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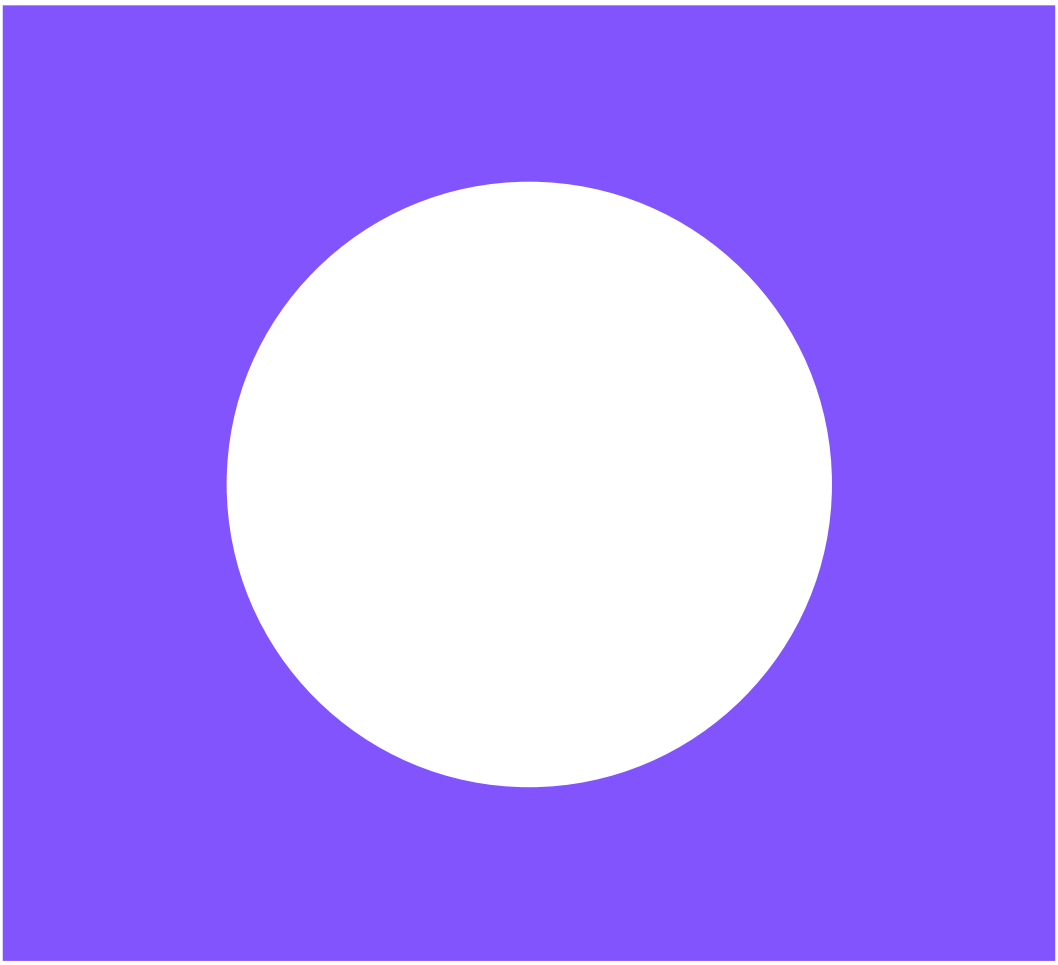

Almaty International Airport

Environmental and Social Impact Assessment Report - Chapter 11

September 2025

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Almaty International Airport

Environmental and Social Impact Assessment Report - Chapter 11

September 2025

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Contents

Tables

Figures

Acronyms and abbreviations

Abbreviation / Acronym	Definition
AoI	Area of Influence
AP	Assessment Point
APU	Auxiliary Power Unit
BAKAD	Big Almaty Ring Road
CDO	Continuous Descent Operations
CFA	Continuous Flight Auger
EBRD	European Bank for Reconstruction and Development
ECAC	European Civil Aviation Conference
EHS	Environmental, Health, and Safety
ESIA	Environmental and Social Impact Assessment
EU	European Union
GPU	Ground Power Unit
GSE	Ground Support Equipment
ICAO	International Civil Aviation Organization
IFC	International Finance Corporation
Lday	Daytime Equivalent Continuous Sound Level
Lnight	Night-time Equivalent Continuous Sound Level
LTO	Landing and Take-Off
PPV	Peak Particle Velocity
VdB	Vibration decibels
WHO	World Health Organization

11 Noise

11.1 Introduction

11.1.1 This chapter of the Environmental and Social Impact Assessment (ESIA) reports the findings of an assessment of the likely significant environmental effects on noise and vibration as a result of the Project.

11.1.2 An assessment of likely significant effects has been undertaken for each of the sensitive receptors identified in the study area, with detailed results presented for 108 selected receptors. Where necessary, commitment to mitigation measures has been made to manage any impacts on receptors.

11.1.3 The Project is expected to result in temporary and permanent impacts including:

- Temporary noise and vibration impacts arising during construction activities
- Permanent noise impacts due to aircraft associated with:
  - Auxiliary power unit (APU) use
  - Taxiing
  - Landing and take off
  - Flight paths
  - Ground support equipment (GSE)
- Permanent changes in road traffic noise associated with increased patronage of the airport once the Project is implemented
- Temporary changes in road traffic noise associated with the transfer of materials during construction

11.1.4 The airport lies adjacent to the communities of Guldala, Tbilisskaya, Imeni, Al'merek and Turksib comprising sensitive receptors such as residential properties, educational establishments, places of worship and healthcare facilities, which are considered sensitive to noise and vibration.

11.1.5 Therefore, there is potential for noise and vibration impacts due to the Project to result in adverse effects such as annoyance, sleep disturbance and disruption to communication, which are defined by the World Health Organization (WHO) as critical health effects[1]. Consequently, it is important that potential significant adverse effects are identified so that measures to avoid them can be considered and residual significant adverse effects can be reduced to a minimum.

11.1.6 The detailed noise impact assessment and associated appendices are included in the appendix of this ESIA. This section presents a summary of the assessment findings as applied within the methodology the ESIA.

11.2 Methodology

11.2.1 To undertake the ESIA, the methodology described in section 4.7 of **ESIA Chapter 4: ESIA scope and methodology** was followed. A bespoke methodology for the assessment of noise and vibration impacts is described in the sections below.

[1] World Health Organization (1999) Guidelines for Community Noise

Applicable guidelines and standards

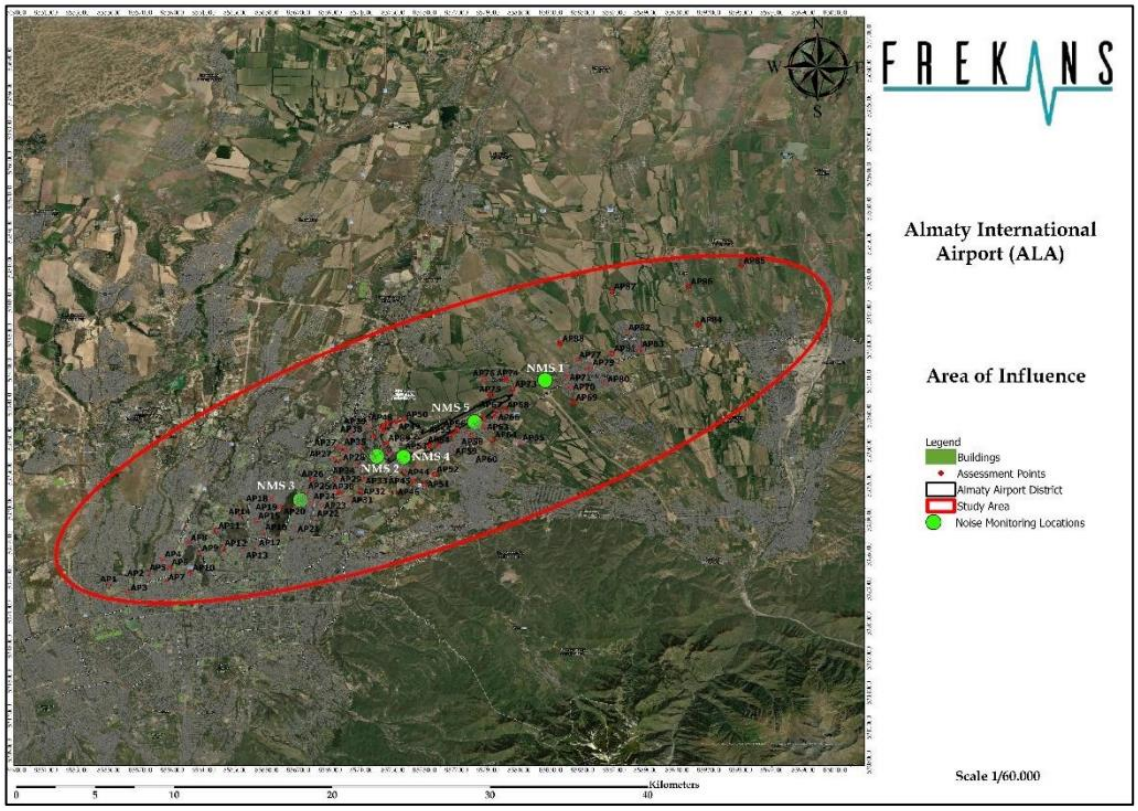
11.2.2 The assessment has been undertaken considering relevant legislation, standards, and guidance as follows:

- International Finance Corporation (IFC) (2007) Environmental, Health, and Safety (EHS) Guidelines: General Guidelines
- IFC (2007) EHS Guidelines: Airports
- IFC (2007) General EHS Guidelines: Construction and Decommissioning
- National Noise Standards of the Republic of Kazakhstan
  - MSN 2.04-03-2005: Noise protection standards
  - SNiP RK 2.04-03-2002: Construction norms and rules for noise protection
  - GOST 23337-2014: Noise limitations for construction activities
- WHO (1999) ‘Guidelines for Community Noise’
- WHO (2018) Environmental Noise Guidelines for the European Region
- International Civil Aviation Organization (ICAO) (2008) Document 9829 Guidance on the Balanced Approach to Aircraft Noise Management, Second edition. 2008
- British Standards Institution (2009+A1:2014) British Standard BS 5228 ‘Code of practice for noise and vibration control on construction and open sites – Part 1: Noise and Part 2: Vibration’
- British Standards Institution (1993) British Standard BS 7385 Evaluation and measurement for vibration in buildings - Guide to damage levels from groundborne vibration
- European Union (2014) Regulation (EU) No. 598/2014 of the European Parliament and of the Council of 16 April 2014 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach and repealing Directive 2002/30/EC
- European Civil Aviation Conference (ECAC) (2016) Document 29 Report on Standard Method of Computing Noise Contours around Civil Airports

Area of Influence for noise and vibration

11.2.3 The Area of Influence (AoI) for noise and vibration impacts due to the Project, for the purpose of identifying potential significant adverse effects, includes all areas where the noise criteria, as set out below, are predicted to be exceeded as a result of the Project. Figure 11.1 shows the AoI for the Project.

Figure 11.1: AoI for noise and vibration



Source: Frekans Acoustics

Methodological approach

11.2.4 This section of the ESIA chapter presents the methodology applied to the assessment of impacts.

11.2.5 The national noise standards of the Republic of Kazakhstan are presented in Table 11.1 and are applied to:

- Areas directly adjacent to residential buildings, recreational facilities and homes for the elderly
- Areas directly adjacent to the buildings of polyclinics (doctors' surgeries), schools and other educational institutions, kindergartens, recreation areas of residential districts, and groups of residential buildings.

Table 11.1: National noise standards of the Republic of Kazakhstan

Time	Average compound frequencies of octave bands (Hz)								Noise level dB	
	63	125	250	500	1,000	2,000	4,000	8,000	L_{Aeq}	$L_{A(max)}$
07:00 to 23:00	75	66	59	54	50	47	45	44	55	70
23:00 to 07:00	67	57	49	44	40	37	35	33	45	60

Source: National noise standards of the Republic of Kazakhstan

11.2.6 The European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy considers noise and vibration as forms of pollution with performance requirements described by the EBRD Environmental and Social Requirements. This requires that projects comply with European Union standards.

11.2.7 The IFC / World Bank Group General Performance Standards are commonly used by international lenders and apply in non-designated countries under the Equator Principles. The compliance of a project's environment impacts with the Performance Standards is assessed in accordance with the IFC and World Bank Group EHS Guidelines.

11.2.8 WHO (1999) 'Guidelines for Community Noise' provides the basis of the criteria used or referenced within standards, guidance and assessment methodologies underpinning government policy and guidance internationally. The guidelines are intended to inform the long-term management of community noise to help meet the WHO's core objective of "the attainment by all peoples of the highest possible levels of health". The key guideline values are:

- Critical health effect of serious annoyance during the daytime and evening corresponds with the guideline value of 55 dB L_{Aeq} in outdoor living areas
- Critical health effect of sleep disturbance during the night-time corresponds with the guideline value of 45 dB L_{Aeq} in outside bedrooms
- Critical health effect of hearing impairment at any time of day corresponds with the guideline value of 70 dB L_{Aeq} in industrial, commercial, shopping and traffic areas both indoors and outdoors

11.2.9 The IFC General EHS Guidelines: Environmental 'Noise management' refer to the WHO guidelines and state that noise impacts should not exceed the levels presented in Table 11.2, or result in a maximum increase in background levels of 3 dB at the nearest receptor location.

