	658 686	15 919 402
2035	12 574 587	3 046 862	673 256	16 294 705
2036	12 871 825	3 118 884	688 148	16 678 857
2037	13 176 089	3 192 608	703 370	17 072 067
2038	13 487 545	3 268 075	718 929	17 474 549
2039	13 806 364	3 345 326	734 831	17 886 521
2040	14 132 719	3 424 403	751 086	18 308 207
2041	14 466 788	3 505 349	767 700	18 739 836
2042	14 808 754	3 588 208	784 681	19 181 643
2043	15 158 803	3 673 026	802 039	19 633 868
2044	15 517 127	3 759 849	819 780	20 096 756
2045	15 883 921	3 848 724	837 913	20 570 558
2046	16 259 385	3 939 700	856 448	21 055 533

Valuation, alternative 2

	Kilometers transferred from cars	Kilometers transferred from buses	Kilometers transferred from planes	SUM
2022	9 425 658	2 450 178	506 589	12 382 425
2023	9 648 462	2 508 096	517 795	12 674 352
2024	9 876 532	2 567 382	529 248	12 973 162
2025	10 109 994	2 628 070	540 955	13 279 018
2026	10 348 974	2 690 192	552 921	13 592 087
2027	10 593 603	2 753 783	565 152	13 912 537
2028	10 844 014	2 818 877	577 653	14 240 544
2029	11 100 345	2 885 509	590 431	14 576 285
2030	11 362 735	2 953 717	603 491	14 919 943
2031	11 631 327	3 023 537	616 840	15 271 704
2032	11 906 269	3 095 007	630 485	15 631 761
2033	12 187 709	3 168 167	644 431	16 000 307
2034	12 475 802	3 243 056	658 686	16 377 544
2035	12 770 705	3 319 716	673 256	16 763 677
2036	13 072 579	3 398 187	688 148	17 158 914
2037	13 381 589	3 478 513	703 370	17 563 472
2038	13 697 903	3 560 738	718 929	17 977 570
2039	14 021 694	3 644 907	734 831	18 401 432
2040	14 353 138	3 731 065	751 086	18 835 290
2041	14 692 418	3 819 260	767 700	19 279 378
2042	15 039 717	3 909 540	784 681	19 733 939
2043	15 395 226	4 001 954	802 039	20 199 218
2044	15 759 139	4 096 552	819 780	20 675 470
2045	16 131 653	4 193 386	837 913	21 162 952
2046	16 512 973	4 292 509	856 448	21 661 930

Freight

	Alternative 1	Alternative 2
2022	54 597 369	60 663 743
2023	56 550 972	62 834 413
2024	58 574 479	65 082 754
2025	60 670 391	67 411 545
2026	62 841 299	69 823 665
2027	65 089 886	72 322 096
2028	67 418 932	74 909 925
2029	69 831 317	77 590 352
2030	72 330 021	80 366 690
2031	74 918 134	83 242 371
2032	77 598 854	86 220 949
2033	80 375 496	89 306 107
2034	83 251 492	92 501 658
2035	86 230 397	95 811 553
2036	89 315 893	99 239 882
2037	92 511 795	102 790 883
2038	95 822 052	106 468 946
2039	99 250 756	110 278 618
2040	102 802 147	114 224 608
2041	106 480 613	118 311 793
2042	110 290 703	122 545 225
2043	114 237 125	126 930 138
2044	118 324 757	131 471 953
2045	122 558 654	136 176 282
2046	126 944 048	141 048 942

Appendix 9: NSB, assumptions and calculation

Assumptions

(1) Train data

Train data	Value	Comment
Number of seats	264	Nsb.no
Total cost	91560000	Cost per train (based on contract 2009, adjusted for 2014)
Lifetime (years)	25	
Energy usage KWh/km	6	Conservative assumption based on train data
Energy cost NOK/KWh	0,39	Conservative
Maintenance costs per km	16	Conservative assumption based on Märklin
Preparation cost (daily)	2300	Conservative assumption based on Märklin
Weight (tonnes)	218	Nsb.no

(2) Assumed train schedule

Alternative 1

Number of travels yearly	2220	3 times daily each way on workdays, 2 times remaining
Length	180	km
Time usage	76	minutes
Number of kilometer per year	399600	

Alternative 2

Number of travels yearly	2220	3 times daily each way on workdays, 2 times remaining
Length	215	km
Time usage	91	minutes
Number of kilometers per year	477300	

Punctuality	90 %

(3) Ticket price assumptions

Price assumptions, train	Commuting	Leisure	Business
Fixed price	16,85	22,87	28,90
km cost, interval 1	0,54	1,27	1,61
Limit interval 1	150	150	150
km cost, interval 2	0,54	0,45	0,61

(4) Distances (km)

Alternative 1	Narvik	Bjerkvik	Setermoen	Andselv	Tromsø
Narvik		17	60	86	180
Bjerkvik	17		43	69	163
Setermoen	60	43		26	120
Andselv	86	69	26		94
Tromsø	180	163	120	94	

Alternative 2	Narvik	Bjerkvik	Setermoen	Andselv	Nordkjosbotn	Tromsø
Narvik		17	60	86	142	215
Bjerkvik	17		43	69	125	198
Setermoen	60	43		26	82	155
Andselv	86	69	26		56	129
Nordkjosbotn	142	125	82	56		73
Tromsø	215	198	155	129	73	

Formula for ticket price:
Ticket price = Fixed price + km cost interval (1 or 2) x travel length

(5) Estimation of Ticket Prices (Commuting) *Updated to 2022-prices

Alternative 1	Narvik	Bjerkvik	Setermoen	Andselv	Tromsø
Narvik		26,02	49,20	63,21	113,89
Bjerkvik	26,02		40,03	54,05	104,72
Setermoen	49,20	40,03		30,87	81,54
Andselv	63,21	54,05	30,87		67,53
Tromsø	113,89	104,72	81,54	67,53	

Alternative 2	Narvik	Bjerkvik	Setermoen	Andselv	Nordkjosbotn	Tromsø
Narvik		26,02	49,20	63,21	93,40	132,75
Bjerkvik	26,02		40,03	54,05	84,24	123,59
Setermoen	49,20	40,03		30,87	61,06	100,41
Andselv	63,21	54,05	30,87		47,04	86,39
Nordkjosbotn	93,40	84,24	61,06	47,04		56,21
Tromsø	132,75	123,59	100,41	86,39	56,21	

(5) Estimation of Ticket Prices (Leisure)

Alternative 1	Narvik	Bjerkvik	Setermoen	Andselv	Tromsø
Narvik		44,38	98,78	131,67	104,06
Bjerkvik	44,38		77,27	110,17	96,39
Setermoen	98,78	77,27		55,77	174,69
Andselv	131,67	110,17	55,77		141,80
Tromsø	104,06	96,39	174,69	141,80	

Alternative 2	Narvik	Bjerkvik	Setermoen	Andselv	Nordkjosbotn	Tromsø
Narvik		44,38	98,78	131,67	202,52	119,85
Bjerkvik	44,38		77,27	110,17	181,02	112,18
Setermoen	98,78	77,27		55,77	126,61	92,78
Andselv	131,67	110,17	55,77		93,72	186,08
Nordkjosbotn	202,52	181,02	126,61	93,72		115,23
Tromsø	119,85	112,18	92,78	186,08	115,23	

(5) Estimation of Ticket Prices (Business)

