Case Study – Helsinki Airport

Introduction to the airport

Helsinki airport was originally built for the Summer Olympics in 1952. Currently, approximately 1500 companies operate at the airport providing 25000 jobs. Helsinki airport became the largest airport in Finland and the fourth busiest airport within the Nordic countries. About 90% of Finland's international air traffic pass through Helsinki Airport [1]. In 2018, the airport handled approximately 21 million passengers, including almost 18 million international passengers and 3 million domestic passengers [1]. On average, the airport handles around 350 departures a day. Two terminals include a total of 29 gates with jet bridges and 80 remote aircraft parking stands.

Runway number	Direction and code	Length [m]	Notes
1	04R / 22L	3500 m	First runway
2	15 / 33	3901 m	Direction 15 used for propeller and low visibility departures. Direction 33 only used during strong winds from northwest.
3	04L / 22R	3060 m	Introduced in 2002

Table 12.1: The overview of runways at Helsinki Airport

The airport makes use of three runways. The runway characteristics are shown in table above and an overview of the three runways is shown in Figure 12.1.

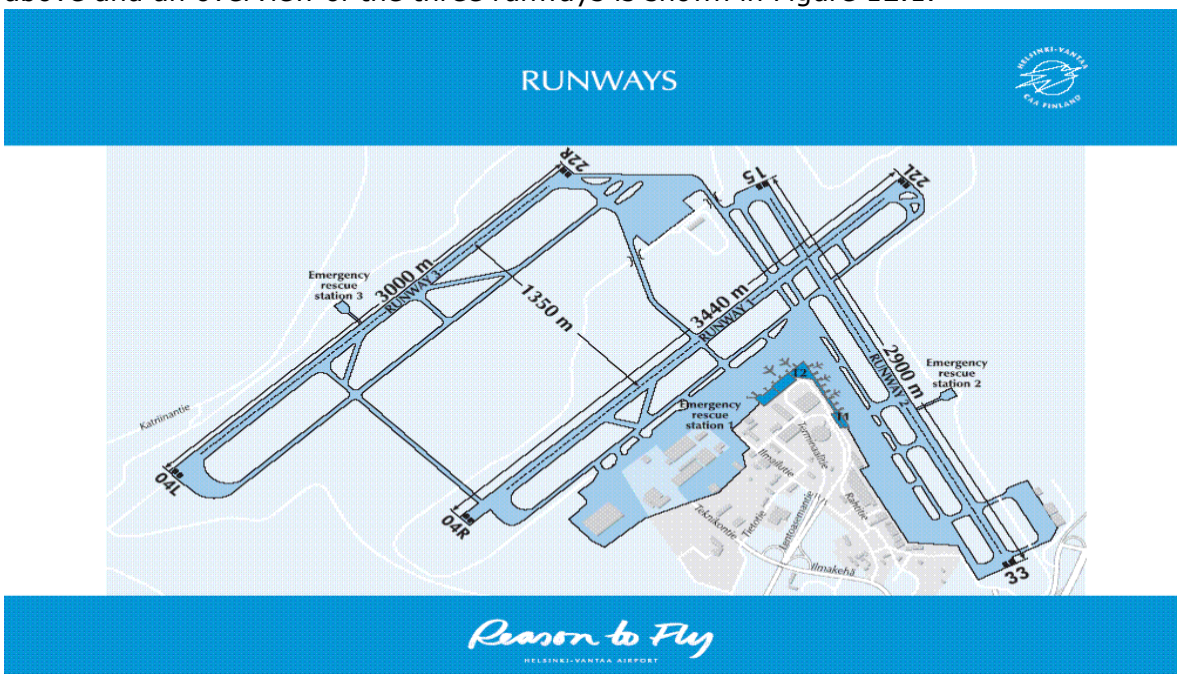

Figure 12.1: Map showing the three runways used at Helsinki Airport [3]

Approach to the Balanced Approach (BA)

a. A summary of national regulations and how these have been implemented by the airport