Table 11.2: WBG-IFC Noise level guidelines

Receptor	$L_{Aeq,1h}$ dB Daytime 07:00 to 22:00*	$L_{Aeq,1h}$ dB Night-time 22:00 to 07:00*
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Source: Section 1.7 Noise of the IFC / World Bank Group General EHS Environmental Guidelines
* For Almaty International Airport, the locally established regulatory time periods are 09:00-22:00 (day-time) and 22:00-09:00 (night-time). All Lday and Lnight calculations are performed using these local regulatory time periods.

11.2.10 The IFC Environmental, Health, and Safety Guidelines: Airports (2007) and the 'Construction and Decommissioning' section of the IFC General EHS Guidelines identify the main types of noise and vibration impacts and typical mitigation measures. They do not present methodologies or criteria for the assessment of noise and vibration impacts that are additional to those of the General Guidelines.

11.2.11 Regulation (EU) No 598/201477 requires the management of airport operational noise impacts in a sustainable way by the achievement of defined noise abatement objectives, efficient operation and avoiding creating competitive advantages or disadvantages. It applies to (Member State) airports with more than 50,000 civil aircraft movements per calendar year. Values referencing the Lender's advisory traffic and technical due diligence report indicate that this threshold is already exceeded by the airport.

11.2.12 Reference is made to Resolution A33/7 of the ICAO concept of the 'Balanced Approach' as a basis of sustainable noise management of airports. The measures of the 'Balanced Approach' should be applied in achieving the noise abatement objectives, and noise-related operating restrictions should only be applied where these are found not to be sufficient.

11.2.13 The Regulation requires that the noise impacts are regularly assessed including the cost effectiveness of any mitigation measures. Annex I of the Regulations outlines the approach to the assessment of operational aircraft noise associated with airports.

11.2.14 The British Standard BS 5228 (2009+A1:2014) 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise and Part 2: Vibration' provides a methodology to predict and assess temporary noise and vibration impacts arising during construction. The 'Example method 2 – 5 dB(A) change' states:

"*Noise levels generated by site activities are deemed to be potentially significant if the total noise (preconstruction ambient plus site noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB LAeq,T from site noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant effect*."

11.2.15 BS 5228 provides comprehensive guidance on the assessment of vibration due to construction activity. It considers levels of vibration from construction in terms of peak particle velocity (PPV) defined as the instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position and is expressed in millimetres per second (mm/s). BS 5228 provides guidance on the levels of vibration associated with human perception and disturbance and the onset of potential structural damage to different types of buildings.

11.2.16 Table 11.3 presents guidance on threshold values for the human perception of vibration arising during construction.

Table 11.3: BS 5228 Part 2 guidance on the human perception effects of vibration due to construction activity and significance of effect

Vibration level PPV mm/s	Effect
0.14	Vibration might be perceptible in most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3	Vibration might be just perceptible in residential environments.
1.0	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning has been given to the residents.
10.0	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

Source: BS 5228 Part 2:2009+A1:2014

11.2.17 BS 5228 Part 2:2009+A1:2014 states that low frequency vibration at a PPV of 15mm/s may cause cosmetic damage in un-reinforced or light framed structures e.g. for residential / light commercial use. BS 5228 states that vibration at a PPV of 50mm/s may cause cosmetic damage in heavy commercial buildings. These values apply to transient vibration which does not induce a resonant response in structures and low-rise buildings. A source of continuous low frequency vibration may induce a vibration response in buildings or structures at their resonant frequencies. The building would then be subject to additional dynamic forces arising from its own motion. Therefore, BS 5228 Part 2:2009+A1:2014 recommends that the values given should be reduced by 50% to take into account dynamic magnification due to resonances. Therefore, Table 11.4 summarises the criteria for assessing ground-borne vibration during construction activity in terms of potential cosmetic damage of buildings.

Table 11.4: BS 5228 Part 2 guidance on the human perception effects of vibration due to construction activity and significance of effect

Vibration level PPV mm/s	Effect
0.14	Low risk of cosmetic damage to un-reinforced or light framed structures / buildings (e.g. residential buildings)
0.3	Vibration might just be perceptible to building occupants in residential environments

Vibration level PPV mm/s	Effect
15.0 to 20.0	Onset of increased risk of cosmetic damage to unreinforced or light framed structures.

Source: BS 5228 Part 2:2009+A1:2014

11.2.18 The selected assessment criteria are summarised in Table 11.5.

Table 11.5: Comparison of noise and vibration limits and selected criteria

Receptor type	WHO	IFC EHS	Kazakhstan national	Assessment criteria applied
Operational noise				
Residential (day)	55 dB $L_{Aeq,16h}$	55 dB $L_{Aeq,1h}$	55 dB(A)	55 dB(A)
Residential night	45 dB $L_{Aeq,8h}$	45 dB $L_{Aeq,1h}$	45 dB(A)	45 dB(A)
Schools	-	-	55 dB L_{day}	55 dB L_{day}
Hospitals	-	-	45 dB L_{night}	45 dB L_{night}
Commercial/industrial	-	70 dB $L_{Aeq,1h}$	-	70 dB(A)
Construction noise				
Construction (day)	55 dB $L_{Aeq,16h}$	55 dB $L_{Aeq,1h}$	-	55 dB(A)
Vibration limits				
Residential (comfort)	-	-	-	0.3 mm/s (BS 5228-2)
Residential (damage)	-	-	-	15 to 20 mm/s (BS 5228-2)

Determining Magnitude, Sensitivity, and Impact Significance

11.2.19 The responsivity of the receptor is evaluated on the basis of the importance and the sensitivity of receptor to the impact. The responsivity is selected in accordance with the following matrix.

Table 11.6: Determination of Responsivity of Receptors

	Sensitivity			
Importance	**Negligible**	**Low**	**Medium**	**High**
Low	Low	Low	Low	Medium
Medium	Low	Low	Medium	High
High	Medium	Medium	High	High

11.2.19.1 The sensitivity of receptors is aligned with the ESIA methodology as described in **ESIA Chapter 4: ESIA scope and methodology** except that no receptors are assigned ‘Negligible’ sensitivity.

11.2.19.2 The importance is determined by the criteria given in Table 11.7.

Table 11.7: Determination of Importance of Receptors

Importance	Key criteria	Receptors
High	Legally protected or nationally designated Strong stakeholder concern High sensitivity or vulnerability Critical public service function	Hospitals Educational buildings Religious buildings
Medium	Regionally important but not legally protected Moderate sensitivity Residential use	Residential buildings

Importance	Key criteria	Receptors
Low	No formal protection Low sensitivity Limited or local economic function	Commercial buildings Workplaces Barns/stables

11.2.20 The magnitude of impacts is determined from a combination of the extent and the scale of impact, as shown in the matrix on Table 11.8. where extent is defined as:

- Single: possible noise and/or vibration impact on a single building
- Site: possible noise and/or vibration impact on 5 to 10 buildings
- Local: possible noise and/or vibration impact on 10 to 100 buildings
- Regional: possible noise and/or vibration impact on 100 to 1,000 buildings

Table 11.8: Determination of Impact Magnitude

	Scale				
Extent	**No Impact**	**Small**	**Medium**	**Large**	**Very Large**
Single	Negligible	Minor	Minor	Minor	Minor
Site	Negligible	Minor	Moderate	Moderate	Major
Local	Negligible	Moderate	Moderate	Major	Major
Regional	Negligible	Moderate	Major	Major	Major

11.2.21 The scale of noise impact is the measure of how much noise exceeds limiting values at receptor locations. It is evaluated as the exceedance level with respect to the background noise levels. This assessment uses mainly L_{day} and L_{night}.

11.2.22 The criteria to determine the magnitude of noise impact during construction and operation are detailed in Table 11.9.

Table 11.9: Scale of Magnitude of Noise Impact

Noise impact scale category	Exceedance of noise limits WBG - IFC Criteria
No Impact	<1
Small	1 to 3
Medium	3 to 5
Large	5 to 8
Very Large	>8

11.2.23 Based on the guidance given in BS 5228 Part 2:2009+A1:2014, Table 11.10 presents the criteria for assessing the magnitude of temporary construction vibration impacts on sensitive receptors.

Table 11.10: Scale of Magnitude of Construction Vibration Impact

Vibration level PPV mm/s	Category of construction vibration impact scale
<0.14	No Impact
<0.3	Small
<1	Medium
<10	Large
>10	Very Large

Limitations and assumptions

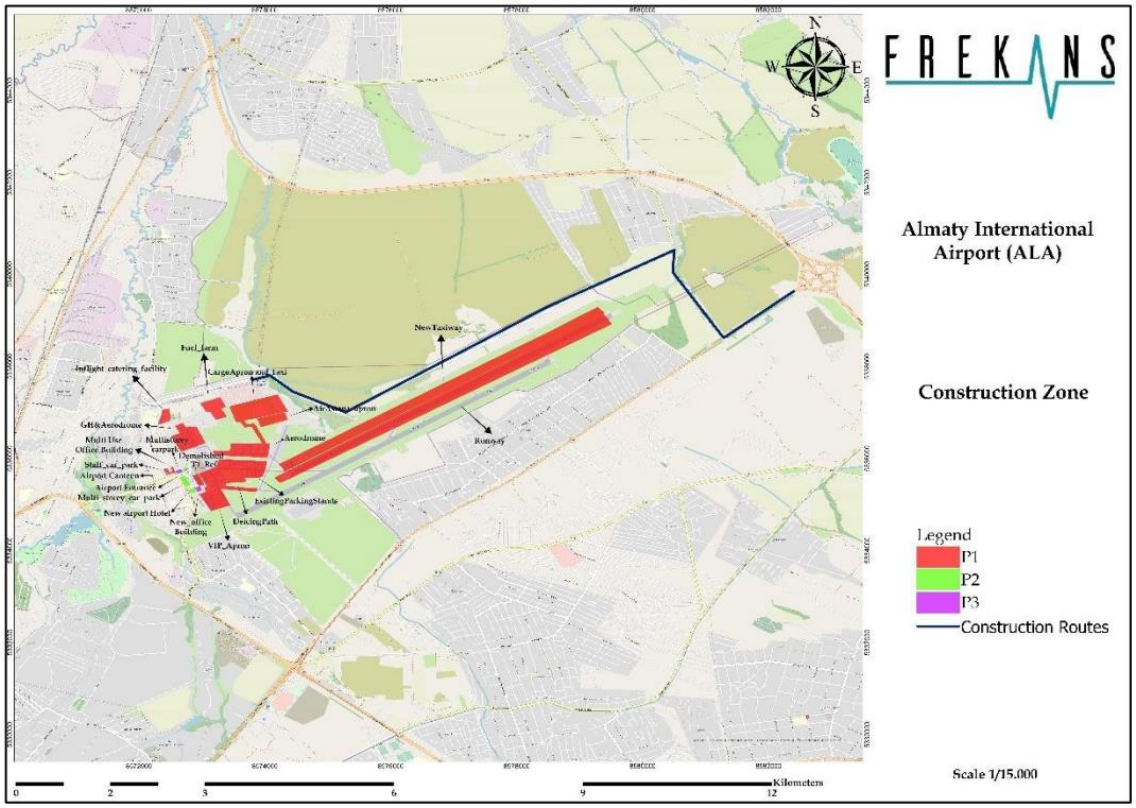
11.2.24 Construction noise predictions have been undertaken using guidance and methodology from BS 5228-1:2009+A1:2014.

11.2.25 The construction is divided on three phases:

- Phase 1 – Critical Infrastructure (2025 to 2027)
- Phase 2 - Operational Enhancement (2026 to 2028)
- Phase 3 – Supporting Infrastructure (2027 to 2030)

11.2.26 The construction areas are divided into areas, defined as ‘polygons’, as shown in Figure 6-1 of the Environmental Noise & Vibration Assessment Report prepared by Frekans Acoustics (see Figure 11.2 below).

Figure 11.2: Construction noise calculation polygons



Source: Frekans Acoustics

11.2.27 The general information on construction activities and plant are presented Table 11.11 below, which describes the main items of construction plant to be used during each phase of work and the corresponding reference sound power level (L_W), corrected from the sound pressure levels presented in BS 5228-1, and used in the noise predictions.

Table 11.11: Summary of methodology for the identification of significant effects

Activity	Plant	BS 5228 reference	L_w dB(A)
Site preparation & earthworks	Tracked excavator	BS 5228-1: Table C.1, Item 12	110
	Articulated dump truck	BS 5228-1: Table C.2, Item 33	109
	Vibratory roller	BS 5228-1: Table C.2, Item 39	102

Activity	Plant	BS 5228 reference	L_w dB(A)
	Water pump	BS 5228-1: Table C.2, Item 45	93
Foundation & piling works	Tracked excavator	BS 5228-1: Table C.1, Item 12	110
	Concrete mixer truck	BS 5228-1: Table C.4, Item 20	108
	Tubular steel piling – hydraulic hammer	BS 5228-1: Table C.3, Item 3	116
	Water pump	BS 5228-1: Table C.2, Item 45	93
Structural condition	Wheeled mobile crane	BS 5228-1: Table C.3, Item 30	98
	Concrete mixer truck	BS 5228-1: Table C.4, Item 20	108
	Water pump	BS 5228-1: Table C.2, Item 45	93
External works & utilities	Tracked excavator	BS 5228-1: Table C.1, Item 12	110
	Grader	BS 5228-1: Table C.6, Item 31	114
	Vibratory roller	BS 5228-1: Table C.2, Item 39	102
	Articulated dump truck	BS 5228-1: Table C.2, Item 33	109

11.2.28 A more detailed list of equipment used in the assessment is provided in Appendix 1 of the Environmental Noise & Vibration Assessment Report.