Alternative 1	Narvik	Bjerkvik	Setermoen	Andselv	Tromsø
Narvik		56,21	125,27	167,03	137,81
Bjerkvik	56,21		97,97	139,73	127,53
Setermoen	125,27	97,97		70,66	221,64
Andselv	167,03	139,73	70,66		179,88
Tromsø	137,81	127,53	221,64	179,88	

Alternative 2	Narvik	Bjerkvik	Setermoen	Andselv	Nordkjosbotn	Tromsø
Narvik		56,21	125,27	167,03	256,98	158,99
Bjerkvik	56,21		97,97	139,73	229,67	148,70
Setermoen	125,27	97,97		70,66	160,61	122,69
Andselv	167,03	139,73	70,66		118,85	236,10
Nordkjosbotn	256,98	229,67	160,61	118,85		146,15
Tromsø	158,99	148,70	122,69	236,10	146,15	

(6) Average Ticket Prices

	Alternative 1	Alternative 2
Commuting	**63,11**	**72,69**
Leisure	**103,50**	**116,54**
Business	**132,37**	**139,73**

(7) Cost Assumptions

Cost assumptions (Updated to 2022-prices)

Delay, average addition to turning time	20
Minimum turning time passenger traffic (minutes)	10
Minimum turning time freight traffic (minutes)	75
Additional time crew (% adding to route+turning time)	30 %
Other income, passenger traffic (share of traffic income)	2 %
Wage per hour including social costs engine driver	956
Wage per hour including social costs, train driver	911
Wage per hour including social costs conductor	910,91
Administration costs, addition to operative costs	10 %
Equipment reserve, freight and passenger traffic	10 %
Electricity costs per km	2,34
Maintenance per km	19,13
Preparation cost, daily	2749,23

VAT	8 %

(8) Cost, passenger traffic

	Alternative 1	Alternative 2
Cost per hour	3 334	3 334
Total average time per journey (hours)	1,91	2,23
Cost per journey (including electricity and maintenance)	10 221,43	12 056,44

Income

	Alternative 1				Alternative 2			
	Commuting	Leisure	Business	SUM (ex VAT)	Commuting	Leisure	Business	SUM (Ex VAT)
2022	7 702 738	82 849 632	14 628 387	105 180 757	9 087 009	97 470 330	16 487 592	123 044 931
2023	7 884 815	84 807 661	14 969 902	107 662 378	9 301 808	99 773 916	16 872 818	125 948 541
2024	8 071 197	86 811 965	15 319 395	110 202 557	9 521 684	102 131 945	17 267 050	128 920 679
2025	8 261 984	88 863 639	15 677 053	112 802 676	9 746 757	104 545 703	17 670 499	131 962 960
2026	8 457 280	90 963 801	16 043 067	115 464 149	9 977 151	107 016 509	18 083 381	135 077 040
2027	8 657 194	93 113 599	16 417 632	118 188 424	10 212 991	109 545 709	18 505 915	138 264 615
2028	8 861 832	95 314 204	16 800 947	120 976 984	10 454 406	112 134 685	18 938 329	141 527 419
2029	9 071 308	97 566 818	17 193 218	123 831 345	10 701 527	114 784 848	19 380 853	144 867 228
2030	9 285 736	99 872 671	17 594 654	126 753 061	10 954 490	117 497 646	19 833 724	148 285 859
2031	9 505 232	102 233 019	18 005 469	129 743 720	11 213 432	120 274 557	20 297 183	151 785 172
2032	9 729 917	104 649 151	18 425 882	132 804 950	11 478 495	123 117 099	20 771 479	155 367 072
2033	9 959 913	107 122 386	18 856 118	135 938 417	11 749 824	126 026 821	21 256 864	159 033 509
2034	10 195 345	109 654 074	19 296 406	139 145 824	12 027 566	129 005 312	21 753 600	162 786 477
2035	10 436 343	112 245 594	19 746 981	142 428 918	12 311 874	132 054 196	22 261 950	166 628 020
2036	10 683 037	114 898 363	20 208 084	145 789 484	12 602 902	135 175 138	22 782 187	170 560 227
2037	10 935 562	117 613 826	20 679 962	149 229 351	12 900 809	138 369 841	23 314 588	174 585 238
2038	11 194 057	120 393 467	21 162 865	152 750 389	13 205 758	141 640 047	23 859 440	178 705 245
2039	11 458 662	123 238 801	21 657 052	156 354 516	13 517 916	144 987 542	24 417 031	182 922 490
2040	11 729 522	126 151 382	22 162 786	160 043 691	13 837 453	148 414 152	24 987 662	187 239 267
2041	12 006 785	129 132 799	22 680 338	163 819 922	14 164 542	151 921 746	25 571 637	191 657 926
2042	12 290 601	132 184 678	23 209 984	167 685 263	14 499 364	155 512 240	26 169 268	196 180 871
2043	12 581 126	135 308 685	23 752 007	171 641 818	14 842 100	159 187 591	26 780 874	200 810 565
2044	12 878 519	138 506 524	24 306 695	175 691 738	15 192 937	162 949 806	27 406 784	205 549 527
2045	13 182 941	141 779 941	24 874 346	179 837 228	15 552 068	166 800 938	28 047 330	210 400 336
2046	13 494 560	145 130 722	25 455 261	184 080 543	15 919 688	170 743 088	28 702 857	215 365 632

Costs

	Alternative 1			Alternative 2		
	Operative Costs	VAT	SUM	Operative Costs	VAT	SUM
2022	28 794 858	8 414 461	37 209 319	32 868 572	9 843 594	42 712 167
2023	29 140 396	8 612 990	37 753 387	33 262 995	10 075 883	43 338 878
2024	29 490 081	8 816 205	38 306 286	33 662 151	10 313 654	43 975 805
2025	29 843 962	9 024 214	38 868 176	34 066 097	10 557 037	44 623 133
2026	30 202 090	9 237 132	39 439 222	34 474 890	10 806 163	45 281 053
2027	30 564 515	9 455 074	40 019 589	34 888 589	11 061 169	45 949 758
2028	30 931 289	9 678 159	40 609 448	35 307 252	11 322 194	46 629 445
2029	31 302 464	9 906 508	41 208 972	35 730 939	11 589 378	47 320 317
2030	31 678 094	10 140 245	41 818 339	36 159 710	11 862 869	48 022 579
2031	32 058 231	10 379 498	42 437 729	36 593 626	12 142 814	48 736 440
2032	32 442 930	10 624 396	43 067 326	37 032 750	12 429 366	49 462 116
2033	32 832 245	10 875 073	43 707 318	37 477 143	12 722 681	50 199 824
2034	33 226 232	11 131 666	44 357 898	37 926 869	13 022 918	50 949 787
2035	33 624 947	11 394 313	45 019 260	38 381 991	13 330 242	51 712 233
2036	34 028 446	11 663 159	45 691 605	38 842 575	13 644 818	52 487 393
2037	34 436 788	11 938 348	46 375 136	39 308 686	13 966 819	53 275 505
2038	34 850 029	12 220 031	47 070 060	39 780 390	14 296 420	54 076 810
2039	35 268 229	12 508 361	47 776 591	40 257 755	14 633 799	54 891 554
2040	35 691 448	12 803 495	48 494 943	40 740 848	14 979 141	55 719 989
2041	36 119 745	13 105 594	49 225 339	41 229 738	15 332 634	56 562 372
2042	36 553 182	13 414 821	49 968 003	41 724 495	15 694 470	57 418 965
2043	36 991 821	13 731 345	50 723 166	42 225 189	16 064 845	58 290 034
2044	37 435 722	14 055 339	51 491 061	42 731 891	16 443 962	59 175 853
2045	37 884 951	14 386 978	52 271 929	43 244 674	16 832 027	60 076 701
2046	38 339 571	14 726 443	53 066 014	43 763 610	17 229 251	60 992 860

