

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

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Verkenning buitenlands geluidbeleid luchtvaart

Eindrapport

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Eindrapport

Geschreven voor

Ministerie van Infrastructuur & Waterstaat
DG Luchtvaart en Maritieme Zaken

To70
PO Box 85818
2508 CM The Hague, The Netherlands
tel. +31 (0)70 3922 322
Email: info@to70.nl

Auteurs

Bernard Snaauw
Ruud Ummels

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Inhoudsopgave

Synthese.....	4
1 Inleiding.....	5
1.1 Aanleiding.....	5
1.2 Doelstelling.....	5
1.3 Vraagstelling.....	5
1.4 Afbakening.....	5
1.5 Leeswijzer.....	6
2 Internationale context.....	7
2.1 ICAO.....	7
2.2 EU.....	8
3 Normstelling en grenswaarden.....	11
3.1 Situatie in Nederland.....	11
3.2 Ervaringen in het buitenland.....	11
4 Rol van de sector en reductiedoelstelling.....	13
4.1 Situatie in Nederland.....	13
4.2 Ervaringen in het buitenland.....	13
5 Ruimtelijke ordeningsmaatregelen.....	14
5.1 Situatie in Nederland.....	14
5.2 Ervaringen in het buitenland.....	14
6 Hinderbeperkende maatregelen.....	16
7 Actuele gegevens en inzichten.....	17
8 Individuele rechtsbescherming.....	18
Landenrapportage – Detailinformatie per land.....	19

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Verkenning buitenlands geluidbeleid luchtvaart

Synthese

1 Inleiding

1.1 Aanleiding

De Luchtvaartnota 2020-2050 is in november 2020 vastgesteld door het kabinet. Hierin worden doelen gesteld ten aanzien van het verbeteren van de leefomgevingskwaliteit rondom luchthavens, waaronder het terugbrengen van geluidhinder. Het doel is om te komen tot een stelsel van normen en maatregelen dat gezamenlijk de hinder rond de luchthavens aantoonbaar vermindert en goed aansluit bij de ervaren hinder van de omwonenden. In het kader van de voorbereidingen op de beleidsontwikkeling hiervoor, heeft IenW behoefte aan nader inzicht hoe in het buitenland wordt omgegaan met het beleid ten aanzien van vliegtuiggeluid.

1.2 Doelstelling

De doelstelling van deze verkenning is te leren van de ervaringen in het buitenland op het gebied van geluidbeleid voor de luchtvaart.

1.3 Vraagstelling

In deze synthese wordt specifiek op een zevental aspecten met betrekking tot het beleid ten aanzien van vliegtuiggeluid ingegaan:

1. Welke wijze van normstelling wordt in het buitenland gehanteerd ten aanzien van geluidbelasting en hinder? Welke grenswaarden horen bij deze normstelling?
2. Wordt hierbij geboden aan de sector om zich te ontwikkelen? Op welke wijze?
3. Zijn er in het buitenland sturingsinstrumenten die worden gebruikt om de geluidbelasting en/of hinder als gevolg van luchtvaart te beperken?
4. Welk ruimtelijk ordeningsbeleid is gerelateerd aan de geldende normen? Welke maatregelen worden hierbij genomen, in welke verhoudingen (isolatie, uitkoop, verhuisregelingen)?
5. Welke instrumenten worden ingezet om hinder te beperken? Worden deze vanuit overheidswege ingezet/opgelegd, of heeft de sector vrijheid om de inzet hiervan te bepalen?
6. Hoe gaat men in het buitenland om met het beschikbaar komen van actuele gegevens (bijvoorbeeld vliegtuigprestatiegegevens) of nieuwe inzichten (bijvoorbeeld naar aanleiding van modelvalidaties) in het vliegtuiggeluidbeleid?
7. Hoe gaat men in het buitenland om met individuele rechtsbescherming van omwonenden bij het overschrijden van grenswaarden?

1.4 Afbakening

De verkenning richt zich op acht landen; Duitsland, Frankrijk, Verenigd Koninkrijk, Italië, Zweden, Noorwegen, Zwitserland en Australië. De verkenning omvat zowel het beleid ten aanzien van hubs als regionale luchthavens (die vergelijkbaar zijn met de Nederlandse luchthavens van nationale betekenis). Met uitzondering van Australië kennen alle landen Europese regelgeving en zijn daardoor goed vergelijkbaar met Nederland. Duitsland, Frankrijk en het Verenigd Koninkrijk zijn door het ministerie geselecteerd aangezien die landen een vergelijkbare hub als Nederland hebben. Noorwegen, Zweden en Zwitserland zijn toegevoegd omdat deze landen vaak vooroplopen in milieubeleid.

1.5 Leeswijzer

Deze synthese vat de resultaten van de verkenning samen. Hoofdstuk 2 geeft de internationale context van de wet- en regelgeving voor vliegtuiggeluid. Vervolgens worden in de hoofdstukken 3 tot en met 8 de onderzoeksvragen een voor een behandeld. De landenrapportage geeft voor ieder land afzonderlijk detailinformatie en vermeldt welke organisaties To70 heeft gesproken voor dit onderzoek.

2 Internationale context

De wet- en regelgeving voor vliegtuiggeluid bestaat uit een set kaders op internationaal (ICAO en EU) en nationaal niveau. Dit hoofdstuk geeft de belangrijkste internationale context weer.

2.1 ICAO

ICAO (International Civil Aviation Organization) is een intergouvernementele organisatie die wordt gefinancierd en geleid door 193 nationale overheden om hun diplomatie en samenwerking op het gebied van luchtvervoer te ondersteunen. ICAO stelt internationale standaarden, 'recommended practices' en procedures vast met betrekking tot de technische gebieden van de luchtvaart, inclusief vliegtuiggeluid. De standaarden worden, zodra ze zijn aangenomen, door elke ICAO-lidstaat in zijn eigen land van kracht.

Het belangrijkste overkoepelende beleid voor vliegtuiggeluid is de 'Balanced Approach to Aircraft Noise Management' (ICAO Doc 9829). Deze leidraad is vastgesteld tijdens de 33^{ste} ICAO Assembly in 2001.

The goal is to address noise problems on an individual airport basis and to identify the noise-related measures that achieve maximum environmental benefit most cost-effectively using objective and measurable criteria.

Het doel van de Balanced Approach is om de geluidproblemen van een luchthaven te identificeren en vervolgens verschillende maatregelen te verkennen om de hinder te verminderen. Deze maatregelen zijn onderverdeeld in vier categorieën en dienen in samenhang bestudeerd te worden om op de meest kosteneffectieve manier een maximaal milieuvoordeel te behalen.

1. Vermindering van het geluid aan de bron
2. Ruimtelijke ordening en ontwikkeling
3. Operationele maatregelen
4. Exploitatiebeperkingen

Geluid aan de bron

De eerste pijler van de Balanced Approach is het reduceren van vliegtuiggeluid aan de bron. Door middel van geluidcertificering worden limieten gesteld aan de geluidsproductie van vliegtuigen. Volgens een vaste voorgeschreven procedure wordt bepaald hoeveel geluid vliegtuigen maken. Het totale gemeten geluidniveau (de som van drie meetwaarden) moet voldoen aan de geluidslimieten afhankelijk van het maximale startgewicht, om binnen een bepaalde geluidscategorie te vallen. Zwaardere vliegtuigen mogen meer geluid maken dan lichtere vliegtuigtypes. Omdat vliegtuigen lange tijd dienstdoen, bemoeilijkt dit de snelle introductie van stillere vliegtuigen. In de afgelopen tientallen jaren zijn de geluidslimieten aangescherpt: van "hoofdstuk 2" (chapter 2) limieten in 1973, "hoofdstuk 3" in 1978, "hoofdstuk 4" in 2006 (10 dB(A) stiller dan hoofdstuk 3), naar de huidige "hoofdstuk 14" limieten in 2017 (7 dB(A) stiller dan hoofdstuk 4). Doordat regelgeving het gebruik van stillere vliegtuigen stimuleert, wordt bij het ontwerp van vliegtuigen met technologische ontwikkeling geprobeerd om de hoeveelheid geluid die een vliegtuig maakt te verminderen. Hierdoor neemt ook het geluid rond luchthavens af.

