

6	302	LUXEMBURG	930
AZ	419	TURIN	935
LH	1122	NEAPEL	935
LH	1906	MADRID	935
LH	1022	STUTTGART HBF	935
AF	1701	LYON	940
AY	822	HELSINKI	940
AA	071	STANFORD-DALLAS	945
AF	743	PARIS	945
LH	1118	VENEZIG	945
DL	023	DALLAS	950
6	892	AMSTERDAM	950

23.171.27 • August 2023

## Balanced Approach study Schiphol Airport

### *Addendum*

## **Balanced Approach study Schiphol Airport**

Addendum

### **Report**

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The Hague, August 2023

## Summary

The Dutch Ministry of Infrastructure and Water Management (IenW) has commissioned To70 to update the Balanced Approach study report (our reference 22.171.20<sup>1</sup>) with input collected from the public consultation that was conducted by IenW from March 15<sup>th</sup> till June 15<sup>th</sup>. Which information has been assessed, what changes are made to the study and what the most cost effective (combination of) measure(s) is to meet the noise abatement objectives is part of this addendum. This summary provides an overview of the main results.

Two combinations have been made, which contain the most cost-effective measures to meet the noise abatement objectives:

Pillar	Combination A	Combination B
Reduce noise at source	Use of quieter aircraft during nighttime period	Use of quieter aircraft during nighttime period
Noise abatement operational procedures	Minimize the use of the secondary runways	Minimize the use of the secondary runways
Operating restrictions	Cap the number of movements during the nighttime to 28,700 movements	Cap the number of movements during the nighttime to 27,000 movements
	Cap the number of annual movements to 452,500 movements	Cap the number of annual movements to 462,500 movements

The reduction in terms of noise exposure of the proposed combinations have been calculated, resulting in the following reductions compared to the baseline scenario:

Measure	Number of highly annoyed people within 48 dB(A) $L_{den}$	Number of houses within 58 dB(A) $L_{den}$	Number of severely sleep disturbed people within 40 dB(A) $L_{night}$	Number of houses within 48 dB(A) $L_{night}$
Noise abatement objective	-20% (-15%)	-20% (-15%)	-15%	-15%
Combination A	-15.9%	-17.3%	-15.0%	-18.9%
Combination B	-15.7%	-16.9%	-21.9%	-26.5%

<sup>1</sup> [https://www.internetconsultatie.nl/balanced\\_approach\\_schiphol/document/11061](https://www.internetconsultatie.nl/balanced_approach_schiphol/document/11061)

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## 1 Introduction

### 1.1 Introduction

The Dutch Ministry of Infrastructure and Water Management (IenW) has commissioned To70 to update the Balanced Approach study report (our reference 22.171.20<sup>2</sup>) with input collected from the public consultation that was conducted by IenW from March 15<sup>th</sup> till June 15<sup>th</sup>. This update includes the assessment and processing of new insights, implementation reviews by Air Traffic Control the Netherlands (LVNL), Schiphol Airport and the Human Environment and Transport Inspectorate (ILT), alternative measures and changes to the noise abatement objective.

### 1.2 Research question

IenW has commissioned To70 to update the Balanced Approach study report based on the outcome of the consultation phase. The update includes:

- Reassessment of the selection criteria;
- Reassessment of the autonomous development used in the baseline scenario;
- Reassessment of existing measures on the shortlist based on the noise abatement objectives, updated selection criteria, implementation reviews by Air Traffic Control the Netherlands (LVNL), Schiphol Airport and the Human Environment and Transport Inspectorate (ILT) and input gathered from the stakeholders and general public in the public consultation;
- Assessment of new measures gathered from the stakeholders and general public in the public consultation;
- Establishing a new shortlist of measures including the reassessment of the selection criteria, reassessment of the existing measures and assessment of new measures;
- Calculation of the most cost effective (combination of) measure(s) to meet the noise abatement objectives.