Appendix 10: Maintenance costs

Initial maintenance costs	
Alternative 1	**Alternative 2**
6 393 600	7 636 800
6 470 323	7 728 442
6 547 967	7 821 183
6 626 543	7 915 037
6 706 061	8 010 018
6 786 534	8 106 138
6 867 972	8 203 411
6 950 388	8 301 852
7 033 793	8 401 475
7 118 198	8 502 292
7 203 617	8 604 320
7 290 060	8 707 572
7 377 541	8 812 062
7 466 071	8 917 807
7 555 664	9 024 821
7 646 332	9 133 119
7 738 088	9 242 716
7 830 945	9 353 629
7 924 916	9 465 872
8 020 015	9 579 463
8 116 256	9 694 416
8 213 651	9 810 749
8 312 214	9 928 478
8 411 961	10 047 620
8 512 905	10 168 192

Reduced maintenace costs from transfer	
Alternative 1	**Alternative 2**
2 522 364	2 637 618
2 580 307	2 698 285
2 639 582	2 760 349
2 700 220	2 823 843
2 762 253	2 888 798
2 825 713	2 955 249
2 890 632	3 023 230
2 957 045	3 092 776
3 024 984	3 163 924
3 094 486	3 236 711
3 165 587	3 311 174
3 238 324	3 387 352
3 312 733	3 465 284
3 388 854	3 545 011
3 466 726	3 626 574
3 546 389	3 710 016
3 627 885	3 795 379
3 711 256	3 882 709
3 796 545	3 972 051
3 883 795	4 063 450
3 973 053	4 156 955
4 064 365	4 252 613
4 157 778	4 350 476
4 253 339	4 450 592
4 351 100	4 553 015

Freight maintenance	
Alternative 1	Alternative 2
9 146 531	11 535 098
9 425 081	11 882 148
9 712 565	12 240 205
10 009 281	12 609 634
10 315 540	12 990 815
10 631 662	13 384 138
10 957 978	13 790 007
11 294 834	14 208 843
11 642 582	14 641 078
12 001 592	15 087 160
12 372 244	15 547 553
12 754 931	16 022 737
13 150 061	16 513 208
13 558 056	17 019 480
13 979 352	17 542 086
14 414 401	18 081 574
14 863 671	18 638 515
15 327 646	19 213 497
15 806 826	19 807 131
16 301 732	20 420 046
16 812 898	21 052 897
17 340 883	21 706 359
17 886 260	22 381 132
18 449 625	23 077 940
19 031 596	23 797 533

Reduced maintenance from freight transfer	
Alternative 1	Alternative 2
9 166 608	10 185 120
9 494 608	10 549 564
9 834 344	10 927 049
10 186 237	11 318 041
10 550 720	11 723 023
10 928 246	12 142 496
11 319 281	12 576 979
11 724 307	13 027 008
12 143 827	13 493 141
12 578 357	13 975 952
13 028 436	14 476 040
13 494 619	14 994 021
13 977 484	15 530 537
14 477 626	16 086 251
14 995 664	16 661 849
15 532 239	17 258 044
16 088 014	17 875 571
16 663 675	18 515 195
17 259 935	19 177 705
17 877 530	19 863 922
18 517 224	20 574 693
19 179 807	21 310 896
19 866 099	22 073 443
20 576 947	22 863 275
21 313 232	23 681 369

Appendix 11: CBA presentation, both methods and alternatives

Alternative 1	
User benefits	
1.1 Time benefits for passengers	1 648 440 658
1.2 Time benefits for freight users	45 761 033
1.3 Benefit payable cost for passengers	74 354 878
SUM USER BENEFITS	1 768 556 569
Benefits for operators	
2.1 Income NSB	1 739 306 523
2.2 Costs NSB	-560 962 612
2.3. Change in public purchase	-1 178 343 911
SUM OPERATOR BENEFIT	0
Public benefits	
3.1 Changed tax	-1 038 063 655
3.2 Change in public purchase	1 178 343 911
3.3 Additional costs Jernbaneverket	-257 183 986
3.4 Saved costs of maintenace other operators	214 575 232
SUM PUBLIC BENEFITS	97 671 503
Benefits for society in general	
4.1 Reduced accident costs	1 230 229 398
4.2 Reduced costs of noise	2 150 545 950
4.3 Reduction in local emissions	276 772 181
4.4 Reduction in global emissions	373 133 570
4.5 Health benefits	148 023 338
SUM BENEFITS FOR SOCIETY	4 178 704 436
5. Residual Value	4 443 721 425
6. Tax financing costs	-5 468 464 981
Gross present value	5 020 188 952
7. Investment costs	27 439 996 407
NET PRESENT VALUE	-22 419 807 455
Costs/Benefits ratio	0,18

Alternative 2	
User benefits	
1.1 Time benefits for passengers	1 312 984 923
1.2 Time benefits for freight users	35 178 055
1.3 Benefit payable cost for passengers	85 480 176
SUM USER BENEFITS	1 433 643 154
Benefits for operators	
2.1 Income NSB	2 034 803 034
2.2 Costs NSB	-644 278 481
2.3 Change in public purchase	-1 390 524 553
SUM OPERATOR BENEFIT	0
Public benefits	
3.1 Changed tax	-1 049 567 171
3.2 Change in public purchase	1 390 524 553
3.3 Additional costs Jernbaneverket	-317 270 255
3.4 Saved costs of maintenace other operators	235 719 651
SUM PUBLIC BENEFITS	259 406 779
Benefits for society in general	
4.1 Reduced accident costs	1 350 537 471
4.2 Reduced costs of noise	2 385 240 594
4.3 Reduction in local emissions	305 084 044
4.4 Reduction in global emissions	411 200 403
4.5 Health benefits	149 584 407
SUM BENEFITS FOR SOCIETY	4 601 646 918
5. Residual Value	5 521 673 484
6. Tax financing costs	-6 767 389 525
Gross present value	5 048 980 810
7. Investment costs	34 096 354 403
NET PRESENT VALUE	-29 047 373 593
Costs/Benefits ratio	0,15

Alternative 1	
User benefits	
1.1 Time benefits for passengers	2 476 677 784
1.2 Time benefits for freight users	72 140 119
1.3 Benefit payable cost for passengers	111 628 195
SUM USER BENEFITS	2 660 446 098
Operator Benefits	
2.1 Income NSB	2 614 858 811
2.2 Costs NSB	-875 981 503
2.3 Change in public purchase	-1 738 877 308
SUM OPERATOR BENEFITS	0
Public benefits	
3.1 Changed tax	-1 529 673 964
3.2 Change in public purchase	1 738 877 308
3.3 Additional costs Jernbaneverket	-387 998 559
3.4 Saved costs of maintenace other operators	335 094 665
SUM PUBLIC BENEFITS	156 299 450
Benefits for society in general	
4.1 Reduced accident costs	1 924 837 915
4.2 Reduced costs of noise	3 383 234 807
4.3 Reduction in local emissions	433 474 738
4.4 Reduction in global emissions	586 294 857
4.5 Health benefits	222 573 698
SUM BENEFITS FOR SOCIETY	6 550 416 015
5. Residual Value	2 641 479 151
6. Tax financing costs	-5 456 739 392
Gross present value	6 551 901 322
7. Investment costs	27 439 996 407
NET PRESENT VALUE	-20 888 095 085
Costs/Benefits ratio	0,24