Ruimtelijke ordening en ontwikkeling

Ruimtelijke ordening is een middel om ervoor te zorgen dat de activiteiten in de buurt van luchthavens verenigbaar zijn met de luchtvaart. Het belangrijkste doel is om niet compatibel landgebruik (zoals woningen en scholen) verder weg van de luchthavens te plaatsen, en compatibele landgebruik (zoals industrie en commercieel gebruik) juist aan te moedigen. Daarnaast kunnen overheden de geluidhinder tot een minimum te beperken door zones vast te stellen waar beperkingen gelden om geluidgevoelige gebouwen, zoals woningen, te ontwikkelen. Ook kan worden gedacht aan mitigerende maatregelen zoals grondaankoop of geluidisolatie. Ruimtelijke ordening is ook essentieel om ervoor te zorgen dat de winst die wordt behaald door het verminderde geluid van de nieuwste generatie vliegtuigen niet teniet wordt gedaan door verdere woningbouw rond luchthavens, zo stelt ICAO.

Operationele maatregelen

Voorbeelden van operationele maatregelen die bijdragen aan het verminderen van de geluidbelasting zijn het gebruik van preferentiële start- en landingsbanen, het optimaliseren van de ligging van vliegroutes en het introduceren van start- en landingsprocedures, zoals glijvluchtnaderingen. Deze maatregelen zijn gericht op het reduceren van het vliegtuiggeluid zonder dat deze negatieve effecten hebben voor de vliegveiligheid of luchthavencapaciteit.

Exploitatiebeperkingen

De meest strikte vorm van maatregelen om de geluidoverlast rondom luchthavens te beperken zijn exploitatiebeperkingen. Exploitatiebeperkingen zijn maatregelen waarbij de toegang van vliegtuigen tot een luchthaven wordt beperkt. Een voorbeeld is vliegtuigen die veel geluid maken niet meer toe te laten op bepaalde luchthavens. Deze zijn doorgaans gebaseerd op de certificatie geluidwaarden van vliegtuigen. Andere voorbeelden zijn bijvoorbeeld een nachtsluiting of geluidsquota/budgetten. Exploitatiebeperkingen zouden volgens ICAO pas overwogen moeten worden als andere maatregelen qua kosten en effectiviteit onvoldoende resultaat opleveren.

2.2 EU

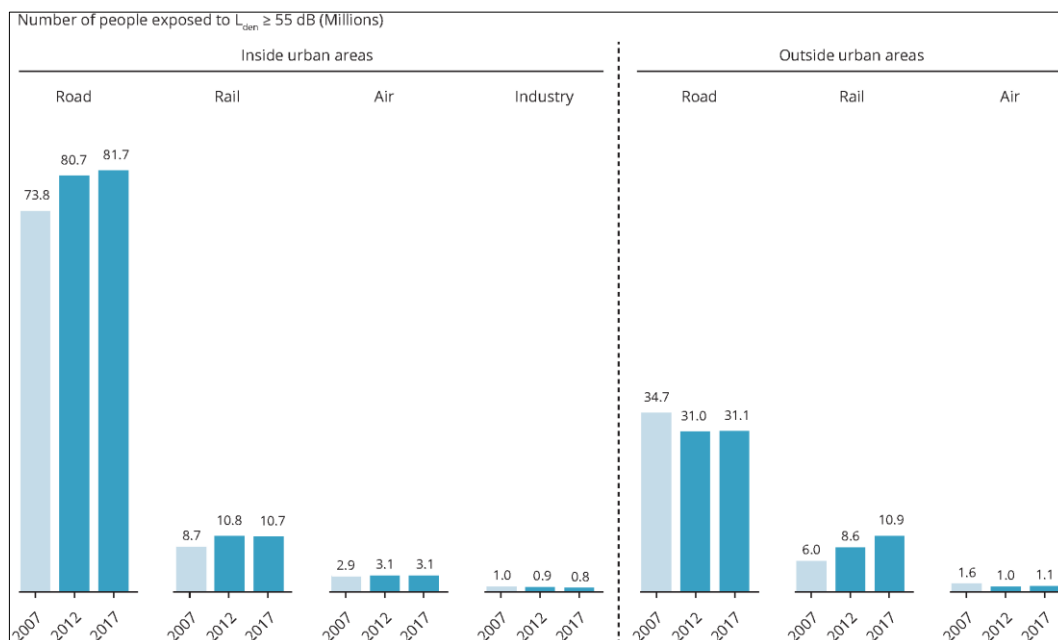
De EU werkt ook aan het definiëren van de aanpak voor een gemeenschappelijk luchtvaartbeleid in Europa. De EU heeft verschillende richtlijnen uitgevaardigd met betrekking tot milieukwesties, onder meer voor de regulering van geluidsnormen voor vliegtuigen. Lidstaten zijn verplicht om te voldoen aan de eisen van de richtlijnen en deze op te nemen in de nationale wetgeving.

Richtlijn 92/14/EEG verbodt Hoofdstuk 2-vliegtuigen vanaf 1 april 2002 om in de EU te landen.

Richtlijn 2002/49/EC inzake de evaluatie en de beheersing van omgevingslawaai ("Environmental Noise Directive") schrijft voor dat de 'competent authority' iedere vijf jaar een actieplan maakt voor luchthavens met meer dan 50.000 vliegtuigbewegingen groothandelsverkeer. Belanghebbenden hebben de mogelijkheid tot inspraak op dit actieplan. De richtlijn heeft ook tot doel de methoden voor het bepalen van geluid in de hele EU te harmoniseren, maar bevat geen grenswaarden.

Sinds de introductie van Richtlijn 2002/49/EC zijn lidstaten verplicht het aantal mensen dat blootgesteld wordt aan een geluidbelasting ≥ 55 dB(A) L_{den}^1 en ≥ 50 dB(A) L_{night}^2 te rapporteren voor de geluidbronnen uit de richtlijn (wegen, spoorwegen, luchthavens en industrie). Op basis van deze data maakt de European Environment Agency een rapportage en stelt de achterliggende data beschikbaar. Dit stelt ons in staat de geluidssituatie van verschillende geluidbronnen en van luchthavens onderling met elkaar te vergelijken.

Onderstaande figuur laat het totaal aantal mensen in Europa blootgesteld aan ≥ 55 dB(A) L_{den} zien voor de eerste drie END rapportages, voor de gebieden die vallen onder strategische geluidbelastingkaarten. Hieruit komt duidelijk naar voren dat wegverkeer de meest dominante bron van omgevingslawaaï is in Europa.