11.2.29 For the noise modelling, the equipment is assumed to be working in the construction polygon simultaneously and at full performance.

11.2.30 The construction vibration analysis focuses on pile driving activities, which typically generate the highest vibration levels during airport construction projects. Calculations were conducted according to the information and reference vibration levels gathered from guidance issued by the Federal Transit Administration. The reference values are presented in Table 11.12.

Table 11.12: Reference Vibration Levels of Construction Equipment

Equipment		PPV at 25 ft (in/sec)	Approximate Lv at 25 ft = 7.6 m
Pile driver (impact)	upper range	1.518	112
	typical	0.644	104
Pile driver (sonic)	upper range	0.734	105
	typical	0.170	93
Clam shovel drop (slurry wall)		0.202	94
Hydromil (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory		0.210	94
Hoe ram		0.089	87
Excavator		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

RMS velocity in decibels (VdB RE 1 micro-inch/second)

11.2.31 The reference value for impact pile driver and excavator were used in the assessment of vibration.

11.2.32 No pilling activities were reported for the multi-use office building construction.

11.2.33 Calculations and assessment procedures of construction noise and vibration are accurate in line with the accuracy and detail level of the provided information and Project documents.

11.2.34 The operational noise assessment encompasses the following components:

- Aircraft operations (Landing and Take-off (LTO) cycles)
- Ground Support Operations

11.2.35 The daytime and night-time impacts of the air traffic movements are considered under the current runway configuration (2025) and the future runway configuration based on air traffic estimations for the years 2030, 2040 and 2050.

11.2.36 The air traffic movements considered in the assessment are summarised in Table 11.13. The table also summarises the assumptions in terms of fleet composition.

Table 11.13: Air Traffic Assumptions

Assessment year	Daily aircraft movements	Fleet
2025 - Baseline	272	95.3% Chapter 4 aircraft 4.7% Chapter 3 aircraft
2030	351	95.3% Chapter 4 aircraft 4.7% Chapter 3 aircraft
2040	473	90% Chapter 4 aircraft 0.5% Chapter 3 aircraft 9.5% Chapter 14 aircraft
2050	577	70% Chapter 4 aircraft 30% Chapter 14 aircraft

11.2.37 The ground operations modelling includes APU usage and GSE operations. The APU are modelled as stationary point sources with sound power levels 105 to 115 dB(A) depending on aircraft type and an operating height of 6 to 8 metres above ground level.

11.2.38 The GSE operations are modelled as area sources. Table 11.14 summarises the noise modelling assumptions.

Table 11.14: Ground Support Equipment

Equipment type	Sound Power Level (dBA)	Usage factor
Baggage loaders	98 to 105	0.3
Catering trucks	95 to 102	0.2
Fuel trucks	100 to 108	0.15
Aircraft tugs	96 to 103	0.25
Ground power units	105 to 112	0.4

11.2.39 Impact magnitude is assessed based on the predicted scale and extent of impact. This is used to determine the significance of resulting effects, taking into account receptor responsivity which is a function of sensitivity and importance.

11.3 Baseline

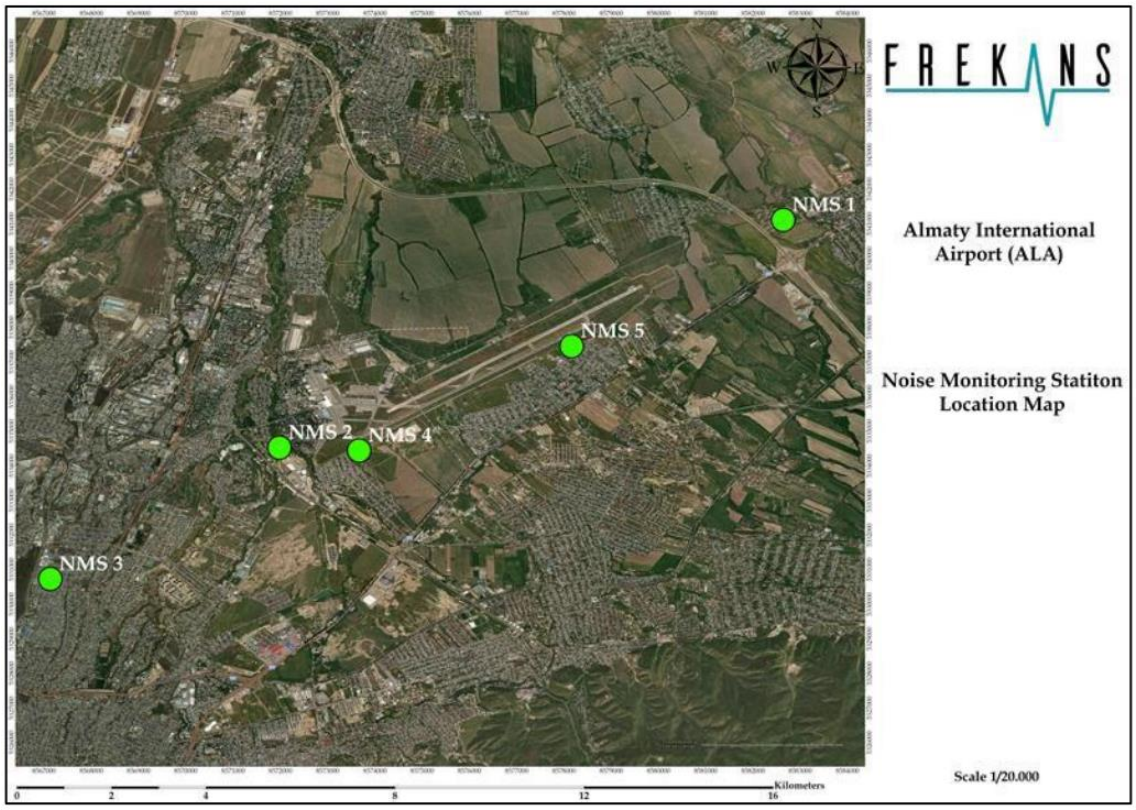
Current baseline

11.3.1 Generally, noise associated with aircraft movements is a significant feature of the environment surrounding airports, which may affect communities at relatively long distances from the airport. Consequently, the AoI may be quite large and depend on flight paths and operating regimes. Aircraft noise comprises intermittent noise events from LTO cycles and more steady noise from aircraft sources on the ground such as engines during taxiing and the APU. Furthermore, noise from road traffic accessing the airport can also elevate the general background noise. Localised sources such as the operation of building services plant and GSE may also contribute.

11.3.2 Baseline noise measurements were obtained by Frekans Acoustics (August 2025) using the outputs of the five noise-monitoring stations located within the surrounding area and the results are presented within the Environmental Noise & Vibration Assessment report.

11.3.3 The locations of the five noise-monitoring stations are shown in Figure 5-2 of the Frekans Acoustics report and are reproduced in Figure 11.3 below. The results of the measurements are compiled and presented in the Quarterly Noise Measurement Report. These are summarised in Table 11.15.

Figure 11.3: Baseline noise monitoring stations



Source: Frekans Acoustics

11.3.4 The values are based on the time intervals defined for L_{day} and L_{night} in the WBG Noise guidelines (07:00 to 22:00 and 22:00 to 07:00, respectively), as well as the local assessment criteria of Kazakhstan, which define L_{day} as 09:00 to 22:00 and L_{night} as 22:00 to 09:00.

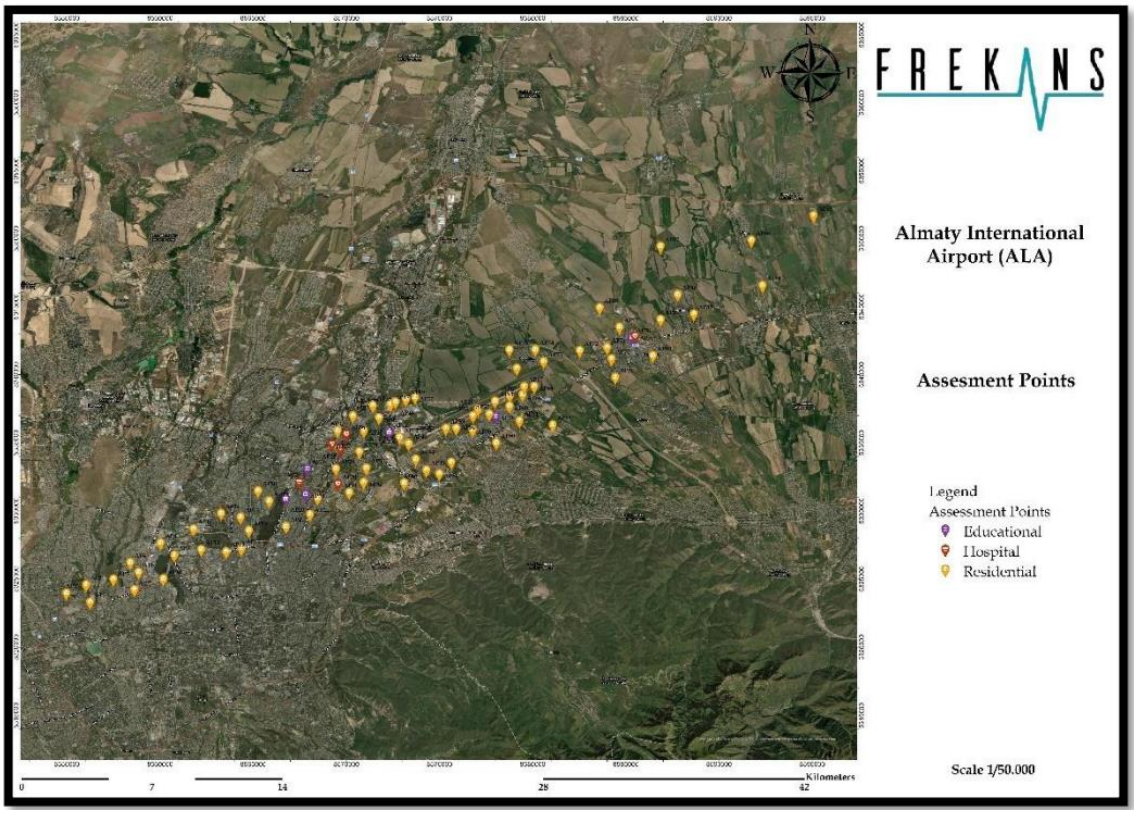
Table 11.15: Summary of the baseline noise monitoring results (January to July 2025)

Monitoring location	L_{dn} dB(A), WBG		L_{dn} dB(A), Local	
	L_{day} dB(A) (07:00-22:00)	L_{night} dB(A) (22:00-07:00)	L_{day} dB(A) (09:00-22:00)	L_{night} dB(A) (22:00-09:00)
NMS 1	64.8	61.8	65.0	62.3
NMS 2	59.8	58,6	59.9	58.7
NMS 3	62.9	63,9	62.6	64.0
NMS 4	73.6	72.7	73.6	72.9
NMS 5	70.6	70.3	70.4	70.6

11.3.5 The Frekans Acoustics report identifies 108 assessment points (AP) considered to be representative of the receptors potentially impacted within the AoI. Figure 11.4 shows the location of these APs. The APs include:

- 96 residential locations
- 7 hospitals
- 5 educational establishments

Figure 11.4: Assessment points



Source: Frekans Acoustics

11.3.6 The details of the APs are given in Table 11.16.

Table 11.16: Assessment points

Assessment Points	Location	Use	Extent	Sensitivity	Importance
AP 1	Turksib/Almaty	Residential	Local	High	Medium
AP 2	Turksib/Almaty	Residential	Local	High	Medium
AP 3	Turksib/Almaty	Residential	Local	High	Medium
AP 4	Turksib/Almaty	Residential	Local	High	Medium
AP 5	Turksib/Almaty	Residential	Local	High	Medium
AP 6	Turksib/Almaty	Residential	Local	High	Medium
AP 7	Turksib/Almaty	Residential	Local	High	Medium
AP 8	Turksib/Almaty	Residential	Local	High	Medium
AP 9	Turksib/Almaty	Residential	Local	High	Medium
AP 10	Turksib/Almaty	Residential	Local	High	Medium

Assessment Points	Location	Use	Extent	Sensitivity	Importance
AP 11	Turksib/Almaty	Residential	Local	High	Medium
AP 12	Turksib/Almaty	Residential	Local	High	Medium
AP 13	Turksib/Almaty	Residential	Local	High	Medium
AP 14	Turksib/Almaty	Residential	Local	High	Medium
AP 15	Turksib/Almaty	Residential	Local	High	Medium
AP 16	Turksib/Almaty	Residential	Local	High	Medium
AP 17	Turksib/Almaty	Hospital	Site	High	High
AP 18	Turksib/Almaty	Residential	Local	High	Medium
AP 19	Turksib/Almaty	Residential	Local	High	Medium
AP 20	Turksib/Almaty	Educational	Site	High	High
AP 21	Turksib/Almaty	Residential	Local	High	Medium
AP 22	Turksib/Almaty	Residential	Local	High	Medium
AP 23	Turksib/Almaty	Residential	Local	High	Medium
AP 24	Turksib/Almaty	Educational	Site	High	High
AP 25	Turksib/Almaty	Hospital	Site	High	High
AP 26	Turksib/Almaty	Residential	Local	High	Medium
AP 27	Turksib/Almaty	Hospital	Site	High	High
AP 28	Turksib/Almaty	Educational	Site	High	High
AP 29	Turksib/Almaty	Residential	Local	High	Medium
AP 30	Turksib/Almaty	Hospital	Site	High	High
AP 31	Turksib/Almaty	Residential	Local	High	Medium
AP 32	Turksib/Almaty	Residential	Local	High	Medium
AP 33	Turksib/Almaty	Residential	Local	High	Medium
AP 34	Turksib/Almaty	Residential	Local	High	Medium
AP 35	Turksib/Almaty	Residential	Local	High	Medium
AP 36	Turksib/Almaty	Hospital	Site	High	High
AP 37	Turksib/Almaty	Residential	Local	High	Medium
AP 38	Turksib/Almaty	Residential	Local	High	Medium
AP 39	Turksib/Almaty	Residential	Local	High	Medium
AP 40	Turksib/Almaty Near Airport	Residential	Local	High	Medium
AP 41	Turksib/Almaty Near Airport	Educational	Site	High	High
AP 42	Turksib/Almaty Near Airport	Residential	Local	High	Medium
AP 43	Turksib/Almaty Near Airport	Residential	Local	High	Medium
AP 44	Turksib/Almaty	Residential	Local	High	Medium
AP 45	Turksib/Almaty	Residential	Local	High	Medium
AP 46	Turksib/Almaty	Residential	Local	High	Medium
AP 47	Turksib/Almaty Near Airport	Residential	Local	High	Medium
AP 48	Turksib/Almaty Near Airport	Residential	Local	High	Medium