Alternative 2	
User benefits	
1.1 Time benefits for passengers	1 972 853 771
1.2 Time benefits for freight users	55 456 551
1.3 Benefit payable cost for passengers	128 334 330
SUM USER BENEFITS	2 156 644 652
Operator Benefits	
2.1 Income NSB	3 059 152 611
2.2 Costs NSB	-997 451 933
2.3 Change in public purchase	-2 061 700 678
SUM OPERATOR BENEFITS	0
Public benefits	
3.1 Changed tax	-1 530 388 782
3.2 Change in public purchase	2 061 700 678
3.2 Additional costs Jernbaneverket	-478 588 838
3.4 Saved costs of maintenance other operators	368 289 008
SUM PUBLIC BENEFITS	421 012 067
Benefits for society in general	
4.1 Reduced accident costs	2 114 080 974
4.2 Reduced costs of noise	3 752 751 942
4.3 Reduction in local emissions	477 974 913
4.4 Reduction in global emissions	646 346 944
4.5 Health benefits	224 920 983
SUM BENEFITS FOR SOCIETY	7 216 075 757
5. Residual Value	3 282 245 665
6. Tax financing costs	-6 735 068 467
Gross present value	6 340 909 674
7. Investment costs	34 096 354 403
NET PRESENT VALUE	-27 755 444 729
Costs/Benefits ratio	0,19

Appendix 12: Lifetime of a selection of Norwegian Lines

Name:	Opened in:	Lifespan:	Upgrades:
Bergen Line	1909	115 yrs	25 km line change, fully electrified in 1964 and notable upgrades.
Dovre Line	1921	93 yrs	Fully electrified in 1970, no route changes and notable upgrades are in progress.
Nordland Line	1962	52 yrs	A line change between Hommelvik and Hell, and some minor upgrades.
Østfold Line	1879	135 yrs	Fully electrified in 1940. Some sections have been upgraded to double tracks.
Rauma Line	1924	90 yrs	Some minor upgrades, while the route is unchanged.
Sørlandet Line	1944	70 yrs	Fully electrified in 1956, some minor line changes and some upgrades on the oldest parts of the line.
Gjøvik Line	1902	112 yrs	Fully electrified in 1963, while the route is unchanged.

Source:

Jernbaneverket (2014). *Banestrekningene*. Gathered 15.1.2014 from: http://www.jernbaneverket.no/no/Jernbanen/Banestrekningene/

Appendix 13: NPV, both alternatives and methods

Alternative 1 (Discounted to 2018-NOK)															
	Investment costs	Time benefits	Ticket benefits	Freight users	Jernbaneverket	Maintenance transfer	CO2	Local Emissions	Accidents	Noise	NSB income	NSB Cost	Health	Taxes and surcharge	SUM
2017	-5 487 999 281	0	0	0	0	0	0	0	0	0	0	0	0	0	-5 487 999 281
2018	-5 487 999 281	0	0	0	0	0	0	0	0	0	0	0	0	0	-5 487 999 281
2019	-5 487 999 281	0	0	0	0	0	0	0	0	0	0	0	0	0	-5 487 999 281
2020	-5 487 999 281	0	0	0	0	0	0	0	0	0	0	0	0	0	-5 487 999 281
2021	-5 487 999 281	0	0	0	0	0	0	0	0	0	0	0	0	0	-5 487 999 281
2022	0	83 742 953	3 785 474	2 031 631	-13 031 353	9 801 920	17 831 699	12 533 868	55 876 412	96 081 471	88 200 517	-31 202 296	7 502 788	-53 986 788	279 168 296
2023	0	82 013 929	3 706 579	2 013 710	-12 755 284	9 689 528	17 437 848	12 400 211	55 265 613	95 177 305	86 393 788	-30 295 245	7 349 416	-52 873 602	275 523 796
2024	0	80 320 625	3 629 330	1 995 947	-12 486 393	9 578 675	17 052 984	12 268 211	54 662 620	94 282 274	84 624 074	-29 415 234	7 199 178	-51 771 012	271 941 279
2025	0	78 662 303	3 553 693	1 978 341	-12 224 476	9 469 335	16 676 893	12 137 844	54 067 315	93 396 271	82 890 616	-28 561 442	7 052 012	-50 678 846	268 419 858
2026	0	77 038 239	3 479 633	1 960 890	-11 969 336	9 361 485	16 309 365	12 009 086	53 479 581	92 519 194	81 192 672	-27 733 074	6 907 854	-49 596 936	264 958 653
2027	0	75 447 726	3 407 119	1 943 593	-11 720 781	9 255 100	15 950 199	11 881 913	52 899 305	91 650 942	79 529 514	-26 929 358	6 766 643	-48 525 118	261 556 796
2028	0	73 890 070	3 336 117	1 926 448	-11 478 623	9 150 156	15 599 195	11 756 302	52 326 373	90 791 414	77 900 429	-26 149 548	6 628 318	-47 463 227	258 213 424
2029	0	72 364 591	3 266 596	1 909 455	-11 242 683	9 046 631	15 256 160	11 632 229	51 760 675	89 940 513	76 304 719	-25 392 917	6 492 821	-46 411 105	254 927 685
2030	0	70 870 625	3 198 526	1 892 611	-11 012 784	8 944 500	15 129 799	11 509 673	51 202 103	89 098 140	74 741 700	-24 658 763	6 360 095	-45 368 595	251 907 629
2031	0	69 407 521	3 131 875	1 875 917	-10 788 756	8 843 741	15 004 721	11 388 610	50 650 550	88 264 199	73 210 702	-23 946 407	6 230 081	-44 335 541	248 937 212
2032	0	67 974 640	3 066 615	1 859 369	-10 570 433	8 744 333	14 880 909	11 269 021	50 105 911	87 438 596	71 711 069	-23 255 187	6 102 725	-43 311 793	246 015 773
2033	0	66 571 357	3 002 716	1 842 968	-10 357 657	8 646 254	14 758 347	11 150 882	49 568 083	86 621 237	70 242 159	-22 584 465	5 977 972	-42 297 199	243 142 652
2034	0	65 197 061	2 940 149	1 826 711	-10 150 269	8 549 482	14 637 018	11 034 173	49 036 965	85 812 029	68 803 341	-21 933 620	5 855 770	-41 291 614	240 317 196
2035	0	63 851 153	2 878 888	1 810 597	-9 948 120	8 453 996	14 516 906	10 918 874	48 512 457	85 010 881	67 394 001	-21 302 051	5 736 066	-40 294 893	237 538 756
2036	0	62 533 046	2 818 904	1 794 626	-9 751 063	8 359 777	14 397 997	10 804 964	47 994 462	84 217 704	66 013 532	-20 689 176	5 618 808	-39 306 893	234 806 689
2037	0	61 242 166	2 760 172	1 778 795	-9 558 955	8 266 804	14 280 273	10 692 422	47 482 883	83 432 409	64 661 344	-20 094 429	5 503 948	-38 327 474	232 120 358
2038	0	59 977 948	2 702 664	1 763 104	-9 371 658	8 175 057	14 163 721	10 581 231	46 977 626	82 654 907	63 336 858	-19 517 264	5 391 436	-37 356 500	229 479 131
2039	0	58 739 844	2 646 356	1 747 552	-9 189 038	8 084 516	14 048 324	10 471 369	46 478 599	81 885 114	62 039 506	-18 957 150	5 281 224	-36 393 835	226 882 381
2040	0	57 527 312	2 591 222	1 732 137	-9 010 964	7 995 164	13 934 069	10 362 819	45 985 709	81 122 942	60 768 731	-18 413 573	5 173 264	-35 439 344	224 329 487
2041	0	56 339 825	2 537 237	1 716 857	-8 837 310	7 906 980	13 820 940	10 255 562	45 498 867	80 368 308	59 523 990	-17 886 033	5 067 512	-34 492 898	221 819 836
2042	0	55 176 864	2 484 379	1 701 713	-8 667 953	7 819 947	13 708 923	10 149 578	45 017 984	79 621 129	58 304 748	-17 374 048	4 963 921	-33 554 368	219 352 818
2043	0	54 037 923	2 432 623	1 686 702	-8 502 775	7 734 047	13 598 004	10 044 851	44 542 975	78 881 323	57 110 484	-16 877 149	4 862 448	-32 623 626	216 927 831
2044	0	52 922 505	2 381 946	1 671 824	-8 341 659	7 649 262	13 488 170	9 941 362	44 073 754	78 148 809	55 940 686	-16 394 882	4 763 050	-31 700 547	214 544 279
2045	0	51 830 125	2 332 326	1 657 076	-8 184 494	7 565 574	13 379 407	9 839 095	43 610 236	77 423 506	54 794 852	-15 926 806	4 665 683	-30 785 010	212 201 571
2046	0	50 760 306	2 283 741	1 642 459	-8 031 169	7 482 967	13 271 701	9 738 031	43 152 340	76 705 336	53 672 491	-15 472 494	4 570 306	-29 876 892	209 899 122
SUM	-27 439 996 407	1 648 440 658	74 354 878	45 761 033	-257 183 986	214 575 232	373 133 570	276 772 181	1 230 229 398	2 150 545 950	1 739 306 523	-560 962 612	148 023 338	-1 038 063 655	-21 395 063 899