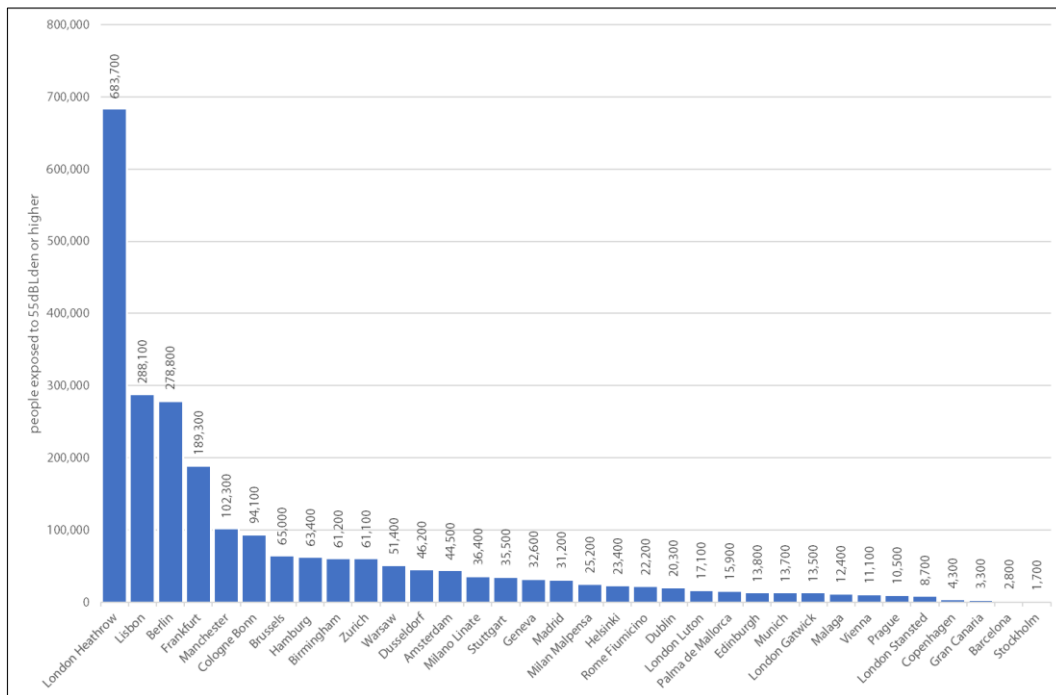
* *Opgemerkt wordt dat lidstaten gegevens over de 4^e karteringsronde in juli 2022 moeten publiceren, en daarom ontbreken in bovenstaande figuur.*

Onderstaande figuur laat de blootstellingsgegevens rond luchthavens voor het jaar 2017 zien. Voor Nederland wordt alleen data van Amsterdam Airport Schiphol data gerapporteerd. Data voor Franse en Griekse luchthavens is niet gerapporteerd.

Deze figuur laat zien dat rond de luchthavens van Londen Heathrow, Lissabon, de oude luchthaven van Berlijn en Frankfurt meer mensen worden blootgesteld aan ≥ 55 dB(A) L_{den} in vergelijking tot Schiphol.

¹ L_{den} staat voor Level day, evening, night, ofwel het tijdgewogen jaargemiddelde geluidniveau buitenshuis in de dag, de avond en de nachtperiode. 's Avonds (19.00 tot 23.00 uur) geldt er een correctie van +5 dB en 's nachts (23.00 tot 07.00 uur) van +10 dB.

² L_{night} staat voor het over alle nachtperiodes van een jaar gemiddelde geluidniveau buitenshuis, waarbij de nachtperiode loopt van 23.00 tot 07.00 uur.



EU Verordening 598/2014 past regels en procedures toe met betrekking tot de invoering van geluid gerelateerde exploitatiebeperkingen op EU-luchthavens. Deze verordening verving een eerdere richtlijn, 2002/30, die voorschreef dat ICAO's Balanced Approach zou worden gevolgd wanneer de invoering van geluid gerelateerde exploitatiebeperkingen op EU-luchthavens werd overwogen. De nieuwe verordening is specifiek in de rechten en verantwoordelijkheden van de belanghebbenden tijdens het geluidsbeoordelingsproces, en voorziet in een nieuwe en bredere definitie van wat een exploitatiebeperking inhoudt.

Wanneer een nieuwe exploitatiebeperking wordt overwogen, vereist EU598/2014 dat een gedefinieerde doelstelling wordt vastgesteld en moet worden aangetoond waarom andere maatregelen binnen de Balanced Approach (die de capaciteit niet zouden beperken) de doelstelling niet zouden bereiken. Het schrijft ook een proces voor voor de evaluatie van de kosteneffectiviteit van de voorgestelde exploitatiebeperkingen. Over nieuwe beperkingen moet overleg worden gepleegd en voor de invoering ervan moet een implementatietermijn worden gegeven.

EU598/2014 sorteert voor op de invoering van geluidsbeperkingen om het aantal marginaal conforme Hoofdstuk 3-vliegtuigen te verminderen (in de richtlijn gedefinieerd als luchtvaartuigen die met een cumulatieve marge van niet meer dan 5 dB(A) voldoen aan de certificeringsgrenzen van hoofdstuk 3). Het verbiedt de invoering van beperkingen die erop gericht zijn het aantal vliegtuigen te verminderen dat aan de Hoofdstuk 4-norm voldoet.

3 Normstelling en grenswaarden

3.1 Situatie in Nederland

In Nederland vormt de Wet luchtvaart met de onderliggende regelgeving het nationale kader voor de vergunningverlening voor de luchtvaart en voor de bescherming van de omgeving tegen luchtvaartgeluid. Dit is voor regionale luchthavens vastgelegd in luchthavenbesluiten en voor Schiphol in het Luchthavenindelingbesluit Schiphol (LIB) en het Luchthavenverkeerbesluit Schiphol (LVB).

De regels en grenswaarden voor het vliegverkeer geven een milieugebruiksruimte per luchthaven. De regels en grenswaarden verschillen per luchthaven. Voorbeelden voor de regels en grenswaarden zijn:

- Een maximaal aantal vliegtuigbewegingen
- Regels aan het baan- en luchtruimgebruik
- Grenswaarden voor de geluidbelasting op jaarbasis

De grenswaarden voor geluid, ofwel geluidruimte, zijn gebaseerd op geluidberekeningen met een voorgeschreven rekenmodel. De berekende geluidbelasting op basis van het feitelijke vliegverkeer wordt met hetzelfde rekenmodel aan de grenswaarden getoetst.

In de Wet luchtvaart is voor Schiphol geregeld dat bij een aanpassing van een besluit het beschermingsniveau voor de omgeving nooit lager mag zijn dan dat van het eerste besluit. Dit beschermingsniveau is voor geluid uitgedrukt in onder andere het aantal woningen binnen de 58 dB(A) L_{den} -contour en het (berekend) aantal ernstig gehinderden binnen de 48 dB(A) L_{den} -contour. Hiermee maken we in Nederland naast een geluidbelastingindicator, ook gebruik van een geluidhinderindicator.

De Inspectie Leefomgeving en Transport (ILT) ziet erop toe dat de luchthavens, luchtvaartmaatschappijen en de luchtverkeersleiding binnen de vastgestelde milieunormen en milieuregels blijven.

3.2 Ervaringen in het buitenland

De Europese Commissie schrijft in de Environmental Noise Directive (Richtlijn 2002/49/EC) het gebruik van L_{den} en L_{night} voor bij de evaluatie en de beheersing van omgevingslawaai. Deze richtlijn ziet toe op de wijze waarop strategische geluidbelastingkaarten en actieplannen tot stand komen (zie hoofdstuk 2.2). De END schrijft geen grenswaarden of regels voor. Het is aan de lidstaten zelf om normen vast te leggen in nationale wet- en regelgeving. Daarbij staat het de lidstaten vrij om alternatieve of aanvullende geluidbelasting- en/of geluidhinderindicatoren te gebruiken.