EU Regulation 598/2014, national Aviation Act 864/2014 and government decree 401/2016 form the regulation basis of the implementation of the Balanced Approach in Finland. Based on those regulations, the Ministry of Transport and Communications has established a working group on noise management at Helsinki Airport. The working group is led by the Finnish Transport and Communications Agency that is also the designated competent authority according to EU Regulation 598/2014. The working group is composed by the airport, Air Navigation Service Provider (ANSP), relevant ministries, environmental and aviation authorities, regional council, municipalities and major airlines. As a technical co-operation framework referred to by EU Regulation 598/2014 the Collaborative Environmental Management (CEM) working arrangement for the Helsinki Airport was established in 2018. It's formed by major airlines, ANSP and the airport.

b. Review of NAPs and previous BA interventions

In 2015, Finnish Transport Safety Agency, as the competent authority in accordance with the Directive 2002/30/EC, decided on noise-related operating restrictions at Helsinki Airport. Operating restrictions had been requested by an application submitted on the basis of the environmental permit requirement. In its decision, the Finnish Transport Safety Agency rejected to impose any noise-related operating restrictions at Helsinki Airport, as it could not find any ground for them for the time being. The process involved establishment of the noise management objective for the airport and none of the proposed operational restrictions were found necessary for achieving the objective.

Previous Balanced Approach interventions included Continuous Descent Operation implementation and continuous monitoring of the performance, NADP1 implementation for runway 22L departures, departure route design minimising the noise impact on residential areas and noise level restrictions on certain departure routes. In 2017, effective noise abatement strategies for high-weight aircraft were applied in the same way as for low-weight aircraft. The regulations are in line with the International Civil Aviation Organisation's (ICAO) recommendations (Chapter 14). The overall goal is a reduction of the total land area exposed to aircraft noise by 2%. In other words, 500,000 people will no longer be included within the noise zones [4].

Different cooperation with the land-use planners were undertaken to look closely at the population density around the airport. Departure tracks have been fine-tuned according to the geography and location of suburbs. This has been stepwise implemented during the past 15 years and is meanwhile well optimised. Finavia maintains effective cooperation with Vantaa's local government, which has led to a consensus forming on route-planning and runway use.

The runway usage preference principle includes approximately 20 different combinations. The primarily preferred runway for landings is runway 2 (15) from the northwest. Depending on weather and capacity conditions runway 1 (22L) is used from the southwest. For wind conditions from the north or east, runway 3 (04L) or runway 1 (04R) are typically used for landings. Take-offs are made from Runway 1 (04R) in north-eastern direction. The runway usage during the night-time differs and certain combinations are avoided. Restrictions include jet airplane landings on runway 2 (33) from the southeast and take-offs from runway 2 (15) towards the northeast. Landings are primarily carried out on runway 2 (15) from the northwest. For take-offs runway 3 (22R) is used towards the southwest. The airport is located close to a large rural tract to

the north, which it can use for night-time approaches, orienting flights away from the suburbs of the capital to the south.
Airspace and Standard Instrumental Departure changes as well as the NADP1 implementation were published in the Aeronautical Information Publication (AIP) and taken into use in accordance with the Aeronautical Information Regulation and Control (AIRAC) system.

c. Identification of any trends and overarching processes and internal systems that underpin Balanced Approach implementation
A noise area forecast has been included in the Helsinki Region Land-Use Master Plan defining housing restrictions in noise areas. CEM working arrangement promotes active co-operation of the major airlines and ANSP to find operationally feasible solutions to further improve arrival and departure procedures supporting the noise management. Noise charges and other economic incentives were implemented to encourage avoiding night-time operations and supporting the use of quieter aircraft types.

Introduction to the intervention
Implementing an increased amount of departures at the runway RWY-22L was complex and brought several concerns. One concern was that using the runway RWY-22L more intensively causes more air traffic to fly over noise-sensitive residential areas. Therefore, the noise level-based departure procedure (by ICAO) Noise Abatement Departure Procedure (NADP1) was introduced to prevent more intensive noise exposure for the residents. This implies that the airplanes climb higher with constant speed before acceleration is applied. This means that airplanes are flying slower but at the higher altitude. The result is a lower noise level due to a higher flight altitude. The altitude difference between NADP1 and Finavia's ("Baseline") regular procedure is schematically sketched in Figure 12.2.