Assessment Points	Location	Use	Extent	Sensitivity	Importance
AP 49	Turksib/Almaty Near Airport	Residential	Local	High	Medium
AP 50	Turksib/Almaty Near Airport	Residential	Local	High	Medium
AP 51	Turksib/Almaty	Residential	Local	High	Medium
AP 52	Turksib/Almaty	Residential	Local	High	Medium
AP 53	Guldala Near Airport	Residential	Local	High	Medium
AP 54	Guldala Near Airport	Residential	Local	High	Medium
AP 55	Guldala Near Airport	Residential	Local	High	Medium
AP 56	Guldala Near Airport	Residential	Local	High	Medium
AP 57	Guldala	Residential	Local	High	Medium
AP 58	Guldala	Educational	Site	High	High
AP 59	Guldala	Residential	Local	High	Medium
AP 60	Guldala	Residential	Local	High	Medium
AP 61	Guldala	Residential	Local	High	Medium
AP 62	Guldala	Residential	Local	High	Medium
AP 63	Guldala	Residential	Local	High	Medium
AP 64	Guldala	Residential	Local	High	Medium
AP 65	Guldala	Residential	Local	High	Medium
AP 66	Guldala	Residential	Local	High	Medium
AP 67	Guldala	Residential	Local	High	Medium
AP 68	Guldala	Residential	Local	High	Medium
AP 69	Almerek	Residential	Local	High	Medium
AP 70	Almerek	Residential	Local	High	Medium
AP 71	Almerek	Residential	Local	High	Medium
AP 72	Almerek	Residential	Local	High	Medium
AP 73	Almerek	Residential	Local	High	Medium
AP 74	Almerek	Residential	Local	High	Medium
AP 75	Almerek	Residential	Local	High	Medium
AP 76	Almerek	Residential	Local	High	Medium
AP 77	Almerek	Residential	Local	High	Medium
AP 78	Almerek	Educational	Site	High	High
AP 79	Almerek	Hospital	Site	High	High
AP 80	Almerek	Residential	Local	High	Medium
AP 81	Almerek	Residential	Local	High	Medium
AP 82	Almerek	Residential	Local	High	Medium
AP 83	Almerek	Residential	Local	High	Medium
AP 84	Almerek	Residential	Local	High	Medium
AP 85	Almerek	Residential	Local	High	Medium
AP 86	Almerek	Residential	Local	High	Medium
AP 87	Almerek	Residential	Local	High	Medium
AP 88	Almerek	Residential	Local	High	Medium

Assessment Points	Location	Use	Extent	Sensitivity	Importance
AP 89	Turksib/Almaty Near Airport	Residential	Site	High	Medium
AP 90	Turksib/Almaty Near Airport	Residential	Site	High	Medium
AP91	Turksib/Almaty Near Airport	Residential	Site	High	Medium
AP 92	Almerek	Residential	Local	High	Medium
AP 93	Almerek	Residential	Local	High	Medium
AP 94	Turksib/Almaty	Residential	Local	High	Medium
AP 95	Turksib/Almaty	Residential	Site	High	Medium
AP 96	Turksib/Almaty	Residential	Local	High	Medium
AP 97	Turksib/Almaty	Residential	Local	High	Medium
AP 98	Turksib/Almaty	Residential	Local	High	Medium
AP 99	Turksib/Almaty	Residential	Local	High	Medium
AP 100	Turksib/Almaty	Residential	Local	High	Medium
AP 101	Turksib/Almaty	Residential	Local	High	Medium
AP 102	Turksib/Almaty	Residential	Local	High	Medium
AP 103	Turksib/Almaty	Residential	Local	High	Medium
AP 104	Turksib/Almaty	Residential	Local	High	Medium
AP 105	Turksib/Almaty	Residential	Local	High	Medium
AP 106	Turksib/Almaty	Residential	Local	High	Medium
AP 107	Guldala	Residential	Local	High	Medium
AP 108	Guldala	Residential	Local	High	Medium

Future baseline

11.3.7 The future baseline is considered as the ‘No Build Scenario’ for noise due to operational aircraft noise and GSE in the years 2030, 2040 and 2050.

11.4 Potential impacts

11.4.1 The potential construction phase effects are associated with:

- Noise and vibration impacts due to construction activities
- Road traffic noise impacts due to additional vehicle movements associated with construction

11.4.2 The potential operational phase effects are associated with:

- Airport noise:
  - Noise due to aircraft during APU use, taxiing, LTO cycles and using flight paths
  - Noise due to the use of GSE
- Road traffic noise due to vehicle movements associated with the patronage of the airport

11.5 Assessment of effects

Construction phase effects

Construction activities – noise

11.5.1 The construction noise assessment has been undertaken considering four construction phases:

- Phase 1: New runway construction activities (concurrent with existing activities)
- Phase 1+2: Combined runway and terminal expansion (with modified operational patterns)
- Phase 2+3: Infrastructure modernisation with active operations (peak cumulative exposure period)
- Phase 3: Final construction activities with full operational integration

11.5.2 The construction noise assessment represents the cumulative impact, including the 2025 baseline noise levels, derived from the operational noise maps.

11.5.3 The summary of impacts is provided in Table 11.17, which shows that a significant effect is only expected to arise at one receptor: AP89. This is expected to affect around 25 residents in 8 dwellings. The full results of the assessment at all points are presented in Appendix 3 of the Environmental Noise & Vibration Assessment report.

Table 11.17: Construction noise assessment results

Const. Phase	Point	Use	Distance	Source	Baseline	Cum.	Lim. Val.	Lim. Exc.	Magnitude Of Impact			Responsivity			Impact Significance	Mitigation
									Scale Of Impact	Extent	Imp. Mag	Imp.	Sens.	Resp.		
			m	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)								
1	AP89	Residential	16	71.3	62.1	71.8	65.1	+6.7	Large	Site	Mod.	Med.	High	High	Major	Precaution Design & Monitoring
1+2	AP89	Residential	16	71.4	62.1	71.9	65.1	+6.8	Large	Site	Mod.	Med.	High	High	Major	Precaution Design & Monitoring
2+3	AP89	Residential	16	65.0	62.1	66.8	65.1	+1.7	Small	Site	Minor	Med.	High	High	Moderate	Precaution Design & Monitoring
3	AP89	Residential	16	64.9	62.1	66.7	65.1	+1.6	Small	Site	Minor	Medium	High	High	Moderate	Precaution Design & Monitoring

11.5.4 Key findings of the construction noise assessment are:

- The majority of sensitive receptors experience no measurable impact as a result of construction noise.
- Receptors adjacent to the western boundary are predicted to be subject to minor to major noise effects.
- The highest cumulative noise levels (construction + current operational) will take place during Phase 1+2.
- The only identified exceedance of Kazakhstan's national construction noise limits (70 dBA L_{Aeq} daytime) is at AP89 during Phase 1 and Phase 1+2.

Construction activities – vibration

11.5.5 The construction vibration assessment focuses on pile-driving activities which are the most likely to generate high levels of vibration.

11.5.6 The assessment follows methodology from BS 5228-2:2009. Distance calculations indicate that construction activities within 22 metres of the receptors may result in significant vibration impacts.

11.5.7 Out of the 15 strategically selected receiver points representing the closest proximity to construction activities, all of the locations show vibration levels well below the threshold limit.

11.5.8 The point AP89, which is located 16 metres from the construction polygon P1_Multi Use Office Building, is the most susceptive to significant vibration impacts due to the distance. However, no piling operations are planned for this area. The closest piling operation will be 55 metres from AP89. The PPV value is 0.078 mm/s, which is below the BS 5228-2:2009 limit value of 0.3 mm/s.

11.5.9 The summary of the construction vibration results for the selected points is presented in Table 11.18.

Table 11.18: Construction Vibration Results

Point	Distance	Construction Polygon	PPV	BS 5228 Limit Value	Magnitude of Impact			Responsivity			Impact Sig.
	M		mm/s	mm/s	Scale Of Impact	Extent	Impact Mag	Imp.	Sens.	Resp.	
AP 40	540	P1_inflight_catering facility	0.0025	0.3	No impact	Local	Neg.	Med.	High	High	No impact
AP 41	340	P2_Multi_storey_car_park	0.0051	0.3	No Impact	Local	Neg.	High	High	High	No Impact
AP 42	215	P1_VIP_Apron	0.0101	0.3	No Impact	Local	Neg.	Med.	High	High	No Impact
AP 43	420	P1_VIP_Apron	0.0037	0.3	No Impact	Local	Neg.	Med.	High	High	No Impact
AP 47	90	P1_inflight_catering_facility	0.0373	0.3	No Impact	Local	Neg.	Med.	High	High	No Impact
AP 48	240	P1_inflight_catering_facility	0.0086	0.3	No Impact	Local	Neg.	Med.	High	High	No Impact
AP 49	185	P1_Fuel_farm	0.0126	0.3	No Impact	Local	Neg.	Med.	High	High	No Impact
AP 50	330	P1_CargoApron and Taxi	0.0053	0.3	No Impact	Local	Neg.	Med.	High	High	No Impact
AP 56	280	P1_Runway	0.0068	0.3	No Impact	Local	Neg.	Med.	High	High	No Impact
AP 61	280	P1_Runway	0.0068	0.3	No Impact	Local	Neg.	Med.	High	High	No Impact
AP 62	350	P1_Runway	0.0049	0.3	No Impact	Local	Neg.	Med.	High	High	No Impact
AP 67	260	P1_Runway	0.0076	0.3	No Impact	Local	Neg.	Med.	High	High	No Impact
AP 75	450	P1_NewTaxiway	0.0033	0.3	No Impact	Local	Neg.	Med.	High	High	No Impact
AP 89	55	P1_Multi Use Office Building	0.0780	0.3	No Impact	Site	Neg.	Med.	Med.	Med.	Minor
AP 90	45	P1_inflight_catering_facility	0.1054	0.3	No Impact	Site	Neg.	Med.	Med.	Med.	No Impact
AP 91	120	P1_GH&Aerodrome	0.0242	0.3	No Impact	Site	Neg.	Med.	Med.	Med.	No Impact

Construction traffic – noise

11.5.10 Construction is expected to generate additional vehicle movements:

- Phase P1: 12 trucks per hour
- Phase P1 and P3: 6 trucks per hour

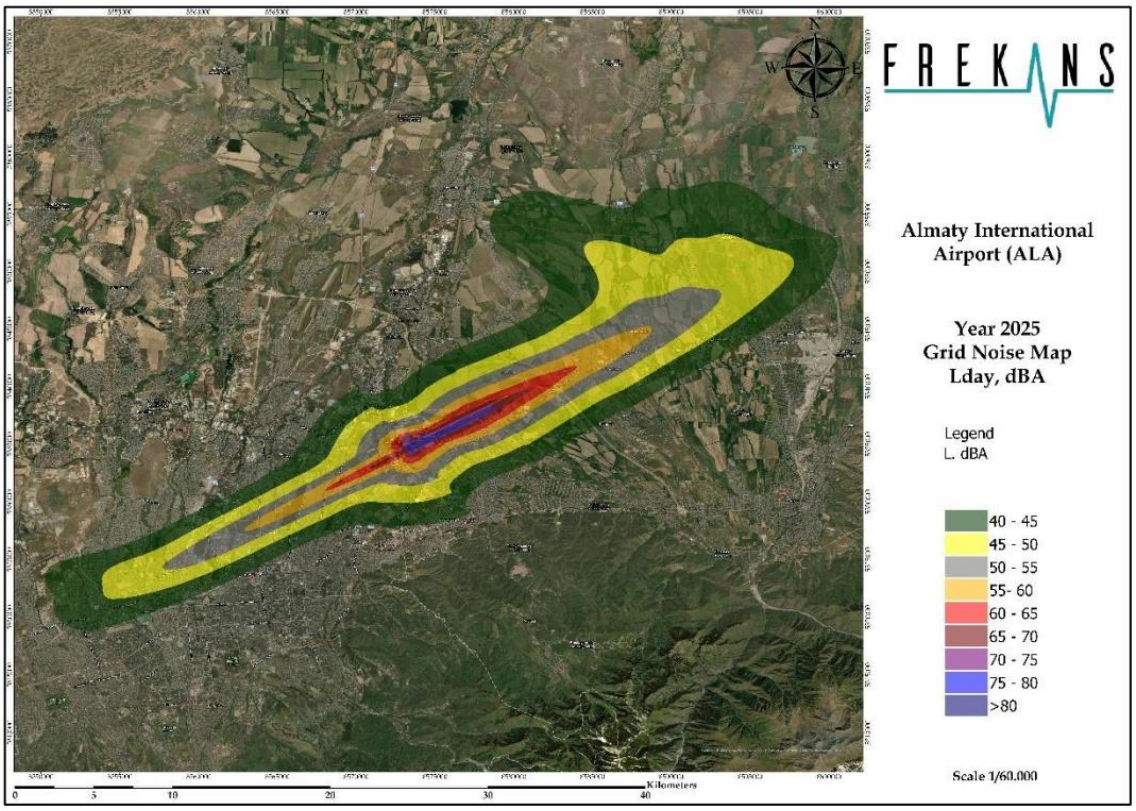
11.5.11 Figure 4-6 of the Environmental Noise & Vibration Assessment report indicates the construction traffic route accessing from the Big Almaty Ring Road (BAKAD) at the State Road 351, along the northern suburban connection road to Al'Merek and Uliksa Ahmetova Street into the airport at the north. The additional traffic results in a 0.7% increase in traffic volume on Uliksa Ahmetova Road and 0.4% increase on the A351. Corresponding increases in average road traffic noise from these roads would be negligible and not significant.