De verkenning laat zien dat ieder land andere normen voor de vergunningverlening en de bescherming van de omgeving tegen luchtvaartgeluid hanteert. De belangrijkste overeenkomst is dat alle landen daarbij in ieder geval wel een gemiddelde geluidbelasting gebruiken. Maar zowel de periode waarover wordt gemiddeld verschilt (van het gehele jaar tot een gemiddelde zomerdag), als de drempelwaarden die worden gehanteerd. Naast L_{den} (in Frankrijk, Noorwegen en Zweden), zien we ook het gebruik van het equivalente geluidniveau $L_{Aeq,dag}$ en $L_{Aeq,nacht}$ (Duitsland en het Verenigd Koninkrijk), en enkele land-

specifieke geluidmaten, zoals ANEF in Australië, Lrk in Zwitserland en LVA in Italië. Dit bemoeilijkt de onderlinge vergelijking.

De meeste landen hanteren naast primaire geluidmaten, ook secundaire geluidmaten, zoals bijvoorbeeld de *number above threshold* (Nxx) geluidcontouren, welke zijn gebaseerd op het aantal keer dat geluid boven een bepaalde drempelwaarde uitkomt. Dergelijke contouren dienen ter informatie in het beleid en de communicatie.

In de onderzochte landen wordt de geluidbelasting wel gemonitord, maar niet gehandhaafd. In enkele landen hebben overschrijdingen plaatsgevonden van de vastgestelde geluidsruimte voor ruimtelijke ordening waarbinnen een luchthaven mag opereren, waarna de luchthaven een plan moest maken hoe de geluidbelasting in de toekomst weer kan afnemen. Er is er geen enkel land met een norm voor het aantal (ernstig) gehinderden of slaapverstoorden. Wel zijn er exploitatiebeperkingen, zoals een quota count (in het Verenigd Koninkrijk), zie hiervoor de landenrapportage.

4 Rol van de sector en reductiedoelstelling

4.1 Situatie in Nederland

Het is in Nederland aan de sector zelf om binnen de grenswaarden voor de geluidbelasting te blijven. Het uitgangspunt van een geluidruimte is, dat als het geluidniveau per vliegbeweging lager is, er meer vliegbewegingen in de geluidruimte passen. Omgekeerd geldt dit ook, als het geluidniveau per vliegbeweging hoger is, dan passen er minder vliegbewegingen in de geluidruimte.

In de Luchtvaartnota heeft het kabinet doelen gesteld ten aanzien van het terugbrengen van de geluidhinder rondom luchthavens. Minder negatieve gezondheidseffecten zijn een voorwaarde voor de toekomstige ontwikkeling van de luchtvaart. Alleen als de luchtvaart er aantoonbaar in slaagt om stiller en schoner te worden, dan kan groei worden gerealiseerd.

4.2 Ervaringen in het buitenland

Geen van de onderzochte landen heeft een concrete hinderreductie doelstelling voor het terugbrengen van de geluidhinder rondom luchthavens. Alleen in de regio Parijs gold in het verleden een doelstelling, maar die is inmiddels behaald. Het is in alle onderzochte landen aan de sector om zich binnen de, voor ruimtelijke ordening vastgestelde, geluidcontour te ontwikkelen. Als het geluidniveau per vliegbeweging lager is passen er meer vliegbewegingen in de geluidruimte. Overheden gaan er vaak (ongeschreven) van uit dat als er een knelpunt wordt gesignaleerd, de sector zelf het initiatief neemt om maatregelen te treffen om zich in te zetten dit knelpunt op te lossen. Hierbij hanteren luchthavens de Balanced Approach zoals voorgeschreven in Verordening 598/2014. Dat dit effect resulteert zien we vooral terug in het feit dat door de jaren heen meer vliegtuigbewegingen konden worden geacommodeerd binnen eenzelfde (of zelfs lager wordende) jaargemiddelde geluidbelasting. We zien echter ook verschillende voorbeelden waar de geluidbelasting lokaal groter is dan afgesproken (waaronder in Duitsland, Italië en Australië) zonder dat dit gevolgen heeft voor de sector. Dat komt omdat de overheid in de onderzochte landen, zoals in het vorige hoofdstuk aangegeven, de geluidbelasting niet handhaaft.

5 Ruimtelijke ordeningsmaatregelen

5.1 Situatie in Nederland

Voor de ruimtelijke ontwikkelingen rondom luchthavens zijn gebieden vastgesteld waar beperkingen gelden om geluidgevoelige gebouwen, zoals woningen, toe te laten. Onderstaande tabel geeft een overzicht van de beperkingen zoals die voor de verschillende luchthavens in Nederland gelden.

Categorie Luchthavens	Geen nadere afweging nodig	Niet toegelaten behoudens uitzonderingen	Uitzonderingen
Schiphol (LIB)	Buiten de buitengrens LIB 5-gebied ³ . Voor woningbouwlocaties binnen bestaand stedelijk gebied is buiten de grens van het LIB 4-gebied geen afweging nodig.	Binnen LIB 4-gebied ⁴ .	<ul style="list-style-type: none"> Bouwplan of herstructurering <25 woningen; bouwplan lintbebouwing <3 woningen Verplaatsing binnen beperkingengebied Bedrijfswoningen
Andere burgerluchthavens (Besluit burgerluchthavens)	Buiten 48 dB(A) L_{den} -contour. In het gebied binnen de 48 dB(A) L_{den} en buiten de 56 dB(A) L_{den} -contour, mag maar hoeft de provincie geen beperkingen in te stellen.	Binnen 56 dB(A) L_{den} , zoals hieronder genoemd.	<ul style="list-style-type: none"> Opvullen open plek in bebouwing Vervanging van aanwezige bebouwing (militaire luchthaven: aanwezige niet-geluidgevoelige bebouwing)

5.2 Ervaringen in het buitenland

Ruimtelijkeorderingsbeleid wordt door luchthavens gezien als een belangrijke maatregel om te voorkomen dat er nieuwe woningen worden gebouwd in gebieden waar geluidhinder optreedt. Alle landen hebben dan ook zones vastgesteld waar niet gebouwd mag worden, of alleen onder specifieke voorwaarden. Gedetailleerde informatie per land staat in de landenrapportage.

In de meeste landen, worden daarnaast ook isolatiemaatregelen voorgeschreven én genomen om de geluidniveaus binnenshuis te verlagen. In het Verenigd Koninkrijk verwacht de overheid dat als de operatie van de luchthaven verandert waarbij de geluidbelasting met meer dan 3 dB $L_{Aeq,dag}$ toeneemt en de geluidbelasting meer dan 63 dB $L_{Aeq,dag}$ bedraagt, de sector compensatie aanbiedt aan omwonenden.

³ Oude 20 Ke, bouwen binnen bestaand stedelijk gebied, motiveringsplicht externe veiligheid voor alle ontwikkelingen

⁴ 58 L_{den} , max 25 woningen per bouwplan

De meeste landen passen eens in de vijf of tien jaar de zones aan. In Duitsland worden de zones alleen aangepast als het verschil meer dan 2 dB(A) L_{day} of L_{night} bedraagt ten opzichte van de bestaande contour. Dit betekent concreet dat het verkeer meer dan 50% zou kunnen toenemen zonder dat de ruimtelijke ordeningscontouren worden aangepast.

Uit de verkenning constateren we dat in de onderzochte landen een hogere geluidbelasting wordt toegestaan dan in Nederland voor woningbouw of andere bestemmingen.

Ondanks de ruimtelijke ordeningsmaatregelen, zien we in de meeste landen dat de lokale autoriteiten alsnog de nieuwbouw van geluidgevoelige bestemmingen in deze zones toestaan en waardoor nieuwe mensen blootgesteld worden aan vliegtuiggeluid. Zo worden er, als onderdeel van het ruimtelijke ordeningsbeleid in Noorwegen, rond verkeersknooppunten (zoals luchthavens) juist woningen gebouwd, zelfs in gebieden waar de geluidbelasting van luchtvaart meer dan 62 dB(A) L_{den} kan bedragen.

