

# Reykjaviks Flygplatsområde

– Värdering av tre planeringsalternativ

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# The Reykjavik Airport Area

- Valuation of Three Alternative Plans

## Reykjaviks Flygplatsområde

- Värdering av Tre Planeringsalternativ

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## **Preface**

We would like to thank Associate Professor Trausti Valsson and Associate Professor Birgir Jonsson, our two instructors at the University of Iceland, who guided and supported us with our dissertation. Their knowledge and many useful contacts within different companies and authorities were of tremendous help. During our work with this dissertation they invested much time and effort in reading it through over and over again. We are also very grateful for their input and comments.

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Finally we would like to thank Carl-Magnus Willert, Lic. Eng. at Lund Institute of Technology, for his encouraging e-mails and useful advice.

Linda Ekeröth

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## Abstract

If the Reykjavik Airport is relocated, the airport area, which is situated close to the City Centre of Reykjavik, can be used for other purposes. This dissertation values and compares three planning proposals for the airport area. All three proposals suggest that the area should be developed with dwellings and workplaces, but they do not use the same density numbers or size of planning area. The valuations are based on estimations and calculations of costs and revenues, which can be derived from each proposal.

The proposals are also compared to the present use as an airport to find out whether or not a development of the area is economically justified. To compare the three plans with the airport, the annual financial result of the airport, the value of the land and buildings, together with some major investment costs are used.

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## Summary

Reykjavik Airport is situated in a very attractive area close to the City Centre of Reykjavik. This proximity is the reason for disturbance and danger for surrounding areas during take-offs and landings. The location of the airport and its negative side effects raise the question as to whether this area should be used for other purposes.

The aim of this dissertation is to investigate and value three alternative plans for the airport area and its surroundings. The valuation is limited to the proposed land use and external costs in terms of the infrastructures needed to realise each proposal. This dissertation deals with investments and the value of land and buildings as specified in the three alternatives. Furthermore, a brief investigation of some of the positive and negative side effects arising from the plans and the present airport is made. A comparison between the alternatives is made in order to find out which of them is economically the most advantageous. This dissertation also investigates whether one, or several, of the plans are more profitable than maintaining the airport, by comparing the alternatives to today's use and value as an airport area.

The uncertainty in the calculations is due to the figures used often being rough estimations or assumptions. Another contributing factor to the uncertainty is the development of the Icelandic economy, together with changes in political opinions. The calculations are made from the construction contractor's point of view, which we have decided will be the City of Reykjavik. To be able to calculate a result for each alternative, we first assume that the City of Reykjavik buys the land that is owned by the State. The lots, created in the area, are then sold through a hypothetical bidding procedure together with their future buildings. Thereafter, a construction company is contracted to build up the area according to the plan in question. In short, the result is the revenues minus the costs. The currency used in the calculations is Icelandic kronor (ISK), where 1 USD equals 85.50 ISK.

Alternative A is a proposal made by four students at the Department of Civil and Environmental Engineering at the University of Iceland in 1999. This proposal suggests a complete relocation of the airport. The area they use in their proposal is 181 ha and consists of the former airport area together with some adjacent areas. The students want to make Reykjavik more compact and by building in the airport area they are one step closer to their goal. The plan is characterised by a high density of buildings in the north and northeast of the area. Further to the south, by the sea, the density will decrease. In this alternative the number of inhabitants is calculated to be 19 309 and the number of workplaces 9 593. The result generated by Alternative A amounts to 16 617 million ISK.

Alternative B is one of the proposals for the development of new areas in the Regional Plan 2024 for the Reykjavik Area. This proposal is made by nes Planners and it also suggests a complete relocation of the airport. According to this proposal, 5 000 dwellings, with 12 000 inhabitants, and 5 000 workplaces would be built within an area of 140 ha. In the northern part there would be a higher density of buildings than in the southern, coastal part. nes Planners also want to maintain the open passages, which the former runways create, as green areas. These passages would give a pleasing view over the surroundings with their well-known landmarks. In Alternative B the result amounts to 6 260 million ISK.

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Alternative C is proposed by Associate Professor Trausti Valsson at the Department of Civil and Environmental Engineering at the University of Iceland. This is a proposal where the runways of the airport are relocated to an island created by landfill in Skerjafjörður. The former airport area, together with some adjacent areas, a total of 191 ha, have a high density of buildings, and would be used for residential areas, commerce and workplaces. In order to carry out this high density structure, no one-family houses are envisioned in the area. The calculated number of inhabitants is 27 924 and the number of workplaces 13 947. The result generated by Alternative C amounts to 20 104 million ISK.

When comparing the results of the three plans, it shows that Alternative C is found to be economically the most advantageous. This is due to the larger area and the high density numbers used in this plan. To make the alternatives more coherent, the adjacent areas that are included in Alternative A and C, are subtracted. The new results, which are generated from the alternatives after the subtraction, still show that Alternative C is the most profitable. It now becomes evident that the difference between the results for Alternative A and C is almost negligible.

In 1997, the Economic Institute at the University of Iceland made a valuation of the present airport. The figures used from this report are enumerated to the currency value for the year 2000. Alternative A, B and C are compared with the present airport in order to establish whether the airport area should be developed or not. This comparison shows that even though the airport generates an annual profit, and the value of the land and buildings at the present airport is estimated to be 2 802 million ISK, while the results generated from the alternative plans are substantially higher. Since the result from the airport in 2000 was approximately 75 million ISK, the airport will have to be in full use for many years, just to cover the least profitable alternative. Considering this, a development of the airport area seems to be justified from an economic point of view.

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## Sammanfattning

Reykjavíks flygplats är belägen i ett mycket attraktivt område nära Reykjavíks stadskärna. Vid de starter och landningar som sker på flygplatsen kan denna närhet resultera i störningar och olycksrisker för de närliggande områdena. Flygplatsens lokalisering och dess negativa bieffekter gör att vi frågar oss huruvida detta område bör ha en annan markanvändning.

Målet med detta examensarbete är att undersöka och värdera tre planeringsalternativ för flygplatsområdet och dess omgivning. Värderingen begränsas till den föreslagna markanvändningen och de kostnader för infrastruktur som behövs för att genomföra det aktuella planeringsalternativet. Examensarbetet rör investeringar och värderingar av mark och byggnader enligt de tre alternativen. Några av intäkterna som varje alternativ ger upphov till, för Reykjavíks kommun och staten, är uppskattade. Vidare är en översiktlig genomgång gjord av alternativens och den nuvarande flygplatsens positiva och negativa sidoeffekter. En jämförelse görs mellan alternativen för att ta reda på vilket av dem som är mest ekonomiskt lönsamt. För att ta reda på om ett, eller flera, av planeringsalternativen är mer ekonomiskt lönsamt än att behålla flygplatsen, så görs en jämförelse mellan alternativen och dagens användning och värde som en flygplats.

Alla uträkningar har en viss grad av osäkerhet eftersom siffrorna som används ofta är grova uppskattningar. En annan bidragande faktor till osäkerheten är utvecklingen av Islands ekonomi tillsammans med ändringar i de politiska värderingarna. Uträkningarna görs ur byggherrens perspektiv och som byggherre har vi valt kommunen. För att kunna beräkna ett resultat för varje alternativ, antar vi först att kommunen köper upp den mark som ägs av staten. De nybildade tomterna säljs sedan genom ett hypotetiskt anbudsförfarande tillsammans med sina planerade byggnader. Därefter anlitas ett byggföretag för att bebygga området enligt alternativet i fråga. Valutan som används i beräkningarna är isländska kronor (ISK), där 1 USD motsvarar 85.50 ISK.

Alternativ A är ett planeringsförslag som är gjort 1999 av fyra studenter vid Väg och Vatten och Miljö Institutionen vid Islands Universitet. Detta förslag föreslår en fullständig flytt av flygplatsen. Planeringsområdet är i detta alternativ 181 hektar och utgörs av det före detta flygplatsområdet samt några intilliggande områden. Studenterna vill förtäta Reykjavík och genom att bebygga flygplatsområdet kommer de ett steg närmare sitt mål. Planen karakteriseras av en hög densitet av byggnader i de norra och nordöstra delarna och en lägre densitet längre söderut, vid havet. I detta förslag beräknas antalet invånare till 19 309 och antalet arbetstillfällen till 9 593. Resultatet för Alternativ A uppgår till 16 617 miljoner ISK.

Alternativ B är ett av förslagen till nybyggnadsområden i Regionplan 2024 över Reykjavíksområdet. Detta förslag är gjort av nes Planners och det föreslår också en fullständig flytt av flygplatsen. Enligt förslaget ska 5 000 bostäder för 12 000 invånare samt 5 000 arbetstillfällen skapas inom området, vilket är 140 hektar. På områdets norra del kommer det att vara en högre densitet av byggnader jämfört med den södra, kustnära delen. nes Planners vill också behålla de öppna passagera, som de före detta landningsbanorna utgjorde, i form av grönområden. Dessa passager kommer att ge



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möjlighet till en vacker utsikt över omgivningarna med sina välkända landmärken. För Alternativ B uppgår resultatet till 6 260 miljoner ISK.

Alternativ C är ett förslag gjort av docent Trausti Valsson vid Väg och Vatten och Miljö institutionen vid Islands Universitet. Detta är ett förslag där flygplatsens landningsbanor flyttas ut till en ö som är uppbyggd av fyllnadsmassor i Skerjafjörður. Förslaget utgörs av det före detta flygplatsområdet tillsammans med några av de närliggande områdena och uppgår till totalt 191 hektar. Området kommer att ha en hög densitet av byggnader som används till bostäder, handel och arbetsplatser. För att kunna uppnå denna höga densitet av byggnader, kommer det inte att finnas några enfamiljshus i området. Antalet invånare beräknas till 27 924 och antalet arbetstillfällen till 13 947. Resultatet för Alternativ C uppgår till 20 104 miljoner ISK.

Vid en jämförelse av resultaten från de tre planeringsalternativen, visar det sig att Alternativ C är mest lönsamt ur ekonomisk synvinkel. Detta beror på att detta alternativ har en större area och högre densitetstal än de andra alternativen. För att göra alternativen mer jämförbara dras de intilliggande områden, som har inkluderats i Alternativ A och C, bort. Även efter det här markborttagandet visar det sig att Alternativ C är det mest lönsamma. Värt att notera är dock att skillnaden mellan resultaten för Alternativ A och C nu är nästintill försumbar.

En värdering av den nuvarande flygplatsen gjordes 1997 av Ekonomiska Institutet vid Islands Universitet. Siffrorna som används från denna rapport är uppräknade till penningvärdet år 2000. Alternativ A, B och C jämförs med den nuvarande flygplatsen för att få en uppfattning om huruvida flygplatsområdet ska bebyggas eller inte. Denna jämförelse visar att även om flygplatsen genererar en vinst varje år, och att värdet på den nuvarande flygplatsens mark och byggnader uppskattas till 2 802 miljoner ISK, är resultatet som genereras från planeringsalternativen avsevärt högre. Då flygplatsens resultat för år 2000 uppskattningsvis var 75 miljoner ISK, skulle flygplatsen behöva vara i bruk under många år för att ens komma upp i det minst lönsamma alternativets nivå. Med detta i åtanke verkar det vara ekonomiskt försvarbart att bebygga flygplatsområdet.

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# 1 Introduction

## 1.1 Introduction to the Reykjavik Airport area

The City of Reykjavik is situated in the southwest of Iceland. In this region there are two main airports, the Reykjavik Airport and the Keflavik International Airport. The distance between Reykjavik and Keflavik is approximately 50 kilometres.

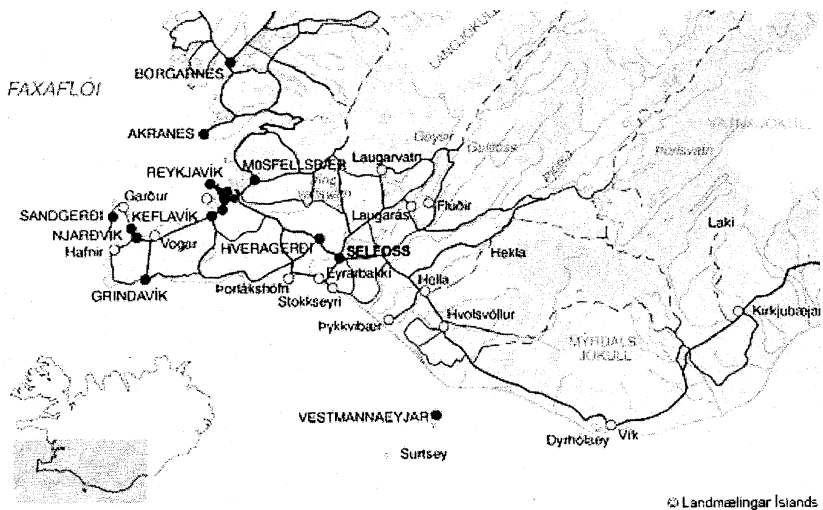
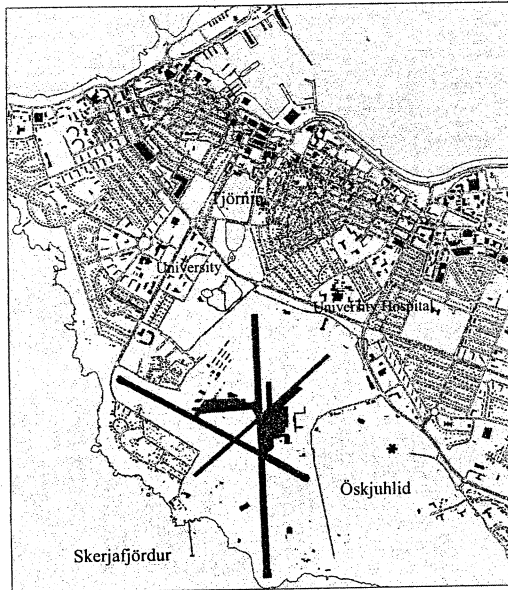


Figure 1.1 The southwest of Iceland

The Reykjavik Airport is situated in a very attractive area close to the City Centre of Reykjavik. This proximity gives rise to disturbance and danger for the areas within the flight corridors. On the other hand, it is an advantage for passengers whose destination is close to the City Area, since virtually no time is lost for transfer from the airport to the City Centre.

No formal decision has yet been taken (February 2001) regarding the future of the airport. If it is relocated, completely or partially, the land could be used for other purposes, such as housing, commerce and workplaces. These purposes are well suited considering the location of the area and its vicinity to the University of Iceland and the University Hospital. Using the area for housing, commerce or workplaces is also well within the intentions of the proposal for the Regional Plan 2024. These intentions are to condense the city and in this way try to create a more vibrant and distinctive City Centre.



*Figure 1.2 The Reykjavik Airport and its surroundings*

### **1.2 Aim**

The aim of this dissertation is to investigate the investment costs and incomes from three proposed plans for the land that would become available if Reykjavik Airport is relocated.

The aim is also to investigate which one of these proposals is economically the most attractive, by comparing them to each other. Furthermore, we will compare the investment costs and income revenues based on the proposals to the present use and value as an airport, to investigate whether a development of the airport area is justifiable.

### **1.3 Method**

Literature studies have given an insight into and an understanding of both the planning history and today's planning procedures in Reykjavik. Persons initiated in the proposals, the Civil Aviation Administration (CAA), the construction business, the planning procedure and valuation issues were interviewed. These interviews were done in order to gain information and the necessary figures needed to complete this dissertation.

The valuations are done from the construction contractor's point of view, which we decided would be the City of Reykjavik. As a method of valuation we compare all the costs involved in the development of the area to the revenues connected to the sale of the lots and buildings. This is done for each of the three plans in order to find which is the most profitable.

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The costs that will be taken into consideration are the cost for purchase of the land from the State and the construction costs involved in the development of the area. To be able to calculate the construction costs, we need to categorise the buildings according to building type, for instance, one-family houses, apartments and workplaces. To be added to the construction costs is a profit of 10 percent for the construction company.

The revenues that we will take into consideration are generated through the sale of the lots and buildings. The sale of the lots is done through a hypothetical bidding procedure, whereby the highest bidder gets the lot. To get the hypothetical bidding prices we divide the area into sectors according to value areas, which is based on the density of buildings and the location within the area. When it comes to the sale of the buildings connected to each lot, there is a fixed price. This price comprises the construction cost and an additional five percent, which is added by the City as their safety margin. Some of the lots and buildings will not be sold since they are needed as official buildings. We assume that three percent of the lots and buildings will be used for these purposes and they will therefore not generate any revenues for the City.

All major infrastructures, such as main roads, tunnels and bridges, are financed by the State. Since residents in other areas will also use these infrastructures, only half of the costs will be calculated as costs for the new area. The length of the roads that will be taken into consideration in the calculations is the distance from a point within the area to the first connection to another main road.

All the calculations are done on the assumption that the construction and sale will take place during the year 2000. This is done although we are aware of the fact that a possible development of the area will not be done, if done at all, until after the year 2018, according to the proposal for the Regional Plan 2024. The currency used in the calculations is Icelandic kronor (ISK), where 1 USD equals 85.50 ISK.

To be able to compare the present use of the area as an airport with the three proposed plans, we will look at the annual financial result of the airport, the value of the land and buildings, together with some major investment costs. Where old figures for the operation costs, which are a part of the annual result, and for the investment costs are used, these are enumerated on the basis of the Consumers Price Index (CPI).

#### **1.4 Limitations**

The valuation will concern only the three alternative plans. It will not include the costs and benefits to be derived from each plan on the national economics level. One exception to this is that we take into consideration a part of the costs of the roads that have to be built to create the necessary traffic links to the area. Another exception is that the tax revenues, generated from each plan, for the City of Reykjavik and the State are estimated.

We assume that all the costs for demolishing or moving existing buildings, which will be necessary in the development of the area, will be the same for all three proposals. The same assumption is made regarding the savings that can be made by using the existing buildings during the construction period and using some of the existing foundations for the new constructions. These costs and savings are therefore left out of our calculations.



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## **1.5 The uncertainty in the calculations**

The calculations have some degree of uncertainty, because the figures used are often rough estimations or assumptions. Another contributing factor to the uncertainty is the development of the Icelandic economy, as well as possible political changes.

The calculations regarding the costs of the development of the area and the revenues from the sale of the lots and buildings are done as if all these measures took place in the same year. This will of course have some consequences for the results. One example is that the capital, from the sale, will not generate any interest during the construction time. Another example is that the construction costs might change, and this change is not taken into account in our calculations.

The greatest uncertainty is that a development of the area will not take place until the year 2018. By that time the real estate market may have changed considerably.

## **1.6 Problem**

The problem of this dissertation is to calculate the investment costs and revenues for three alternative plans for the airport area in order to appraise them economically.

We will also make a comparison of these calculations to investigate whether one, or several, of the plans are more advantageous than maintaining the area as an airport.

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## 2 Background

### 2.1 History of the airport<sup>1</sup>

The first flight from Iceland took place on the third of September 1919. The pilot was a Dane, Cecil Faber, and this flight took off from the place where the Reykjavik Airport is situated today. At that time this land was marshland, but the ground was fairly level and the area was situated close to the city. In 1919 the first airline company, Flugfelag Islands, was established and with just one aircraft it made 146 flights during its first year. In the autumn of 1920, the company was liquidated and the aircraft was sold to the Royal Danish Airforce.

On the first of May in 1928, a new airline company was founded, and for the second time the name Flugfelag Islands was used. The company flew with German pilots but for the first time two Icelandic men were sent abroad to be trained as pilots. In the same year the first regular domestic flights were started between Reykjavik and Akureyri, the main town in the north of Iceland. In 1931, this company was also liquidated due to financial difficulties.