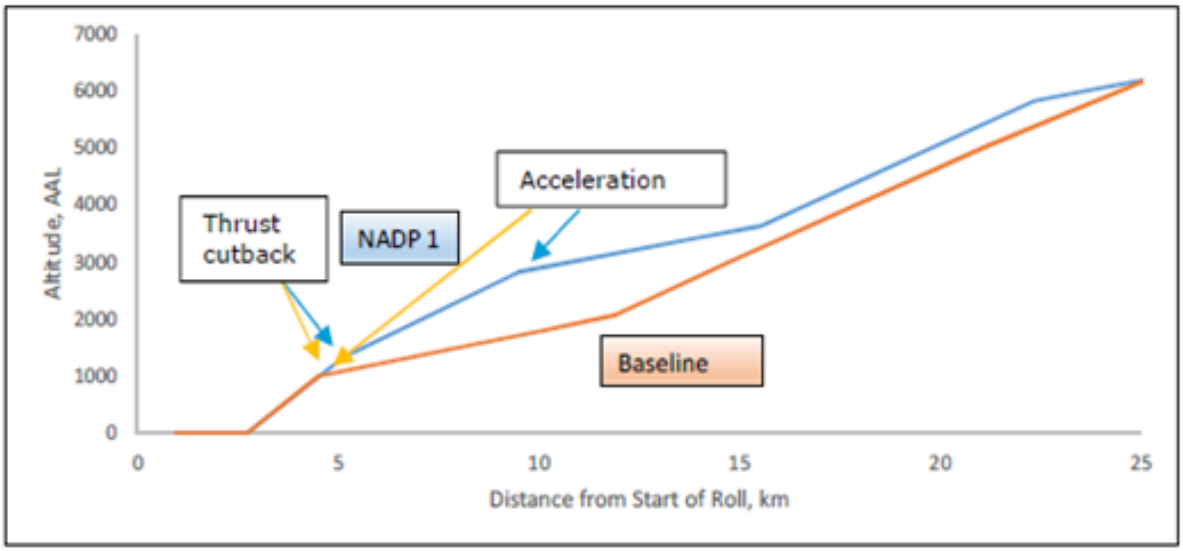

Figure 12.2: The NADP1 procedure enabled a reduction of the noise level due to higher flight altitude and longer noise attenuation distances

Delve into the processes behind the case

a. Identification of the 'need'
The departure demand at Helsinki Airport increased during the last years. It was foreseen that the usage of the primary departure runway RWY-22R would reach its limits

especially during the afternoon peak hours between 16:00 h and 18:00 h. Figure 12.3 shows the most typical runway configurations at Helsinki Airport.