6 Hinderbeperkende maatregelen

Net als in Nederland zijn het vooral de luchthavens met meer dan 50.000 vliegtuigbewegingen die ICAO's Balanced Approach hanteren voor het systematisch identificeren en beheersen van geluidhinder. Overheden gaan er hierbij vaak (ongeschreven) van uit dat de luchthaven hierin het initiatief neemt.

Welke maatregelen het meest effectief hangt af van de lokale situatie. Op hoofdlijnen wordt ingezet op:

1. Vermindering van het geluid aan de bron
Vlootvernieuwing heeft op nagenoeg alle luchthavens geleid tot groeimogelijkheden binnen de bestaande geluidruimte. Vlootvernieuwing wordt, vooral op grotere luchthavens, vaak gestimuleerd door differentiatie van landingsgelden;
2. Ruimtelijke ordening en ontwikkeling
De rol die luchthavens hierin spelen is veelal beperkt tot isolatieprogramma's en/of omgevingsfondsen om de leefomgeving nabij luchthavens te verbeteren. Daarnaast vindt afstemming plaats met lokale planningsautoriteiten over zonering, maar zoals in het vorige hoofdstuk aangegeven komt het voor dat er toch gebouwd wordt in deze zones.
3. Operationele maatregelen
Hier dient onderscheid te worden gemaakt tussen baangebruik en route optimalisaties. Vooral luchthavens met meerdere banen maken gebruik van preferentieel baangebruik, zowel bij parallelle banen (waar bijvoorbeeld gedurende een deel van de dag één baan wordt gebruikt voor starts en gedurende het andere deel van de dag de andere baan), als bij banenstelsels met kruisende banen (waar specifieke banen gesloten zijn gedurende een deel van de dag (of nacht) of waarbij het baangebruik per dag in de week verschilt). Qua vliegroutes zetten sommige luchthavens in op spreiding, andere op concentratie. Door moderne navigatiemiddelen is het steeds vaker mogelijk routes te ontwerpen die de bebouwde omgeving mijden. Ook wordt in alle landen ingezet op andere start- of landingsprocedures, zoals glijvluchtnaderingen of steilere naderingen. Baan- en/of routeoptimalisaties kunnen echter resulteren in nieuw gehinderden, of negatieve effecten hebben op de werklast voor verkeersleiders of voor de luchthavencapaciteit. Dit kan een reden zijn voor luchthavens om bepaalde operationele maatregelen niet te implementeren.
4. Exploitatiebeperkingen
De meest strikte maatregel om geluidoverlast rondom luchthavens te beperken komt in alle onderzochte landen voor. Zo zijn er veel luchthavens met een nachtsluiting, kan er een maximaal aantal vliegtuigbewegingen per uur gelden, of zijn er beperkingen voor bepaalde vliegtuigtypes. Drie van de luchthavens in Londen hebben een quota count systeem voor de nacht. Het zijn overwegend overheden die dergelijke maatregelen opleggen, waarbij de uitvoering van de beperking bij de luchthaven ligt. Het valt op dat nauwelijks gebruik wordt gemaakt van analyses om de kosten en baten van dergelijke maatregelen te bepalen.

Meer detail over de maatregelen die in de verschillende landen worden genomen is terug te vinden in de landenrapportage. Uit de verkenning komt duidelijk naar voren dat de maatregelen die genomen worden zeer afhankelijk zijn van de lokale situatie.

7 Actuele gegevens en inzichten

Uit de verkenning blijkt dat er verschillen tussen landen zijn in hoe er wordt omgegaan met het beschikbaar komen van actuele gegevens of nieuwe inzichten.

Zo worden in het Verenigd Koninkrijk, Noorwegen en Zwitserland metingen gebruikt om geluidmodellen te kalibreren. In Zwitserland wordt gebruik gemaakt van metingen uit de jaren negentig, terwijl er rond de Londense luchthavens een continu meetprogramma loopt. In Noorwegen voert men metingen uit als er nieuwe vliegtuigtypes of helikopters worden ingezet om vervolgens op te nemen in de daar gebruikte modellen. In landen als Frankrijk, Italië en Australië wordt gebruik gemaakt van de standaard geluid- en prestatiegegevens beschikbaar uit de daar gehanteerde geluidmodellen.

In het Verenigd Koninkrijk, Zwitserland en Zweden vinden jaarlijks controleberekeningen plaats door de overheid. In Zweden met als doel om te bepalen of meer woningen geïsoleerd dienen te worden.

In meerdere landen, onder andere Duitsland, Frankrijk, Italië en Australië, worden geluidcontouren eens per vijf of tien jaar bepaald. Deze contouren worden vooral gebruikt voor de ruimtelijke ordening. Hierdoor gebruikt men ook maar eens in de vijf of tien jaar nieuwe gegevens of de laatste inzichten.

Uit de verkenning blijkt niet dat overheden hun beleid aanpassen in verband met het beschikbaar komen van actuele gegevens of inzichten.

8 Individuele rechtsbescherming

In Nederland worden de regels en grenswaarden voor het vliegverkeer gehandhaafd door ILT. Het verleden leert dat er nauwelijks overschrijdingen zijn geweest, en dat wanneer deze optreden, de inspectie hiertegen optreedt. In het geval dat dit niet zou gebeuren kunnen omwonenden naar de rechter stappen met een verzoek tot handhaving.

In de onderzochte landen wordt de geluidbelasting wel gemonitord, maar niet gehandhaafd. Aangezien het systeem van grenswaarden en handhaving niet bestaat, zijn er ook weinig aangrijpingspunten voor rechtsbescherming. Wel is er in verschillende landen een vorm van rechtsbescherming bij isolatie. Als blijkt dat de geluidbelasting hoger is dan aangenomen, dan wordt van de luchthaven verwacht dat alsnog geïsoleerd wordt of op een andere manier compensatie plaatsvindt.

Bij de luchthaven van Frankfurt hebben omwonenden een aanklacht tegen de deelstaat Hessen ingediend over een overschrijding van de geluidbelasting. Dit is het gevolg van ander baangebruik dan eerder aangenomen. De rechter heeft bepaald dat hij de aanklacht niet in behandeling neemt in verband met de coronapandemie. Dit geeft de luchthaven (meer) tijd om met een oplossing te komen.



Verkenning buitenlands geluidbeleid luchtvaart

Landenrapportage – Detailinformatie per land

Contents

- Germany
- France
- United Kingdom
- Australia
- Switzerland
- Italy
- Norway
- Sweden

- Policy overview of researched countries

Country context - 1

Germany



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- Germany is one of the largest countries in Europe
- As a federal system, Germany consists of 16 federal states whose state governments partly take on their own state duties
- Each state has the power to determine the importance of air traffic (balance between health impact and economical benefit) within the national legislation boundaries
 - Leipzig Airport is for example an important logistical hub, operating mainly at night. Local State has special legislation in place to accommodate this different from other states
- It has over 80 airports, from which 16 are international airports
- Largest airports are Frankfurt, Munich, and Dusseldorf
 - Frankfurt number of passengers in 2019: 70 million
 - Munich number of passengers in 2019: 48 million
 - Dusseldorf number of passengers in 2019: 25 million
- German also relies on some busy domestic routes, such as Frankfurt-Berlin and Munich-Berlin

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Country context - 2

Germany



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

The designated competent authorities in Germany are:

Land	Flughäfen im Anwendungsbereich der Verordnung (50.000 zivile Flugbewegungen)	Zuständigkeit für Verordnung (EU) Nr. 598/2014
Baden-Württemberg	Flughafen Stuttgart	Ministerium für Verkehr und Infrastruktur Baden-Württemberg
Bayern	Flughafen München Flughafen Nürnberg	Bayerische Staatsministerium des Inneren, für Bau und Verkehr
Brandenburg	Verkehrsflughafen Berlin Brandenburg	Gemeinsame Obere Luftfahrtbehörde Berlin-Brandenburg
Hamburg	Flughafen Hamburg	Behörde für Wirtschaft, Verkehr und Innovation
Hessen	Flughafen Frankfurt	Hessisches Ministerium für Wirtschaft, Energie, Verkehr und Wohnen
Niedersachsen	Flughafen Hannover	Niedersächsisches Ministerium für Wirtschaft, Arbeit, Verkehr und Digitalisierung
Nordrhein-Westfalen	Flughafen Düsseldorf Flughafen Köln	Ministerium für Verkehr des Landes Nordrhein-Westfalen
Sachsen	Flughafen Leipzig/Halle	Sächsisches Staatsministerium für Wirtschaft, Arbeit und Verkehr

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How is noise impact measured? Are there any noise limits?