One of the true pioneers of Icelandic aviation was Agnar Kofoed-Hansen. He was trained by the Royal Danish Airforce in 1934 and got his license in 1936. Kofoed-Hansen wanted to create a new airline company, but no one in Reykjavik was interested in financing his project. Instead he went to Akureyri and teamed up with the financier Vilhjalmur Thor. Together they formed a new company, Flugfelag Akureyrar, on the third of June 1937 and bought the plane TF-Örn. With this small aircraft, which took only four passengers, Kofoed-Hansen flew all over Iceland and during the first year had transported 770 passengers. On the 13<sup>th</sup> of March 1940, the head office of the company was moved to Reykjavik and the name of the company was changed, and for the third time the name Flugfelag Islands was used.

On the 10<sup>th</sup> of May 1940, the British army invaded Iceland. The main reasons for this were that the British wanted to be able to protect their convoys in the North Atlantic and that there were also indications that the German army wanted the island. In October 1940 the British army began to construct the airport without authorisation from the Icelandic government. The blueprints used were given to them by Kofoed-Hansen. The land was, as mentioned before, marshy but the British did not have to go far to find fill material. The red scoria, which is light gravel from volcanic craters, was transported from craters east of Reykjavik and used as fill material. Three runways were built; 300 feet (91.4 meters) wide and in different directions to always be able to utilise the wind conditions optimally. They also built several hangars, two control towers and one hotel, south of the airport area, by the sea. One of the two control towers was built into the Öskjuhlid hillside. This was a safety precaution in case the tower next to the runways was destroyed by bombing. The tower at Öskjuhlid hill could then take over all the air traffic control. During the occupation the British were in charge of the airport, but the Icelanders were allowed to continue their domestic flights.

The sixth of July 1946, the airport was handed over by the British to the Icelandic State. This was done at a formal ceremony at which a key was given to the Prime

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<sup>1</sup> Olafsson Valdimar, former Chief Controller ATS Operations, Reykjavik Airport

Minister of Iceland. The CAA of Iceland has, since that date, handled the operations of the airport.

Over the years larger aircraft came into use and the gravel foundations made directly on top of the marshy land slowly began to give way. Therefore proper foundations and asphalt pavements had to be constructed. A new control tower was built in 1961 and a new control centre in 1995.

The most recent project at the airport is the current renovation of the runways. The project is estimated to cost 1 600 million ISK<sup>2</sup> and will be completed in 2002.

## 2.2 Airport data

The Reykjavik Airport area is about 150 ha<sup>(3)</sup> and the ownership is divided between the City of Reykjavik and the State. The central and southern parts of the airport area are owned by the State and amount to 40 percent of the area, which is 60 ha. The City owns 60 percent of the area, namely 90 ha<sup>(4)</sup>.

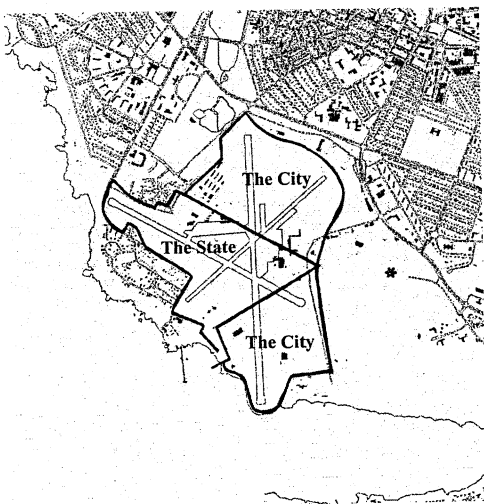


Figure 2.1 The ownership relations of the airport area

The number of employees within the airport area is 566<sup>5</sup>. The majority of these employees, 377, work at the pilot school, Icelandair or other operators. The CAA has 122 employees and the Coast Guard has 45. The rest, 22, have other functions.

The total aircraft movements at Reykjavik Airport over recent years have fluctuated<sup>6</sup>. The most drastic change has been in the domestic movements, and of these the decrease is most noticeable in pilot training and tutorial flights, including practice

<sup>2</sup> Grimsdottir Ingibjörg, Icelandic Civil Aviation Administration, Reykjavik Airport

<sup>3</sup> Grimsdottir Ingibjörg,

<sup>4</sup> Gudlaugsdottir Ingibjörg R, Head of Master Plan Division, The City Planning Office of Reykjavik, City of Reykjavik

<sup>5</sup> Grimsdottir Ingibjörg

<sup>6</sup> For detailed numbers of the movements at the airport, see Appendix 1

landings with immediate take-offs. This decrease is due to the fact that several of these flights have been transferred to small airfields outside Reykjavik.

Domestic flights constitute the majority of all total movements at the airport, see figure 2.2, since the only international destinations served by Reykjavik Airport are Greenland and the Faroe Islands. All the other international flights arrive and depart at Keflavik Airport.

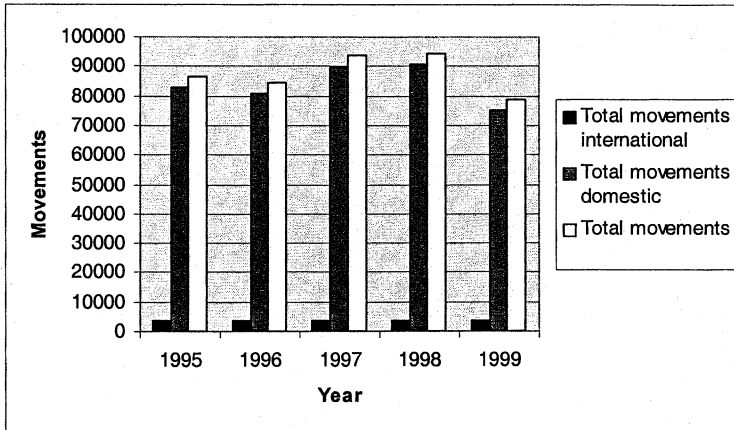


Figure 2.2 Total aircraft movements at Reykjavik Airport

The aircraft movements are, according to some investigations, expected to increase by at least 4 percent<sup>7</sup> per year. This prediction would mean that the air traffic at Reykjavik Airport would double by the year 2015.

According to other research<sup>8</sup>, this development might not be the case at all. The historical development has been that sea and air travel to and from Reykjavik have not increased at the same pace as the growth in population over the years. When looking into the future modal-split<sup>9</sup> between sea, air and road transportation, this development will continue. An additional factor, which supports this theory, is the recent urbanisation of the Reykjavik area by people shifting in from rural areas, which at present are served by air transportation.

The scheduled flights carry the majority of the domestic passengers<sup>10</sup>. Over recent years these scheduled flights have increased, in contrast to charter flights. This decrease of charter flights is a result of the abolishment of the quote system, used by the airline company Islandsflug. In this former system, they had a quota on passengers that they could carry on scheduled flights, and passengers outside the quota were called passengers carried by charter flights. The abolishment of the quote system resulted in a decrease of passengers carried by charter flights, because all the passengers carried by scheduled flights were counted as schedule flights. Despite the

<sup>7</sup> Rambóll, Foranalyse vedrørende en eventuel flytning af Reykjavik Lufthavn, 2000, p. 4

<sup>8</sup> Valsson Trausti, Vegakerfid og ferdamalin, Steindorsprent-Gutenberg ehf, 2000, p. 24

<sup>9</sup> Modal-split is the division, in percentage, between all possible means of transportation.

<sup>10</sup> For detailed numbers of the passenger transports, see Appendix 2

reduction in some areas, the total transport of passengers has increased over recent years, as shown in figure 2.3.

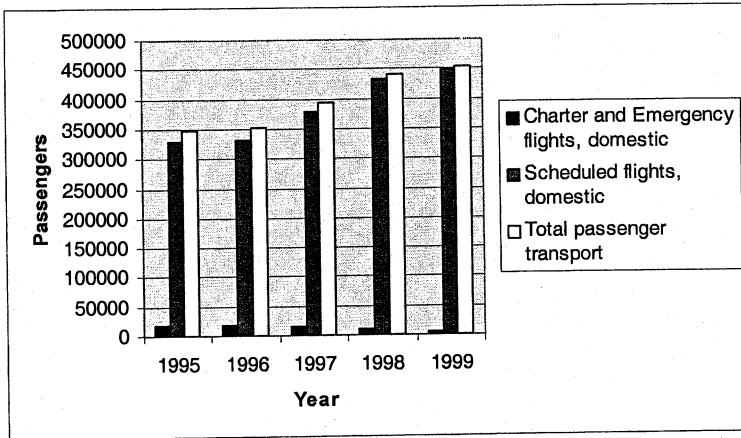


Figure 2.3 Transport of passengers at Reykjavik Airport

Almost half of all the movements at the airport are tutorial flights with small aircraft. The others are divided between scheduled flights and general aviation, which is taxi flights, emergency flights and private flights. This division is shown in figure 2.4.

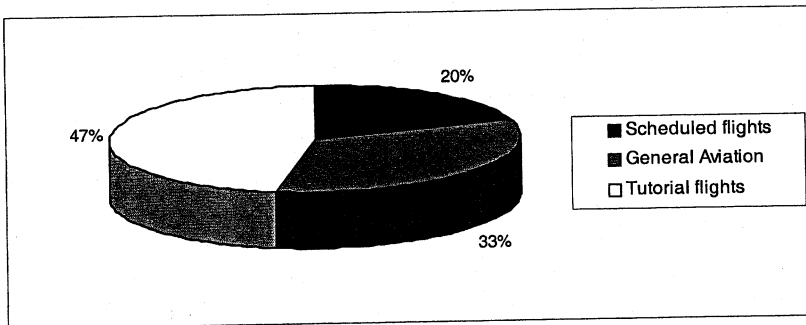


Figure 2.4 Movements divided into different types of flights

In the airport area there are 11 hangars and several small private hangars. The Allies built the six largest hangars during World War II, without any long-term view in mind. The remaining five hangars of medium and small size were built between the years 1950-1975. The most recent hangars are 45 small, privately owned hangars (Fluggardar), which were built between 1978-1994 in the northwest sector of the airport area<sup>11</sup>.

<sup>11</sup> For more detailed information about the hangars see Appendix 3

## 2.3 Relocation proposals

The problem of where to relocate the airport, if it is to be relocated, is not taken into consideration in the valuations made in this dissertation. However, the reader will find it useful to have some insight into the different proposals for relocation, which are now being discussed.

The Co-ordinating Committee, which is in charge of the Regional Plan 2024, has engaged nes Planners to work on a proposal for this plan. nes Planners is a consulting group consisting of two Danish firms, Anders Nyvig and Skaarup & Jespersen, and two Icelandic firms, VST Consulting Engineers (Verkfræðistofa Sigurðar Thoroddsen) and Vinnustofa Arkitekta Consulting Architects. The committee has also contracted a joint venture of three consulting firms to investigate all realistic solutions for the relocation of the airport. The joint venture consists of an Icelandic firm, Linuhönnun Consulting Engineers, a Danish consulting firm, Ramböll, and a German firm, Airport Research Centre. They have not yet worked out a final proposal but at the moment they are working on two main suggestions<sup>12</sup>.

One of the main suggestions is to build a new airport at Vatnsleysustrandarhreppur, which is situated south of the town Hafnarfjörður and halfway between Reykjavík and Keflavík. The idea is to have a gradual relocation of the airport, starting with the training flights. In the meantime, while the Vatnsleysustrandarhreppur Airport is being enlarged, the activity at Reykjavík Airport will be decreased until the move is completed.

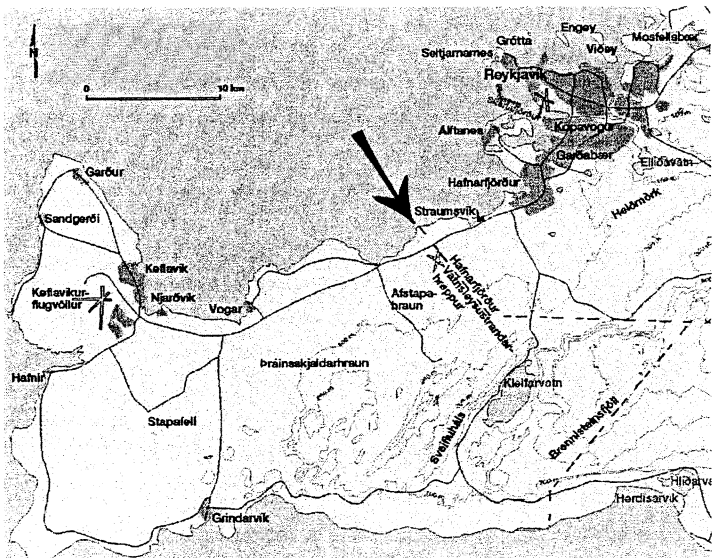
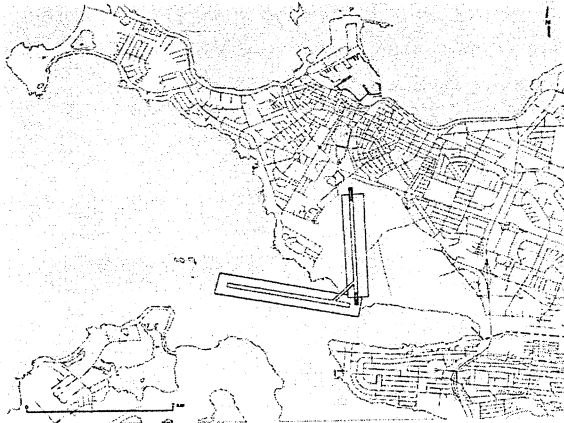


Figure 2.5 The Vatnsleysustrandarhreppur proposal

The other main suggestion is to rebuild the Reykjavík Airport, leaving just two runways, instead of three. The proposal suggests that the east-west runway will be

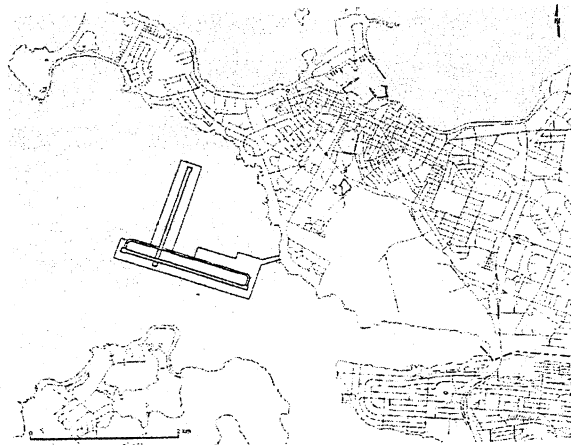
<sup>12</sup> Sigthorsson Haraldur, Traffic Engineer, Linuhönnun Consulting Engineers

relocated to a landfill, parallel to the coastline, in Skerjafjörður. This east-west runway would then be the main runway and the north-south runway could be shortened at its northern end. These plans will make more space available at the northern and eastern parts of the present airport area for other land use.



*Figure 2.6 The Landfill proposal*

Another suggestion, made by Associate Professor Trausti Valsson at the University of Reykjavik, is to relocate all the runways to an island created by landfill on skerries and shallows in Skerjafjörður. In this suggestion, the terminal buildings would probably remain within the present airport area. This proposal would leave most of the present airport area for other land use and will also retain the airport close to the centre of the Capital Area.



*Figure 2.7 The Island proposal*

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## 2.4 The referendum regarding the future of the airport

To reach a decision on the future of the airport, there will be a referendum in Iceland on the 17<sup>th</sup> of March 2001. In this referendum all the inhabitants of Reykjavik, over 18 years of age, are eligible to vote.

In the referendum there are five suggestions<sup>13</sup>:

- To keep the airport at its present location, but with only two runways instead of three. This will leave 31 ha of the airport area for other land use.
- To keep the airport at its present location, but with only two runways and with one of them on landfills in Skerjafjörður. This suggestion will leave 70 ha of the airport area for other land use.
- To build a new airport on landfills and skerries in Skerjafjörður. This means that the whole airport area will be available for other land use.
- To build a new airport in Vatnsleysustrandarhreppur, which is situated south of the town Hafnarfjörður. This suggestion will also leave the whole airport area available for other land use.
- To move all domestic flights to the international Keflavik Airport. The whole airport area will also in this case be available for other land use.

The City Hall will follow the result of the referendum if more than 2/3 of all eligible voters participate or if at least 50 percent of all voters support the same suggestion.

## 2.5 A parallel case of airport relocation

The discussion regarding the future of Reykjavik airport has some parallel cases throughout Europe. A case of current interest in Sweden is the Bromma Airport, Stockholm, which was opened for traffic in 1936. The airport is the second largest in Sweden today, with 1.1 million passengers in the year 2000. Its destinations are, besides seven Swedish cities, also Jutland in Denmark and, as of March 2001, London and Brussels<sup>14</sup>. The majority of airport movements today comprise private and tutorial flights<sup>15</sup>.

The debate concerning the future of Bromma airport has been going on since the mid-1990's. The City of Stockholm wants to use the 140 ha<sup>16</sup> of centrally situated land to build at least 3 000 dwellings<sup>17</sup>. According to the City of Stockholm the development of the area is a necessity in order to meet the increase in population.

The benefits of a relocation of the airport are that noise and air pollution and the dangers of accidents would decrease, together with the fact that a large area would be made available for dwellings<sup>18</sup>. Despite this, a majority of the inhabitants in the adjacent area, Bromma Kyrka, are against the development of the area. Instead, they want to keep the airport but at the same traffic intensity. A total of 62 percent of the inhabitants are not disturbed by the air traffic, 38 percent are disturbed by noise

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<sup>13</sup> Olafsson Stefan, Borgaralydraedi og borgarskipulag – Atkvaedagreidsla medal almennings um framtidarneytingu Vatnsmyrarsvaedis og stadsetningu flugvallar fyrir innanlandsflug, 2001, p. 100-102

<sup>14</sup> Aftonbladet, 2000-08-01, Bromma flygplats, p. 17

<sup>15</sup> Aftonbladet, 2000-03-21, Kvarnkullen Tomas, Utrikesflyg – Vilket lyft för Bromma, p. 18

<sup>16</sup> Svenska Dagbladet, 1999-11-02, Österholm Peo, Bromma flygplats kan få höjt arrende, p. 10

<sup>17</sup> Svenska Dagbladet, 1997-09-10, Österholm Peo, Barkarby och Bromma konkurrerar om projekten, p. 8

<sup>18</sup> Svenska Dagbladet, 1996-02-08, Almgren Jan, Borgarråd vill lägga ner Bromma flygplats 1998, p.13



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pollution, 32 percent by air pollution and 21 percent are afraid of air crashes. If the area is to be developed the inhabitants are willing to accept 1 500 one-family houses<sup>19</sup>.

The arguments for keeping the airport are, for example, that the Stockholm area will need at least two airports in the future. According to the Swedish Board of Civil Aviation, the traffic at Bromma Airport cannot be moved to Arlanda Airport. Despite the construction of a third runway and that all the private and tutorial flights could be moved to smaller, practice fields, Arlanda Airport does not have the capacity. The result would be that domestic flights would not be able to take off during the rush hours between seven and nine o'clock in the morning. The time to travel from the City Centre will also increase by 20 minutes, which may have a negative effect on the region's and the country's competitiveness. The reasons for this are, amongst others, that the decision-makers demand the proximity and fast access to the City Centre, where head offices and official management are situated. If Bromma is shut down there may be a danger of large companies, such as Electrolux and Ericsson, moving their head offices elsewhere<sup>20</sup>.

Bromma Airport's contract for tenancy expires in 2011 and, according to the City of Stockholm, a possible development of the area can wait until then<sup>21</sup>.

It is interesting to see that some of the arguments regarding the future of Bromma Airport can also be found in the present debate concerning the Reykjavik Airport.

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<sup>19</sup> Svenska Dagbladet, 1996-03-08, Österholm Peo, Villaägare vill behålla Bromma flygplats, p. 8

<sup>20</sup> Svenska Dagbladet, 1997-05-16, editorial, Flygfältets fördel: det finns, p. 2

<sup>21</sup> Svenska Dagbladet, 1997-09-10, p. 8

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## **3 The present value of the airport**

### **3.1 Master Plan 1996 - 2016<sup>22</sup>**

The City Planning Office of Reykjavik is responsible for urban planning for the Municipality of Reykjavik under the direction of the Planning and Traffic Committee.