Alternative 2 (Discounted to 2018-NOK))

	Investment cost	Time benefits	Ticket benefits	Freight users	Jernbaneverket	Maintenance transfe	CO2	Local Emissions	Accidents	Noise	NSB Income	NSB Cost	Health	Taxes and surcharge	SUM
	-6 819 270 881	0	0	0	0	0	0	0	0	0	0		0	0	-6 819 270 881
	-6 819 270 881	0	0	0	0	0	0	0	0	0	0		0	0	-6 819 270 881
	-6 819 270 881	0	0	0	0	0	0	0	0	0	0		0	0	-6 819 270 881
	-6 819 270 881	0	0	0	0	0	0	0	0	0	0		0	0	-6 819 270 881
	-6 819 270 881	0	0	0	0	0	0	0	0	0	0		0	0	-6 819 270 881
	0	66 684 464	4 351 505	1 561 784	-16 076 813	10 752 653	19 629 292	13 802 232	61 253 693	106 541 523	103 180 723	-35 816 772	7 581 914	-55 742 668	287 703 530
	0	65 309 170	4 260 846	1 548 007	-15 736 538	10 630 751	19 197 728	13 656 318	60 592 088	105 541 304	101 067 539	-34 777 328	7 426 923	-54 517 587	284 199 221
	0	63 962 256	4 172 078	1 534 352	-15 405 054	10 510 495	18 775 949	13 512 191	59 938 806	104 551 142	98 997 640	-33 768 833	7 275 101	-53 303 651	280 752 471
	0	62 643 135	4 085 162	1 520 818	-15 082 113	10 391 858	18 363 725	13 369 825	59 293 723	103 570 925	96 970 138	-32 790 348	7 126 383	-52 100 682	277 362 547
	0	61 351 233	4 000 058	1 507 402	-14 767 473	10 274 815	17 960 830	13 229 195	58 656 716	102 600 539	94 984 166	-31 840 963	6 980 705	-50 908 505	274 028 717
	0	60 085 989	3 916 728	1 494 106	-14 460 901	10 159 339	17 567 045	13 090 275	58 027 666	101 639 874	93 038 872	-30 919 795	6 838 004	-49 726 947	270 750 254
	0	58 846 852	3 835 136	1 480 926	-14 162 171	10 045 406	17 182 155	12 953 040	57 406 455	100 688 819	91 133 423	-30 025 991	6 698 221	-48 555 838	267 526 435
	0	57 633 284	3 755 246	1 467 863	-13 871 062	9 932 991	16 805 952	12 817 466	56 792 965	99 747 268	89 267 003	-29 158 720	6 561 295	-47 395 011	264 356 541
	0	56 444 755	3 677 021	1 454 915	-13 587 360	9 822 069	16 668 366	12 683 530	56 187 084	98 815 113	87 438 813	-28 317 179	6 427 169	-46 244 302	261 469 993
	0	55 280 750	3 600 427	1 442 081	-13 310 859	9 712 618	16 532 152	12 551 207	55 588 699	97 892 250	85 648 068	-27 500 591	6 295 784	-45 103 550	258 629 035
	0	54 140 762	3 525 431	1 429 360	-13 041 356	9 604 613	16 397 291	12 420 474	54 997 699	96 978 574	83 894 003	-26 708 200	6 167 085	-43 972 596	255 833 139
	0	53 024 296	3 451 998	1 416 752	-12 778 656	9 498 031	16 263 765	12 291 309	54 413 977	96 073 983	82 175 865	-25 939 275	6 041 017	-42 851 283	253 081 778
	0	51 930 865	3 380 096	1 404 254	-12 522 569	9 392 851	16 131 559	12 163 688	53 837 425	95 178 375	80 492 919	-25 193 107	5 917 525	-41 739 458	250 374 426
	0	50 859 994	3 309 694	1 391 867	-12 272 912	9 289 049	16 000 655	12 037 591	53 267 940	94 291 652	78 844 444	-24 469 007	5 796 559	-40 636 969	247 710 558
	0	49 811 217	3 240 759	1 379 590	-12 029 505	9 186 605	15 871 037	11 912 995	52 705 418	93 413 715	77 229 734	-23 766 311	5 678 065	-39 543 667	245 089 651
	0	48 784 079	3 173 261	1 367 420	-11 792 175	9 085 498	15 742 688	11 789 880	52 149 757	92 544 466	75 648 096	-23 084 372	5 561 993	-38 459 407	242 511 185
	0	47 778 132	3 107 171	1 355 358	-11 560 753	8 985 705	15 615 592	11 668 223	51 600 859	91 683 810	74 098 854	-22 422 563	5 448 294	-37 384 042	239 974 640
	0	46 792 940	3 042 458	1 343 402	-11 335 076	8 887 207	15 489 734	11 548 005	51 058 626	90 831 652	72 581 344	-21 780 278	5 336 920	-36 317 433	237 479 500
	0	45 828 073	2 979 094	1 331 552	-11 114 985	8 789 983	15 365 099	11 429 206	50 522 961	89 987 897	71 094 915	-21 156 929	5 227 822	-35 259 439	235 025 249
	0	44 883 112	2 917 052	1 319 806	-10 900 325	8 694 014	15 241 670	11 311 804	49 993 770	89 152 455	69 638 932	-20 551 945	5 120 954	-34 209 922	232 611 377
	0	43 957 646	2 856 303	1 308 164	-10 690 948	8 599 280	15 119 433	11 195 782	49 470 960	88 325 234	68 212 770	-19 964 773	5 016 271	-33 168 747	230 237 374
	0	43 051 273	2 796 820	1 296 625	-10 486 706	8 505 762	14 998 373	11 081 119	48 954 439	87 506 144	66 815 819	-19 394 878	4 913 728	-32 135 781	227 902 736
	0	42 163 599	2 738 577	1 285 187	-10 287 460	8 413 441	14 878 475	10 967 796	48 444 117	86 695 096	65 447 480	-18 841 739	4 813 281	-31 110 894	225 606 958
	0	41 294 237	2 681 548	1 273 851	-10 093 072	8 322 300	14 759 726	10 855 795	47 939 907	85 892 003	64 107 167	-18 304 852	4 714 888	-30 093 955	223 349 543
	0	40 442 810	2 625 708	1 262 614	-9 903 410	8 232 319	14 642 110	10 745 098	47 441 722	85 096 778	62 794 306	-17 783 730	4 618 505	-29 084 838	221 129 993
SUM	-34 096 354 403	1 312 984 923	85 480 176	35 178 055	-317 270 255	235 719 651	411 200 403	305 084 044	1 350 537 471	2 385 240 594	2 034 803 034	-644 278 481	149 584 407	-1 049 567 171	-27 801 657 552