Germany



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- The German Act for Aircraft Noise Protection from 2007 (https://www.bmuv.de/fileadmin/bmu-import/files/english/pdf/application/pdf/flulaermg_en.pdf) mandates commercial and military airports to have noise protection zones: two daytime zones and one nighttime zone (if applicable)
- The establishment of the noise protection zones are a responsibility of the federal government and must be reported to the national government. An update of the protection zones is required every 10 years.
- The contours are made based on LA_{eq} and Number Above Threshold (NAT) using $L_{A,max}$. The contours are made based on the average 6 months future forecast of flights movements.
- The nighttime protection zone is created by the union of the LA_{eq} night contour with the number above threshold (NAT) with the $L_{A,max}$ values stated in the table.
- The German Civil Aviation Law (Section 19a) obliges the operators of civil airports to set up and operate installations for the measurement of noise near the airport. The operation of these installations is described in DIN 45643 "Measurement and Assessment of Aircraft Noise"
- Noise measurement stations are placed along the flight paths and in residential areas within or beside the protection zones and data open to the public via <https://franom.fraport.de/franom.php>

Zone	Existing civilian airfield	New/expanding civilian airfield
Daytime protection zone 1 (06:00 – 22:00)	65 dB(A) LA_{EQ} Day	60 dB(A) LA_{EQ} Day
Daytime protection zone 2 (06:00 – 22:00)	60 dB(A) LA_{EQ} Day	55 dB(A) LA_{EQ} Day
Night-time protection zone (22:00 – 06:00)	55 dB(A) LA_{EQ} Night and 6 x 72 dB(A) LA_{MAX} Night	50 dB(A) LA_{EQ} Night and 6 x 68 dB(A) LA_{MAX} Night

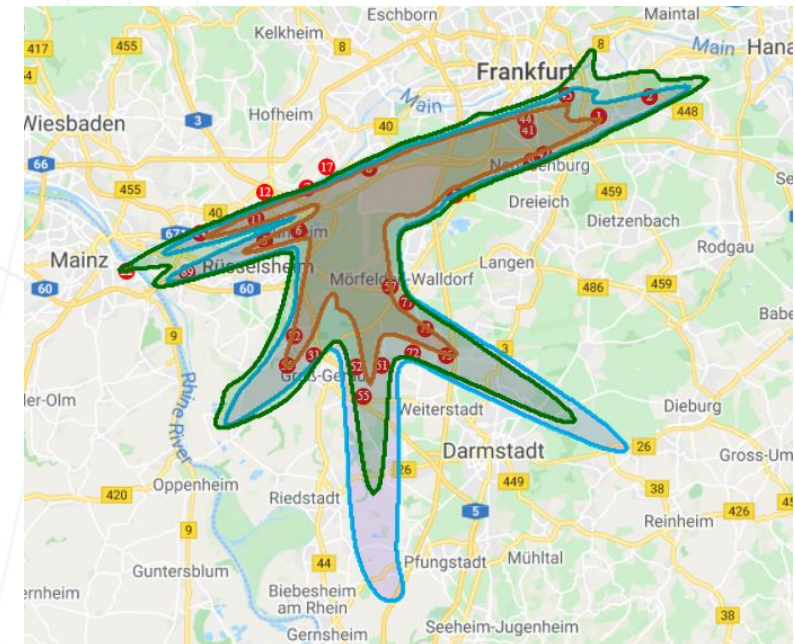


Figure: Protection zones and measurement stations at Frankfurt Airport

<https://framap.fraport.de/framap/main/r/isfl/go>

Does government set noise goals? How do airports/ANSPs/airlines deliver?

Germany



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- Government firmly believes in the constitution and the 20 rights that people are entitled to have. One of these right is 'no indemnity to the human body'. These rights are translated in the national legislation regarding aircraft noise (Fluglärmsgesetz)
- There is a transition ongoing to a "greener" national government, which may result in a different approach to environmental management for airports (for example more focus on reducing noise and emissions in favor of capacity and efficiency)
- National government doesn't specify specific noise goals but do require updating the protection zones every 10 years. Part of the 10-year update is the review of scientific evidence (for example results from NORAH study) that aircraft noise and annoyance stayed at the same level or decreased. Noise limits of the protection zones can be changed if this is deemed required during this update.
- National government prescribes the use of ICAO balanced approach to minimise aircraft noise (<https://www.bmuv.de/themen/luft-laerm-mobilitaet/laerm/themenbereiche-laerm/fluglaerm>)
- Airports, ANSPs, local community(groups) and airlines collaborate in working groups to minimise aircraft noise and annoyance around airports.

Is there any spatial planning policy?

Germany



Country context

Measurement and noise limits

Government goals

Spatial planning policy

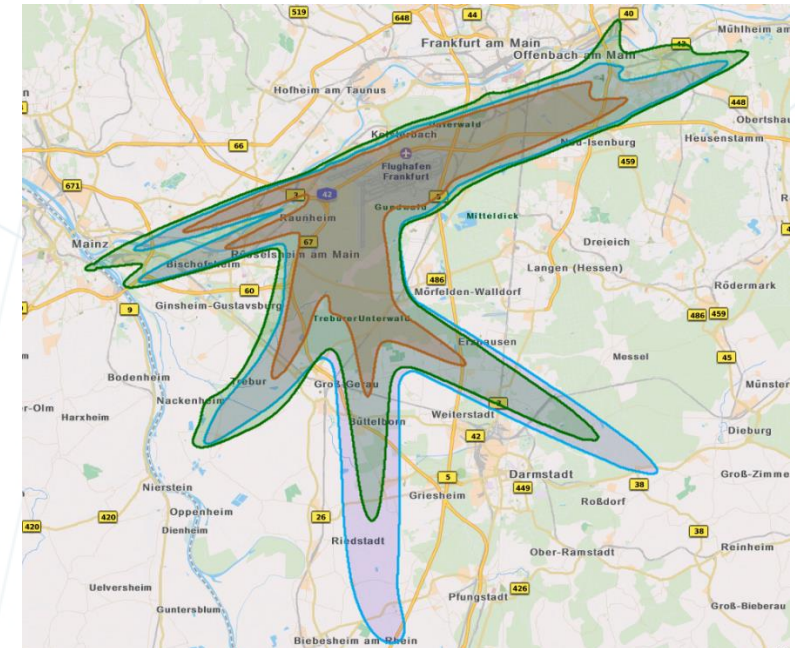
Mitigation measures

New data and knowledge

Noise limit enforcement

- The law stipulates what rules and restrictions apply for each protection zone. For example, no hospitals or elderly care homes can be built in any of the protection zones. While the daytime protection zone 1 and nighttime protection zones prohibit any construction of new dwellings. For existing dwellings in the same zones, the cost of soundproofing will be covered. Houses in the nighttime protection zone will get compensation for the installation of a ventilation system for rooms primarily used for sleeping. There are also different compensations schemes for sound insulation depending on the protection zone a dwelling resides in.
- The protection zones are different for existing airfields and new/expanding airports. An expansion of an airfield shall be deemed substantial if it leads to an increase of at least 2 dB(A) $L_{Aeq,day}$. A new/expanding airport impacts new/other people and therefore the protection zones are larger than zones for existing airports.