### 1.3 Scope and assumptions

- IenW has provided (parts of) the responses to the public consultation that needed to be assessed in this update. To70 has had no direct access to all responses to the public consultation or say which information should or shouldn't be processed in this update;
- To70 was tasked by IenW to develop combinations that would result in a reduction of (about) -15% for the Lden noise abatement objectives instead of the 20% in the initial study;
- This update has been performed in line with the same methodology and tools as used in the Balanced Approach study report (our reference 22.171.20);
- This research is performed in close parallel with research performed by Decisio and Beelining about the cost-effectiveness of the (combination of) measures to meet the noise abatement objectives.

### 1.4 Reading guide

It is advisable to read this addendum alongside the Balanced Approach study report (our reference 22.171.20). Chapter 2 provides an overview of the changes that we're made to the noise abatement objectives, the reassessment of the selection criteria and the reassessment of the autonomous

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<sup>2</sup> [https://www.internetconsultatie.nl/balanced\\_approach\\_schiphol/document/11061](https://www.internetconsultatie.nl/balanced_approach_schiphol/document/11061)

development used in the baseline scenario. Chapter 3 contains the reassessment of existing measures, assessment of new measures and the resulting (new) shortlist of measures. Chapter 4 closes of this addendum with the calculation of the most cost effective (combination of) measure(s) to meet the noise abatement objectives.



## 2 Updates and reassessments

### 2.1 Noise abatement objectives

lenW has decided to keep the noise abatement objectives for the 48 dB(A)  $L_{den}$  and 58 dB(A)  $L_{den}$  at -20%, but to aim for -15% and thus leaving room to realize promising alternative measures after November 2024. This decision is based on all the alternative measures that were shared with lenW during the consultation phase. More information about the noise abatement objectives can be found in the notification document drafted by lenW. Based on this decision, To70 was tasked by lenW to develop combinations that would result in a reduction of (about) -15% for the number of highly annoyed people within the 48 dB(A)  $L_{den}$  and the number of houses within the 58 dB(A)  $L_{den}$ . Table 1 provides an overview of the noise abatement objectives.

**Table 1 - noise abatement objectives**

Criteria related to the noise abatement objective	Baseline scenario figure	Noise abatement objective
Number of houses within the 58 dB(A) $L_{den}$ contour	7,081	-20% (-15%)
Number of highly annoyed people within the 48 dB(A) $L_{den}$ contour	113,862	-20% (-15%)
Number of houses within the 48 dB(A) $L_{night}$ contour	5,685	-15%
Number of severely sleep disturbed people within the 40 dB(A) $L_{night}$ contour	24,365	-15%

### 2.2 Reassessment of the selection criteria

The interpretation of some of the selection criteria (see paragraph 4.2 of the To70 Balanced Approach study report 22.171.20) were reassessed based on the input that was collected during the consultation phase. The following selection criteria were reassessed:

- Achievability → effect of the measure should be achieved by November 2024 (introduction noise reduction target);
- Distribution of nuisance → the measure shouldn't have the sole purpose to shift nuisance to other areas around the airport.

#### 2.2.1 Achievability

Some comments were made and there was some unclarity about the exact definition of the achievability selection criteria. It was unclear if the measure should be achievable by november 2024 or in the year surrounding november 2024 (e.g. a year including the IATA winter season 24/25 and summer 25). As already mentioned in paragraph 4.2 of the To70 Balanced Approach study report 22.171.20, the measure should be implemented and the full impact should be noticeable by november 2024.

After reassessing all the measures with this definition, it was concluded that measures M1 (Stimulate use of quieter aircraft through revision of airport charges) was not achievable. It is not achievable since the

effect of changed airport charges are noticeable from April 2025 and onwards. This means that measure M1 was removed from the shortlist.

### **2.2.2 Distribution of nuisance**

Some comments were made about the definition of the 'distribution of nuisance' selection criteria. It was unclear why some changes in runway use were not scored as negative on this selection criteria. The foundation of this selection criteria is preferential runway system that is in place at Schiphol Airport. The primary runways (runway 18R/36L and runway 06/24) are the preferred runways due to the fact that the least amount of people are situated in the extension of these runways. The secondary runways (09/27, 18L/36R and 18C/36C) are used once there is for more capacity (exceeding the capacity of a single runway) or under specific circumstances (adverse weather conditions, maintenance, etc.).