A Master Plan is a plan covering the entire local municipality. It consists primarily of the local authority's policy on land use, the traffic system and regional development. The Master Plan is both the municipality authority's administrative tool and a guarantee that all the construction projects in the area are carried out according to an approved plan. The local authority approves the Master Plan, which is then ratified by the Minister of the Environment and is reviewed every four years in the wake of municipal elections. The Master Plan is the basis of the Detailed Plan.

There is no confirmed Regional Plan in place for the Capital Area, but there is one underway. Therefore, the Reykjavik Master Plan 1996 – 2016 was used as a base for the valuation of the present airport area. This Master Plan was made public during April – May 1997, ratified by the Minister of the Environment in August and published in September of the same year. The Master Plan 1996 – 2016 is the fifth of its kind for Reykjavik.

According to the Master Plan 1996 – 2016, new residential areas will be built, principally in the eastern outskirts of the Reykjavik Area and on the Geldinganes peninsula in the northeast. There is a need for new residential areas, since the annual increase in the population has been about 1.5 percent since 1985. About 60 percent of Iceland's total population of about 270 000, resides in the Capital Area, which is one of the fastest growing in Europe.

The present Master Plan does not propose any changes for the Reykjavik Airport. The airport will, according to the plan, continue as the centre for domestic flights till the year 2016. The upcoming referendum and the revision of the Master Plan in 2001 – 2002 will decide the future of the airport.

### **3.2 Investment and operation costs for the airport<sup>23</sup>**

If the Reykjavik Airport is to remain at its present location, drastic changes and improvements have to be made. These include major renovations of the runways, construction of new taxiways and terminal aprons for aircraft and new additional equipment. The costs of these renovations are estimated to be 1 700 – 1 850 million ISK, this estimation being based on the currency value for the year 1996.

Furthermore there is a plan to build a new air terminal and a cargo apron. The estimated costs of these investments are 720 – 850 million ISK, based on the currency value for the year 1996.

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<sup>22</sup> Reynarsson Bjarni, Masterplan of Reykjavik 1996 – 2016, A summary, The City Planning Office of Reykjavik, 1997, p. 1-6

<sup>23</sup> Economics Institute, University of Iceland, Stadsetning Reykjavikurflugvallar, Skýrsla nr. C97:01, 1997, p. 10-12, Hall Axel, Economic Institute, University of Iceland

We enumerated all the figures for the major renovations and new constructions, to the currency value for the year 2000 using the CPI. These investment costs now amount to 2 749 – 3 067 million ISK. An overview of the costs is given in table 3.1.

Domains	Lower limit 1996	Upper limit 1996	Lower limit 2000	Upper limit 2000
Runways + Taxiways + Equipment	1 300	1 400	1 477	1 590
Terminal aprons	400	450	454	511
Air terminal + Cargo apron	720	850	818	966
<b>Total:</b>	<b>2 420</b>	<b>2 700</b>	<b>2 749</b>	<b>3 067</b>

Table 3.1 Investment costs for the airport in million ISK

No major changes in the operation costs of the airport are expected. The operation costs for the Icelandic CAA (Flugmalastjorn) in 1995, enumerated to the currency value for the year 1996, are shown in table 3.2. At the bottom of this table we have enumerated the operation costs to the currency value for the year 2000, again using the CPI.

Operations	Wages	Other operational costs	Total costs	Special revenue	Difference
General operations	9	28	37	51*	-14
Snow removal	5	1	6	0	6
Fire prevention	39	5	44	0	44
Maintenance	5	2	7	3	6
Carpenters	7	1	8	4	4
<b>Total 1996:</b>	<b>65</b>	<b>37</b>	<b>102</b>	<b>58</b>	<b>46</b>
<b>Total 2000:</b>	<b>74</b>	<b>42</b>	<b>116</b>	<b>66</b>	<b>52</b>

\*Different service fees, for example landing fee.

Table 3.2 Budgeted costs of the operations at the airport in million ISK

### 3.3 The financial result for the airport

The financial result for the Reykjavik Airport in 1999 was 74 million ISK and a large part of the revenues, 51 million ISK, derives from landing fees<sup>24</sup>. The result for 1999, enumerated to the currency value for the year 2000, amounted to 77 million ISK. Since the CAA expects a slight decrease in the result for the year 2000, we assume it will amount to approximately 75 million ISK for the year 2000.

### 3.4 Value of the land and buildings in the year 2000

As a method to determine the value of the land and buildings, the airport area, apart from the runways, was divided into categories, I and II. The values are estimated by

<sup>24</sup> Grimsdottir Ingibjörg

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using the rateable values<sup>25</sup> and, thereafter, adding 15 percent<sup>26</sup> to get the approximate market values for the year 2000. An estimation of the costs involved in moving the buildings in the airport area, if the airport is relocated, has also been done<sup>27</sup>.

Category I is an area in which most of the existing buildings can be used in all future plans. The value of these lots and buildings is 2 308 million ISK. This category consists of Hotel Loftleidir, the Icelandair offices, the Flight Control Tower and the North Atlantic Flight Control Centre. In this area there are also old single storey barracks, the old Flight Control Tower, hangar number 1, built in 1943 and three smaller hangars, number 7, 8 and 10, built in 1950, 1969 and 1975, respectively. All of these buildings are of no real value.

Category II consists of four areas:

1. The Coast Guard Flight Services. In this area there is an inexpensive, single storey office building and a medium sized hangar, number 2. Both the office building and the hangar are in a reasonable condition, although the hangar was built in 1943. In this area there are also a storage building for the CAA, a boat shed owned by the City of Reykjavik and a small building owned by the Sport Divers Association. Today's value is about 82 million ISK and an estimation of the cost for moving the hangar will amount to at least 50 percent of its value. The cost of moving the other buildings will amount to approximately 30 percent, because these buildings are relatively easy to relocate.
2. The second area is the southwest sector of the airport area, which includes three World War II hangars, number 3, 6 and 11, and one smaller hangar, number 14, from 1969. Today's value is 101 million ISK. Most of this value cannot be utilized if the airport is relocated, since it is hardly financially feasible to move and rebuild them.
3. The Icelandair area includes the old passenger terminal, a cargo handling building and a large maintenance hangar, number 4, built in 1943. Today's value of these buildings is 160 million ISK. The removal of these buildings will cost approximately 20 percent of their value. In addition, there are three, small, single storey buildings. These buildings are mostly from the World War II period, and therefore of little value.
4. The fourth area is the Fluggardar Area, which consists of many small, privately owned hangars for small private aircraft. The value of these buildings is estimated to be 151 million ISK. As they are small and recently built, they can easily be moved for a cost of approximately 20 percent of their value.

### **3.5 Value of the runways in the year 2000**

The runways do not have an assigned value at the Valuation Office of Iceland (VOI), but since a renovation of the runways is underway, the renovation costs can be used as their value. To use these costs as the value are common when the property being

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<sup>25</sup> Olafsson Magnus, Director of Assessments, The Valuation Office of Iceland, Gunnarsson Snorri, Economist, The Valuation Office of Iceland. The rateable value in Iceland is, according to the law, the market value of real estates in November each year. This value is adjusted once a year and comes into effect the first of December.

<sup>26</sup> Jonsson Birgir, Associate Professor, Department of Civil and Environmental Engineering, University of Iceland, Valsson Trausti, Associate Professor, Department of Civil and Environmental Engineering, University of Iceland

<sup>27</sup> Jonsson Birgir, Valsson Trausti

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valued is so specialized that properties of that nature are rarely sold on the open market. This makes it almost impossible to assess their value by reference to comparable sales of similar properties<sup>28</sup>.

The renovation of the east-west runway has already been completed and the work on the north-south runway, which is also the longest one, has just started. The short south-west to north-east runway will be abandoned. The estimated costs of these renovations, including new taxiways are, as mentioned before, 1 600 million ISK.

The referendum regarding the location of the airport might postpone the renovation of the north-south runway. This means that the additional cost of rebuilding it at the present location will not be lost, if the airport is relocated. The taxiways and the rebuilding of a terminal apron are also on hold because of the upcoming referendum. Due to the referendum, the plans for the airport area might also be completely changed. If this is the case, only the cost of the east-west runway is a partly lost investment. This is because the detailed planning of the area can make use of approximately 50 percent<sup>29</sup> of that investment as building foundations, roads and road materials and parking areas. This same percentage applies for all three plans alternatives.

Finally there are the investments in flight safety instruments, amounting to 53 million ISK<sup>30</sup>. The cost of moving these instruments, if the airport is relocated, is probably only about 5 - 10 percent<sup>31</sup> of the investment cost, due to the fact that they are easy to move.

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<sup>28</sup> Adair, Downie, McGreal and Vos, *European Valuation Practice – Theory and Techniques*, Chapman & Hall, 1996, p. 27

<sup>29</sup> Jonsson Birgir, Valsson Trausti

<sup>30</sup> Grimsdottir Ingibjörg

<sup>31</sup> Jonsson Birgir, Valsson Trausti

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## 4 Valuation of the Planning Alternatives

### 4.1 Methods and figures used in the valuations

#### 4.1.1 The rise in market prices

The depression during the early 1990's led to abnormally low real estate prices, but since the middle of the 1990's there has been a growing building boom in Iceland. When the boom started, the supply of lots and housing was insufficient, which produced a very rapid increase in prices. During the boom, real estate prices increased by 20-25 percent<sup>32</sup>, but there are indications (December 2000) that these prices are levelling off. However, there are still no signs of a decrease in construction activity. Today the situation is approaching normal with regard to supply and demand of lots and housing.

One example of how real estate prices have increased in Reykjavik is when the company DeCode Genetics wanted to expand and move their business to a single lot. The company's consultant<sup>33</sup> for site selection investigated various locations, but finally the choice fell on a building lot on the outskirts of the University Area, close to the Reykjavik Airport. The reasons for choosing this site were its proximity to the City Centre, to the University and to the University Hospital. Another important factor was the positive response from the University Board to having this research company as a neighbour. Although the University had acquired the building and planning rights, the lot itself was owned by the City of Reykjavik and not, as commonly believed, by the University. Because of this, the City of Reykjavik decided that the University would be granted half of the price that DeCode Genetics offered to pay in order to get building rights on the lot. The building rights include roads with sidewalks, street lamps and all equipment demanded by the Local Plan. Furthermore, all sewers, water supply and drainage are included, but an additional fee for the connection to the systems for sewers, electricity, hot and cold water etc have to be paid. The contract was signed in February 2000 and the purchase-price was settled at twice the minimum fee<sup>34</sup> for the area and this amounted to 124 849 312 ISK<sup>35</sup>.

Another factor that has had a great effect on the market price for lots in Reykjavik in general, is that the City of Reykjavik has initiated the use of a bidding procedure for lots. This means that the lot, or lots, are sold to the highest bidder. The bidding procedure was probably used for the first time in 1984 in the Stigahlid area, which is located not far from the City Centre, and was not repeated until many years later. The 21 lots that were on the market for bidders in Stigahlid were sold for a total price of 34 746 000 ISK<sup>36</sup>. Included in this price were both the lots and the building rights. In 1984 the usual minimum fee for lots in this area would have been 365 000 ISK for each lot, giving a total price of 7 665 000 ISK. This shows that the true market price for the lots in this area, due to the bidding procedure, was about five times the minimum fee.

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<sup>32</sup> Hallgrímsson Hallgrímur, Cost and Planning Engineer, Hönnun hf Consulting Engineers

<sup>33</sup> Stefánsson Hjörleifur, Architect, Fjöltnisvegur 12, Reykjavik

<sup>34</sup> The minimum fee, which is charged by the municipality, changes according to the area in Reykjavik and includes the building rights to the lot. This means that the minimum fee also varies with the building type.

<sup>35</sup> Jonsson Gunnlaugur H, Director of Finances, University of Iceland

<sup>36</sup> Jonsson Agust, General Secretary and Legal Counsellor, Reykjavik City Engineer

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The bidding procedure was recently used in the Grafarholt area, which is situated in the northeastern outskirts of Reykjavik. In the year 2000, the work was started in the three first construction zones in the Grafarholt area. In this area the price includes only the building rights, but included in the building rights is also the cost of heating the steep streets in the area with geothermal water to prevent icing. The building rights do not include ownership and therefore the lots are leased, which is the common rule in Reykjavik, to those who place the highest bids. The building rights for the lots in zone one were sold for a total price of 365 551 300 ISK, which is three times the minimum fee. In zone two the total price for the building rights amounted to 448 764 266 ISK, more than twice the minimum fee. The highest bids were placed in zone three where the buyers paid almost four times the minimum fee, which equals a total of 275 237 542 ISK.

These three examples all show that the market price is much higher than the minimum fee, especially when a bidding procedure is used. This is something we have to take into consideration when we estimate what the bidding or the purchase-prices for the lots within the airport area will be. The Stigahlid area is more comparable than the Grafarholt area, because it is closer to the City Centre. What we also have to bear in mind is that the bidding in Stigahlid took place over 15 years ago, during a relatively meagre economic period. The market prices are probably even higher now, due to the building boom and the increased importance of the location in people's minds. But one has also to keep in mind that in Stigahlid the price included an ownership of the lots, and not only the building rights.

#### **4.1.2 Categorisation into building types in the alternative plans**

The three plans for the Reykjavik Airport area, which we are considering, do not specify detailed information on aspects such as the categorisation into different kinds of building types. Therefore we had to make this categorisation ourselves, after consultation with people associated with each proposal.

For each proposal we categorised the buildings as: one-family houses, apartment houses and workplaces. Included in workplaces are schools, day nurseries and shopping centres. The categorisation could not be made completely comparable between the proposals, since the areas for each proposal are different. Other contributing reasons for not being able to produce absolutely comparable numbers are that for each proposal the density numbers (nytingarhlutfall)<sup>37</sup>, for different density areas, varies, as do the size of these areas.

The areas with the same density number are not always connected geographically. Where this is the case, we have calculated the categorisation into building types for each of the smaller areas that have the same density number.

In the calculations for the categorisation into building types, we used figures that can be deemed to be typical for a City Centre Area<sup>38</sup>. The floor space of the average one-family house is therefore estimated to be 180 m<sup>2</sup>, the average apartment 100 m<sup>2</sup> and a

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<sup>37</sup> Density number is calculated by dividing the floor area in the building/buildings by the area of the lot. Density number = m<sup>2</sup> floor / m<sup>2</sup> ground. A high density number is usually correlated with higher buildings.

<sup>38</sup> Valsson Trausti

workplace for one person 20 m<sup>2</sup>. The size of the average household in Iceland is estimated to be 2.4 persons<sup>39</sup>.

#### 4.1.3 General construction costs

Figures for all the construction costs, except larger roads, tunnels and bridges, are based on figures from one of Iceland's largest construction contractors, ISTAK<sup>40</sup>, and one of the leading engineering consulting firms, Hönnun<sup>41</sup>. The construction costs obviously vary for the different projects, and therefore the figures are estimations of an average building project. These figures are applicable for the year 2000 and are shown in tables 4.1 and 4.2.

<b>Buildings</b>	<b>ISK per m<sup>2</sup></b>
One-family house	200 000*
Apartment building	80 000
Office building	100 000*
School building	90 000
Shopping centre	80 000**
<b>Other costs</b>	<b>ISK per m<sup>2</sup></b>
Roads	1 000***
Pavements	10 000
Green areas	1 000-2 000
Water mains	1 000

\* Upper limit.

\*\* Only the external constructions and parking facilities.

\*\*\* ISK per m<sup>3</sup>.

Table 4.1 Construction costs according to ISTAK Construction Contractors

<b>Buildings</b>	<b>ISK per m<sup>2</sup></b>
One-family house	115 000
Apartment building	90 000
Office building	110 000
School building	140 000
Shopping centre	250 000*
<b>Other costs</b>	<b>ISK per m<sup>2</sup></b>
Roads	90 000**
Green areas	1 000

\* All shops and external constructions and parking facilities are included.

\*\* The price of roads include all sewers, drainage, water supplies, pavements, street lights and all walking paths. The price is per metre.

Table 4.2 Construction costs according to Hönnun Consulting Engineers

<sup>39</sup> Briem Richard, Architect and Urban Planner, Vinnustofa Arkitekta Consulting Architects, nes Planners

<sup>40</sup> Pálsson Sigurjon, Civil Engineer, ISTAK Construction Contractors

<sup>41</sup> Hallgrímsson Hallgrímur



The figures from ISTAK and Hönnun are to a large extent in agreement with each other. In the following calculations, the construction costs equal the mean value of the given prices. One exception is the construction cost of a one-family house, where we used the figure from Hönnun, because the figure given by ISTAK is an upper limit and not representative for an average one-family house. Another exception is the costs of shopping centres, for which the figure from Hönnun was used. This is because the figure from ISTAK takes into consideration only the external constructions and parking facilities, but in the figure from Hönnun all external as well as internal facilities are included.

According to Hönnun the road costs and all the necessary services can also be calculated as a cost per m<sup>2</sup> for a whole area. This cost would be approximately 1 500 ISK per m<sup>2</sup>, which is the cost we used in our calculations. The reason for using this figure is that the three plans we are working with do not, as mentioned above, give detailed information such as the length of the smaller roads in the area.

The construction costs used in our calculations are shown in table 4.3.

<b>Buildings</b>	<b>ISK per m<sup>2</sup></b>
One-family house	115 000
Apartment building	85 000
Office building	105 000
School building	115 000
Shopping centre	250 000
<b>Other costs</b>	<b>ISK per m<sup>2</sup></b>
Roads	1 500*
Green areas	1 500

\* ISK per m<sup>2</sup> for the whole area.

*Table 4.3 Construction costs used in the calculations*

The construction costs for larger roads, tunnels, bridges and roadways on landfills are all gathered from the Icelandic Public Roads Administration, PRA (Vegagerdin). These infrastructures are financed by the State, in contrast to all the other construction costs, which are the building contractor's costs, and are listed in table 4.4.

Construction	No. of lanes	ISK per m
Main roads	6	700 000 <sup>42</sup>
Main roads	4	470 000 <sup>43</sup>
Tunnel	2	800 000 <sup>44</sup>
Bridges	4	2 500 000 <sup>45</sup>
Roadways on landfill	4	1 200 000 <sup>46</sup>

Table 4.4 Construction costs according to the Public Roads Administration

In our calculations of the cost of constructing the main roads, it must be kept in mind that residents in other areas of the Capital Area will also use these roads. Therefore we estimated only half of these road costs as being an investment for each plan. We had to make an estimation of how much of the main roads, feeding the area, should be assigned to the airport area. We decided that the length, which should be taken into our calculations, would be the distance from a point within the area to the first connection to another main road. The point within the area varies, depending on whether the specific plan proposes main roads within the area, or just from the outskirts of the area.

The tunnel listed in the table above is a two lane tunnel, with an average capacity of 10 000 cars per 24 hours and a maximum of 15 000 cars per 24 hours<sup>47</sup>. This capacity appears to be reasonable considering the amount of traffic that the airport area, together with adjacent areas, will generate. We calculated only half the construction costs as being an investment for each plan, for the same reasons as given above for the case of the main roads.

The approaches of a bridge crossing a fjord or a strait are usually a roadway on landfill. In Iceland a lot of earth, for example gravel, is used in these constructions due to its low cost and its accessibility. If a bridge is to be built across a fjord one kilometre across, the bridge itself may be only about 300 metres long, while the rest would be roadway on landfill<sup>48</sup>. This is something that we have to take into consideration when we calculate the construction costs of a bridge. Once again we estimate only half of the construction costs as being an investment for each proposed plan.