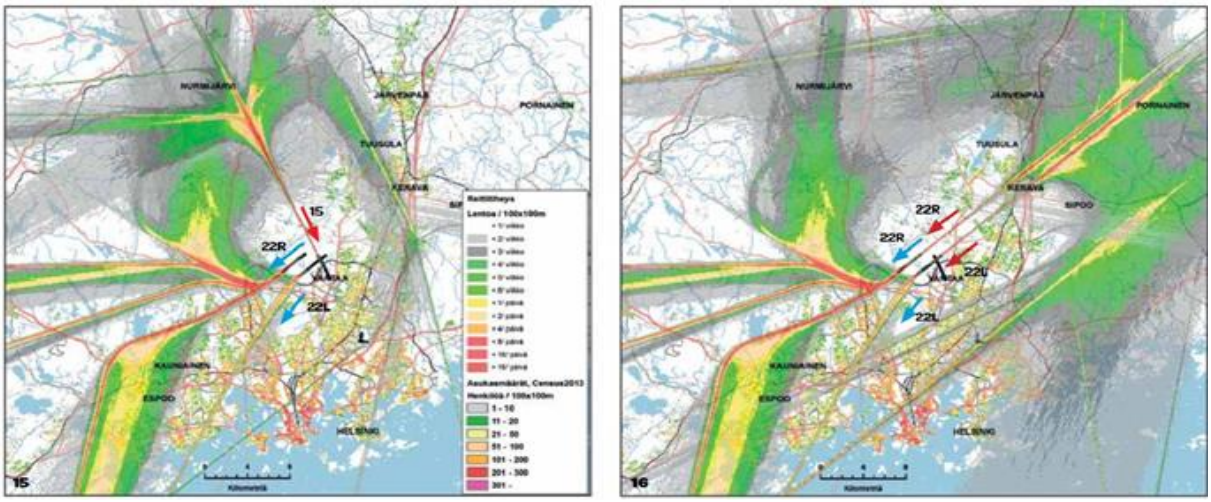

Figure 12.3: Typical runway configurations at Helsinki Airport

An additional departure runway was required to handle the increased capacity of aircraft departures. One possible solution to increase the departure capacity was to use runway RWY-22L more intensively within the already implemented noise restrictions. Until April 2018, only one exit point (DOBAN) was used for the traffic to the south. Increased airplane traffic from RWY-22L that fulfilled the security requirements was enabled by splitting the DOBAN exit point into two separate exit points (KOIVU and VALOX), as shown in Figure 12.4.

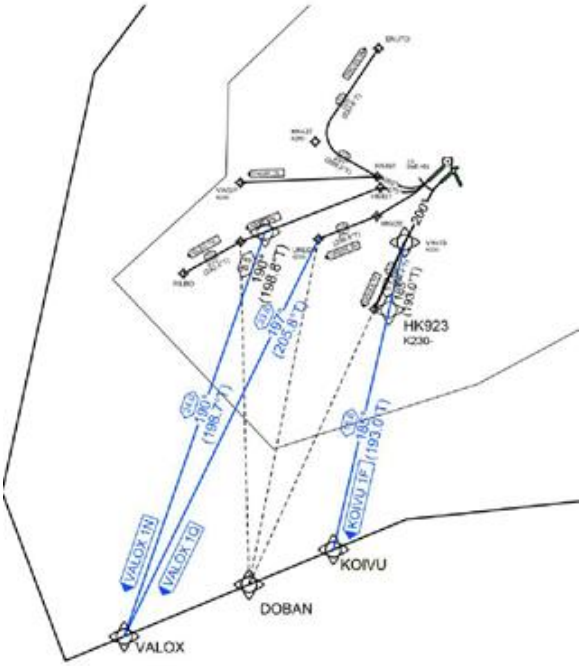

Figure 12.4: Splitting the DOBAN exit point into the two separate exit points VALOX and KOIVU

b. The design of options

There was only one option to increase the flight capacity and it was using the runway RWY-22L. The NADP1 departure procedure was chosen since it appeared as the best solution for the populated areas.

c. The selection of the intervention
It was expected that the runway RWY-22L would be used more intensively in the future due to the increased air traffic demands. The Integrated Noise Model (INM) was used to calculate the estimated noise abatement for the usage of runway RWY-22L. A flight profile was created for the changed departure procedure. The estimated noise levels for departures using runway RWY-22L were compared with the estimated noise levels for the NADP1 departure procedure. A reduction in maximum noise levels (L_{max}) was expected based on the calculations. Measurements proved that the application of the NADP1 departure procedure resulted in a reduction of the L_{max} levels of approximately 3 dB. Summing up, the results for decision making were less noise exposure and emissions, less taxi time and air time.

Implementation
The airspace was changed by replacing the exit point DOBAN with two new exit points KOIVU and VALOX. In the same context, the Standard Instrument Departure (SID) route was adjusted to better avoid certain residential areas. The traffic flows are further managed by Estonian Air Navigation Service Provider (ANSP) by using the Route Availability Document (RAD). The airspace changes were planned and implemented in cooperation between ANS Finland (Finnish ANSP), EANS (Estonian ANSP) and Finavia. The RAD was updated by Estonian ANSP as the traffic flows towards south proceed to Estonian airspace after leaving the Terminal Manoeuvring Area (TMA). The gradual traffic increase from RWY-22L was enabled by splitting the DOBAN exit point to KOIVU and VALOX points, as shown in Table 12.2.

Post-Implementation evaluation.
A post-implementation evaluation was not carried out. The comparison of multiple track flight departure profiles between Finavia's regular used departure procedure and NADP1 in practise is shown in Figure 12.5. For NADP1, the aircraft is required to climb with constant speed to a higher altitude before acceleration (green circle) as compared to Finavia's regular procedure (red circle). Reduction of noise levels was enabled because the attenuation distance is longer for an aircraft flying at higher altitude.