A measure scores negative on this selection criteria if noise exposure (and associated nuisance) is transferred from one secondary runway to the other secondary runway. A measure that decreases the use of secondary runways and subsequently increases the use of the primary runways is in line with the noise preferential runway use system and therefore scores positive on this selection criteria.

After reassessing all the measures with this definition, it was concluded that measure M8 (Partial closure of runway 09/27 during specific weather conditions) does not meet this selection criteria. Increased use of runway 18C/36C and 18L/36R were observed compensating for the decreased use of runway 09/27. This was part of the reason that measure M8 was removed from the shortlist.

## **2.3 Reassessment of the autonomous development**

Some comments were placed on the assumptions related to the autonomous development. The autonomous development is part of the baseline scenario (which corresponds to the situation in november 2024). The autonomous development (see paragraph 3.2 of the To70 Balanced Approach study report 22.171.20) that were part of the baseline scenario are the following:

- A continuation of fleet renewal, by 0.1 dB for landings and 0.2 dB for take-offs, to match the situation in november 2024;
- Increased arrival runway capacity as a result of the implementation of RECAT-EU;
- Increased use of CDA procedures for specific runway combinations;
- Increased use of reduced flaps operations.

Comments were made on the expected fleet renewal by november 2024 and the assumed increased use of CDA procedures for specific runway combinations.

### **2.3.1 Fleet renewal**

More than 100 airlines operate from and to Schiphol Airport. Most of those airlines are renewing their fleet, but for most airlines it is unknown if and how new aircraft will fly to and from Schiphol Airport. Given this fact, fleet renewal is and has been forecasted based on historic trends for Schiphol Airport. For this research, it was assumed that the historic trends for Schiphol Airport (-0.1 dB for landings and -0.2 dB for take-offs) were accurate enough to forecast the situation in november 2024. Some comments were made about the validity of this assumption.



To verify whether this assumption was correct, we received detailed fleet renewal plans ( ) for the period until December 2025<sup>3</sup>. To check the expected impact of fleet renewal until 2024, we performed a sensitivity analysis by calculating three scenarios with the detailed fleet renewal plans ( ) until November 2024. In all three scenarios we continued to use the historic trend of Schiphol Airport (-0.1 dB for landings and -0.2 dB for take-offs correction for all other airlines) to see whether the expected fleet renewal ( ) is exceeding/lacking behind the historic trend for Schiphol Airport. The results indicate that fleet renewal ( ) until November 2024 is in line with the historic trend of -0.1 dB for landings and -0.2 dB for take-offs and not significantly exceeding or lacking compared to the historic trend. It was therefore concluded that this trend is accurate enough for the purpose of this study.

### **2.3.2 Increased use of CDA procedures**

Some comments were made whether it is accurate to assume an increase in CDA procedures by November 2024 in the baseline scenario. This assumption is based on the information from the Dutch Airspace Redesign program at the time of establishing the autonomous developments (starting in november 2022). Based on the forecasts by that time, CDAs were selected as the preferred procedure for arrivals on runway 18C and 06 during 2+1 runway use (where flight profile data was available) to simulate the development taking place to increase the use of CDAs.

It is unclear how much increased use of CDAs is going to be achieved by November 2024, but an increase may be expected. It is assumed that the original assumption (CDAs selected as the preferred procedure for arrivals on runway 18C and 06 during 2+1 runway use) is valid for the purpose of this study. The main reason for this is that the assumption has been taken into account for all (combination) of measures and that the impact of this assumption does not play a significant role in this study.

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<sup>3</sup> It was indicated to To70 that the fleet renewal plans are commercially sensitive and may not be disclosed in any way or form.

### 3 Reassessment of measures

#### 3.1 Reassessment of existing measures

The longlist of existing measures (see appendix B of the To70 Balanced Approach study report 22.171.20) was reassessed based on the noise abatement objectives, the reassessment of some of the selection criteria and the implementation reviews by LVNL, Schiphol Airport and ILT. The following changes can be observed:

- Some measures have a different score on the Achievability and Distribution of nuisance selection criteria due to the new definition of these selection criteria;
- Some noise abatement operational procedures have received different scores based on the implementation reviews and viewings from LVNL, Schiphol Airport and ILT.