In chapter 4.1.2 on page 29 above, we explained how the categorisation into building types was done. To be able to calculate the construction costs we had to take this categorisation one step further and categorise the workplaces as offices, schools and

<sup>42</sup> Sigurbjörnsdóttir Kristín H, Head of Economics Department, Public Roads Administration

<sup>43</sup> Sigurbjörnsdóttir Kristín H

<sup>44</sup> Haraldsson Hreinn, Director of Development Division, Public Roads Administration

<sup>45</sup> Gunnarsson Rögnvaldur, Head of Construction Department, Public Roads Administration

<sup>46</sup> Gunnarsson Rögnvaldur

<sup>47</sup> Haraldsson Hreinn

<sup>48</sup> Gunnarsson Rögnvaldur

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shopping centres. This was done because these various workplaces do not have the same construction costs. We assumed that in each plan there would be three percent schools and day nurseries, 20 percent shopping centres and the rest, 77 percent, offices.

#### **4.1.4 Procedure to determine the market price**

The initial stage in determining the market price is to assume that the land will belong to one owner only. The custom in Reykjavik has been that before the development of a new area, the City would buy the land owned by others. This is a procedure we apply in our dissertation. Since the City of Reykjavik owns the larger part, 90 ha, of the land, we assume that the City would buy the remaining 60 ha of the land from the State. The price of the land will be somewhat higher than the price of unplanned land, due to the expected new Detailed Plan of the area. We assume that the City will buy the land from the State before the new Detailed Plan, which we also assume will be in accordance with our alternative plans, is ratified. The price will therefore not be as high as if this new Detailed Plan were already in use. An estimated price of the land is 4 000<sup>49</sup> ISK per m<sup>2</sup>.

To build up the area according to our three alternatives, we assume that the City will contract a construction company. To accept the contract, this company will require a profit of 10 percent<sup>50</sup>.

In Iceland it is common to sell lots, including building rights, and the future buildings, before the area is actually built up. This makes it possible to use the money from the sale to finance the development of the area. We assume that the lots including building rights, in our alternatives, will be sold in a hypothetical bidding procedure. The buildings will have a fixed price. The lots with official buildings will not be sold, since these are reserved for social services, which the City has to provide. These lots represent three percent of the lots to be used for the construction of workplaces. To determine the market price of the lots in our three alternatives, we divide each planning area into four value areas. The value areas are decided on the basis of density numbers and location. The value areas will have an estimated market price of five, four, three and two times, respectively, the average minimum fee for each building type. We will call these numbers, by which the minimum fee is multiplied, the market price factors. In this case we have to use the average minimum fee in Reykjavik, since an airport area does not have an assigned minimum fee.

To determine the price of the non-official buildings, we will use the calculated construction cost plus the profit required by the construction company and an additional five percent required by the City as a safety margin. If this safety margin is not consumed during the construction period, these five percent could be called a net profit for the City. The market price of the lots for non-official buildings, together with the price of these buildings, will constitute the price the buyer will have to pay.

The price of all the lots with official buildings, green areas and roads that are not financed by the State, is a cost that the market price of the other lots, together with taxes, is supposed to cover.

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<sup>49</sup> Torfasson Gunnar, Consulting Structural Civil Engineer, VGT Consulting Engineers

<sup>50</sup> Pálsson Sigurjon

## 4.2 Alternative A – Student Proposal 1999

### 4.2.1 Description of Alternative A

Alternative A<sup>51</sup> is a proposal produced by four students at the Department of Civil and Environmental Engineering at the University of Iceland in 1999<sup>52</sup>. This proposal suggests a complete relocation of the airport to make the land available for other use, and includes some areas adjacent to the airport. Therefore the area available for the plan amounts to 181 ha compared to 140 ha in the Regional Plan 2024.

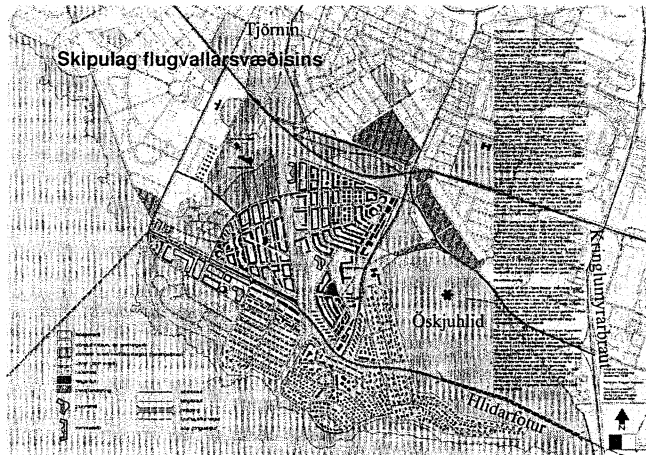


Figure 4.1 Alternative A

The students' idea for the future of Reykjavik is a more compact city than the accepted idea in recent Reykjavik planning policy. This wish for higher density is partly for environmental reasons, but it is also motivated by the assumption that Reykjavik's City Centre is in need of an enlargement, similar in character to other northern European cities. A denser city can, together with other planning steps, such as the mixing of city functions, result in less traffic and in a not so extensive expansion of the network of main roads. This will also lead to lower maintenance costs and less pollution.

The green areas in the proposal are deliberately limited to one main open passage running through the area from north to south. The reasons for this are that the students consider the green areas in the surroundings, for example at Öskjuhlid hill, so large and so well situated as green areas, that they provide the possibility of a greater use of the area than otherwise. They also believe that an intense use of the area will have positive economic effects for the City of Reykjavik, due to the large number of dwellings and work places.

For aesthetic reasons they want the highest density numbers in the north and northeast. The buildings in those areas would be higher, with density numbers

<sup>51</sup> See Appendix 4

<sup>52</sup> Gunnarsson Orri, Engineering Student, Department of Civil and Environmental Engineering, University of Iceland

between 0.9-1.09 and 1.3-1.49. In the southern, coastal part, the buildings would be lower to allow the higher buildings, standing further back, a view of the sea. These areas will have density numbers between 0.5-0.89.

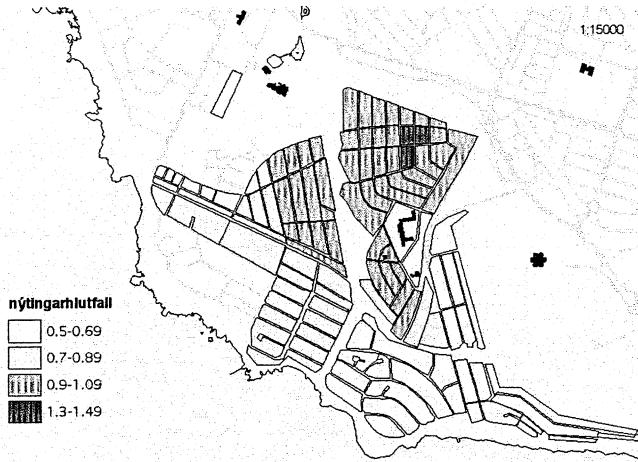


Figure 4.2 Density numbers – Alternative A

According to this planning proposal, there is a need for additional roads leading to the area. One of those is the road Hlidarfotur, which branches off Kringlumyrarbraut road and approaches the area from the southwest. A part of this road will be constructed as a tunnel through the Öskjuhlid hill, as the graveyard located there will be in its path. At the foot of Öskjuhlid hill is also an area of geological interest, which a planned tunnel will leave undisturbed. This road surfaces just before it connects to Kringlumyrarbraut. From the west coast of the area, a bridge will be built over Skerjafjörður, to connect the Reykjavik peninsula with the northern tip of the Alftanes peninsula.

#### 4.2.2 Categorisation into building types for Alternative A

In the student proposal we worked with the density numbers shown in figure 4.2 on page 35 above. The density numbers for each area lie within certain intervals. To be able to carry out the categorisation into building types, we needed one specific density number for each of these intervals. For this we chose the mean value of each interval.

We also had to subtract a certain percentage from each specific density number, because the numbers stated in the proposal did not include the interior roads. Since the roads were included in the other proposals we had to do this subtraction to make the calculations for the proposals comparable. From the area with high density number we subtracted five percent, from the area with medium-high density 10 percent, from the area with medium density 15 percent and from the area with low density we subtracted 20 percent. The reason for subtracting different percentages is that in the higher density areas, the buildings are higher or stand closer together, which results in less space for roads for each apartment or workplace.

As mentioned above, the building types were categorised into: one-family houses, apartment houses and workplaces. We assumed that the least dense areas would be built with one-family houses and that the more dense areas, which are situated closest to the old City Centre, will have a majority of apartment buildings, but also some workplaces. In the same manner we assumed that the areas with the medium building density would have mostly apartments, but also a few workplaces. To get realistic numbers of each building type, different percentages were tried until a satisfactory result was achieved<sup>53</sup>. In this proposal the outcome of the categorisation is shown in table 4.5.

Density	One-family houses	Apartments	Workplaces
High	0%	10%	90%
Medium-High	0%	75%	25%
Medium	10%	80%	10%
Low	75%	20%	5%

Table 4.5 Categorisation into building types – Alternative A

#### 4.2.3 Construction costs for Alternative A

The construction costs of buildings, roads and green areas are given in ISK per m<sup>2</sup>. Therefore, in order to get the construction costs of the buildings in Alternative A, we needed to calculate the total floor-area of dwellings and workplaces. This was done by using the density formula<sup>54</sup>, after measuring the areas assigned to each of the density numbers. The construction costs of the main roads, tunnels, bridges and roadway on landfills, were given in ISK per metre, and therefore the lengths of these structures were measured. The total construction cost of dwellings, workplaces, infrastructures and green areas amounted to 117 434 million ISK. When divided between the construction company and the State, the costs are 114 551 and 2 883 million ISK, respectively.

<sup>53</sup> For detailed calculations see Appendix 5

<sup>54</sup> Density number = m<sup>2</sup> floor / m<sup>2</sup> ground

The total construction cost of dwellings, workplaces, infrastructures are listed in table 4.6.

<b>Costs for the construction company</b>			
<b>Buildings</b>	<b>Size (m<sup>2</sup>)</b>	<b>ISK per m<sup>2</sup></b>	<b>Cost (million ISK)</b>
One-Family houses	258 511	115 000	29 729
Apartments	660 932	85 000	56 179
Offices	147 726	105 000	15 511
Schools	5 756	115 000	662
Shopping centres	38 371	250 000	9 593
<b>Total</b>	<b>1 111 295</b>	<b>-</b>	<b>111 674</b>
<b>Infrastructure</b>	<b>Area (m<sup>2</sup>)</b>	<b>ISK per m<sup>2</sup></b>	<b>Cost (million ISK)</b>
Roads	1 771 763	1 500	2 658
<b>Total</b>	<b>-</b>	<b>-</b>	<b>2 658</b>
<b>Other costs</b>	<b>Size (m<sup>2</sup>)</b>	<b>ISK per m<sup>2</sup></b>	<b>Cost (million ISK)</b>
Green areas	145 913	1 500	219
<b>Total</b>	<b>145 913</b>	<b>-</b>	<b>219</b>
<b>Total for constr. comp.</b>	<b>-</b>	<b>-</b>	<b>114 551</b>
<b>Costs for the State</b>			
<b>Infrastructure</b>	<b>Length (m)</b>	<b>ISK per m</b>	<b>Cost (million ISK)</b>
Main roads	3 240	470 000	761
Tunnel	1 140	800 000	456
Bridges	680	2 500 000	850
Roadways on landfill	1 360	1 200 000	816
<b>Total for the State</b>	<b>-</b>	<b>-</b>	<b>2 883</b>
<b>Total construction costs</b>	<b>-</b>	<b>-</b>	<b>117 434</b>

Table 4.6 Construction costs – Alternative A

Since the construction company requires a profit of 10 percent, this percentage was added to the total construction costs for the construction company. The construction costs plus 10 percent amounted to 126 006 million ISK, which is the amount the City has to pay the construction company.

#### 4.2.4 Estimation of the value areas in Alternative A

The value areas are estimated to be relatively similar to the density areas, which means that areas with high density numbers also have the highest value. An exception to this is the coastal area, which has a somewhat high value, due to its location, despite the low density in this area. Another exception is the area closest to Öskjuhlid hill, which also has a relatively high value due to its location next to a vast green area. The location aspect is a factor that has gained in importance over recent years, as reflected in an increase in value.

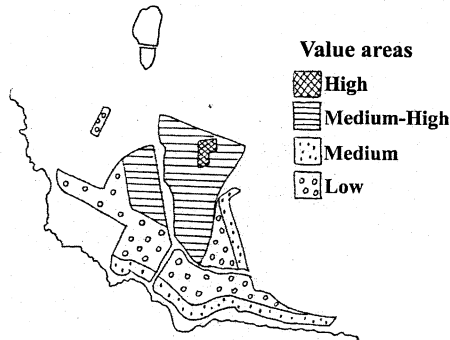


Figure 4.3 The value areas – Alternative A

#### 4.2.5 Estimation of the market price for lots and buildings in Alternative A

For each building type there is a minimum fee, but as previously mentioned, we have to use the average minimum fee<sup>55</sup> on the airport area. This fee was multiplied by the market price factor corresponding to each value area, to acquire the market price per m<sup>2</sup>. To be able to compare the three alternatives with each other, we calculated the market price of the whole area. This was done by using the floor-area of each building type. The market price of the lots with building rights in Alternative A amounted to 16 803 million ISK and is shown in table 4.7. Subtracted from this sum are the lots with official buildings.

Value areas	Building type	Minimum fee (ISK/m <sup>2</sup> )	Market price factor	Market price / m <sup>2</sup>	Floor-area (m <sup>2</sup> )	Market price
High	One-family	10 723	5	53 615	0	0
	Apartment	3 064	5	15 320	2 843	43 552 845
	Workplace	5 362	5	26 810	24 818	665 378 589
Medium-high	One-family	10 723	4	42 892	21 789	934 573 788
	Apartment	3 064	4	12 256	372 285	4 562 722 202
	Workplace	5 362	4	21 448	119 902	2 571 666 745
Medium	One-family	10 723	3	32 169	59 092	1 900 921 058
	Apartment	3 064	3	9 192	29 631	272 366 387
	Workplace	5 362	3	16 086	5 445	87 594 120
Low	One-family	10 723	2	21 446	177 630	3 809 450 728
	Apartment	3 064	2	6 128	256 173	1 569 829 321
	Workplace	5 362	2	10 724	35 931	385 327 736
<b>Total</b>					<b>1 105 540</b>	<b>16 803 383 521</b>

Table 4.7 Market price of the lots – Alternative A

<sup>55</sup> Jonsson Agust



The price of all the non-official buildings, after the five percent the City requires as a safety margin has been added, amounted to 128 219 million ISK. Shown in table 4.8 is also the net profit for the City, a total of 6 106 million ISK.

Buildings	Construction costs	Construction costs + 10%	Price of the buildings	Net profit on buildings for the City
One-Family houses	29 729	32 702	34 337	1 635
Apartments	56 179	61 797	64 887	3 090
Offices	15 511	17 062	17 916	853
Shopping centres	9 593	10 552	11 080	528
<b>Total</b>	<b>111 012</b>	<b>122 113</b>	<b>128 219</b>	<b>6 106</b>

Table 4.8 Price of the buildings and net profit for the City in million ISK – Alternative A

### 4.3 Alternative B – Proposal for Regional Plan 2024

#### 4.3.1 Description of Alternative B

Alternative B<sup>56</sup> is a proposal for the Regional Plan 2024 made by nes Planners<sup>57</sup>. nes Planners has made three different proposals for where to build up new areas in the Capital Area in the period after 2018, and Alternative B is one of these. This proposal assumes a complete relocation of the airport, although no formal decision in that matter has been taken yet (February 2001). According to nes Planners' calculations, the planning area is 140 ha.

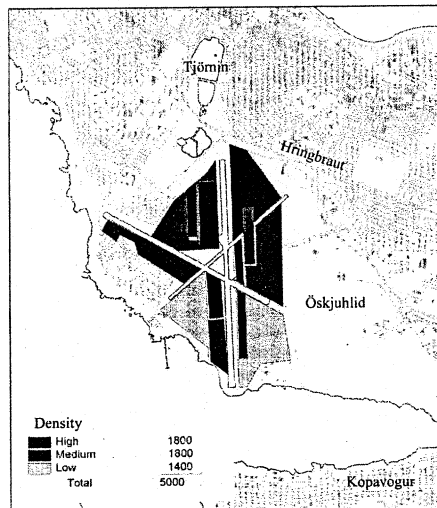


Figure 4.4 Alternative B

<sup>56</sup> See Appendix 6

<sup>57</sup> nes Planners, Draft Report Regional Plan 2024, 2000, p.73-75

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Today, the three runways divide the airport area into six different sections. nes Planners want to maintain this division to emphasise the large open passages that are characteristic of the structure of the old parts of Reykjavik. The passages would create a visual link between well-known landmarks, both in the city and also towards its surroundings.

North of the airport area, the lake Tjörnin is situated. Today its water quality depends on the water percolating from the airport area. Therefore, in this alternative, 40 ha are preserved as green areas, including the passages that the former runways constitute.

The buildings are planned as 5 000 dwellings and 5 000 workplaces. This mixture would contribute to a better balance between housing and workplace in the Capital Area, and also save unoccupied land in the outskirts of Reykjavik.

The highest density of buildings is planned in the northern part of the area, where 31 ha would have 120 dwellings per ha, and 41 ha 60 dwellings per ha<sup>58</sup>. This part of the area is closest to the City Centre. Further south, towards the coast, the density decreases, and 38 ha would have 35 dwellings per ha<sup>59</sup>. Here the buildings are suggested to be lower and the dwellings larger.

The main roads in the Regional Plan 2024 proposal concerning this area, are situated in the eastern part. A new road, Hlidarfotur, would start at Hringbraut road and run south along Öskjuhlid hill, to the east of the area, almost all the way down to the coast. There it branches into two roads, one continuing south as a bridge over Skerjafjörður to the western part of the Kopavogur peninsula, the other turning to the east and running south of Öskjuhlid hill towards Kringlumyrarbraut road and Kopavogur. A part of this road would be constructed as a tunnel, to avoid the graveyard and the area with geological landmarks, situated at the foot of Öskjuhlid hill.

#### **4.3.2 Categorisation into building types for Alternative B**

In Alternative B, we knew that nes Planners planned to have 5 000 dwellings and 5 000 workplaces within the airport area<sup>60</sup>. We also knew that in the high density area there were to be 1 800 dwellings, in the medium density area 1 800 and in the low density area 1 400. The dwellings were categorised into one-family houses and apartments.

In the categorisation into workplaces, we assumed that in the high density area there were to be a large proportion of workplaces. In the medium density area, this proportion decreases, and in the low density area, none are planned.

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<sup>58</sup> Briem Richard

<sup>59</sup> Briem Richard

<sup>60</sup> For detailed calculations, see Appendix 7

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In this proposal, the outcome of the categorisation is shown in table 4.9.

Density	One-family houses	Apartments	Workplaces
High	0%	40%	60%
Medium	5%	65%	30%
Low	20%	80%	0%

Table 4.9 Categorisation into building types – Alternative B

### 4.3.3 Construction costs for Alternative B

To be able to calculate the construction costs of the buildings in Alternative B, we once again needed the total floor-area of dwellings and workplaces. In the proposal for the Regional Plan 2024 nes Planners stated that they wanted 5 000 dwellings and 5 000 workplaces.

To get the floor-area of the dwellings, we used the categorisation into one-family houses and apartments made in chapter 4.3.2 on page 40 above, and arrived at the number of one-family houses in this proposal. We then multiplied this number by the average size of a one-family house, which is estimated to be 180 m<sup>2</sup>. In the same manner we obtained the number of apartments and multiplied it by the average size of an apartment, which is estimated to be 100 m<sup>2</sup>.

Concerning the floor-area of the workplaces, we used the number of workplaces, which is 5 000. This number was multiplied by the average size of one workplace, which is estimated to be 20 m<sup>2</sup>.

The construction costs of the main roads, bridges and roadways on landfill were given in ISK per metre. To be able to calculate these costs, the length of each structure was measured and multiplied by the cost per metre.

All the construction costs for Alternative B are listed in table 4.10. The cost for the construction company is 55 648 million ISK and for the State 2 026 million ISK. The total construction cost was therefore 57 674 million ISK.