Alternative 2 (Discounted to 2018-NOK)

	Investment costs	Time benefits	Ticket benefits	Freight users	Jernbaneverket	Maintenance transfer	CO2	Local Emissions	Accidents	Noise	NSB income	NSB Cost	Health	Taxes and surcharge	SUM
2017	-5 487 999 281	0	0	0	0	0	0	0	0	0	0	0	0	0	-5 487 999 281
2018	-5 487 999 281	0	0	0	0	0	0	0	0	0	0	0	0	0	-5 487 999 281
2019	-5 487 999 281	0	0	0	0	0	0	0	0	0	0	0	0	0	-5 487 999 281
2020	-5 487 999 281	0	0	0	0	0	0	0	0	0	0	0	0	0	-5 487 999 281
2021	-5 487 999 281	0	0	0	0	0	0	0	0	0	0	0	0	0	-5 487 999 281
2022	0	85 365 046	3 858 798	2 070 984	-13 283 769	9 991 782	18 177 097	12 776 647	56 958 732	97 942 559	89 908 952	-31 806 682	7 648 117	-55 032 506	284 575 757
2023	0	84 004 466	3 796 540	2 062 584	-13 064 864	9 924 700	17 861 077	12 701 173	56 606 949	97 487 327	88 490 627	-31 030 532	7 527 791	-54 156 882	282 210 956
2024	0	82 665 593	3 735 289	2 054 219	-12 850 934	9 858 325	17 550 848	12 626 383	56 258 500	97 034 853	87 094 682	-30 274 014	7 409 359	-53 282 471	279 880 630
2025	0	81 348 081	3 675 027	2 045 888	-12 641 859	9 792 648	17 246 294	12 552 269	55 913 343	96 585 113	85 720 763	-29 536 619	7 292 790	-52 409 181	277 584 556
2026	0	80 051 589	3 615 739	2 037 590	-12 437 517	9 727 660	16 947 306	12 478 822	55 571 435	96 138 081	84 368 523	-28 817 853	7 178 054	-51 536 920	275 322 508
2027	0	78 775 780	3 557 409	2 029 326	-12 237 793	9 663 350	16 653 774	12 406 033	55 232 732	95 693 732	83 037 619	-28 117 232	7 065 124	-50 665 596	273 094 258
2028	0	77 520 326	3 500 022	2 021 096	-12 042 574	9 599 708	16 365 591	12 333 895	54 897 194	95 252 042	81 727 716	-27 434 288	6 953 971	-49 795 119	270 899 578
2029	0	76 284 899	3 443 562	2 012 898	-11 851 748	9 536 726	16 082 653	12 262 398	54 564 778	94 812 985	80 438 480	-26 768 562	6 844 566	-48 925 399	268 738 238
2030	0	75 069 181	3 388 015	2 004 735	-11 665 209	9 474 394	16 026 126	12 191 535	54 235 446	94 376 540	79 169 588	-26 119 611	6 736 883	-48 056 346	266 831 276
2031	0	73 872 857	3 333 365	1 996 604	-11 482 851	9 412 704	15 970 050	12 121 297	53 909 156	93 942 681	77 920 716	-25 487 000	6 630 893	-47 187 871	264 952 601
2032	0	72 695 618	3 279 598	1 988 506	-11 304 572	9 351 645	15 914 418	12 051 677	53 585 869	93 511 385	76 691 550	-24 870 308	6 526 572	-46 319 885	263 102 072
2033	0	71 537 157	3 226 699	1 980 441	-11 130 272	9 291 209	15 859 225	11 982 667	53 265 547	93 082 630	75 481 777	-24 269 122	6 423 891	-45 452 301	261 279 549
2034	0	70 397 176	3 174 656	1 972 409	-10 959 854	9 231 388	15 804 466	11 914 258	52 948 151	92 656 393	74 291 093	-23 683 044	6 322 826	-44 585 031	259 484 886
2035	0	69 275 380	3 123 453	1 964 409	-10 793 224	9 172 173	15 750 134	11 846 444	52 633 644	92 232 650	73 119 196	-23 111 684	6 223 351	-43 717 989	257 717 938
2036	0	68 171 477	3 073 077	1 956 442	-10 630 289	9 113 555	15 696 224	11 779 217	52 321 989	91 811 381	71 965 789	-22 554 661	6 125 441	-42 851 086	255 978 557
2037	0	67 085 183	3 023 515	1 948 507	-10 470 960	9 055 527	15 642 732	11 712 569	52 013 150	91 392 562	70 830 581	-22 011 607	6 029 071	-41 984 238	254 266 593
2038	0	66 016 216	2 974 754	1 940 605	-10 315 148	8 998 079	15 589 650	11 646 494	51 707 090	90 976 174	69 713 284	-21 482 161	5 934 218	-41 117 358	252 581 896
2039	0	64 964 300	2 926 781	1 932 734	-10 162 768	8 941 204	15 536 976	11 580 984	51 403 773	90 562 193	68 613 615	-20 965 973	5 840 856	-40 250 362	250 924 313
2040	0	63 929 161	2 879 582	1 924 895	-10 013 737	8 884 895	15 484 703	11 516 032	51 103 166	90 150 599	67 531 297	-20 462 703	5 748 964	-39 383 164	249 293 692