The measures 'Extension of the current night regime (M7)' and 'Partial closure of runway 09/27 (Buitenveldertbaan) during specific weather conditions (M8)' were removed from the shortlist based on the conclusions in the implementation review by LVNL. Measure M7 will result in continuous disruptions during the day as a result of decreasing capacity in the early morning. This results in operational instability and therefore affects the 'reliability of the operation' selection criteria. LVNL concluded that implementing measure M8 will not bear any change to the current operation, since runway 09/27 is only being used when there are clear operational reasons to do so. This means that measure M8 will not result in a reduction of noise exposure once implemented. This measure was therefore removed from the shortlist since it also received a negative score on the 'distribution of nuisance' selection criteria.

Appendix A provides an updated overview of the longlist of measures and the scores per measures.

#### 3.2 Assessment of new measures

The consultation phase has generated a number of new measures that were eligible for assessment. The following new measures were included in the assessment:

- Fleet renewal (on top of autonomous development);
- Use of quieter aircraft during nighttime period;
- Optimization of current procedures (specifically increasing the use of the 800ft NADP2 variant);
- Night curfew (no scheduled arrivals from 00:00 – 05:00 and departures from 00:00 – 06:00) and maximum number of movements during nighttime at 22,000;
- A ban on the noisiest aircraft;
- A ban on private jets and business aviation.

##### 3.2.1 Fleet renewal

The expected fleet renewal until November 2024 has been reassessed as part of the autonomous development in the baseline scenario (see paragraph 2.3.1). There is no indication that the fleet renewal until November 2024 is exceeding the rate of the historic trends at Schiphol Airport. Therefore, fleet renewal (on top of the autonomous development) has been added to the longlist of measures, but has failed to meet the shortlist.

### 3.2.2 Use of quieter aircraft during nighttime period

A measure was proposed to shift some of the noisier wide body aircraft from the nighttime period to the daytime period and use quieter aircraft during the nighttime period. This measure is based on input [REDACTED] (which substitutions they can do before November 2024) and contains two elements:

- Shift wide-body aircraft movements during nighttime to the daytime period and fill that slot with a narrow-body aircraft during nighttime;
- Replacing a noisier wide-body aircraft with a less-noisy wide-body aircraft, [REDACTED]. This noisier aircraft will be replaced from a daytime movement.

This measure has a two-fold effect: the  $L_{den}$  penalty for the nighttime movements (10x penalty) is now applied to a (quieter) aircraft instead of a (noisier) wide-body aircraft.

This measure meets the selection criteria and has therefore been added to the shortlist of measures and the impact has been calculated as part of the new combinations of measures. Roughly 10,000 movements will be changed as a result of this measure.

### 3.2.3 Increased use of NADP2 800ft acceleration height variant

Currently, the majority of the airlines use the NADP2 as the departure procedure at Schiphol Airport. There are multiple NADP2 variants, which differ in acceleration height. In general, an NADP2 is flown by accelerating at 1500ft, 1000ft or 800ft. The NADP2 variant with the acceleration height at 800ft has the lowest noise exposure (when looking at the noise exposure in total), but does concentrate the noise exposure closer to the airport. A measure to make this NADP2 800ft a standard procedure for multiple (Schiphol Airport based) airlines was suggested. It was also mentioned that this measure could be implemented before November 2024 in the operating procedures of the airlines. This measure was already part of a measure from the initial study, which was called 'Optimization of current procedures'. The measure received neutral scores for several selection criteria, since it was unclear if these measures were enforceable since airlines select their preferred NADP2 variant. In consultation with IenW, it was determined to not include this measure as part of the shortlist given that there are uncertainties about how to enforce this measure and that it will result in a different distribution of nuisance (increasing noise exposure at some locations closer to the airport).

### 3.2.4 Night curfew and cap number of movements during nighttime

A measure was proposed by the Royal Schiphol Group to introduce a night curfew, no scheduled arrivals from 00:00 – 05:00 and no scheduled departures from 00:00 – 06:00, and cap the number of movements during nighttime to 22,000. This measure would significantly exceed the  $L_{night}$  noise abatement objectives, since it was already concluded that restriction the number of nighttime movements below 27,000 movements is not required to meet these objectives. Further reducing the number of movements during the night below 25,000 will also result in a negative score on the 'Quality of the network' selection criteria. See 4.4.4 of the To70 Balanced Approach study report 22.171.20 for more information about the sources behind nighttime capacity restrictions. This measure has been added to the longlist of measures, but has failed to meet the shortlist due to the negative score on the 'Quality of the network' selection criteria.