<b>Costs for the construction company</b>			
<b>Buildings</b>	<b>Size (m<sup>2</sup>)</b>	<b>ISK per m<sup>2</sup></b>	<b>Cost (million ISK)</b>
One-Family houses	73 048	115 000	8 400
Apartments	459 400	85 000	39 049
Offices	32 109	105 000	3 371
Schools	1 251	115 000	144
Shopping centres	8 340	250 000	2 085
<b>Total</b>	574 148	-	53 049
<b>Infrastructure</b>	<b>Area (m<sup>2</sup>)</b>	<b>ISK per m<sup>2</sup></b>	<b>Cost (million ISK)</b>
Roads	1 410 352	1 500	2 116
<b>Total</b>	-	-	2 116
<b>Other costs</b>	<b>Size (m<sup>2</sup>)</b>	<b>ISK per m<sup>2</sup></b>	<b>Cost (million ISK)</b>
Green areas	321 712	1 500	483
<b>Total</b>	321 712	-	483
<b>Total for constr. comp.</b>	-	-	<b>55 648</b>
<b>Costs for the State</b>			
<b>Infrastructure</b>	<b>Length (m)</b>	<b>ISK per m</b>	<b>Cost (million ISK)</b>
Main roads	3 900	470 000	917
Tunnel	1 140	800 000	456
Bridges	267	2 500 000	333
Roadways on landfill	533	1 200 000	320
<b>Total for the State</b>	-	-	<b>2 026</b>
<b>Total construction costs</b>	-	-	<b>57 674</b>

Table 4.10 Construction costs – Alternative B

An additional 10 percent was added to the total construction cost for the construction company since it requires a profit. This amounted to 61 213 million ISK and is what the City has to pay the construction company.

#### 4.3.4 Estimation of the value areas in Alternative B

The division into different value areas is made to correspond to the division into density areas. The estimation is based on the assumption that a high density area has a high value. An exception to this is the low density area along the coast, which has a higher value due to its location.

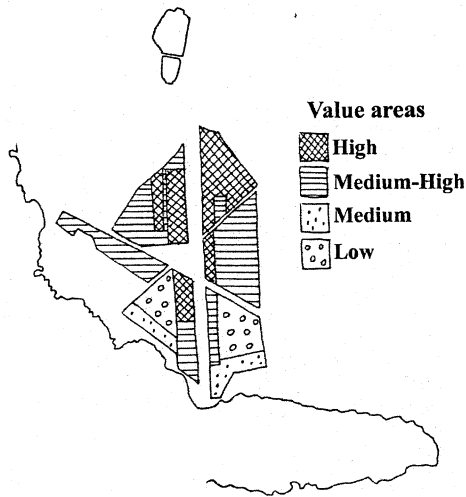


Figure 4.5 The value areas – Alternative B

#### 4.3.5 Estimation of the market price for lots and buildings in Alternative B

In the same way as for Alternative A, see chapter 4.2.5 on page 38 above, we calculated the market price for all the lots, including building rights, in Alternative B. The market price amounted to 8 766 million ISK, after subtracting the lots with official buildings, and is shown in table 4.11.

Value areas	Building type	Minimum fee (Cr/m <sup>2</sup> )	Market price factor	Market price / m <sup>2</sup>	Floor-area (m <sup>2</sup> )	Market price
High	One-family	10 723	5	53 615	0	0
	Apartment	3 064	5	15 320	180 000	2 757 600 000
	Workplace	5 362	5	26 810	22 698	608 533 380
Medium-high	One-family	10 723	4	42 892	22 648	971 400 859
	Apartment	3 064	4	12 256	167 400	2 051 654 400
	Workplace	5 362	4	21 448	17 751	380 723 448
Medium	One-family	10 723	3	32 169	13 074	420 569 785
	Apartment	3 064	3	9 192	29 053	267 053 338
	Workplace	5 362	3	16 086	0	0
Low	One-family	10 723	2	21 446	37 326	800 498 543
	Apartment	3 064	2	6 128	82 947	508 300 442
	Workplace	5 362	2	10 724	0	0
<b>Total</b>					<b>572 897</b>	<b>8 766 334 195</b>

Table 4.11 Market price of the lots – Alternative B

When the City's safety margin of five percent was added, the price of all the non-official buildings amounted to 61 106 million ISK, as shown in table 4.12. The table also shows the net profit for the City, a total of 2 910 million ISK.

Buildings	Construction costs	Construction costs + 10%	Price of the buildings	Net profit on buildings for the City
One-Family houses	8 400	9 241	9 703	462
Apartments	39 049	42 954	45 102	2 148
Offices	3 371	3 709	3 894	185
Shopping centres	2 085	2 294	2 408	115
<b>Total</b>	<b>52 906</b>	<b>58 197</b>	<b>61 106</b>	<b>2 910</b>

Table 4.12 Price of the buildings and net profit for the City in million ISK – Alternative B

## 4.4 Alternative C- Proposal by Professor Trausti Valsson

### 4.4.1 Description of Alternative C

Alternative C<sup>61</sup> is a proposal made by Professor Trausti Valsson at the Department of Civil and Environmental Engineering at the University of Iceland. This is a proposal in which the runways of the airport would be relocated to an island created by landfill on skerries and shallows in Skerjafjörður. The former airport area would be used for residential areas, commerce and workplaces. Valsson's proposal includes the airport area and some surrounding areas. The total size of the planning area amounts to 191 ha.

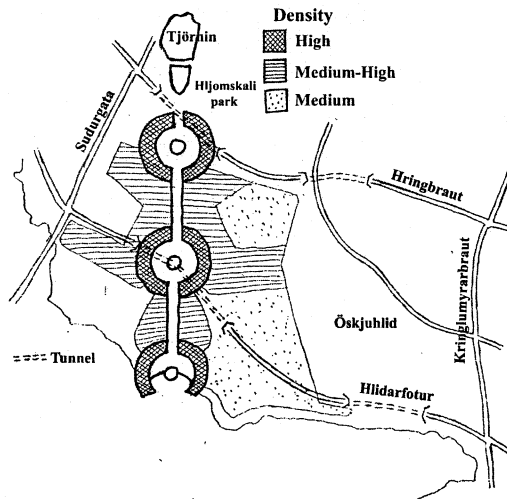


Figure 4.6 Alternative C

Trausti Valsson's proposal is based on the idea of having three centres running along a straight line from the lake Tjörnin in the north to Skerjafjörður in the south. Within this straight line, or axis, a major part of the green areas would be situated. This open

<sup>61</sup> See appendix 8

passage would create a link between the City Centre of Reykjavik and the airport area and would also provide a beautiful view over the sea. These green areas are deliberately kept small, and are situated in the western part of the area because of the already existing large green area, Öskjuhlid hill, in the east and the Hljomskali park in the north.

In order to create centres within the area, located on the green axis, the plan proposes a circular structure of high density buildings, surrounding the three centres. The density number for these areas is 1.26. The lowest density areas are located in the southern part and have a density number of 0.64. The rest of the area has a density number of 0.9. This proposal does not have any areas with really low density numbers. Valsson argues that one-family houses should not be located in an area that is so centrally situated that it could become a natural extension of the Old City Centre.

One of the main roads in Valsson's proposal connects the eastern and western parts of Reykjavik. This road, Hlidarfotur, runs from Kringlumyrarbraut road in the east to the Sudurgata road in the west. This new road is both an open road as well as a tunnel under today's runways. Another road, Hringbraut, running from east to west, would also be led through a tunnel, in this case under the suggested northern centre. A road on landfill would be built as an extension of the Sudurgata road, out into the Skerjafjörður. This is done in order to connect Reykjavik with Valsson's proposed new airport, on a landfill, in Skerjafjörður. From this landfill the road would go into a tunnel, built on the seabed of the fjord, over to the Alftanes peninsula.

#### 4.4.2 Categorisation into building types for Alternative C

When making the categorisation into building types<sup>62</sup> for Alternative C, we worked with the density numbers stated in chapter 4.4.1 above. The categorisation into building types in this proposal was made only between apartments and workplaces, because Valsson argues that there should be no one-family houses in such a centrally located area. In the three centres, which also have the highest density of buildings, there would be a large proportion of apartments and also quite a large number of workplaces. The other areas in the proposal have somewhat lower density, and in these areas apartments would be the dominating factor. The categorisation for this proposal is shown in table 4.13.

Density	One-family houses	Apartments	Workplaces
High	0%	60%	40%
Medium-High	0%	85%	15%
Medium	0%	95%	5%

Table 4.13 Categorisation into building types – Alternative C

#### 4.4.3 Construction costs for Alternative C

To calculate the total floor-area of the dwellings and workplaces we once again used the density formula after measuring the area of each density number. In the same manner as in Alternative A and B, we measured the main roads and tunnels to get the cost of the infrastructure of the main roads'. The total construction cost of dwellings, workplaces, infrastructures and green areas, is listed in table 4.14 and amounted to

<sup>62</sup> For detailed calculations, see Appendix 9

145 266 million ISK. When divided between the construction company and the State, the costs are 143 142 and 2 124 million ISK, respectively.

<b>Costs for the construction company</b>			
<b>Buildings</b>	<b>Size (m<sup>2</sup>)</b>	<b>ISK per m<sup>2</sup></b>	<b>Cost (million ISK)</b>
One-Family houses	0	115 000	0
Apartments	1 163 500	85 000	98 897
Offices	214 782	105 000	22 552
Schools	8 368	115 000	962
Shopping centres	55 788	250 000	13 947
<b>Total</b>	<b>1 442 438</b>	<b>-</b>	<b>136 359</b>
<b>Infrastructure</b>	<b>Area (m<sup>2</sup>)</b>	<b>ISK per m<sup>2</sup></b>	<b>Cost (million ISK)</b>
Roads	1 919 747	1 500	2 880
<b>Total</b>	<b>-</b>	<b>-</b>	<b>2 880</b>
<b>Other costs</b>	<b>Size (m<sup>2</sup>)</b>	<b>ISK per m<sup>2</sup></b>	<b>Cost (million ISK)</b>
Green areas	253 803	1 500	381
<b>Total</b>	<b>253 803</b>	<b>-</b>	<b>381</b>
<b>Total</b>	<b>-</b>	<b>-</b>	<b>139 619</b>
<b>Costs for the State</b>			
<b>Infrastructure</b>	<b>Length (m)</b>	<b>ISK per m</b>	<b>Cost (million ISK)</b>
Main roads	1 564	470 000	368
Tunnel	2 860	800 000	1 144
Roadways on landfill	1 020	1 200 000	612
<b>Total</b>	<b>-</b>	<b>-</b>	<b>2 124</b>
<b>Total construction costs</b>	<b>-</b>	<b>-</b>	<b>141 743</b>

Table 4.14 Construction costs – Alternative C

Again, since the construction company requires a profit of 10 percent, this percentage was added to the total construction cost for the construction company. The construction cost plus 10 percent amounted to 153 581 million ISK and is what the City has to pay the construction company.

#### 4.4.4 The value areas of Alternative C

The value areas are estimated to be quite similar to the density areas, which means that areas with high density numbers also have the highest value. The highest value areas are located to the three city centres proposed in this plan. The second highest are the areas surrounding these centres, the coastal area and the area closest to Öskjuhlid hill. The two areas remaining attain their high value due to their location. In the third value category comes the rest of the medium density area. The northwest tip of the area is the extension of the University Area. This means that the University, as well as the University Hospital, have a great influence on what kind of buyers this area will attract. Both the University and the University Hospital have an interest in the use to which this section of the area is to be put, and that the buyer is congenial to their



activities, and not simply the highest bidder. This will affect the market price and, therefore, render this area the lowest value.

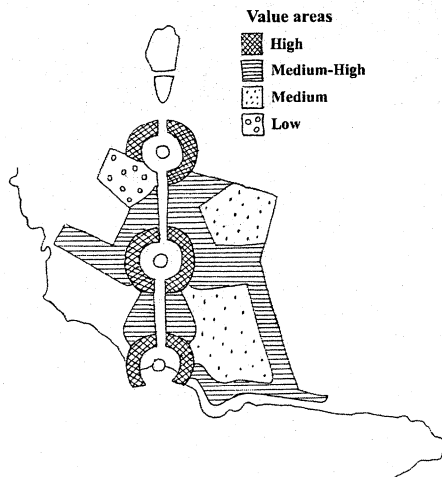


Figure 4.7 The value areas – Alternative C

#### 4.4.5 Estimation of the market price for lots and buildings in Alternative C

Once again we calculated the market price for all the lots, including building rights, in the same way as for Alternative A, see chapter 4.2.5 on page 38 above. For Alternative C the market price amounted to 19 702 million ISK, after the lots with official buildings are subtracted, and is shown in table 4.15.

Value areas	Building type	Minimum fee (ISK/m <sup>2</sup> )	Market price factor	Market price / m <sup>2</sup>	Floor-area (m <sup>2</sup> )	Market price
High	One-family	10 723	5	53 615	0	0
	Apartment	3 064	5	15 320	234 162	3 587 359 911
	Workplace	5 362	5	26 810	151 425	4 059 695 632
Medium-high	One-family	10 723	4	42 892	0	0
	Apartment	3 064	4	12 256	511 485	6 268 754 367
	Workplace	5 362	4	21 448	77 538	1 663 030 138
Medium	One-family	10 723	3	32 169	0	0
	Apartment	3 064	3	9 192	334 481	3 074 547 628
	Workplace	5 362	3	16 086	17 076	274 686 558
Low	One-family	10 723	2	21 446	0	0
	Apartment	3 064	2	6 128	83 372	510 906 588
	Workplace	5 362	2	10 724	24 532	263 076 472
<b>Total</b>					<b>1 434 070</b>	<b>19 702 057 292</b>

Table 4.15 Market price of the lots – Alternative C

In table 4.16 the price of all the non-official buildings, after the City's safety margin of five percent has been added, is shown. The price amounted to 156 383 million ISK. In the same table the net profit for the City is also shown, a total of 7 447 million ISK.

Buildings	Construction costs	Construction costs + 10%	Price of the buildings	Net profit on buildings for the City
One-Family houses	0	0	0	0
Apartmentst	98 897	108 787	114 227	5 439
Offices	22 552	24 807	26 048	1 240
Shopping centres	13 947	15 342	16 109	767
<b>Total</b>	<b>135 397</b>	<b>148 936</b>	<b>156 383</b>	<b>7 447</b>

Table 4.16 Price of the buildings and net profit for the City in million ISK – Alternative C

#### 4.5 Tax revenues generated by the three alternative plans

As the estimation of the annual tax revenues, generated by the three plans, is not the main subject of this dissertation, the estimation of the revenues will serve only to illustrate the scale of the financial resources involved. If the airport area is not developed, the City of Reykjavik will probably loose a major part of the tax revenues that this area would generate, because people, who would otherwise reside in the airport area, would most likely choose to reside in nearby municipalities, as for example Kopavogur. The tax revenues for the State will probably be almost the same since they do not depend on in which municipality the taxpayer lives. However, the revenues for the State may increase due to the large numbers of new workplaces that this area will create.

To estimate the mean revenues generated annually by the inhabitants of Reykjavik, both for the State and the City, we used the average total taxes paid by the individual taxpayer in Reykjavik. The average total tax payments both to the City and the State are 209 000 ISK<sup>63</sup> per individual taxpayer. The mean annual revenues generated by each workplace are, for the State 364 100 ISK<sup>64</sup> and for the City 37 129 ISK<sup>65</sup>.

If the airport is relocated, we assume that the surrounding areas will increase in value, see chapter 4.6 on page 49. To determine how much more revenues this would generate in the future, mostly due to increased building, we estimate that in these areas there would be 5 000 more inhabitants and 2 000 more workplaces. The future Master Plan of Reykjavik and the status of the area in the Capital Area would of course, in reality, heavily influence these figures.

<sup>63</sup> Kolbeins Pall, Statistical Analyst, Internal Revenue

<sup>64</sup> Kolbeins Pall

<sup>65</sup> Kalmans Kristin, City Hall, City of Reykjavik

We assume that 75 percent of the inhabitants are taxpayers, since a certain proportion of the population is minors. The revenues for the City and the State are listed in table 4.17.

Revenues to:	Generated from:	Airport 2000	Alt. A	Alt. B	Alt. C	Increased revenues in surrounding areas
The State	inhabitants	-	3 026	1 881	4 377	784
	workplaces	206	3 492	1 820	5 078	728
The City	inhabitants	-	3 026	1 881	4 377	784
	workplaces	21	356	186	518	74
<b>Total</b>		227	9 900	5 768	14 350	2 370

Table 4.17 Revenues generated annually by the airport and the three plans in million ISK

Before the final numbers are presented, it should be mentioned that possible savings or increased costs, resulting from the various plans, have not been estimated. The decrease in travel costs will depend on the success of the policy of mixed land use, and of the future traffic infrastructure, etc. The City of Reykjavik suffers heavily financially because the city is so spread out, which necessitates a more wide-spread road system, more infrastructures, longer bus routes, etc.

The resulting estimated figures from table 4.17 above therefore do not include possible extra costs or extra savings. With the inclusion of increased revenues in the surrounding areas, the resulting revenues will be as shown in table 4.18.

	Airport 2000	Alternative A	Alternative B	Alternative C
The State	206	8 034	5 213	10 967
The City	21	4 240	2 925	5 753
<b>Total</b>	227	12 274	8 138	16 720

Table 4.18 Resulting estimations of the revenues for the three plans and the airport

#### 4.6 Increase in value in surrounding areas

The reasons why lots and buildings in the surrounding areas will increase in value, if the airport is relocated and instead a new city centre is built, are:

1. Elimination of the flight-hazards and the air traffic pollution. The exposed areas are today mostly in the flight corridor at the northern end of the north-south runway. This is also the case in the recreation area on the south-western part of the Öskjuhlid hill and, to some extent, further east in the Fossvogur valley. The western part of the Karsnes hill area, in the Kopavogur municipality, is another exposed area, situated at the southern end of the north-south runway. Recreation areas in, and at, Skerjafjörður are also exposed, as are areas at the western end of the west-east runway.
2. The limitation of the height of buildings, due to runway-safety, will be eliminated. This concerns especially the areas in the flight corridors mentioned in 1.

3. A new city centre creates more value in the surrounding areas than an airport does. This is because apartments, workplaces and lots are, as a rule, more desirable and thus more expensive, close to a city centre.

It is difficult to estimate how much the value will rise due to these three factors, because the estimation depends on aspects that cannot fully be clarified today, for example, the layout of the new city centre, unforeseen developments in the surrounding areas and the layout of the traffic routes.

The value of the surrounding areas will differ slightly among the three plans. Nevertheless, only one division of the surrounding areas into value zones is made, since we are aiming only for "ballpark" figures.

The estimated increased value of lots and buildings will be most noticeable for vacant lots and for lots with buildings that are of low value and can be replaced. A part of these increases are due to the assumption that commercial activity will be permitted on these lots and special rules will allow their increased utilization.

The increase in value in residential areas will, in some cases, not mean much for the owners, except if they rent out or sell their dwellings. In other cases, the houses may be in such bad shape, that they do not generate more revenue, except if they are improved or if a new house is built. In these cases, increased taxes due to the rise in value of the area might be a burden to the owners. Most of the zones, shown in figure 4.8, follow the index system of the VOI.



Figure 4.8 Zones of increased value in the vicinity of a new city centre

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In Zone 1 there are the following areas:

- a) An extension of the University Area.
- b) The area at the Long Distance Bus Terminal, the University Hospital extension area, the area south of the extension area, south of the new Hringbraut road and the Valur Sports Club area.
- c) The long and narrow area on the western slope of the Öskjuhlid hill. (Alternative A and C propose that this area should be developed).

In Zone 2 there are the following areas:

- a) Today's residential area at Skildinganes. Some of the houses are old wooden buildings, which can easily be moved away to profit from the increased value of the area.
- b) The group of old houses, often termed Skerjafjörður, new blocks for former employees of the University, new blocks for students and the old professor bungalows. Some rebuilding in these older parts might be advisable, which results in a higher value of the lots and the building stock.
- c) The University Area and the University Cinema. The relocation of the airport means fewer limitations in the height permitted for buildings and makes it possible to have higher density numbers, which will increase the value of lots and buildings.