Operational phase effects

Airport noise

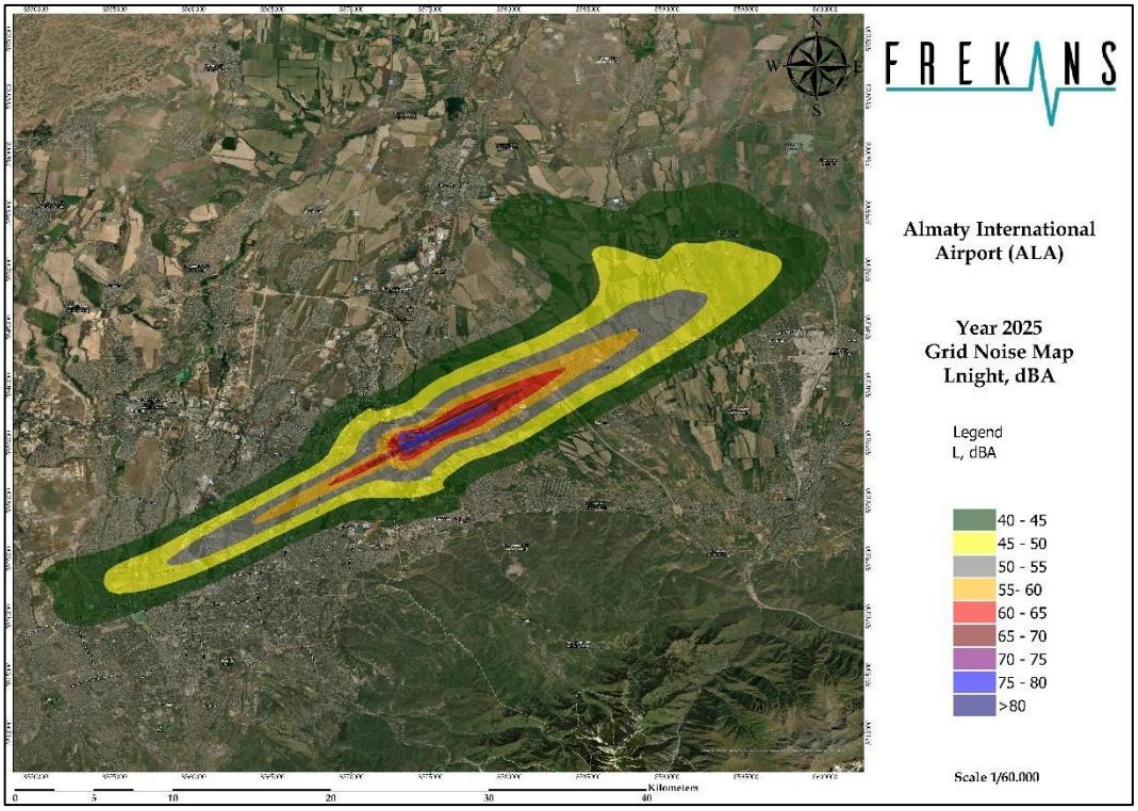
11.5.12 The summary of the current 2025 baseline noise contours as well as for the years 2030, 2040 and 2050 are shown in the following figures and tables.

Figure 11.5: 2025 baseline operational noise – daytime L_{day}



Source: Frekans Acoustics

Figure 11.6: 2025 baseline operational noise – night-time L_{night}

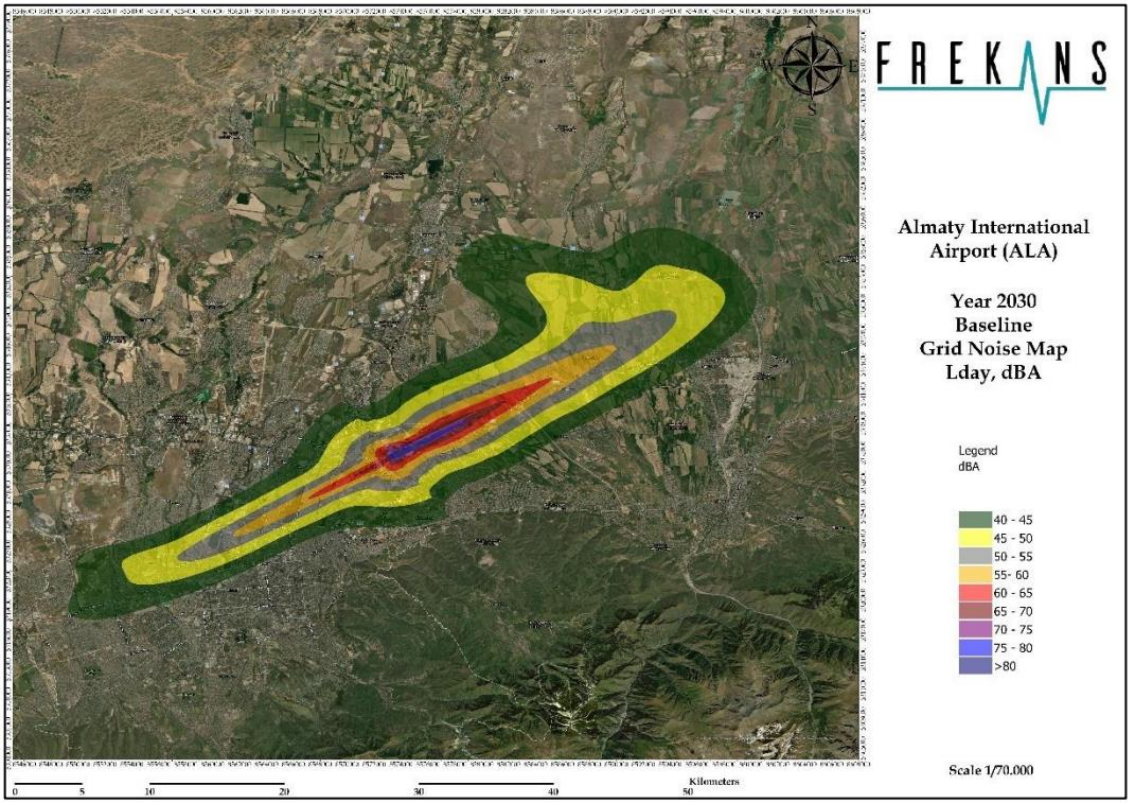


Source: Frekans Acoustics

Table 11.19: Exposure Levels - 2025 baseline

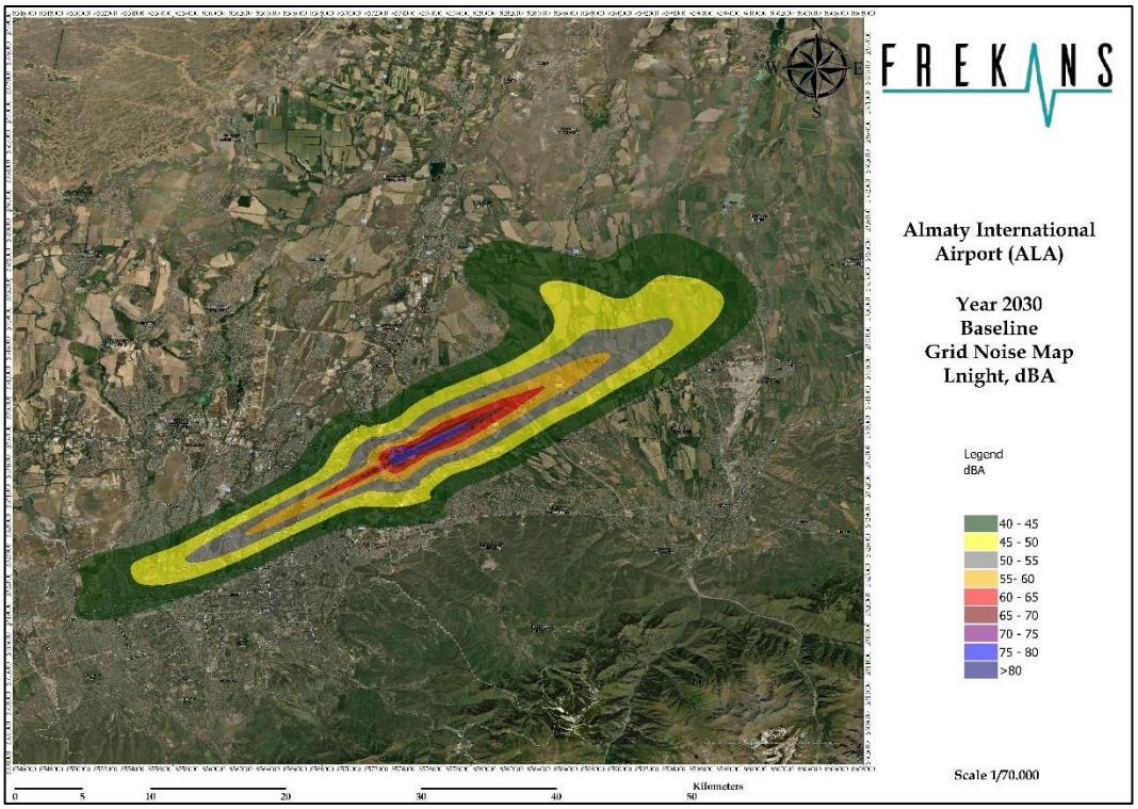
2025	L_{day}		L_{night}	
dBA	Area km²	Number of buildings	Area km²	Number of buildings
40-45	147.6	32,725	142.3	30,042
45-50	88.0	17,692	80.3	16,104
50-55	44.5	10,381	40.9	10,050
55-60	21.2	8,046	18.8	7,285
60-65	8.2	2,453	7.4	2,008
65-70	3.4	592	3.0	459
70-75	1.6	70	1.4	50
75-80	0.8	0	0.8	0
80-85	0.4	0	0.4	0
>85	0.2	0	0.1	0

Figure 11.7: 2030 operational noise – no build scenario – daytime- L_{day}



Source: Frekans Acoustics

Figure 11.8: 2030 operational noise – no build scenario – night-time- L_{night}

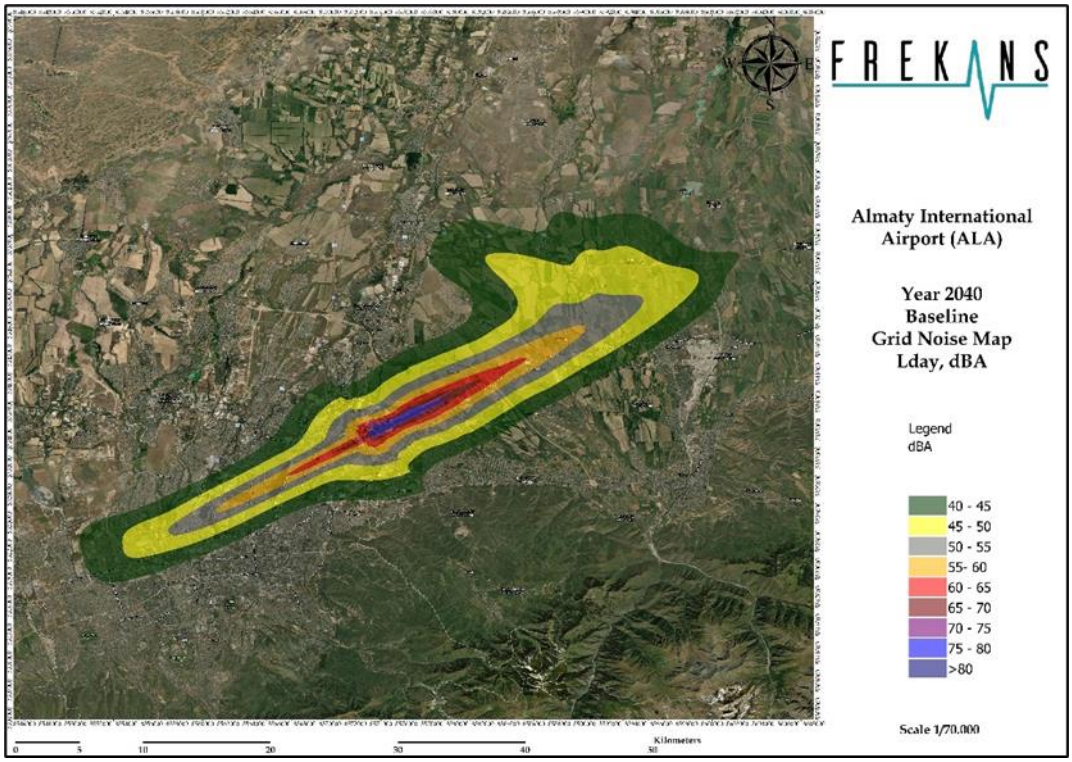


Source: Frekans Acoustics

Table 11.20: Exposure Levels - 2030 no build scenario

2030	L_{day}		L_{night}	
dBA	Area km²	Number of buildings	Area km²	Number of buildings
40-45	155.8	39,178	150.4	35,212
45-50	96.6	19,793	88.5	17,877
50-55	49.9	10,843	46.2	10,353
55-60	25.6	8,669	22.9	8,306
60-65	10.0	3,724	8.9	2,912
65-70	4.2	811	3.7	664
70-75	1.8	108	1.6	77
75-80	0.9	3	0.9	0
80-85	0.5	0	0.4	0
>85	0.2	0	0.2	0