Zone	Existing civilian airfield	New/expanding civilian airfield
Daytime protection zone 1 (06:00 – 22:00)	65 dB(A) L_{Aeq} Day	60 dB(A) L_{Aeq} Day
Daytime protection zone 2 (06:00 – 22:00)	60 dB(A) L_{Aeq} Day	55 dB(A) L_{Aeq} Day
Night-time protection zone (22:00 – 06:00)	55 dB(A) L_{Aeq} Night and 6 x 72 dB(A) L_{Amax} Night	50 dB(A) L_{Aeq} Night and 6 x 68 dB(A) L_{Amax} Night



What measures are taken to reduce aircraft noise and who leads these initiatives?

Germany



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- Airports liaise with airlines, air traffic controllers and local community to minimise noise impact within the designated protection zones. Airports, ANSPs, local community(groups) and airlines collaborate in working groups to minimise aircraft noise and annoyance around airports.
- National government prescribes the use of ICAO balanced approach to minimise aircraft noise (<https://www.bmuv.de/themen/luft-laerm-mobilitaet/laerm/themenbereiche-laerm/fluglaerm>).
- Various operational measures are used at German airports to reduce air traffic noise. These measures include low-noise take-off and landing procedures as well as regulations on night flights. At several airports, Continuous Descent Operations (CDO) are established.
- The German Environment Agency (UBA) advises the German government on noise policy for aircraft noise (UBA also does this for other noise sources). UBA recommends that there should be no regular flights from airports close to towns between 10:00 p.m. and 6:00 a.m. However, this recommendation has not been realised at German airports. The current night flight regulations contain different times For instance, at Frankfurt/Main airport flights between 11:00 p.m. and 5:00 a.m. are not allowed. On the other hand, flights at the airports of Cologne and Leipzig/Halle are permissible during the whole night.

How is new data and knowledge dealt with?

Germany



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

- The noise calculation method to determine the noise protection areas is prescribed in the Fluglärmsgesetz under “Instructions on the Calculation of Noise Protection Areas, ICN”
- The German Act for Aircraft Noise Protection from 2007 is the product of all the latest knowledge (from as far back as 1971) on noise protection.
- The law and legislation contains articles that require to ensure that noise calculations, noise measurements and noise zoning/limits are performed and assessed with the latest available information. How this is performed is not described in detail, but it must be updated every 10 year.
- In the case of an update of the noise calculation scheme, the DLR will determine new calculation input parameters allowing more differentiation. DLR is using measurements to calibrate the (input parameters of the) model. It is unclear how the measurements are incorporated precisely and how these updates will change the noise protection law.

Are noise limits enforced? And how are individual residents protected?

Germany



Country context

Measurement and noise limits

Government goals

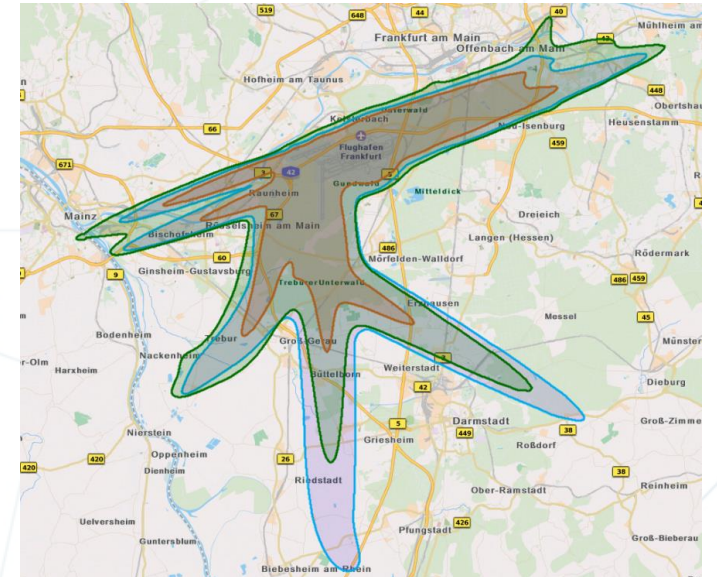
Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

- The law stipulates how each the restrictions and rules which apply for each protection zone. For example, no hospitals or elderly care homes can be built in any of the protection zones. While the daytime protection zone 1 and nighttime protection zones prohibit any construction of new dwellings. For existing dwellings in the same zones, the cost of soundproofing will be covered. Houses in the nighttime protection zone will get compensation for installation of a ventilation system for rooms primarily used for sleeping. There are also different compensations schemes for sound insulation depending on the protection zone a dwelling resides in.
- Noise limits are not enforced. The noise protection zones are assessed every 10 years. If significant changes are found (e.g. more than 2dB Lday/Lnight difference) a revision of the noise protection zone(s) is required.
- The airports also have to get an expansion permit, through the (local) Ministry, where a decision will be made taking into account any changes in noise contours. The Ministry has the power to reject or change the expansion (e.g. reduce number of flights) if deemed necessary for noise protection purposes.
- Everyone that resides in one of the noise protection zones can (by law) apply for compensation or address the ministry to provide adequate protection against aircraft noise. After hearing the parties involved (payee and payer), the competent authority under state law shall determine in writing the amount of the expenses that are reimbursable.



Zone	Existing civilian airfield	New/expanding civilian airfield
Daytime protection zone 1 (06:00 – 22:00)	65 dB(A) LA _{EQ} Day	60 dB(A) LA _{EQ} Day
Daytime protection zone 2 (06:00 – 22:00)	60 dB(A) LA _{EQ} Day	55 dB(A) LA _{EQ} Day
Night-time protection zone (22:00 – 06:00)	55 dB(A) LA _{EQ} Night and 6 x 72 dB(A) LA _{MAX} Night	50 dB(A) LA _{EQ} Night and 6 x 68 dB(A) LA _{MAX} Night

Country context - 1

France



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- France has over 159 airports
- Largest airports are Paris Charles de Gaulle, Paris Orly, Nice Cote d'Azur and Lyon
- CDG number of passengers in 2019: 76 million
 - ORY number of passengers in 2019: 32 million
 - NCE number of passengers in 2019: 14.5 million
 - LYS number of passengers in 2019: 12 million
- Charles de Gaulle and Orly represents, in 2019, 50.4% of the French passenger traffic
- 16 airports and aerodromes are deeply studied for noise measures.
 - Lille-Lesquin, Paris-Orly, Paris-Le Bourget, Paris CDG, Nantes Atlantique, Beauvais – Tille, Lyon Saint Exupery, Nice Cote d'Azur, Marseille Provence, Toulouse Blagnac, Bordeaux Merignac, Bale Mulhouse
 - Toussus le Nobre, Cannes Mandelieu, Paris-Issy les Moulineaux, Pontoise