2041	0	62 910 533	2 833 146	1 917 088	-9 867 973	8 829 143	15 432 825	11 451 630	50 805 234	89 741 371	66 466 056	-19 972 016	5 658 517	-38 515 679	247 689 876
2042	0	61 908 152	2 787 460	1 909 313	-9 725 398	8 773 940	15 381 340	11 387 774	50 509 942	89 334 490	65 417 622	-19 493 591	5 569 494	-37 647 825	246 112 712
2043	0	60 921 758	2 742 512	1 901 569	-9 585 935	8 719 279	15 330 240	11 324 454	50 217 259	88 929 933	64 385 730	-19 027 112	5 481 870	-36 779 515	244 562 043
2044	0	59 951 096	2 698 290	1 893 857	-9 449 508	8 665 153	15 279 522	11 261 666	49 927 149	88 527 682	63 370 118	-18 572 271	5 395 626	-35 910 668	243 037 712
2045	0	58 995 915	2 654 782	1 886 176	-9 316 043	8 611 555	15 229 181	11 199 402	49 639 582	88 127 716	62 370 531	-18 128 771	5 310 738	-35 041 200	241 539 562
2046	0	58 055 967	2 611 977	1 878 526	-9 185 470	8 558 476	15 179 211	11 137 655	49 354 526	87 730 016	61 386 714	-77 118 619	5 227 186	-34 171 028	180 645 137
2047	0	56 492 922	2 541 655	1 827 950	-8 938 169	8 328 056	14 770 540	10 837 795	48 025 750	85 368 054	59 733 995	-17 219 881	5 086 454	-33 251 039	233 604 082
2048	0	54 971 959	2 473 226	1 778 736	-8 697 526	8 103 839	14 372 872	10 546 009	46 732 749	83 069 683	58 125 772	-16 756 269	4 949 511	-32 355 819	227 314 742
2049	0	53 491 944	2 406 639	1 730 847	-8 463 362	7 885 659	13 985 910	10 262 078	45 474 560	80 833 192	56 560 847	-16 305 138	4 816 255	-31 484 701	221 194 729
2050	0	52 051 777	2 341 845	1 684 247	-8 235 502	7 673 352	13 609 366	9 985 791	44 250 245	78 656 914	55 038 055	-15 866 154	4 686 587	-30 637 036	215 239 487
2051	0	50 650 383	2 278 795	1 638 902	-8 013 777	7 466 762	13 242 960	9 716 943	43 058 892	76 539 227	53 556 261	-15 438 988	4 560 409	-29 812 192	209 444 577
2052	0	49 286 718	2 217 443	1 594 778	-7 798 022	7 265 734	12 886 419	9 455 333	41 899 614	74 478 556	52 114 362	-15 023 323	4 437 629	-29 009 556	203 805 685
2053	0	47 959 768	2 157 742	1 551 842	-7 588 075	7 070 118	12 539 477	9 200 766	40 771 548	72 473 364	50 711 283	-14 618 849	4 318 154	-28 228 530	198 318 609
2054	0	46 668 544	2 099 649	1 510 061	-7 383 781	6 879 769	12 201 876	8 953 053	39 673 852	70 522 158	49 345 979	-14 225 265	4 201 896	-27 468 531	192 979 262
2055	0	45 412 083	2 043 120	1 469 406	-7 184 986	6 694 544	11 873 364	8 712 009	38 605 710	68 623 485	48 017 434	-13 842 277	4 088 768	-26 728 994	187 783 666
2056	0	44 189 450	1 988 113	1 429 845	-6 991 545	6 514 306	11 553 696	8 477 455	37 566 325	66 775 929	46 724 657	-13 469 600	3 978 686	-26 009 367	182 727 952
2057	0	42 999 734	1 934 587	1 391 349	-6 803 311	6 338 921	11 242 635	8 249 216	36 554 924	64 978 116	45 466 685	-13 106 957	3 871 568	-25 309 115	177 808 353
2058	0	41 842 049	1 882 502	1 353 890	-6 620 145	6 168 258	10 939 949	8 027 122	35 570 753	63 228 705	44 242 582	-12 754 077	3 767 333	-24 627 715	173 021 205
2059	0	40 715 532	1 831 819	1 317 439	-6 441 910	6 002 190	10 645 412	7 811 007	34 613 079	61 526 394	43 051 436	-12 410 698	3 665 905	-23 964 661	168 362 942
2060	0	39 619 345	1 782 501	1 281 969	-6 268 474	5 840 592	10 358 804	7 600 711	33 681 189	59 869 914	41 892 358	-12 076 564	3 567 208	-23 319 459	163 830 094
2061	0	38 552 670	1 734 511	1 247 455	-6 099 707	5 683 345	10 079 913	7 396 076	32 774 387	58 258 032	40 764 487	-11 751 426	3 471 167	-22 691 627	159 419 284
SUM	-27 439 996 407	2 476 677 784	111 628 195	72 140 119	-387 998 559	335 094 665	586 294 857	433 474 738	1 924 837 915	3 383 234 807	2 614 858 811	-875 981 503	222 573 698	-1 529 673 964	-18 072 834 844