Figure 11.9: 2040 operational noise – no build scenario – daytime- L_{day}



Source: Frekans Acoustics

Figure 11.10: 2040 operational noise – no build scenario – night-time- L_{night}

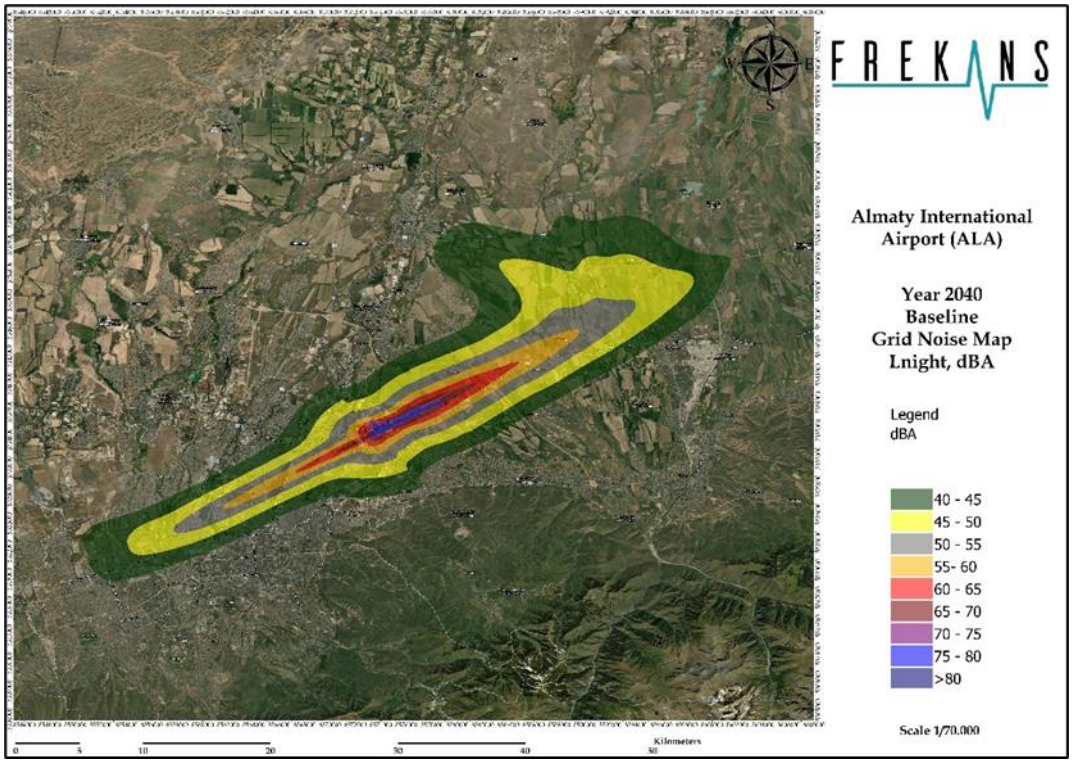
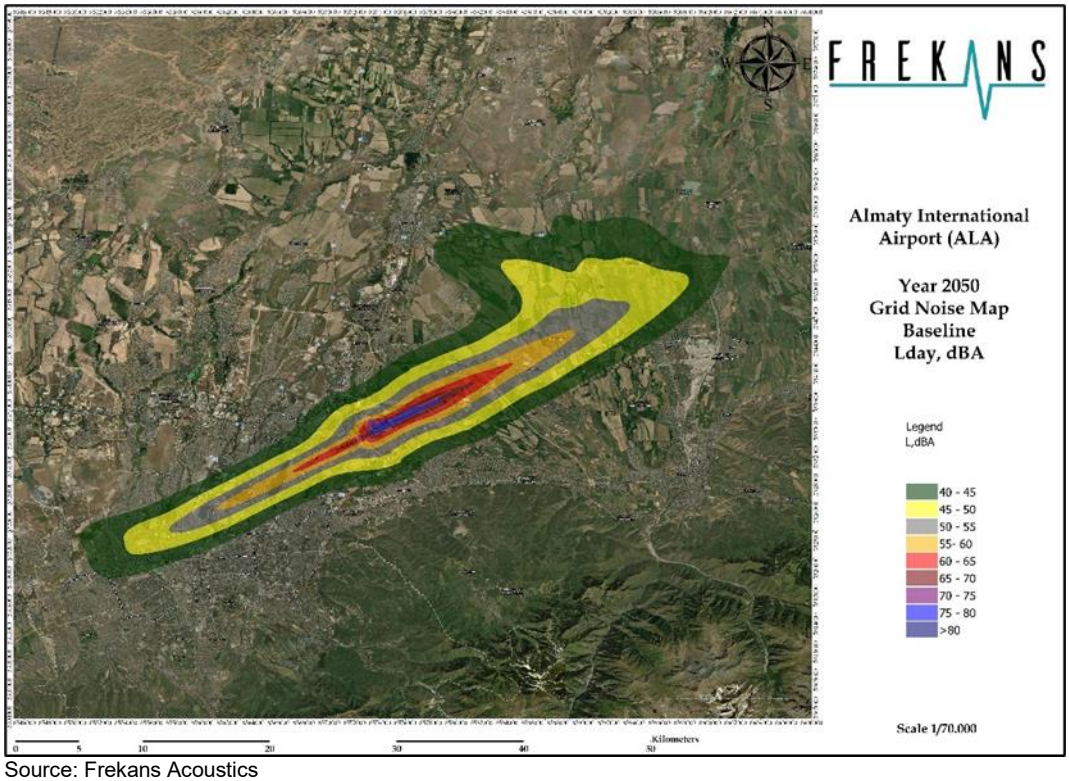


Table 11.21: Exposure Levels - 2040 no build scenario

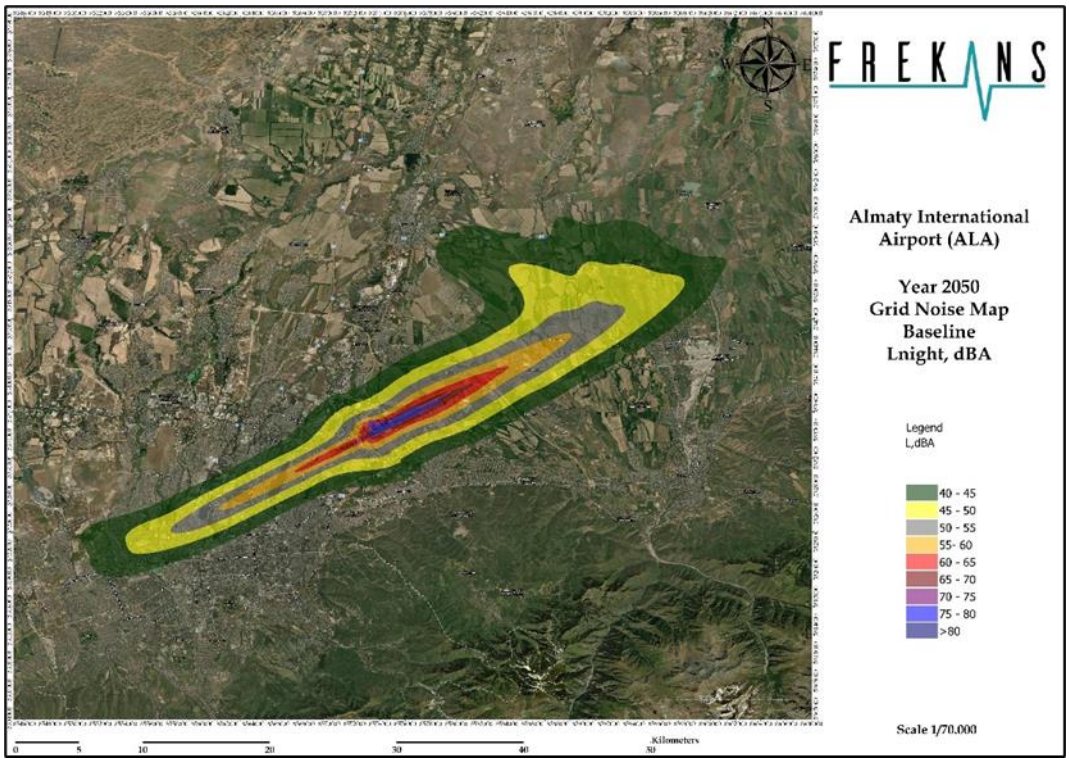
2040	**L_{day}**		**L_{night}**	
dBA	**Area km²**	**Number of Buildings**	**Area km²**	**Number of Buildings**
40-45	154,2	38467	150,1	35288
45-50	103,6	20072	94,9	18110
50-55	51,7	11007	47,8	10493
55-60	26,5	8860	24,0	8650
60-65	10,4	4400	9,3	3518
65-70	4,2	843	3,7	698
70-75	1,7	111	1,5	83
75-80	1,2	3	1,2	1
80-85	0,5	0	0,5	0
>85	0,2	0	0,2	0

Figure 11.11: 2050 operational noise – no build scenario – daytime- L_{day}



Source: Frekans Acoustics

Figure 11.12: 2050 operational noise – no build scenario – night-time- L_{night}



Source: Frekans Acoustics

Table 11.22: Exposure Levels - 2050 no build scenario

2050	L_{day}		L_{night}	
dBA	Area km²	Number of buildings	Area km²	Number of Buildings
40-45	144,3	30944	142,5	30123
45-50	90,1	17715	85,9	17061
50-55	45,4	10108	43,7	9991
55-60	23,1	8628	22,0	8495
60-65	8,8	3298	8,4	2972
65-70	3,5	560	3,3	503
70-75	1,4	54	1,4	48
75-80	1,2	0	1,1	0
80-85	0,5	0	0,5	0
>85	0,1	0	0,1	0

11.5.13 Table 11.23, Table 11.24 and Table 11.25 present the assessment of noise impact in future years with respect to the baseline at three primary regions: Turksib, Guldala, and Al'Merek.

11.5.14 The changes in sound exposure are a result of the utilisation of the northern runway, implementation of eastern take-off and landing routes, and the deployment of advanced fleet technology with reduced noise emissions. The slight differences in totals are due to the noise impact buffers moving into or out of the community boundaries.

Table 11.23: Impact Assessment 2030

		2030-2025							
Scale of Impact	Baseline Exceedance dBA	L_{day}				L_{night}			
		Number of Buildings							
		Turksib	Guldala	Al'Merek	Total	Turksib	Guldala	Al'Merek	Total
Positive Impact	<0	21,568	2,468	0	36,565	21,489	2,443	0	36,381
No Impact	0-1	28,320	5,431	0	39,426	28,302	4,817	0	38,657
Small	1-3	42,727	12,686	3,420	85,425	42,853	13,668	3,416	86,737
Medium	3-5	4,318	4,066	853	12,993	4,390	4,106	846	13,135
Large	5-8	2,293	577	479	4,044	2,174	31	494	3,355
Very Large	>8	3	0	0	209	9	0	0	215

Table 11.24: Impact Assessment 2040

		2040-2025							
Scale of Impact	Baseline Exceedance dBA	L_{day}				L_{night}			
		Number of Buildings							
		Turksib	Guldala	Al'Merek	Total	Turksib	Guldala	Al'Merek	Total

		2040-2025							
Positive Impact	<0	78,006	17,692	3,040	138,165	77,632	17,939	3,034	137,943
No Impact	0-1	18,872	3,412	526	30,024	19,245	3,503	534	30,597
Small	1-3	1,813	3,835	905	9,885	1,985	3,557	898	9,770
Medium	3-5	550	70	308	1,158	376	0	315	909
Large	5-8	5	0	0	5	4	0	0	4
Very Large	>8	1	0	0	1	1	0	0	1