In Zone 3 there are the following areas:

- a) The Melar and Hagar residential areas, east of the Hofsvallagata road.
- b) The old Vesturbær area, approximately east of the Hofsvallagata and Styrimannastigur roads.
- c) The Old City Centre, Kvosin.
- d) The Skuggahverfid, Laugavegur, Thingholt and Skolavörduholt areas.
- e) The Nordurmyri, Raudararholt, Tun and Northern Hlidar areas, which today consist of residential areas, areas of schools and mixed land uses.
- f) The southern Hlidar area, south of the Miklabraut road, east of the hospital and south of the Nestigas station.
- g) The western end of the Karsnes peninsula in Kopavogur, which is mostly a residential area. The elimination of the flight hazards, noise pollution and limitations on the height of buildings will increase the value of this area.

The green areas (G) consist of the following areas:

- a) The Öskjuhlid hill and the north coast of the Fossvogur bay including the Nantholsvik beach.
- b) The coast of Skerjafjörður, west of the north-south runway, all the way to the end of the east-west runway.
- c) The Aegissida coast at Skerjafjörður.
- d) The lake Tjörnin, the Hljomskalagardur park and green area at Nordic House.
- e) The Miklatun park.

The green areas in Reykjavik are not given a value in the VOI. They are owned by the City of Reykjavik and no taxes are calculated for them, or for the investments in them. If buildings are constructed in the green areas, real estate lots are created, and these lots, together with the buildings, will then get a value.

It is a complicated undertaking to calculate and value the green areas in the vicinity of the airport. To be able to estimate the increased value of the surrounding areas, we

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need some idea of the value of the green areas described in the vicinity of the airport, even if they are only very rough estimations. Based on consultations with some experts<sup>66</sup>, the estimation of the value of the green areas was made keeping the following factors in mind:

1. The average value per m<sup>2</sup> in the developed areas closest to the green area.
2. In a developed area there are many more investments, for example, more roads and water mains, than in a green area. The investments in green areas do not produce direct financial returns, but instead they create returns in the form of well-being and pleasure.
3. Regarding today's investments in the green areas, we took guidance from the construction costs for a green area, being approximately 1 500 ISK<sup>67</sup> per m<sup>2</sup>. The investments, as a rule, consist of the following:
  - a) Levelling, soil improvement and the cultivation of green fields and other cultivated areas, such as flowerbeds and areas for bushes and trees.
  - b) Landscaping, such as creating small hills and rockeries.
  - c) The value of the flora in the area.
  - d) The costs of paths and, in some cases, their illumination.
  - e) Access roads and parking areas.
  - f) Other investments such as fountains, statues, benches etc.

How much more valuable these green areas will become, if a new city centre is built, is still more difficult to estimate. The estimation is the same for all three alternatives, because they are all similar in nature. The factor that contributes most to the increase in value is the estimated increase in the number of visitors to the green areas, due to the fact that more apartments and workplaces will be situated close to them. The type of activity located next to the green areas might also decrease their value, and therefore, estimations concerning these decreases were also made. An example of this is if a road for heavy traffic is planned close to the green areas, which would cause both visual and noise pollution, as well as the cutting off of the developed areas from the green areas.

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<sup>66</sup> Axelsson Björn, Landscape Architect, The City Planning Office of Reykjavik, City of Reykjavik, Mogensen Kjartan, Landscape Architect, Nordurbrun 20, 104 Reykjavik

<sup>67</sup> Pálsson Sigurjon

The rateable value<sup>68</sup> of the developed areas and the estimated value of the green areas mentioned above, in the year 2000, together with an estimation of their increase in value if a new city centre is built, are shown in table 4.19. All the estimations can be called “educated guesses”<sup>69</sup>.

Zones	Value of lots		Value of buildings		Value of green areas	
	with airport	with City Centre	with airport	with City Centre	with airport	with City Centre
1 a	25 038	1 025 000	2 198 128	12 270 000	-	-
1 b	82 737	3 083 000	769 934	21 000 000	-	-
1 c	0	1 000 000	0	10 000 000	-	-
2 a	695 853	800 000	2 572 267	3 072 000	-	-
2 b	352 674	528 000	1 357 102	1 500 000	-	-
2 c	275 459	525 000	3 863 477	7 500 000	-	-
3 a	814 745	855 000	12 292 311	12 892 000	-	-
3 b	2 573 984	2 639 000	10 198 262	10 248 000	-	-
3 c	1 350 666	1 421 000	4 715 893	4 951 000	-	-
3 d	10 146 094	10 646 000	43 817 813	46 018 000	-	-
3 e	12 680 881	13 081 000	57 377 759	59 078 000	-	-
3 f	5 984 613	6 225 000	37 963 371	39 063 000	-	-
3 g	1 000 000	1 100 000	7 500 000	8 250 000	-	-
G a	42 918	47 000	240 562	264 000	3 311 000	9 311 000
G b	0	0	0	0	900 000	1 800 000
G c	0	0	0	0	900 000	1 400 000
G d	0	0	0	0	3 000 000	9 000 000
G e	0	0	215 292	236 000	1 236 000	1 336 000
<b>Total</b>	<b>36 025 662</b>	<b>42 975 000</b>	<b>185 082 171</b>	<b>236 342 000</b>	<b>9 347 000</b>	<b>22 847 000</b>
<b>Increase in value</b>	<b>6 949 338</b>		<b>51 259 830</b>		<b>13 500 000</b>	

Table 4.19 Comparison of value of surrounding areas, with an airport or with a new city centre in thousands ISK

The total increase in value of the designated areas according to this estimation is approximately 72 million ISK. In all the estimations, we kept in mind that several aspects in the Reykjavik’s Master Plan have a large impact on the future of these figures. Some of these aspects are, for example, the future status of this part of the Capital Area, as well as the economy of Reykjavik and Iceland.

#### 4.7 Side effects of the airport and the alternative plans

Whether the airport remains at its present location or whether one of our alternative plans is implemented, there will be side effects for the surrounding areas, the City and the State. These side effects can be both positive and negative.

<sup>68</sup> Ingvarsson Örn, Director of Information, Technology and Services Department, The Valuation Office of Iceland

<sup>69</sup> Jonsson Birgir, Valsson Trausti

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Effects can be visualized in many areas, but we believe that some of the more important ones are “Air Transportation and Safety Issues”, “Planning Development in the Capital Area” and “Tourism and Transportation”. Within each of these areas, the side effects are listed as benefits and drawbacks for the present airport and each of the proposed plans, and are shown in Appendix 10, 11 and 12.



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## 5 Results of the Valuations

### 5.1 Review of the Alternatives

Alternative A is a proposal made by four students at the Department of Civil and Environmental Engineering at the University of Iceland in 1999. This proposal suggests a complete relocation of the airport. The planning area that they use is 181 ha and consists of the former airport area together with some adjacent areas. The students want to make the City of Reykjavik compact and, building on the airport area they are one step closer to their goal. The plan is characterised by a high density of buildings in the north and northeast of the area but further to the south, by the sea, the density is decreased.

Alternative B is one of the proposals of where to build up new areas in the Regional Plan 2024 for the Reykjavik Area. This proposal is made by nes Planners and it also suggests a complete relocation of the airport. According to the proposal, 5 000 dwellings, with 12 000 inhabitants, and 5 000 workplaces should be built within an area of 140 ha. In the northern part there will be a higher density of buildings than in the southern coastal part. nes Planners also want to maintain the open passages, which the former runways create, as green areas. These passages will allow a pleasant view over the surroundings with their well-known landmarks.

Alternative C is a proposal made by Associate Professor Trausti Valsson at the Department of Civil and Environmental Engineering at the University of Iceland. In this proposal the runways of the airport are relocated to an island created by landfill in Skerjafjörður. The former airport area, together with some adjacent areas, a total of 191 ha, will have a high density of buildings, and be used for residential purposes, commerce and workplaces. To achieve the desired building density, no one-family houses are planned in the area.

### 5.2 Comparison of the Alternatives

Before the three alternatives are compared, it should be emphasised that this dissertation deals primarily only with figures resulting from the three planning alternatives. This allows us to estimate a probable price range in a bidding procedure for the lots, and also the costs for the City of Reykjavik (internal infrastructure and most parts of the social services), for the State (main roads and some social services) and for private investors (buildings and building rights). This dissertation, on the other hand, does not deal with savings for the City, the State, companies or individuals.

This central area will probably attract a higher income bracket of individuals and companies, creating higher revenues for the City than other suburban areas. Due to the mixing of land uses within the area, the travel costs will be much lower than in the suburbs. The main roads would be built by the State, and the policy of mixing land uses, will mean a reduction in the cost to the State, for the construction of main roads leading to the new city centre. On the other hand, the outlays for the construction of tunnels and bridges might reach considerable costs.

To get an overview of the number of inhabitants and the number of different building types for each alternative and for the present airport, a comparison is made in table 5.1.

	No. of inhabitants	No. of one-family houses	No. of apartments	No. of workplaces
Airport	-	-	-	566
Alternative A	19 309	1 436	6 609	9 593
Alternative B	12 000	406	4 594	5 000
Alternative C	27 924	0	11 635	13 947

Table 5.1 Comparison of numbers of inhabitants and workplaces between the present airport and the three plans

The relatively large differences between the three plans are due to different density numbers but also to variations in the size of the area. To make up for one of these differences, we subtract the areas lying outside the smaller Alternative B, from the larger Alternatives A and C. The numbers of inhabitants, dwellings and workplaces, when the alternatives all have the same area, are shown in table 5.2.

	No. of inhabitants	No. of one-family houses	No. of apartments	No. of workplaces
Airport	-	-	-	566
Alternative A	15 693	1 006	5 533	7 479
Alternative B	12 000	406	4 594	5 000
Alternative C	20 493	0	8 539	9 041

Table 5.2 Comparison of numbers of inhabitants and workplaces between the present airport and the three plans, when the size of the area is the same

The comparison of costs and revenues among the plans is made from the construction contractor's point of view, in this case the City of Reykjavik. Table 5.3 lists the costs, which the City has to pay to buy the land from the State, together with the construction costs, compared to the revenues from the sale of the lots and buildings. The result of each alternative is calculated through this comparison and for Alternative A the result amounted to 16 617 million ISK, for Alternative B 6 260 million ISK and for Alternative C 20 104 million ISK. Together with these profits, each alternative also generates tax revenues for the City.

	Purchase of State land	Market price of lots	Price of buildings	Construction costs + 10%	Result	Tax revenues for the City	Result + tax
Alt. A	2 400	16 803	128 219	126 005	16 617	3 382	19 999
Alt. B	2 400	8 766	61 106	61 213	6 260	2 067	8 327
Alt. C	2 400	19 702	156 383	153 581	20 104	4 895	24 999

Table 5.3 The results for the City generated from the three plans, together with tax revenues, in million ISK

As we mentioned before, the differences in the number of dwellings and workplaces are due to the differences in density numbers and the variations in the size of the area in each plan. To make it possible to see the differences in the figures for the main part of the airport area, which all the alternatives have in common, we once again subtracted the outskirts from the larger alternatives<sup>70</sup>. The result was, in this case, calculated to be 13 257 million ISK for Alternative A, 6 260 million ISK for Alternative B and 13 903 million ISK for Alternative C. The numbers, after the subtractions, for these calculations are shown in table 5.4.

	Purchase of State land	Market price of lots	Price of buildings	Construction costs + 10%	Result	Tax revenues for the City	Result + tax
Alt. A	2 400	13 996	100 977	99 317	13 257	2 460	15 717
Alt. B	2 400	8 766	61 106	61 213	6 260	2 067	8 327
Alt. C	2 400	14 351	111 155	109 203	13 903	3 212	17 115

*Table 5.4 The results for the City generated from the three plans, with the same size of the area, together with tax revenues, in million ISK*

Although the comparison is mainly made from the construction contractor's point of view, we will also in table 5.5 show the result for the State. The result generated from Alternative A amounted to – 483 million ISK, from Alternative B 374 million ISK and from Alternative C 276 million ISK.

	Sale of State land	Costs for infrastructures	Result	Tax revenues	Result + tax
Alternative A	2 400	2 883	-483	6 518	6 035
Alternative B	2 400	2 026	374	3 701	4 075
Alternative C	2 400	2 124	276	9 455	9 731

*Table 5.5 The results for the State generated from the three plans, together with tax revenues, in million ISK*

If the airport is relocated, the surrounding areas will increase in value by approximately 72 million ISK, which was calculated in table 4.19 on page 51 above. This applies to all three plans.

The financial revenues generated from the three plans can be compared to the airport's annual result and the current values of the land and buildings. The airport operation costs are compared to its revenues in order to be able to calculate the annual result. The estimate of the operation costs amounted to 116 million ISK and the result to 75 million ISK. In addition to the operation costs, the airport is also undergoing major renovations to the runways and in the future there will also be a need for a new air terminal together with new cargo and terminal aprons. The cost of these renovations is estimated to be 2 900 million ISK. The land and buildings in the

<sup>70</sup> For calculations see Appendix 13 and 14

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present airport area have an estimated value of 2 802 million ISK. Furthermore, there is also the value of the flight safety instruments, estimated to be 53 million ISK.

### **5.3 Comments on the comparison**

Table 5.1 shows how the number of inhabitants, dwellings and workplaces varies in each alternative. Alternative C provides for the largest amount of all of these, due to a high density of buildings and no one-family houses. Even after the outskirts of the larger alternatives, A and C, have been subtracted, in table 5.2, Alternative C still provides for the largest number of inhabitants, dwellings and workplaces. This clearly indicates the large influence that high density numbers will have on these kinds of figures.

The result in table 5.3 shows, once again, that a large area together with high density numbers are more profitable. That is why Alternative C has the highest result, followed by Alternative A. The variation in the tax revenues for the alternatives correlates with the difference in the number of inhabitants.

In table 5.4 the outskirts of Alternative A and C have been subtracted so that all three plans involve the same sized area. When doing this subtraction, we have to bear in mind that the division into building types will no longer be in balance. Each plan is drawn up as an integrated whole. Subtracting the outskirts of the areas from Alternative A and C will primarily reduce areas with low density numbers. Although this comparison with the same size for all alternatives will not be in balance, it still has its benefits to achieve a result by deleting one variable. Even when the areas were of the same size, Alternative C still has the most profitable result, closely followed by Alternative A. Noticeable in this case is that the difference in the results generated from Alternative A and C, has decreased. These two alternatives now have almost similar results. Alternative B still generates a much lower result, which again shows how a large quantity of high density areas will generate higher profits as a result of more intense land use.

Listed in table 5.5 is the result for the State. In this case the result is a comparison between the sale of the State land and the costs of the major infrastructures. The sale of the land must not necessarily cover the construction costs of the infrastructures, since these costs are usually financed through taxes. It can be noted that in both Alternative B and C, the sale of the land alone covers the cost of the infrastructures. The bridge over Skerjafjörður in Alternative A is very costly and this is the main reason for the negative result of Alternative A.

To compare the present use of the area as an airport to the three proposals entails some difficulties. The numbers are not completely comparable and therefore we decided to look at the annual financial result of the airport, the value of the land and buildings together with some major investment costs. The yearly result generated from the airport is considerably lower than the results generated by the three plans. The airport's result is of course generated annually, but if this result remains almost the same, the airport has to be in full use for many years just to cover the least profitable of the alternatives. Even if the value of land and buildings on the present airport are taken into consideration, the results from the alternative plans are still higher. To continue operating the airport, some renovations are both underway and will have to be undertaken in the near future. This will mean large investments, but

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since development of the area will not eventuate until 2018, most of these costs will have depreciated.

If the airport is relocated and the area developed, the existing buildings, infrastructures and foundations of the runways can be used, to some extent, during the construction period. The savings accrued from this apply to all three plans and are therefore left out of our calculations.

## **6 Discussion**

### **6.1 Criticism of the sources**

In this work we had to rely on information provided by our interviewees. Therefore, it is necessary to comment and criticise those sources, which supplied us with the major part of the information.

Most of the data regarding the present airport was gathered from the CAA. The figures we used are the same as the CAA uses in their records. Naturally they want to make the records appear in a favourable light, so some of the figures might be slightly embellished. CAA is, of course, also a spokesman for the opinion that the airport should remain at its present location.

In the calculations for the present value of the airport, we have used a report produced by the Economics Institute in co-operation with the CAA. The involvement of the CAA might have had some influence on the figures used in their report.

The construction costs were acquired from ISTAK Construction Contractors and Hönnun Consulting Engineers, which are among the largest companies within their respective areas in Iceland. Both companies will of course have an interest in all possible future building projects in conjunction with the airport area. Since most of the figures were coherent between ISTAK and Hönnun, we feel quite confident that the figures are reliable.

The PRA provided us with construction costs for major infrastructures. When acquiring the figures from the PRA, we informed them that their information would be used in a dissertation. Since the PRA is an authority and our dissertation is independent, done at a university, we have no reason to doubt their figures.

The numbers from the VOI are certainly most accurate, since it is a State organisation. One thing that might affect the accuracy is that we do not know how up to date these numbers are.

### **6.2 Our own thoughts**

#### **6.2.1 Thoughts regarding the airport**

In Iceland there is no railway, instead transportation by air has to fill this lack in communication. This makes the airport comparable to railway stations in other European cities and a natural location for a railway station is usually in the centre of the city. Nevertheless, there are obvious and considerable differences between a railway station and an airport, one of the main ones being that the airport generates a lot of disturbances, for example, during take-offs and landings. There is also a danger zone around the airport and within the flight corridors. The airport requires a lot of space, which we think is a waste of valuable land so close to the City Centre.

The scheduled flights are, for some people, the main argument to keep the airport in the city. However, only 20 percent of the movements at the Reykjavik Airport in the year 1999 were scheduled flights. We therefore question whether it is worth keeping the airport, with all its dangers and disturbances, in the city, since it seems that only a minority of flights are worth arguing for.

With an improving road system there is a possibility that travellers choose the car instead of flying. This will probably not be the case between Reykjavik and the Westfjords, East Iceland and the Westman Islands. These regions are located far from Reykjavik and are quite inaccessible by road.

### **6.2.2 Thoughts regarding the planning alternatives**

We think it is more natural to have a built up area, instead of an airport, so close to the City Centre. Reykjavik is already a very widely spread city considering its number of inhabitants. To prevent the city from spreading even more, we feel that a development of the airport area presents a great opportunity of preventing this.

The mix of both one-family houses and apartments in Alternative A would create a pleasant and variable atmosphere. The structure of low buildings by the coast and higher ones further inland is an appealing solution since it would provide the possibility for almost every building to have a view of the sea. Unfortunately this idea, with a view of the sea, has not been taken into consideration when it comes to the green areas. If the open passage, which is reserved as a green area, had been in a straight line, there would have been a beautiful view from the lake Tjörnin and all the way down to the sea.

In Alternative B, we believe that the area could have been more densely planned. As mentioned before, Reykjavik is a widely spread city, therefore we think that all new developed areas should be quite dense. The planning structure has a lot of similarities to the one in Alternative A, which we think is a good way of using the area's possibilities. The difference from Alternative A is that Alternative B, in our opinion uses the green areas in an aesthetically more pleasing way. The straight and open passages, which are so common for the old parts of Reykjavik, are something we find beautiful and think should be used also in this area. A large green area is also located south of the lake Tjörnin, to protect some of the important catchments. This is an environmental aspect we think should have been considered also in the other two alternatives.

Alternative C uses the highest density of the three alternatives. Furthermore, this plan proposes that there should be no one-family houses. We can understand this concept in a city centre. However, since the present City Centre is a mix of different building types, we think this should be the pervading character. The high density with mostly apartment buildings makes us doubtful as to whether this will be aesthetically appealing. This plan also suggests a relocation of the runways to a landfill in Skerjafjörður, which will keep the airport close to the city. Having the airport close to the city, but not immediately in the city, is a solution to many of the problems regarding the debate on the relocation. We believe that the downside of this solution is that the water quality in the fjord might be affected negatively due to the landfill.