### 3.2.5 A ban on the noisiest aircraft

Banning aircraft with a poor noise performance is already made possible through EU regulation 598/2014. Currently, Chapter 3 aircrafts with a cumulative margin of less than 10 EPNdB can be banned based on this regulation. Schiphol Airport proposed a measure to further extend this to ban more aircrafts with a poor noise performance. The proposed measure focuses on aircrafts with a cumulative margin lower than 12 EPNdB that operate in the daytime and 13 EPNdB during nighttime. This measure is also implemented at other airports and would require a Balanced Approach procedure by itself to implement. In consultation with lenW, it was determined to not include this measure as part of the shortlist given that a separate Balanced Approach procedure would be required to install this measure.

### 3.2.6 A ban on private jets and business aviation

Schiphol Airport has put forward a measure that focuses on banning private jets and business aviation. In the initial study, the impact of general aviation and business aviation is incorporated in the results by applying a 2.5% correction throughout the entire noise grid. Therefore, it is currently not possible to accurately determine the impact of this measure in our model. Furthermore, this measure receives a negative score for the 'Achievability' selection criteria since it is unclear whether this measure can be implemented and if legal incorporation can take place before November 2024. In consultation with lenW, it was determined to not include this measure as part of the shortlist given that it would require to remodel all the scenarios to more accurately incorporate the general aviation and business aviation and that it is unclear whether this measure can be implemented before November 2024.

## 3.3 New shortlist of measures

The reassessment of the existing measures and the assessment of the new measures has resulted in a new shortlist. The updated shortlist of measures is presented in Table 2.

**Table 2 - updated shortlist of measures**

Pillar	Measure	Safety	Achievability In 2024	Accordance with legislation	Quality of the network	Reliability of operation	Distribution of nuisance	Emissions	Modelling
Reduce noise at source	Use of quieter aircraft during night time period	+	+	+	+	+	+	+	+
Noise abatement operational procedures	Minimize the use of the secondary runways	+	0	+	+	0	+	+	+
Operating restrictions	Cap the number of annual movements	+	+	0	0	0	+	+	+
	Cap the number of movements during the night time	+	+	+	0	0	+	+	+

With the updated shortlist, the most cost-effective combination of measures can be determined. The impact of these combination of measures have been calculated and the results are presented in chapter 4.



## 4 Combination of measures to meet noise abatement objectives

### 4.1 Combination of measures from the shortlist

Combinations of measures are made based on the philosophy of the Balanced Approach, starting with measures from the 'Reduce noise at source' pillar and moving down to the last pillar 'operating restrictions'. Since the shortlist of measures only contains two measures from the first three pillars, these measures are always part of any combination. To meet the noise abatement objectives, two combinations were made which are described in Table 3.

**Table 3 - proposed combinations of measures**

Pillar	Combination A	Combination B
Reduce noise at source	Use of quieter aircraft during nighttime period	Use of quieter aircraft during nighttime period
Noise abatement operational procedures	Minimize the use of the secondary runways	Minimize the use of the secondary runways
Operating restrictions	Cap the number of movements during the nighttime to meet the $L_{night}$ noise abatement objectives	Cap the number of movements during the nighttime to 27,000 movements
	Cap the number of annual movements to meet the $L_{den}$ noise abatement objectives	Cap the number of annual movements to meet the $L_{den}$ noise abatement objectives

The following steps were followed to calculate the impact of the combinations:

1. As a first step, the two measures from pillar 'Reduce noise at source' and 'Noise abatement operational procedures' were implemented on the baseline scenario;
2. After step 1 was completed, it was concluded that all noise abatement objectives were not met and that capacity reduction measures from the 'Operating restrictions' pillar needed to be used to meet the noise abatement objectives;
3. For combination A, an analysis was performed to accurately determine the required capacity reduction during the nighttime to meet the  $L_{night}$  noise abatement objectives. After this step was completed, the additional daytime capacity reduction was determined (as accurately as possible) to also meet the  $L_{den}$  noise abatement objectives;
4. For combination B, lenW requested to also calculate the required overall capacity reduction if the nighttime capacity was reduce to 27,000 movements. Reducing the nighttime capacity to 27,000 movements results in meeting the  $L_{night}$  noise abatement objectives. The additional daytime capacity reduction was determined (as accurately as possible) to also meet the  $L_{den}$  noise abatement objectives.