Table 11.25: Impact Assessment 2050

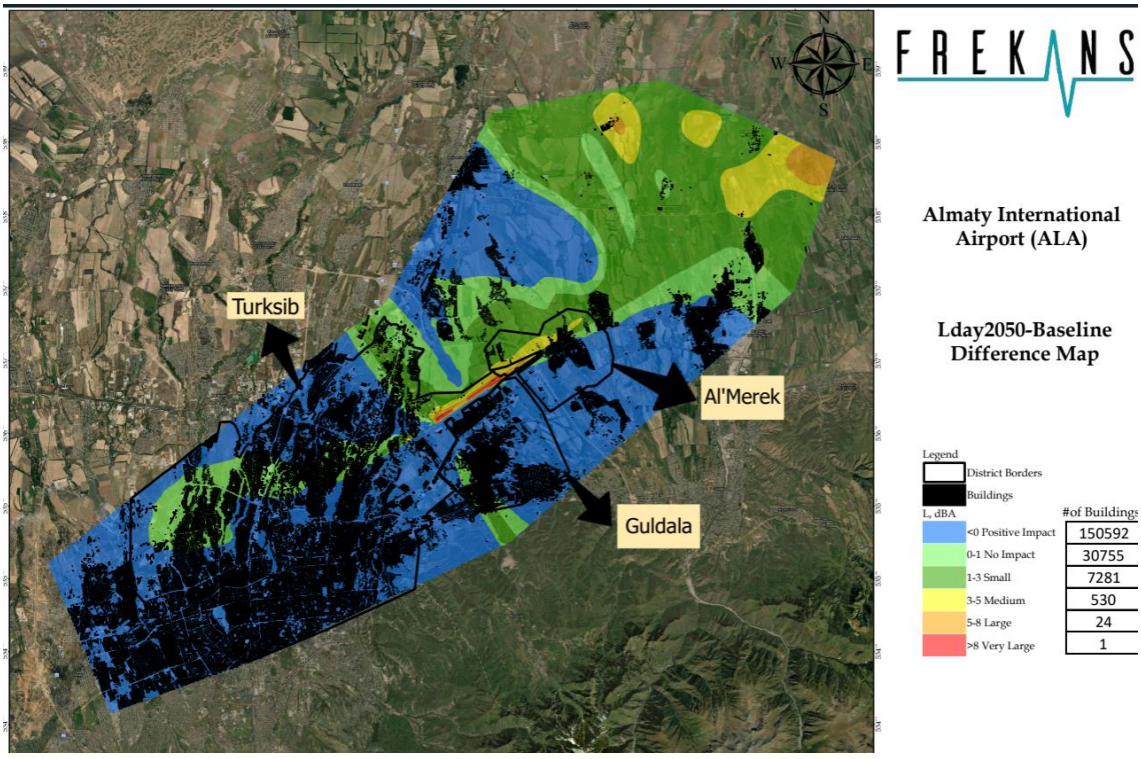
		2050-2025							
Scale of Impact	**Baseline Exceedance dBA**	**L_{day}**				**L_{night}**			
		Number of Buildings							
		Turksib	**Guldala**	**Al'Merek**	**Total**	**Turksib**	**Guldala**	**Al'Merek**	**Total**
Positive Impact	<0	77,724	20,420	2,942	101,086	79,411	20,479	2,909	102,799
No Impact	0-1	19,650	3,356	613	23,619	18,022	3,513	634	22,169
Small	1-3	1,786	1,173	936	3,895	1,755	949	905	3,609
Medium	3-5	46	0	291	337	46	0	328	374
Large	5-8	1	0	0	1	1	0	0	1
Very Large	>8	1	0	0	1	1	0	0	1

11.5.15 In summary, the predictions indicate mainly small and medium scale increases in noise levels in 2030 relative to 2025 conditions in all areas both day and night. However, in Al'Merek, the changes are only increases, whereas there are also reductions in Turksib and Guldala.

11.5.16 Conditions in 2040 and 2050 are predicted to be broadly similar for both day and night. The changes relative to 2025 conditions are mainly decreases in noise levels in all areas particularly in the Turksib area. In Guldala and Al'Merek there is a greater proportion of 'no impact' or small changes.

11.5.17 The changes mainly reflect the influence of fleet modernisation. The contour map (Figure 6-52 reproduced in Figure 11.13) shows an increase in the blue zones, signifying positive or neutral impact changes, particularly in the Turksib region. The Al'Merek region also shows improved conditions compared with 2040 projections. It should be noted while reductions are made, noise levels may still exceed the WHO threshold values.

Figure 11.13: Lday difference contours 2050 vs 2025 baseline



11.5.18 Detailed results presented in the appendices of the Environmental Noise & Vibration Assessment report show **major** and **moderate** adverse impacts are predicted in all assessment years at residential receptors (**high sensitivity**) within the Turksib, Almaty, Guldala and Al'Merek areas, a hospital (AP25 - **high sensitivity**) in Turksib/Amaty, and an educational establishment (AP78 – **high sensitivity**) in Al'Merek.

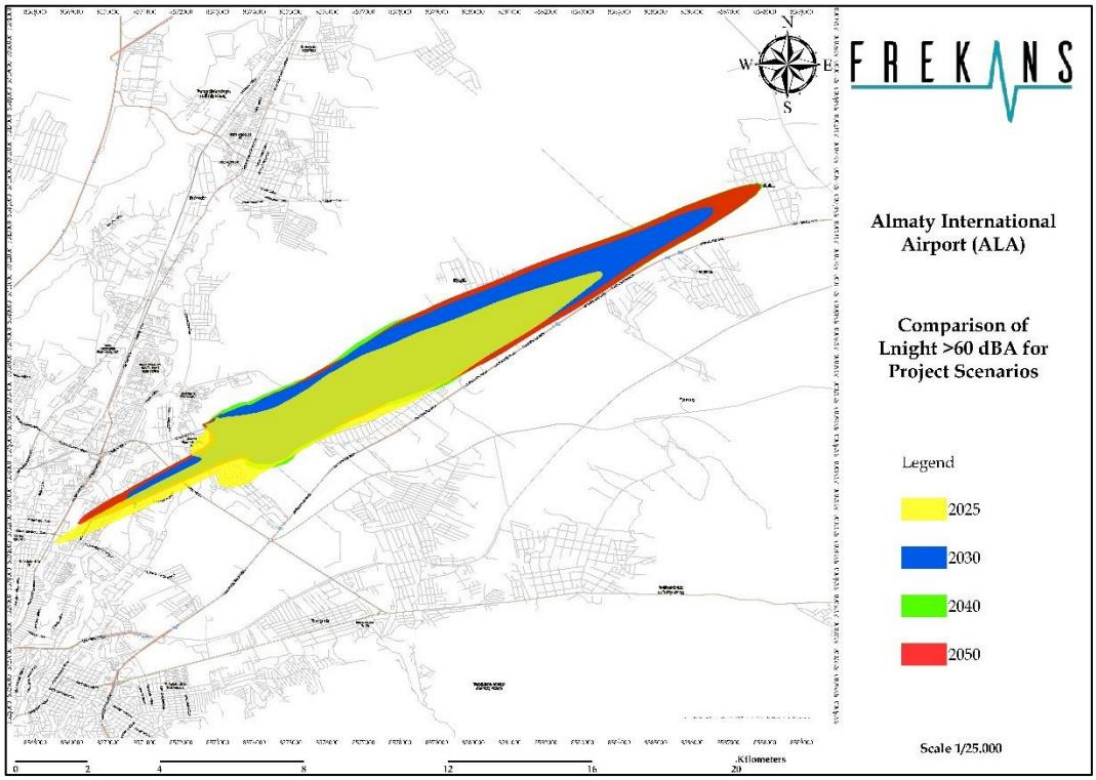
11.5.19 A sleep disturbance analysis was also conducted including a review of the number of buildings exposed to noise levels exceeding 60 dB L_{night} that is used to test eligibility for the noise insulation program. The results are presented in Table 11.26 and Figure 11.14. This shows that exposure is predicted to be lower with the Project.

Table 11.26: Buildings exposed to noise levels exceeding 60 dB L_{night} with and without the Project

	No build	Project
>40 dB Lnight		
2025	65,998	65,998
2030	75,401	69,430
2040	76,841	82,817
2050	69,193	76,058
>45 dB Ldn		
2025	87,291	87,291
2030	101,134	92,908
2040	100,354	105,541
2050	88,480	97,397
>60 dB Lnight		
2025	2,517	2,517
2030	3,653	2,119

2040	4,300	3,292
2050	3,523	3,106

Figure 11.14: Operational noise contours for areas exceeding 60 dB L_{night} under the Project scenarios



Source: Frekans Acoustics

Road traffic noise

11.5.20 The assessment of changes in operational phase road traffic noise considers passenger and cargo access routes. It is noted traffic volumes are expected to increase by relatively large amounts by 2050 with passenger traffic increasing by 75% and cargo by 52%. This magnitude of change is expected to be noticeable. The affected areas are Turksib / Almaty and Al'Merek, where significant effects are predicted to arise.

Conclusion

11.5.21 It is concluded that:

- Construction phase effects
  - Noise effects associated with construction activities are predicted to be **significant adverse** at a group of eight residential receptors (**high sensitivity**) near the terminal during all phases of construction when impacts are predicted to be **major** and **moderate adverse**. The margin by which the noise limit is exceeded is small and it is expected that this can be mitigated through standard measures.
  - Vibration effects due to construction activities are predicted to be **not significant** at all receptors.
  - Noise effects associated with the movement of construction road traffic are predicted to be **not significant** at all receptors.
- Operational phase effects

- Noise due to aircraft and ground support equipment is predicted to result in effects up to **moderate** and **major adverse (significant)** affecting residential, educational and hospital receptors **(high sensitivity)** within Turksib, Almaty, Guldala and Al'Merek, which is therefore assessed as **significant adverse**
- Road traffic associated with passengers and cargo is predicted to increase noticeably in the Turksib / Almaty and Al'Merek areas affecting residential and hospital receptors **(high sensitivity)**. Effects up to **moderate** and **major adverse** are predicted, and are therefore assessed as **significant adverse**.

11.6 Mitigation

11.6.1 Table 11.27 provides a summary of mitigation and enhancement measures to address the impacts and effects identified in this chapter.

Table 11.27: Summary of Mitigation Measures

Type of measure	Detail
Construction	
All phases	• Phase-Based Noise Monitoring and Community Engagement: Periodic noise level monitoring during construction phases, combined with regular community updates and an established complaint response mechanisms. • Temporary acoustic barriers: 4-metre high barriers along western construction boundary providing 8 to 10 dB reduction at critical location AP89.
Phase specific mitigation	**Phase 1 & 1+2 Critical interventions at worst affected location (AP89)** • The northwest facade of the buildings will experience the most significant impact, with noise levels reaching 6.7 dB(A) above the limiting value. It is estimated that a total of 8 dwellings will be affected, potentially impacting approximately 25 residents. • Low-noise equipment mandate: Specification of noise-optimised construction equipment reducing source levels by 3 to 5 dB(A). • Construction sequencing: Strategic work scheduling to minimise simultaneous high-noise activities. • Expected combined reduction: 10 to 12 dB total, bringing levels within compliance thresholds. **Phase 2+3 & Phase 3 Transition Management** • Acoustic monitoring: Continuous noise level verification ensuring maintained compliance. • Adaptive equipment selection: Continued use of low-noise equipment specifications providing 3 to 4 dB source reduction. • Community communication: Proactive notification of remaining construction activities and expected completion timelines.
Community engagement and monitoring	• Residential interface management: Direct communication channels with affected households at AP48, AP49, AP89, AP90, and AP91, including pre-construction surveys and post-completion verification.
Construction hours and equipment management:	• Strict temporal controls: Enforcement of 09:00-22:00 construction window eliminating nighttime community disturbance, with enhanced restrictions. • Maintenance protocols: Daily equipment condition verification ensuring optimal noise performance and immediate replacement of non-compliant machinery.
Vibration mitigation Measures	• Selection of appropriate piling equipment. Where structural requirements permit, smaller and lighter pile driving equipment should be utilised to reduce the magnitude of generated vibrations. • Bored piles and Continuous Flight Auger (CFA) piles should be considered in the first instance. • Where driven piles remain necessary, variable energy hammers with adjustable impact force capabilities should be implemented to provide precise control over the driving energy.

Type of measure	Detail
	• Hydraulic impact hammers should be considered as an alternative to diesel hammers • Precautionary vibration monitoring from closest buildings is recommended at the commencement of construction activities involving piling operations. • High-vibration activities should be scheduled during periods when potential impacts are minimised. • Residents should be informed in advance about the construction schedule, expected vibration levels, and mitigation measures being implemented.
Operation	
Reduction of noise at source	Fleet modernisation strategy at a higher rate of change (70% by 2050) than expected (30% by 2050) – In 2040, the base is 9.5% but increase to a higher rate of 50%. • Enhanced monitoring of aircraft noise certification levels • Collaboration with airlines to prioritise Chapter 14 aircraft deployment • Economic incentives through differential landing fees for quieter aircraft (noise surcharge tariffs for take-off and landing can be implemented in~5 years) • Annual reporting of fleet composition progress toward noise reduction targets
Land use planning and management	• Enhanced municipality coordination to consider aircraft noise in planning decisions • Expanded Noise Insulation Program to treat households and public facilities (e.g. kindergartens) in high-exposure zones (increasing from 100 to 140 buildings annually)
Monitoring	• Continue the continuous noise monitoring at Al'Merek, Guldala and Turksib • Review noise contour maps annually based on operational regimes and aircraft types
Operating restrictions	Restrictions should only be implemented after exhausting other elements of the balanced ICAO 'Balanced approach'. Possible considerations include: • Progressive restrictions to decrease Chapter 3 aircraft to 3% during night-time periods (22:00-09:00) • Noise budget system implementation linking total noise exposure to operational capacity • Differential charging structure based on aircraft noise certification levels

11.6.2 The Noise Management Plan shall define the measures to be applied and be developed in response to changing conditions and requirements. It should be noted that the details of the key commitments within the Noise Management Plan are yet to be negotiated. The Noise Management Plan shall also be reviewed following all significant safety incidents and updated as necessary.

11.7 Summary of residual effects

11.7.1 Residual effects after the application of mitigation are presented in Table 11.28. The residual effects on a receptor basis are indicated in Figures 11-14 to 11-16.