The density numbers, mainly in Alternative A and C, are somewhat higher than the average for Reykjavik. We think that an area close to a city centre should be quite densely planned and this seems to be an opinion that has recently been gaining ground in Iceland. An example of this is the plans on how to develop the Skuggahverfid district, which is an area close to the City Centre of Reykjavik. This is an area of 34

ha, of which Eimskip The Iceland Steamship Company<sup>71</sup> owns 15 ha. The Skuggahverfid district is situated close to the harbour, on the north coast of the Reykjavik peninsula. The idea for the area is to have a very high density of dwellings, shops and workplaces. This will be achieved by using density numbers in the interval of 1.8 - 2.0. These suggested density numbers indicate, just as the planning alternatives that we have been working with, that an area close to a city centre should be densely planned.

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<sup>71</sup> Einarsson Hafsteinn Gautur, Assistant to the Senior Director Corporate Development, Eimskip The Iceland Steamship Company



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## 7 Conclusions

Our conclusion regarding the question as to whether the airport area should be developed or kept as an airport, is that economically the most profitable step would be to develop the area. This conclusion is based on our calculations of the result generated from each of the three plans and from the present airport. All the three plans, especially Alternative A and C, generate large revenues, which, in fact, may even be large enough to finance at least a part of the construction of a new airport. A relocation of the airport will, apart from the purely economic advantages, also eliminate present disturbances such as noise and air pollution as well as flight hazards.

Determining whether one of the alternatives is more advantageous than the others involves some difficulties. Even if Alternative A and C generate the most money, we cannot be sure that they can be carried out. Both of these alternatives use more land than the present airport area consists of and Alternative C uses land very close to the sensitive lake Tjörnin. If we take only the economic aspects into consideration, Alternative C is the most profitable and Alternative B the least. When the outskirts of Alternative A and C were subtracted, the difference between them was almost negligible. This indicates that if one of the fundamental conditions is the same, Alternative A and C are equally profitable. It also indicates that a high density building plan is the most profitable. When stating this, values such as beautiful environs, which are difficult to measure economically, are not considered.

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- Figure 2.2 Page 18 Data from Grimsdóttir Ingibjörg, Icelandic Civil Aviation Administration, Reykjavik Airport
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Engineers

## Glossary

English	Svenska
abolish	avskaffa
accentuate	betona
accrue	tillkomma
adjacent	angränsande, intilliggande
applicable	tillämplig, användbar
appraise	värdera, bedöma
apron	platta på flygplats
ballpark figures	ungefärliga siffror, i runda tal
bracket	kategori, klass
cargo	flyglast, last
catchment	upptagningsområde
comprise	omfatta, innefatta
congenial	behaglig
conjunction	kombination
construction contractor	byggherre
correlate	i förhållande till
deem	anse
depreciate	minska i värde
designate	bestämd, avsedd
dwelling	bostad
eligible	berättigad
embellish	försköna
emphasise	betona, ge eftertryck åt
enumerate	räkna upp
environ	miljö, omgivning
eventuate	inträffa
expenditure	utgifter
feasible	genomförbar
geothermal	geotermisk
inferior	sämre
insufficient	otillräcklig

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Jutland	Jylland
marshland	sumpmark
meagre	knapp, torftig
negligible	försumbar
operation cost	drift och underhållskostnad
originate	härhöra, härstamma
outskirts	utkant, ytterområde
pervading	genomgående
proximity	närhet
rateable value	taxeringsvärde
ratify	stadfästa, bekräfta
referendum	folkomröstning
remains	lämningar
revenue	inkomst
rockery	stenparti
salinity	salthalt (i vatten)
shallow	grund, grundt vatten
skerry	skär
strait	sund
tenancy	arrende
tutorial flights	lektionsflyg, skolflyg
vast	vidsträckt
vibrant	livlig, levande
vicinity	grannskap, i närheten av
water main	vattenledning

## Abbreviations

Alt.	Alternative
CAA	Civil Aviation Administration
CPI	Consumers Price Index
ha	Hectares
ISK	Icelandic Kronor
No.	Number
PRA	Public Roads Administration
USD	United States Dollar
VOI	Valuation Office of Iceland



## Appendices

### Appendix 1 Aircraft Movements at Reykjavik Airport

The table is based on data from Ingibjörg Grimsdóttir, Icelandic Civil Aviation Administration, Reykjavik Airport.

	1995	1996	1997	1998	1999
Scheduled and charter flights, domestic	20 488	17 498	19 888	20 668	21 292
Touch and Go, domestic*	43 199	35 346	37 162	31 421	19 015
Other flights, domestic**	19 060	27 811	32 744	38 540	34 939
<b>Total movements, domestic</b>	<b>82 747</b>	<b>80 655</b>	<b>89 794</b>	<b>90 629</b>	<b>75 246</b>
<i>Change between years</i>		-3%	11%	1%	-17%
Scheduled and charter flights, international	1 282	1 314	1 442	1 098	1 158
Other flights, international	2 486	2 262	2 380	2 592	2 356
<b>Total movements, international</b>	<b>3 768</b>	<b>3 576</b>	<b>3 822</b>	<b>3 690</b>	<b>3 514</b>
<i>Change between years</i>		-5%	7%	-3%	-5%
<b>Total movements</b>	<b>86 515</b>	<b>84 231</b>	<b>93 616</b>	<b>94 319</b>	<b>78 760</b>
<i>Change between years</i>		-3%	11%	1%	-16%

\*Every Touch and Go is counted as one movement. Touch and Go is pilot training and tutorial flights, by which landings with immediate take-off are practiced.

\*\*Other flights are private and tutorial flights.

## Appendix 2 Passenger Transport at Reykjavik Airport

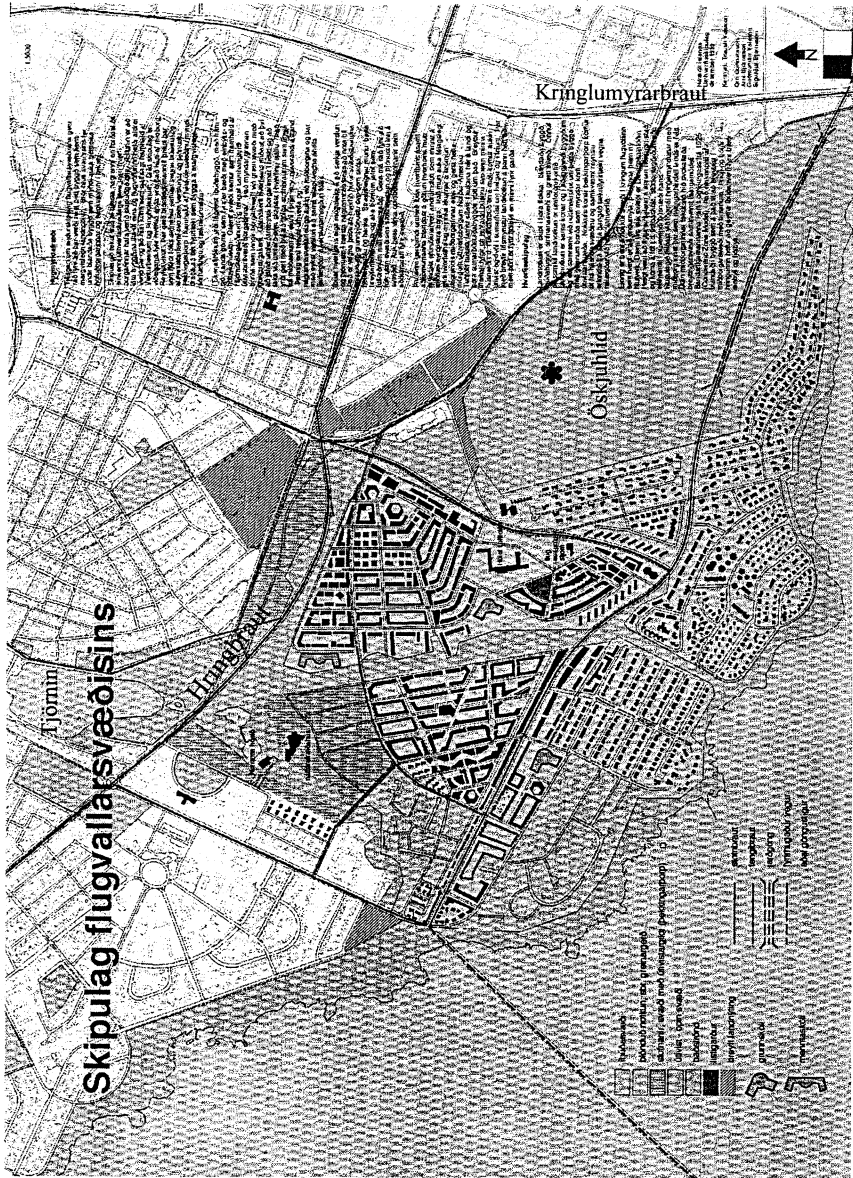
The table is based on data from Ingibjörg Grimsdóttir, Icelandic Civil Aviation Administration, Reykjavik Airport.

	1995	1996	1997	1998	1999
<b>Scheduled flights, domestic</b>	<b>329 072</b>	<b>332 795</b>	<b>378 415</b>	<b>431 441</b>	<b>447 166</b>
Arrivals	163 784	165 159	187 022	210 517	221 022
Departures	165 288	167 636	191 393	220 924	226 144
<i>Change between years</i>		1%	14%	14%	4%
<b>Charter flights, domestic</b>	<b>18 581</b>	<b>18 217</b>	<b>14 691</b>	<b>8 735</b>	<b>5 627</b>
Arrivals	8 889	8 583	6 803	4 091	3 035
Departures	9 692	9 634	7 888	4 644	2 592
<i>Change between years</i>		-2%	-19%	-41%	-36%
<b>Emergency flights</b>	<b>678</b>	<b>417</b>	<b>435</b>	<b>409</b>	<b>124</b>
Arrivals	438	336	323	266	88
Departures	240	81	112	143	36
<i>Change between years</i>		-38%	4%	-6%	-70%
<b>Total passenger transport</b>	<b>348 331</b>	<b>351 429</b>	<b>393 541</b>	<b>440 585</b>	<b>452 917</b>
<i>Change between years</i>		1%	12%	12%	3%

### Appendix 3 The Main Hangars at Reykjavik Airport

Hangars	Building year	Area of the buildings (m <sup>2</sup> )	Volume of the buildings (m <sup>3</sup> )
Hangar 1	1943	2 770	27 700
Hangar 2	1943	1 610	16 100
Hangar 3	1943	2 770	27 700
Hangar 4	1943	2 770	27 700
Hangar 6	1940/1944	655	3 220
Hangar 7	1950	525	3 630
Hangar 8	1969	267	1 750
Hangar 9	1962	162	882
Hangar 10	1975	245	1 320
Hangar 11	1944	691	3 430
Hangar 14	1969	252	835
Private, smaller hangars	1978-1994	7 200	28 800
<b>Total:</b>		<b>19 917</b>	<b>143 067</b>

# Appendix 4 Alternative A



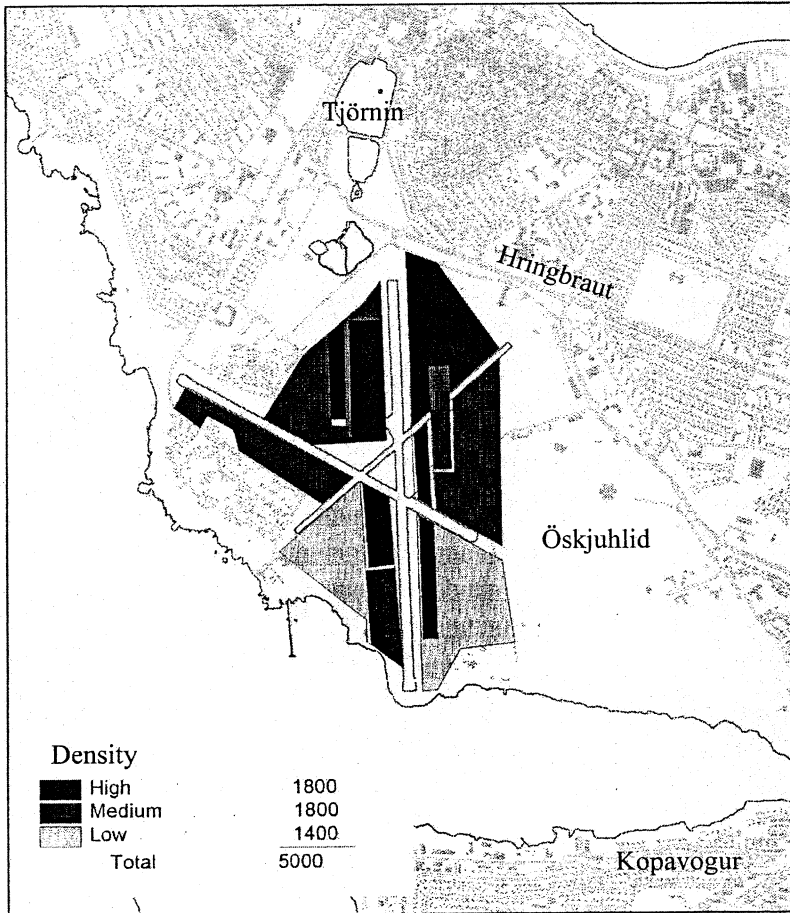
## Appendix 5 Categorisation into Building Types – Alternative A

Density	Area Size (ha)	Size (m <sup>2</sup> )	One-family houses		Apartments		Workplaces		
			Size (m <sup>2</sup> )	% of total	Size (m <sup>2</sup> )	% of total	Size (m <sup>2</sup> )	% of total	
<b>High</b>	H1	2,14	21 375	0	0,0%	2 843	10,0%	25 586	90,0%
<b>Medium-High</b>	MH1	15,30	153 000	0	0,0%	103 275	21,0%	34 425	7,0%
	MH2	38,99	389 925	0	0,0%	263 199	54,0%	87 733	18,0%
<b>Total</b>		54,29	542 925	0	0,0%	366 474	75,0%	122 158	25,0%
<b>Medium</b>	M1	3,51	35 100	2 387	0,8%	19 094	6,4%	2 387	0,8%
	M2	1,15	11 475	780	0,3%	6 242	2,4%	780	0,3%
	M3	37,69	376 875	25 628	8,9%	205 020	71,2%	25 628	8,9%
<b>Total</b>		42,35	423 450	28 795	10,0%	230 357	80,0%	28 795	10,0%
<b>Low</b>	L1	6,05	60 525	21 789	6,8%	5 810	1,8%	1 453	0,5%
	L2	9,32	93 150	33 534	11,3%	8 942	3,0%	2 236	0,8%
	L3	41,87	418 725	150 741	49,5%	40 198	13,2%	10 049	3,3%
	L4	0,72	7 200	2 592	0,8%	691	0,2%	173	0,1%
	L5	3,15	31 500	11 340	3,8%	3 024	1,0%	756	0,3%
	L6	1,35	13 500	4 860	1,5%	1 296	0,4%	324	0,1%
	L7	1,35	13 500	4 860	1,5%	1 296	0,4%	324	0,1%
<b>Total</b>		63,81	638 100	229 716	75,0%	61 258	20,0%	15 314	5,0%
<b>Green areas</b>		14,59	145 913	0	0,0%	0	0,0%	0	0,0%
<b>Total</b>		177,18	1 771 763	258 511		660 932		191 853	

## Continuation of Categorisation into Building Types – Alternative A

Density	One-family houses		Apartments		Workplaces	
	No. of houses	No. of inhab.	No. of apt.	No. of inhab.	No. of workplaces	No. of inhab.
1,33	0	0	28	68		1 279
0,90	0	0	1 033	2 479		1 721
0,90	0	0	2 632	6 317		4 387
	0	0	3 665	8 795		6 108
0,68	13	32	191	458		119
0,68	4	10	62	150		39
0,68	142	342	2 050	4 920		1 281
	160	384	2 304	5 529		1 440
0,48	121	291	58	139		73
0,48	186	447	89	215		112
0,48	837	2 010	402	965		502
0,48	14	35	7	17		9
0,48	63	151	30	73		38
0,48	27	65	13	31		16
0,48	27	65	13	31		16
	1 276	3 063	613	1 470		766
0	0	0	0	0		0
	1 436	3 447	6 609	15 862		9 593

## Appendix 6 Alternative B



## Appendix 7 Categorisation into Building Types – Alternative B

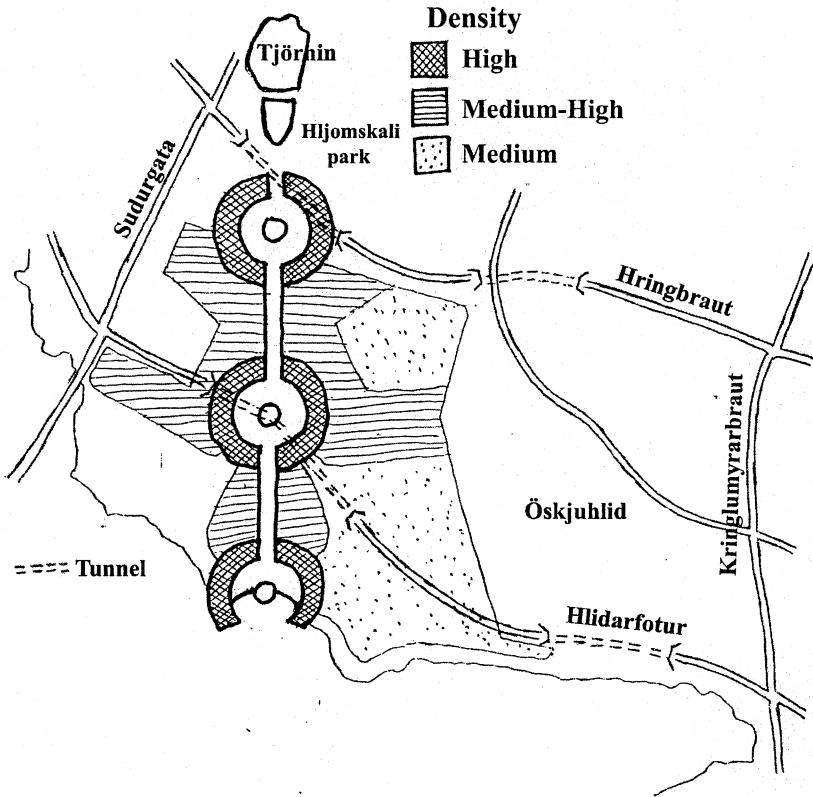
Density	Area Size (ha)	Size (m <sup>2</sup> )	One-family houses		Apartments		
			Size (m <sup>2</sup> )	% of dwellings	Size (m <sup>2</sup> )	% of dwellings	
<b>High</b>							
	H1	15,36	153 634	0	0,0%	90 000	50,0%
	H2	1,91	19 081	0	0,0%	10 800	6,0%
	H3	3,17	31 733	0	0,0%	18 000	10,0%
	H4	2,51	25 106	0	0,0%	14 400	8,0%
	H5	7,87	78 724	0	0,0%	46 800	26,0%
	<b>Total</b>	<b>30,83</b>	<b>308 278</b>	<b>0</b>	<b>0,0%</b>	<b>180 000</b>	<b>100,0%</b>
<b>Medium</b>							
	M1	3,34	33 365	1 814	0,6%	13 392	7,4%
	M2	12,58	125 819	7 031	2,2%	51 894	28,8%
	M3	3,28	32 762	1 814	0,6%	13 392	7,4%
	M4	4,20	41 992	2 268	0,7%	16 740	9,3%
	M5	8,26	82 598	4 536	1,4%	33 480	18,6%
	M6	9,45	94 467	5 184	1,6%	38 502	21,4%
	<b>Total</b>	<b>41,10</b>	<b>411 002</b>	<b>22 648</b>	<b>7,0%</b>	<b>167 400</b>	<b>93,0%</b>
<b>Low</b>							
	L1	21,61	216 073	29 232	11,6%	64 960	46,4% *
	L2	16,03	160 286	21 168	8,4%	47 040	33,6%
	<b>Total</b>	<b>37,64</b>	<b>376 360</b>	<b>50 400</b>	<b>20,0%</b>	<b>112 000</b>	<b>80,0%</b>
<b>Green areas</b>							
		32,17	321 712	0	0,0%	0	0,0%
<b>Total</b>		141,74	1 417 352	73 048		459 400	