Table 4 contains an overview of the resulting measures that are part of the two combinations, which both meet all the noise abatement objectives.



**Table 4 - resulting combinations of measures**

Pillar	Combination A	Combination B
Reduce noise at source	Use of quieter aircraft during nighttime period	Use of quieter aircraft during nighttime period
Noise abatement operational procedures	Minimize the use of the secondary runways	Minimize the use of the secondary runways
Operating restrictions	Cap the number of movements during the nighttime to 28,700 movements	Cap the number of movements during the nighttime to 27,000 movements
	Cap the number of annual movements to 452,500 movements	Cap the number of annual movements to 462,500 movements

#### 4.2 Results of combinations of measures

Table 5 contains an overview of the reduction per combination of measures compared to the baseline scenario. The noise abatement objective per criteria is also displayed in the table. The results of the combinations using the END criteria are presented in Appendix B

**Table 5 - overview results of combination of measures**

Measure	Number of highly annoyed people within 48 dB(A) $L_{den}$	Number of houses within 58 dB(A) $L_{den}$	Number of severely sleep disturbed people within 40 dB(A) $L_{night}$	Number of houses within 48 dB(A) $L_{night}$
Noise abatement objective	-20% (-15%)	-20% (-15%)	-15%	-15%
Combination A	-15.9% (0.9%)	-17.3% (2.3%)	-15.0% (0%)	-18.9% (3.9%)
Combination B	-15.7% (0.7%)	-16.9% (1.9%)	-21.9% (6.9%)	-26.5% (11.5%)

The results lead to the following observations:

- In combination A, it can be concluded that the  $L_{night}$  noise abatement objective related to the number of severely sleep disturbed people within the 40 dB(A)  $L_{night}$  contour is more stringent than the noise abatement objective related to number of houses within 48 dB(A)  $L_{night}$ . This results in an overshoot of 3.9% on the noise abatement objective related to number of houses within 48 dB(A)  $L_{night}$ ;
- In combination A, it can be concluded that reducing the capacity 452.500 movements per year (in combination with the three other measures) results in meeting both  $L_{den}$  noise abatement objectives, with 0,7% margin on the noise abatement objective related to number of highly annoyed people within 48 dB(A)  $L_{den}$ ;
- In combination B, it can be concluded that the  $L_{night}$  noise abatement objectives are met with some margin by reducing the capacity to 27,000 during nighttime;
- In combination B, it can be concluded that reducing the capacity 462.500 movements per year (in combination with the three other measures) results in meeting both  $L_{den}$  noise abatement objectives, with 0,9% margin on the noise abatement objective related to number of highly annoyed people within 48 dB(A)  $L_{den}$ .

## A Appendix A – Update scores of longlist measures

An update was made to the scoreboard of the longlist of measures (see appendix B of the To70 Balanced Approach study report 22.171.20). Changes compared to previous longlist are highlighted in the table. If the measure meets the selection criteria, it is awarded a '+'. If the measure fails to meet the selection criteria it is awarded a '-'. If it wasn't clear whether the selection criteria is met or not, a neutral score was awarded (o). A measure is selected for the shortlist if all selection criteria received a positive or neutral score. A neutral score at the safety and/or modelling selection criteria also excludes the measure from a pass to the shortlist.