Table 11.28: Summary of residual effects for construction and operational phases

Description of effect	Permanent or temporary	Sensitivity of receptor	Magnitude of impact	Significance of effect before additional mitigation	Additional mitigation	Residual effect	Proposed monitoring
Construction phase							
Residential assessment location AP89 Noise levels from construction activities during all phases of construction	Temporary	High	Moderate to major	Significant adverse	• 10 to 12 dB noise reduction • Measures to be set out and committed to within the Noise Management Plan	Not significant adverse	Phase-based noise monitoring
Operational phase							
Noise from aircraft and ground support equipment affecting surrounding communities including residential, hospital and educational receptors	Permanent	High	Moderate to major	Up to Significant adverse	• 1.5 dB night-time noise reduction through route optimization (after 2030) in Turksib / Almaty (western routes) • 1.1 dB peak time route balancing (after 2030) • 0.5 dB APU management (Turksib and Guldala) • Fleet modernisation – all areas • 4 to 7 dB ground noise reduction through infrastructure improvements • 7 to 9 dB indoor noise reduction through building insulation programs • Measures to be set out and committed to within the Noise Management Plan	Up to Significant adverse	Permanent noise monitoring stations Enhanced monitoring of aircraft noise certification levels Enhanced monitoring of APU usage duration and compliance reporting
Operational road traffic noise affecting residential and hospital receptors in the Turksib / Almaty and Al'Merek areas	Permanent	High	Turksib/Almaty - Moderate to major Al'Merek - Moderate	Up to significant adverse	• Enforce adherence to speed limits • Promote and enable the use of public transport to minimise private car usage	Up to significant adverse	None

Figure 11.15: Residual impacts of airport noise - 2030 (orange moderate, red major)

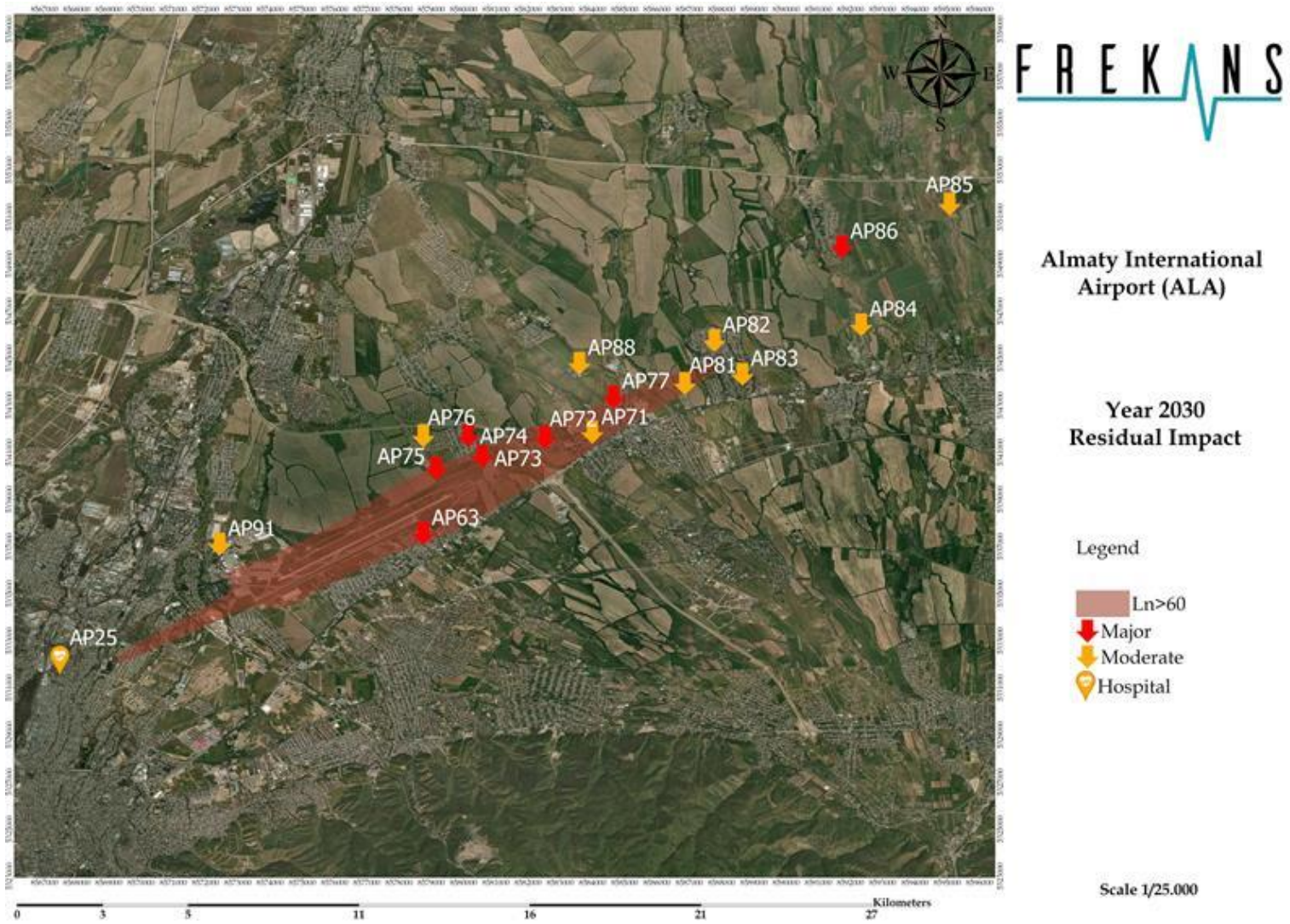


Figure 11.16: Residual impacts of airport noise – 2040 (orange moderate, red major)

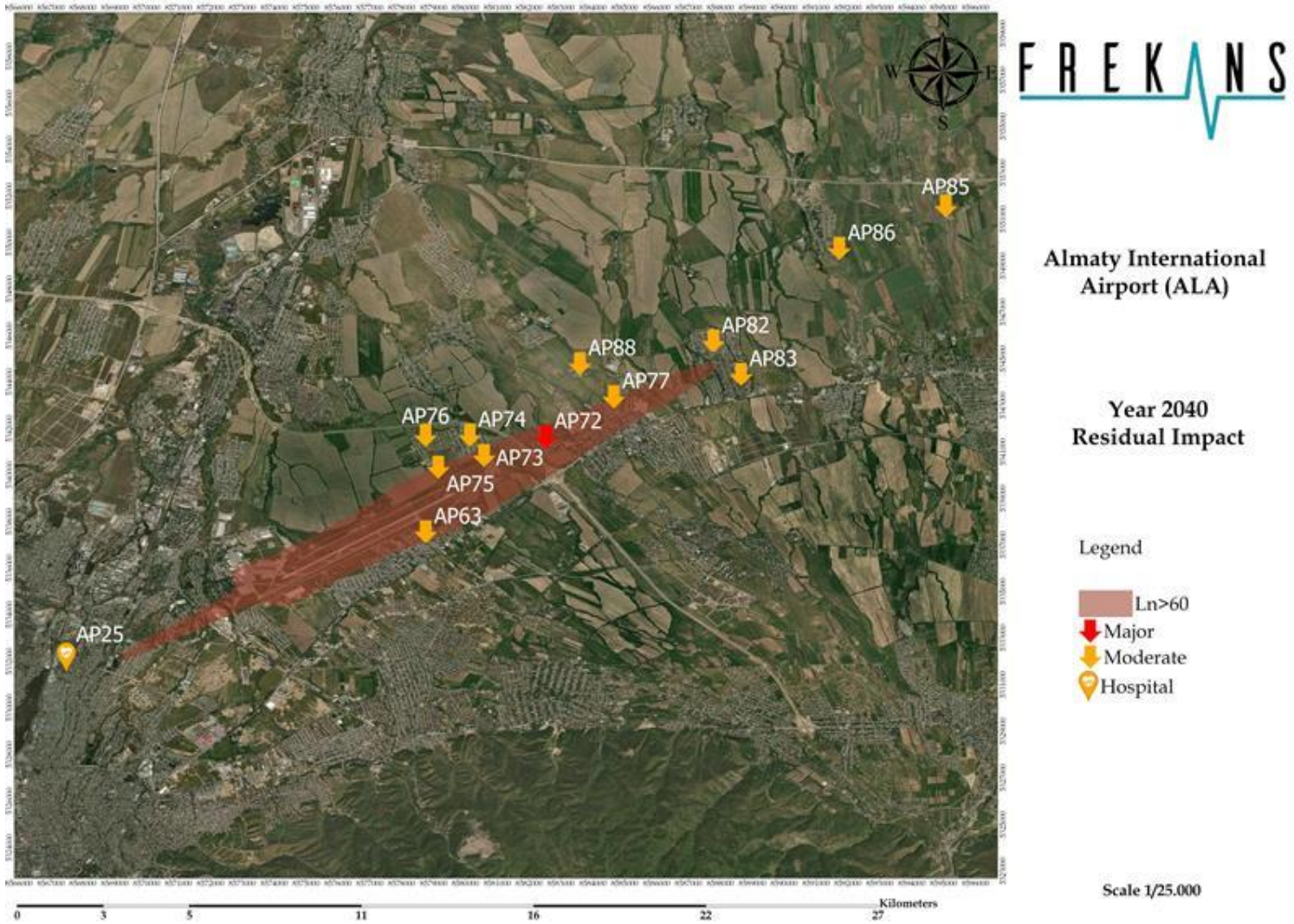
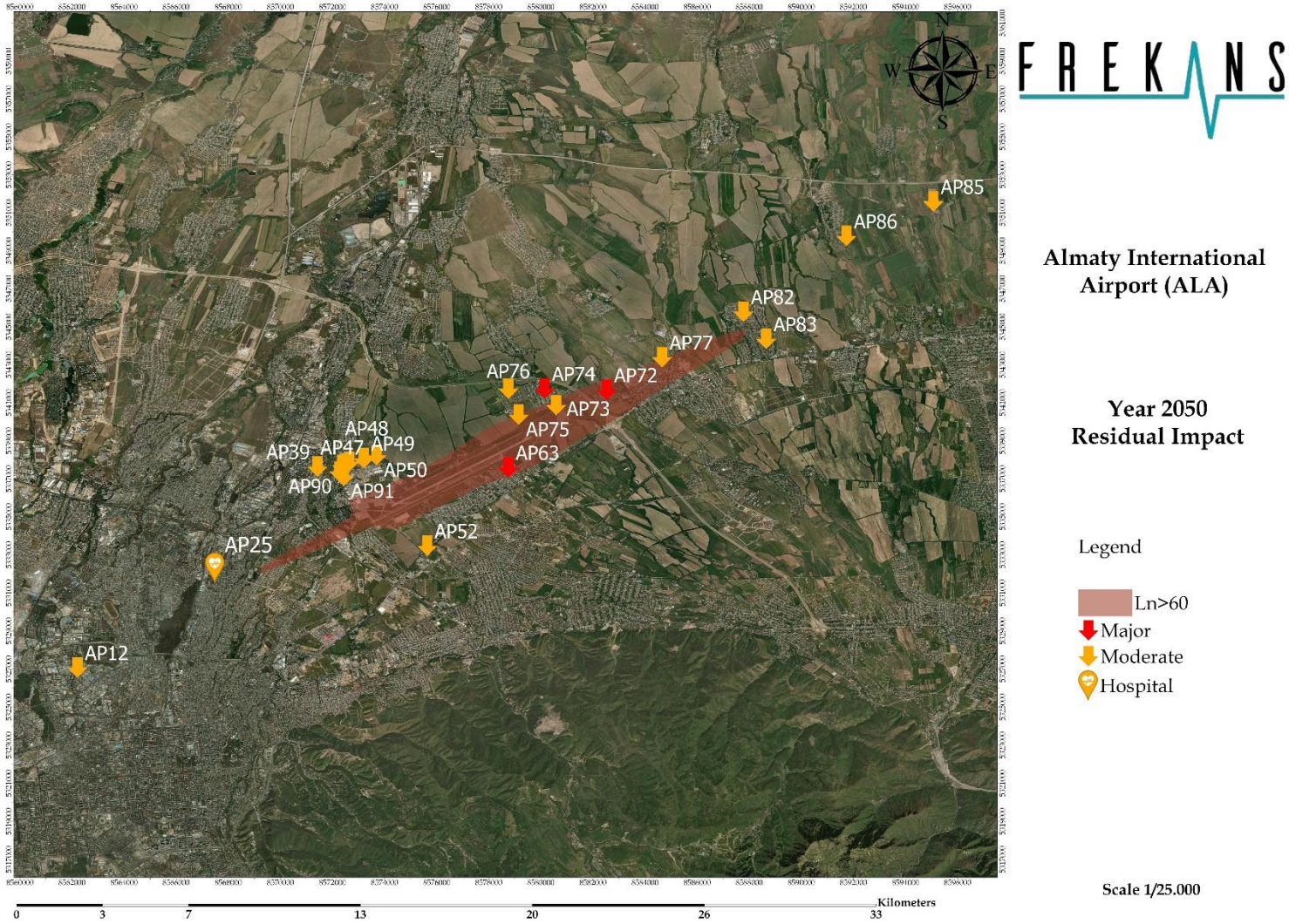


Figure 11.17: Residual impacts of airport noise – 2050 (orange moderate, red major)



FREKANS

Almaty International Airport (ALA)

Year 2050 Residual Impact

Legend

- Ln>60
- Major
- Moderate
- Hospital

Scale 1/25.000