Continuation of Categorisation into Building Types – Alternative B

Size (m <sup>2</sup> )	Workplaces		One-family houses		Apartments		Workplaces	
	% of whole area	Density/m <sup>2</sup>	No. of houses	No. of inhab.	No. of apt.	No. of inhab.	No. of workplaces	No. of workplaces
11 700	30,0%	0,66	0	0	900	2 160	975	
1 404	3,6%	0,64	0	0	108	259	117	
2 340	6,0%	0,64	0	0	180	432	195	
1 872	4,8%	0,65	0	0	144	346	156	
6 084	15,6%	0,67	0	0	468	1 123	507	
<b>23 400</b>	<b>60,0%</b>		<b>0</b>	<b>0</b>	<b>1 800</b>	<b>4 320</b>	<b>1 950</b>	
1 464	2,4%	0,50	10	24	134	321	244	
5 673	9,3%	0,51	39	94	519	1 245	946	
1 464	2,4%	0,51	10	24	134	321	244	
1 830	3,0%	0,50	13	30	167	402	305	
3 660	6,0%	0,50	25	60	335	804	610	
4 209	6,9%	0,51	29	69	385	924	702	
<b>18 300</b>	<b>30,0%</b>		<b>126</b>	<b>302</b>	<b>1 674</b>	<b>4 018</b>	<b>3 050</b>	
0	0,0%	0,44	162	390	650	1 559	0	
0	0,0%	0,43	118	282	470	1 129	0	
<b>0</b>	<b>0,0%</b>		<b>280</b>	<b>672</b>	<b>1 120</b>	<b>2 688</b>	<b>0</b>	
0	0,0%	0	0	0	0	0	0	
<b>41 700</b>			<b>406</b>	<b>974</b>	<b>4 594</b>	<b>11 026</b>	<b>5 000</b>	

## Appendix 8 Alternative C



## Appendix 9 Categorisation into Building Types – Alternative C

Density	Area	Size (ha)	Size (m <sup>2</sup> )	One-family houses	Apartments	Workplaces
				Size (m <sup>2</sup> ) % of whole area	Size (m <sup>2</sup> ) % of whole area	Size (m <sup>2</sup> ) % of whole area
High	H1	6,34	63 428	0	47 951	31 967
	H2	6,34	63 428	0	47 951	31 967
	H3	4,23	42 285	0	31 967	21 312
	H4	4,23	42 285	0	31 967	21 312
	H5	6,34	63 428	0	47 951	31 967
	H6	6,34	63 428	0	47 951	31 967
<b>Total</b>		<b>33,83</b>	<b>338 280</b>	<b>0</b>	<b>255 740</b>	<b>170 493</b>
Medium-High	MH1	28,32	283 205	0	216 652	38 233
	MH2	5,60	56 032	0	42 864	7 564
	MH3	5,64	56 370	0	43 123	7 610
	MH4	24,48	244 779	0	187 256	33 045
<b>Total</b>		<b>64,04</b>	<b>640 386</b>	<b>0</b>	<b>489 895</b>	<b>86 452</b>
Medium	M1	15,98	159 800	0	97 159	5 114
	M2	52,75	527 476	0	320 706	16 879
<b>Total</b>		<b>68,73</b>	<b>687 277</b>	<b>0</b>	<b>417 864</b>	<b>21 993</b>
Green areas		<b>25,38</b>	<b>253 803</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Total</b>		<b>191,97</b>	<b>1 919 747</b>	<b>0</b>	<b>1 163 500</b>	<b>278 938</b>

## Continuation of Categorisation into Building Types – Alternative C

Density	One-family houses		Apartments		Workplaces	
	No. of houses	No. of inhab.	No. of apt.	No. of inhab.	No. of workplaces	No. of workplaces
1,26	0	0	480	1 151		1 598
1,26	0	0	480	1 151		1 598
1,26	0	0	320	767		1 066
1,26	0	0	320	767		1 066
1,26	0	0	480	1 151		1 598
1,26	0	0	480	1 151		1 598
	<b>0</b>	<b>0</b>	<b>2 557</b>	<b>6 138</b>		<b>8 525</b>
0,90	0	0	2 167	5 200		1 912
0,90	0	0	429	1 029		378
0,90	0	0	431	1 035		380
0,90	0	0	1 873	4 494		1 652
	<b>0</b>	<b>0</b>	<b>4 899</b>	<b>11 757</b>		<b>4 323</b>
0,64	0	0	972	2 332		256
0,64	0	0	3 207	7 697		844
	<b>0</b>	<b>0</b>	<b>4 179</b>	<b>10 029</b>		<b>1 100</b>
<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>		<b>0</b>
	<b>0</b>	<b>0</b>	<b>11 635</b>	<b>27 924</b>		<b>13 947</b>

## Appendix 10 Air Transportation and Safety Issues

	Benefits	Drawbacks
<b>Zero (airport stays)</b>	<ul style="list-style-type: none"> <li>- Good domestic air connections to Reykjavik and Kopavogur.</li> <li>- Advantages for ambulance flights, close to two hospitals.</li> </ul>	<ul style="list-style-type: none"> <li>- Limited growth possibilities for the airport.</li> <li>- Flight corridors over densely populated areas, with much noise and air pollution and other health hazards in the vicinity of people.</li> </ul>
<b>Alternative A</b>	<ul style="list-style-type: none"> <li>- No noise or air pollution and other health hazards from flight corridors over densely populated areas.</li> </ul>	<ul style="list-style-type: none"> <li>- Construction of a totally new airport with all infrastructures. Land has to be bought, and the location causes limitations to other land uses.</li> <li>- Inferior air service for Reykjavik, Kopavogur and Mosfellsbær.</li> <li>- Inferior ambulance flight connections, but helicopter services could reduce this drawback.</li> </ul>
<b>Alternative B</b>	- Same as Alternative A.	- Same as Alternative A.
<b>Alternative C</b>	<ul style="list-style-type: none"> <li>- Good air connections to Reykjavik, Kopavogur, Bessastadahreppur, Gardabær and Hafnarfjörður.</li> <li>- Good ambulance flights, close to two hospitals.</li> <li>- Approaches to runways mostly over water, which results in less risk, less noise pollution and less air pollution in the vicinity of inhabited areas.</li> <li>- Gives the opportunity for the airport be expanded into an international airport.</li> </ul>	<ul style="list-style-type: none"> <li>- Inferior air service to Mosfellsbær.</li> <li>- Rather expensive landfill has to be constructed, probably more expensive than buying land south of Hafnarfjörður.</li> <li>- Higher salinity, in bad weather due to waves, than at the present airport.</li> <li>- Ice formation on runways, which can be remedied with heating of the western parts of the runways.</li> </ul>

## Appendix 11 Planning Development in the Capital Area

	Benefits	Drawbacks
<b>Zero (airport stays)</b>	<ul style="list-style-type: none"> <li>- Air Transport Centre close to the Old City Centre.</li> </ul>	<ul style="list-style-type: none"> <li>- Cuts the east and west of Reykjavík apart, thus creating a vacuum in the city structure.</li> <li>- Expensive area taken up by an activity that creates low revenues.</li> <li>- Limits outdoor activities in the surroundings.</li> <li>- Prevents an extension of the Old City Centre</li> <li>- Extended north-south runway to the south, into the Skerjafjörður (if carried out) limits sailing, shipping and recreation along the coast and hinders sea currents.</li> </ul>
<b>Alternative A</b>	<ul style="list-style-type: none"> <li>- Creates an opportunity to strengthen the central function of Reykjavík, moving today's City Centre closer to the geographical centre of the Capital Area.</li> <li>- Creates a needed space for extension for the City Centre and creates a supporting area for the Old City Centre, which is now in a process of decline.</li> <li>- Adds 41 ha to Regional Plan 2024 airport area.</li> </ul>	<ul style="list-style-type: none"> <li>- Creates more traffic, which results in an extension of the main road network.</li> </ul>
<b>Alternative B</b>	<ul style="list-style-type: none"> <li>- Same as Alternative A, except for the extended land area.</li> </ul>	<ul style="list-style-type: none"> <li>- Same as Alternative A.</li> </ul>
<b>Alternative C</b>	<ul style="list-style-type: none"> <li>- Same as Alternative A, except that it adds 51 ha to Regional Plan 2024 airport area.</li> <li>- Air Transport Centre close to the old and new City Centre, and also to the Alftanes peninsula.</li> </ul>	<ul style="list-style-type: none"> <li>- Same as Alternative A.</li> <li>- Limits sailing and shipping activities in the Skerjafjörður and hinders sea currents.</li> </ul>

## Appendix 12 Tourism and Transportation

	Benefits	Drawbacks
<b>Zero (airport stays)</b>	<ul style="list-style-type: none"> <li>- Good location for tourists staying at hotels in Reykjavik, which strengthens the City Centre.</li> <li>- Good for domestic travelers, especially officials going to meetings in the City Centre.</li> </ul>	<ul style="list-style-type: none"> <li>- No integration of domestic and international flights (except Faroe Islands and Greenland flights).</li> </ul>
<b>Alternative A</b>	<ul style="list-style-type: none"> <li>- A new city centre with hotels, shops and restaurants will attract tourists.</li> </ul>	<ul style="list-style-type: none"> <li>- Longer transportation distance for air travelers to Reykjavik City Centre and hotels in Reykjavik.</li> <li>- Longer distance to meeting places for officials from rural areas.</li> </ul>
<b>Alternative B</b>	<ul style="list-style-type: none"> <li>- Same as Alternative A.</li> </ul>	<ul style="list-style-type: none"> <li>- Same as Alternative A.</li> </ul>
<b>Alternative C</b>	<ul style="list-style-type: none"> <li>- Same as Alternative A.</li> <li>- Similar to Zero.</li> <li>- If an international airport is constructed, there will be a high integration of domestic and international flights.</li> </ul>	<ul style="list-style-type: none"> <li>- If an international airport is not constructed, then same as Zero.</li> </ul>

## Appendix 13 Calculations Regarding Alternative A when the Outskirts are Subtracted

Density	Area	One-family houses		Apartments		Workplaces		
		Size (sq. ft.)	% of whole area	Size (sq. ft.)	% of whole area	Size (sq. ft.)	% of whole area	
<b>High</b>	H1	1,07	0	0,0%	1 421	10,0%	12 793	90,0%
<b>Medium-High</b>	MH1	15,30	0	0,0%	103 275	21,0%	34 425	7,0%
	MH2	29,24	0	0,0%	197 400	54,0%	65 800	18,0%
<b>Total</b>		44,54	0	0,0%	300 675	75,0%	100 225	25,0%
<b>Medium</b>	M1	3,51	2 387	0,8%	19 094	6,4%	2 387	0,8%
	M2	1,15	780	0,3%	6 242	2,4%	780	0,3%
	M3	33,92	23 065	8,9%	184 518	71,2%	23 065	8,9%
<b>Total</b>		38,58	26 232	10,0%	209 855	80,0%	26 232	10,0%
<b>Low</b>	L1	6,05	21 789	6,8%	5 810	1,8%	1 453	0,5%
	L2	5,59	20 120	11,3%	5 365	3,0%	1 341	0,8%
	L3	29,31	105 519	49,5%	28 138	13,2%	7 035	3,3%
	L4	0,72	2 592	0,8%	691	0,2%	173	0,1%
	L5	0,00	0	3,8%	0	1,0%	0	0,3%
	L6	1,35	4 860	1,5%	1 296	0,4%	324	0,1%
	L7	0,00	0	1,5%	0	0,4%	0	0,1%
<b>Total</b>		43,02	154 880	75,0%	41 301	20,0%	10 325	5,0%
<b>Green areas</b>		14,59	0	0,0%	0	0,0%	0	0,0%
<b>Total</b>		141,80	1 418 029		553 252		149 575	



Continuation of Calculations Regarding Alternative A when the Outskirts are Subtracted

Density no.	One-family houses		Apartments		Workplaces	
	No. of houses	No. of inhab.	No. of apt.	No. of inhab.	No. of workplaces	No. of workplaces
1,33	0	0	14	34		640
0,90	0	0	1 033	2 479		1 721
0,90	0	0	1 974	4 738		3 290
	0	0	3 007	7 216		5 011
0,68	13	32	191	458		119
0,68	4	10	62	150		39
0,68	128	308	1 845	4 428		1 153
	146	350	2 099	5 037		1 312
0,48	121	291	58	139		73
0,48	112	268	54	129		67
0,48	586	1 407	281	675		352
0,48	14	35	7	17		9
0,48	0	0	0	0		0
0,48	27	65	13	31		16
0,48	0	0	0	0		0
	860	2 065	413	991		516
0	0	0	0	0		0
	1 006	2 415	5 533	13 278		7 479

Continuation of Calculations Regarding Alternative A when the Outskirts are Subtracted

Value areas	Building type	Minimum fee (Cr/m <sup>2</sup> )	Market price factor	Market price / m <sup>2</sup>	Floor-area (m <sup>2</sup> )	Market price
High	One-family	10 723	5	53 615	0	0
	Apartment	3 064	5	15 320	1 421	21 776 423
	Workplace	5 362	5	26 810	12 409	332 689 295
Medium-high	One-family	10 723	4	42 892	40 758	1 748 208 864
	Apartment	3 064	4	12 256	329 380	4 036 883 428
	Workplace	5 362	4	21 448	101 942	2 186 450 651
Medium	One-family	10 723	3	32 169	23 925	769 655 388
	Apartment	3 064	3	9 192	191 403	1 759 376 376
	Workplace	5 362	3	16 086	23 208	373 317 675
Low	One-family	10 723	2	21 446	116 428	2 496 918 856
	Apartment	3 064	2	6 128	31 048	190 259 178
	Workplace	5 362	2	10 724	7 529	80 741 239
<b>Total</b>					<b>879 452</b>	<b>13 996 277 371</b>

Buildings	Construction costs	Construction costs + 10%	Price of the buildings	Net profit on buildings for the City
One-Family houses	20 828	22 911	24 056	1 146
Apartments	47 026	51 729	54 316	2 586
Offices	12 093	13 302	13 968	665
Shopping centres	7 479	8 227	8 638	411
<b>Total</b>	<b>87 426</b>	<b>96 169</b>	<b>100 977</b>	<b>4 808</b>

## Appendix 14 Calculations Regarding Alternative C when the Outskirts are Subtracted

Density	Area		One-family houses		Apartments		Workplaces		
	Size (ha)	Size (m)	Size (m <sup>2</sup> )	% of total area	Size (m <sup>2</sup> )	% of total area	Size (m <sup>2</sup> )	% of total area	
<b>High</b>	H1	1,90	19 028	0	0,0%	14 385	6,0%	9 590	4,0%
	H2	6,34	63 428	0	0,0%	47 951	19,8%	31 967	13,2%
	H3	3,17	31 714	0	0,0%	23 976	10,2%	15 984	6,8%
	H4	1,27	12 686	0	0,0%	9 590	4,2%	6 393	2,8%
	H5	6,34	63 428	0	0,0%	47 951	19,8%	31 967	13,2%
	H6	0,00	0	0	0,0%	0	0,0%	0	0,0%
<b>Total</b>	<b>19,03</b>	<b>190 283</b>	<b>0</b>	<b>0,0%</b>	<b>143 854</b>	<b>60,0%</b>	<b>95 902</b>	<b>40,0%</b>	
<b>Medium-High</b>	MH1	25,49	254 885	0	0,0%	194 987	43,4%	34 409	7,7%
	MH2	5,60	56 032	0	0,0%	42 864	9,4%	7 564	1,7%
	MH3	5,64	56 370	0	0,0%	43 123	9,4%	7 610	1,7%
	MH4	13,46	134 628	0	0,0%	102 991	23,0%	18 175	4,1%
<b>Total</b>	<b>50,19</b>	<b>501 915</b>	<b>0</b>	<b>0,0%</b>	<b>383 965</b>	<b>85,0%</b>	<b>67 759</b>	<b>15,0%</b>	
<b>Medium</b>	M1	8,79	87 890	0	0,0%	53 437	21,9%	2 812	1,2%
	M2	44,84	448 355	0	0,0%	272 600	73,2%	14 347	3,9%
<b>Total</b>	<b>53,62</b>	<b>536 245</b>	<b>0</b>	<b>0,0%</b>	<b>326 037</b>	<b>95,0%</b>	<b>17 160</b>	<b>5,0%</b>	
<b>Green areas</b>	<b>19,04</b>	<b>190 352</b>	<b>0</b>	<b>0,0%</b>	<b>0</b>	<b>0,0%</b>	<b>0</b>	<b>0,0%</b>	
<b>Total</b>	<b>141,88</b>	<b>1 418 795</b>	<b>0</b>		<b>853 856</b>		<b>180 821</b>		

Continuation of Calculations Regarding Alternative C when the Outskirts are Subtracted

Density/ro	One-family houses		Apartments		Workplaces	
	No. of houses	No. of inhab.	No. of apt.	No. of inhab.	No. of workplaces	No. of workplaces
1,26	0	0	144	345		480
1,26	0	0	480	1 151		1 598
1,26	0	0	240	575		799
1,26	0	0	96	230		320
1,26	0	0	480	1 151		1 598
1,26	0	0	0	0		0
	<b>0</b>	<b>0</b>	<b>1 439</b>	<b>3 452</b>		<b>4 795</b>
0,90	0	0	1 950	4 680		1 720
0,90	0	0	429	1 029		378
0,90	0	0	431	1 035		380
0,90	0	0	1 030	2 472		909
	<b>0</b>	<b>0</b>	<b>3 840</b>	<b>9 215</b>		<b>3 388</b>
0,64	0	0	534	1 282		141
0,64	0	0	2 726	6 542		717
	<b>0</b>	<b>0</b>	<b>3 260</b>	<b>7 825</b>		<b>858</b>
0	0	0	0	0		0
	<b>0</b>	<b>0</b>	<b>8 539</b>	<b>20 493</b>		<b>9 041</b>

Continuation of Calculations Regarding Alternative C when the Outskirts are Subtracted

Value areas	Building type	Minimum fee (Cr/m <sup>2</sup> )	Market price factor	Market price / m <sup>2</sup>	Floor-area (m <sup>2</sup> )	Market price
High	One-family	10 723	5	53 615	0	0
	Apartment	3 064	5	15 320	143 854	2 203 838 853
	Workplace	5 362	5	26 810	93 025	2 494 010 969
Medium-high	One-family	10 723	4	42 892	0	0
	Apartment	3 064	4	12 256	465 745	5 708 171 718
	Workplace	5 362	4	21 448	69 901	1 499 234 016
Medium	One-family	10 723	3	32 169	0	0
	Apartment	3 064	3	9 192	244 257	2 245 211 432
	Workplace	5 362	3	16 086	12 470	200 591 916
Low	One-family	10 723	2	21 446	0	0
	Apartment	3 064	2	6 128	0	0
	Workplace	5 362	2	10 724	0	0
<b>Total</b>						<b>14 351 058 904</b>

Buildings	Construction costs	Construction costs + 10 %	Price of the buildings	Net profit on buildings for the City
One-Family houses	0	0	0	0
Apartments	72 578	79 836	83 827	3 992
Offices	14 619	16 081	16 885	804
Shopping centres	9 041	9 945	10 442	497
<b>Total</b>	<b>96 238</b>	<b>105 862</b>	<b>111 155</b>	<b>5 293</b>