Pillar	Measure	Safety	Achievability in 2024	Accordance with legislation	Quality of the network	Reliability of operation	Distribution of nuisance	Emissions	Modelling
Reduce noise at source	Stimulate use of quieter aircraft through financial instrument (including airport charges)	+	-	+	+	+	+	+	+
	Stimulate use of quieter aircraft through noise performance monitoring	+	O	+	+	+	+	+	-
	Stimulate noise reducing retrofitting aircraft (winglets, engine exhaust modifications, etc.)	+	O	+	+	+	+	+	O
	Fleet renewal (on top of autonomous development)	+	O	+	+	+	+	+	+
	Use of quieter aircraft during night time period	+	+	+	+	+	+	+	+
Land-use planning and management	Insulation (conventional insulation, noise cancelling windows, etc.)	+	-	+	+	+	+	+	-
	Expropriation	+	-	+	+	+	+	+	-
	Building conditions and restrictions (including noise adaptive building programs)	+	+	+	+	+	+	+	-
	Change function of buildings (conversion of offices to homes and vice versa)	+	-	+	+	+	+	+	-
Noise abatement operational procedures	Increase the number of continuous decent approaches (on top of autonomous development)	+	-	+	+	+	+	+	+
	Increase the number of aircraft performing N-1 taxi operations / taxibot taxi operations	+	-	+	+	+	+	+	-
	Route optimizations to reduce overall number of highly annoyed people	+	-	+	+	O	+	+	O
	Optimization of current procedures (minimize level segments, optimize climb-out speed, change acceleration height, intersection take-offs, reduced thrust take-off, etc.)	O	O	+	+	O	O	O	O
	Introduction of new procedures (including RNP-AR approaches during parallel approaches)	+	-	+	+	+	+	+	O

Pillar	Measure	Safety	Achievability in 2024	Accordance with legislation	Quality of the network	Reliability of operation	Distribution of nuisance	Emissions	Modelling
	Increase concentration of flightpaths to minimize overall noise exposure	+	-	+	+	0	+	0	0
	Extend the night regime using the primary runways (both in the evening and during early morning)	+	+	+	-	-	+	+	+
	Runway closure (full runway closure or during specific circumstances)	+	+	+	+	0	-	+	+
	Increase runway capacity (on top of autonomous development)	+	-	+	+	+	+	+	+
	Increase crosswind and tailwind limits for runway selection process	0	0	+	+	0	+	+	0
	Minimize the use of the secondary runways	+	0	+	+	0	+	+	+
Operating restrictions	Introduce a ban on noisy aircraft (overall or during specific times of the day)	+	+	-	+	+	+	+	+
	Cap the number of annual movements (e.g. Dutch cabinet decision to reduce number of movements to 440,000)	+	+	0 <sup>4</sup>	0	0	+	+	+
	Cap the number of movements during the night time	+	+	+	0	0	+	+	+
	Curfew/nighttime closure	+	+	+	-	-	+	+	+
	Additional slot criteria	+	-	-	0	+	+	+	-
	Night curfew (no scheduled arrivals from 00:00 – 05:00 and departures from 00:00 – 06:00) and maximum number of movements during nighttime at 22,000	+	+	+	-	+	+	+	+
	Ban aircraft with cumulative margin lower than 12 EPNdB during daytime and 13 EPNdB during nighttime	+	+	-	0	+	+	+	+
Ban private jets	+	-	+	+	+	+	+	0	

<sup>4</sup> This balanced approach procedure is part of the trajectory to determine whether the proposed capacity is most cost-effective, hence the neutral score

## B Appendix B – EU Directive 2002/49/EC (END) criteria

This annex contains the impact of the combinations for the following EU Directive 2002/49/EC (END) criteria:

- Number of highly annoyed people within the 55 dB(A)  $L_{den}$  contour
- Number of houses within the 55 dB(A)  $L_{den}$  contour
- Number of severely sleep disturbed people within the 50 dB(A)  $L_{night}$  contour
- Number of houses within the 50 dB(A)  $L_{night}$  contour

Measure or combination	Reduction compared to the baseline scenario			
	Number of highly annoyed people within 55 dB(A) $L_{den}$	Number of houses within 55 dB(A) $L_{den}$	Number of severely sleep disturbed people within 50 dB(A) $L_{night}$	Number of houses within 50 dB(A) $L_{night}$
Baseline scenario	18,193	19,860	1,393	2,648
Combinations				
Combination A	14,050 (-22.8%)	15,164 (-23.6%)	709 (-49.1%)	1,408 (-46.8%)
Combination B	14,133 (-22.3%)	15,248 (-23.2%)	562 (-59.6%)	1,094 (-58.7%)