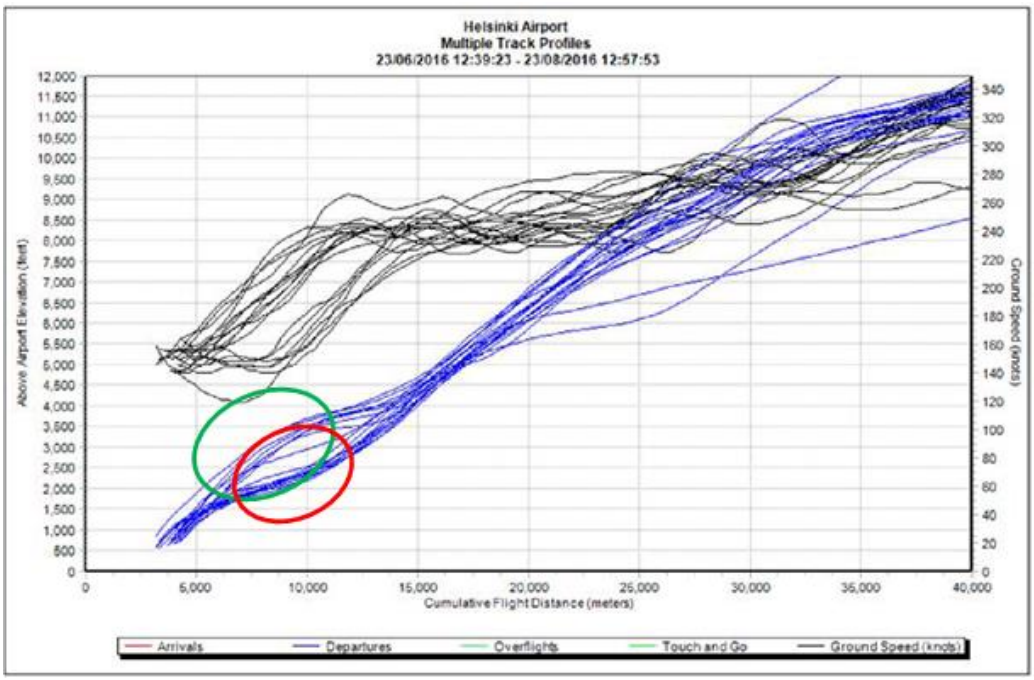

Figure 12.5: Departure profile comparison between commonly used departure procedure and NADP1

Noise measurements at the Runway RWY-22L confirmed the reduction of noise levels by applying NADP1 as compared to the commonly used departure procedure. In Table 12.2, the measured maximum noise levels (LA_{max}) are shown for the commonly used aircraft types.

Airplane type	**Commonly used departure procedure**		**NADP1**		**Delta dB**
	LA_{max}	Movements n	LA_{max}	Movements n	
A319	74.6	37	71.3	10	-3.3
A320	75.3	33	73.4	9	-1.9
A321	75.8	13	72.5	3	-3.3

Table 12.2: Measured LA_{max} noise levels for the airplane types A319, A320 and A321 for varying amounts of air traffic movements

Summary (of the whole airport case)

Departures were split up between RWY-22L and RWY-22R. This led to fuel, time and emission savings due to shorter taxi and flight route distance. The safety and capacity situation at Helsinki Airport improved due to divided traffic flow. The noise exposure was reduced by applying the NADP1 departure procedure. The greatest difficulty was the actual implementation of the changed operational procedure. The avionics data houses did not recognise the changes at the time when the implementation became applicable. The consequence of that was that the implementation of cockpit charts took extra time

and effort. Finavia implemented a note into their flight preparation software to specify departures from the RWY-22L runway.

The overall perception of the benefit of the intervention was positive and worth the effort for the airport and the airlines. There was only a small number of noise related complaints from the nearby residential community. The increased number of flight operations has not significantly increased the annoyance of air traffic noise.

References:

[1] Helsinki Airport is designed for smooth travelling (2016). Finavia
[2] Helsinki Airport Runway 22L departures noise management (2018). Finavia
[3] Helsinki Airport Information - https://helsinkiairport.org/#/searchcars
[4] A balanced approach to noise abatement Helsinki and Lisbon (2016). Futureairport: http://www.futureairport.com/features/featurea-balanced-approach-to-noise-abatement-helsinki-and-lisbon-5724240/