Alternative 2 (Discounted to 2018-NOK))

	Investment costs	Time benefits	Ticket benefits	Freight users	Jernbaneverket	Maintenance transfe	CO2	Local Emissions	Accidents	Noise	NSB Income	NSB Cost	Health	Taxes and surcharge	SUM
	-6 819 270 881	0	0	0	0	0	0	0	0	0	0		0	0	-6 819 270 881
	-6 819 270 881	0	0	0	0	0	0	0	0	0	0		0	0	-6 819 270 881
	-6 819 270 881	0	0	0	0	0	0	0	0	0	0		0	0	-6 819 270 881
	-6 819 270 881	0	0	0	0	0	0	0	0	0	0		0	0	-6 819 270 881
	-6 819 270 881	0	0	0	0	0	0	0	0	0	0		0	0	-6 819 270 881
	0	67 976 135	4 435 793	1 592 035	-16 388 219	10 960 931	20 009 510	14 069 580	62 440 171	108 605 222	105 179 323	-36 510 539	7 728 774	-56 822 397	293 276 318
	0	66 894 270	4 364 260	1 585 578	-16 118 475	10 888 767	19 663 670	13 987 766	62 062 701	108 102 867	103 520 520	-35 621 399	7 607 180	-55 840 768	291 096 939
	0	65 829 640	4 293 883	1 579 148	-15 854 806	10 817 350	19 324 115	13 906 680	61 688 725	107 603 523	101 887 885	-34 754 718	7 487 499	-54 859 856	288 949 066
	0	64 781 968	4 224 642	1 572 743	-15 597 063	10 746 669	18 990 720	13 826 313	61 318 197	107 107 162	100 281 004	-33 909 914	7 369 700	-53 879 564	286 832 577
	0	63 750 986	4 156 520	1 566 364	-15 345 102	10 676 714	18 663 368	13 746 655	60 951 073	106 613 758	98 699 470	-33 086 422	7 253 755	-52 899 791	284 747 347
	0	62 736 426	4 089 498	1 560 012	-15 098 782	10 607 475	18 341 940	13 667 696	60 587 309	106 123 283	97 142 885	-32 283 690	7 139 634	-51 920 439	282 693 246
	0	61 738 027	4 023 558	1 553 685	-14 857 966	10 538 942	18 026 323	13 589 429	60 226 862	105 635 711	95 610 853	-31 501 182	7 027 308	-50 941 410	280 670 141
	0	60 755 532	3 958 684	1 547 383	-14 622 519	10 471 105	17 716 404	13 511 845	59 869 690	105 151 016	94 102 989	-30 738 375	6 916 750	-49 962 607	278 677 896
	0	59 788 686	3 894 857	1 541 107	-14 392 310	10 403 954	17 655 843	13 434 934	59 515 750	104 669 171	92 618 910	-29 994 761	6 807 931	-48 983 932	276 960 139
	0	58 837 240	3 832 061	1 534 857	-14 167 214	10 337 479	17 595 749	13 358 689	59 165 001	104 190 153	91 158 241	-29 269 843	6 700 823	-48 005 289	275 267 947
	0	57 900 949	3 770 279	1 528 632	-13 947 105	10 271 673	17 536 116	13 283 101	58 817 402	103 713 934	89 720 613	-28 563 139	6 595 401	-47 026 583	273 601 274
	0	56 979 571	3 709 495	1 522 432	-13 731 862	10 206 524	17 476 939	13 208 162	58 472 914	103 240 491	88 305 662	-27 874 180	6 491 638	-46 047 716	271 960 070
	0	56 072 868	3 649 693	1 516 258	-13 521 369	10 142 024	17 418 212	13 133 864	58 131 496	102 769 799	86 913 031	-27 202 508	6 389 507	-45 068 595	270 344 280
	0	55 180 607	3 590 856	1 510 108	-13 315 510	10 078 165	17 359 929	13 060 198	57 793 111	102 301 833	85 542 367	-26 547 677	6 288 983	-44 089 125	268 753 845
	0	54 302 556	3 532 969	1 503 983	-13 114 172	10 014 936	17 302 084	12 987 157	57 457 719	101 836 571	84 193 324	-25 909 253	6 190 040	-43 109 210	267 188 705
	0	53 438 490	3 476 017	1 497 883	-12 917 248	9 952 330	17 244 673	12 914 734	57 125 283	101 373 987	82 865 561	-25 286 815	6 092 654	-42 128 758	265 648 792
	0	52 588 186	3 419 984	1 491 808	-12 724 630	9 890 339	17 187 689	12 842 919	56 795 765	100 914 059	81 558 741	-24 679 950	5 996 800	-41 147 673	264 134 039
	0	51 751 424	3 364 857	1 485 758	-12 536 215	9 828 953	17 131 128	12 771 707	56 469 130	100 456 764	80 272 535	-24 088 258	5 902 455	-40 165 864	262 644 372
	0	50 927 988	3 310 619	1 479 732	-12 351 901	9 768 164	17 074 983	12 701 089	56 145 341	100 002 079	79 006 617	-23 511 350	5 809 593	-39 183 238	261 179 717
	0	50 117 666	3 257 257	1 473 731	-12 171 591	9 707 965	17 019 250	12 631 059	55 824 361	99 549 982	77 760 667	-22 948 844	5 718 193	-38 199 700	259 739 995
	0	49 320 248	3 204 757	1 467 754	-11 995 187	9 648 347	16 963 924	12 561 608	55 506 157	99 100 450	76 534 371	-22 400 371	5 628 230	-37 215 160	258 325 127
	0	48 535 530	3 153 104	1 461 801	-11 822 597	9 589 302	16 909 000	12 492 731	55 190 694	98 653 461	75 327 417	-21 865 571	5 539 683	-36 229 525	256 935 029
	0	47 763 308	3 102 285	1 455 872	-11 653 729	9 530 823	16 854 472	12 424 419	54 877 937	98 208 994	74 139 501	-21 344 093	5 452 529	-35 242 704	255 569 616
	0	47 003 384	3 052 286	1 449 967	-11 488 493	9 472 902	16 800 336	12 356 667	54 567 854	97 767 028	72 970 323	-20 835 595	5 366 746	-34 254 604	254 228 800
	0	46 255 561	3 003 095	1 444 087	-11 326 804	9 415 531	16 746 587	12 289 467	54 260 410	97 327 541	71 819 586	-79 762 044	5 282 312	-33 265 134	193 490 195
	0	45 010 219	2 922 242	1 405 207	-11 021 851	9 162 036	16 295 717	11 958 596	52 799 553	94 707 184	69 885 982	-19 792 136	5 140 096	-32 369 534	246 103 312
	0	43 798 406	2 843 566	1 367 375	-10 725 109	8 915 366	15 856 987	11 636 634	51 378 027	92 157 375	68 004 437	-19 259 271	5 001 709	-31 498 047	239 477 453
	0	42 619 218	2 767 009	1 330 561	-10 436 356	8 675 337	15 430 068	11 323 340	49 994 772	89 676 215	66 173 548	-18 740 752	4 867 048	-30 650 022	233 029 984
	0	41 471 777	2 692 512	1 294 738	-10 155 377	8 441 770	15 014 643	11 018 481	48 648 759	87 261 855	64 391 952	-18 236 194	4 736 012	-29 824 830	226 756 099
	0	40 355 230	2 620 022	1 259 880	-9 881 963	8 214 491	14 610 402	10 721 830	47 338 985	84 912 498	62 658 323	-17 745 219	4 608 504	-29 021 853	220 651 128
	0	39 268 743	2 549 483	1 225 960	-9 615 911	7 993 332	14 217 045	10 433 165	46 064 474	82 626 392	60 971 368	-17 267 463	4 484 429	-28 240 496	214 710 520
	0	38 211 507	2 480 843	1 192 953	-9 357 021	7 778 127	13 834 279	10 152 272	44 824 276	80 401 835	59 329 831	-16 802 570	4 363 694	-27 480 175	208 929 852
	0	37 182 736	2 414 051	1 160 835	-9 105 101	7 568 716	13 461 817	9 878 942	43 617 469	78 237 171	57 732 490	-16 350 193	4 246 210	-26 740 324	203 304 818
	0	36 181 662	2 349 057	1 129 582	-8 859 964	7 364 943	13 099 384	9 612 970	42 443 152	76 130 785	56 178 153	-15 909 996	4 131 889	-26 020 392	197 831 227
	0	35 207 541	2 285 813	1 099 170	-8 621 426	7 166 656	12 746 708	9 354 159	41 300 452	74 081 110	54 665 665	-15 481 650	4 020 646	-25 319 843	192 505 001
	0	34 259 645	2 224 272	1 069 577	-8 389 311	6 973 707	12 403 528	9 102 317	40 188 517	72 086 619	53 193 897	-15 064 836	3 912 398	-24 638 155	187 322 174
	0	33 337 270	2 164 388	1 040 781	-8 163 445	6 785 954	12 069 586	8 857 254	39 106 518	70 145 825	51 761 753	-14 659 244	3 807 064	-23 974 820	182 278 885
	0	32 439 728	2 106 116	1 012 760	-7 943 660	6 603 255	11 744 636	8 618 790	38 053 650	68 257 284	50 368 168	-14 264 572	3 704 566	-23 329 344	177 371 377
	0	31 566 351	2 049 413	985 493	-7 729 792	6 425 475	11 428 434	8 386 745	37 029 129	66 419 588	49 012 102	-13 880 526	3 604 828	-22 701 246	172 595 993
	0	30 716 488	1 994 236	958 961	-7 521 682	6 252 482	11 120 746	8 160 948	36 032 191	64 631 368	47 692 545	-13 506 820	3 507 775	-22 090 059	167 949 178
SUM	-34 096 354 403	1 972 853 771	128 334 330	55 456 551	-478 588 838	368 289 008	646 346 944	477 974 913	2 114 080 974	3 752 751 942	3 059 152 611	-997 451 933	224 920 983	-1 530 388 782	-24 302 621 927