Les chiffres-clé de 2019

Passagers commerciaux



214 271 063
+3.8%

Mouvements commerciaux

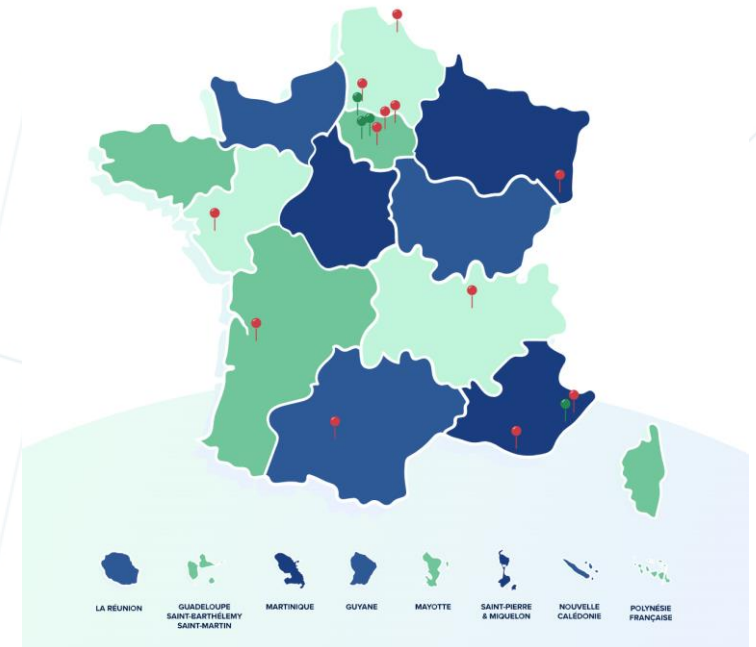


1 967 374
+1.5%

Emport moyen



109
+2.2%



Green – Mainly General Aviation

Red – Mainly Commercial aviation

Source : UAF and ACNUSA

Country context - 2

France



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

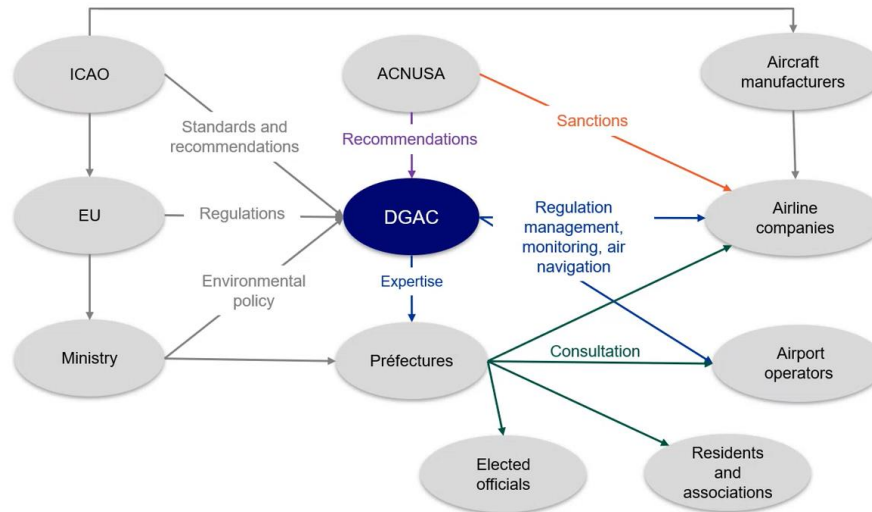
New data and knowledge

Noise limit enforcement

Multiple stakeholders are interacted with different roles and responsibilities, highlighted in the figure below.



Presentation of stakeholders



The competent authorities responsible for the process to be followed when adopting operating restrictions in the Balanced Approach Regulation is the French CAA (DGAC) - Direction du transport aérien (sous-direction du développement durable).

An independent administrative authority regarding noise management - **L’Autorité de contrôle des nuisances aéroportuaires (ACNUSA)** was created by Law No. 99-588 of July 12, 1999:

- it is responsible for controlling all the measures to combat the nuisances generated by air transport and the airport sector;
- it can issue recommendations on any question relating to environmental nuisances on and around airports;
- it must satisfy a duty of information and transparency, particularly to local residents;
- In addition to its powers over all civil airports, it has specific powers over 16 airports and aerodromes (see previous slide), and the power to sanction airlines..



How is noise impact measured? Are there any noise limits?

France



Country context

Measurement and noise limits

Government goals

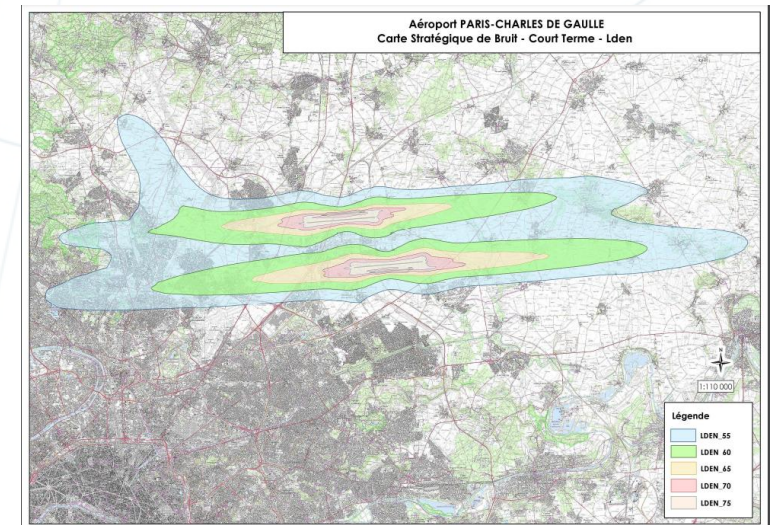
Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- Lden and Lnight are the index used to measure the noise in the different plans. Number above is also used to compare the measures.
- 4 main plans are calculated
 - Plan d'exposition au bruit (PEB) for spatial planning restriction dividing airports in 3 categories (general, aerodromes, military aerodromes)
 - Plan de Gene Sonore (PGS) for isolation measures for airports with more than 20,000 mvts/year of more than 20 tons (12airports concerned)
 - Carte strategique de bruit from directives 2002/49/CE and 2015/996 and 2020/367 to align with the European directives for airports of more than 50,000 passengers (10 airports concerned)
 - Courbe d'environnement sonore (CES) to monitor on some aerodromes the evolution of the noise



Does government set noise goals? How do airports/ANSPs/airlines deliver?

France



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

In terms of noise pollution around airports, the French legislative and regulatory corpus is mainly based on the international standardization established within the framework of the ICAO. France has translated the four pillars of the balanced approach into national regulations through the following concepts:

- Reduction of noise at source: **The tax on airborne noise pollution (TNSA)** levied at each take-off pursuant on the 12 main airports.
- Land-use Planning and Management: **Noise Exposure Plans (PEB)**, the purpose of which is to limit urbanization around airports **and Noise Disturbance Plans (PGS)**, the purpose of which is the isolation of building in the surrounding of the airport, funded by the TNSA
- Noise Abatement operational Procedures: **Operating procedures** to reduce nuisance as much as possible including regulations on the overflight of built-up areas, limiting helicopter traffic in areas with high population density
- Operating Restrictions: **Restrictions on the operation of 16 platforms** within the general framework of the balanced approach procedure.

Some ponctual events have been created to focus on a specific topic such as the **Grenelle Environnement** - Convention of January 28, 2008 involving all players of the French aviation sector

Civil aviation conducts or coordinates numerous preventive actions, such as:

- Plan the sustainable development of airports;
- Limit construction in noisy areas and fight against noise pollution;
- Support industrial research in favor of less polluting aircraft and engines;
- Act for the renewal of fleets;
- Take into account the particularities of light aviation and helicopter transport.

Is there any spatial planning policy?

France



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

Plan d'Exposition au bruit

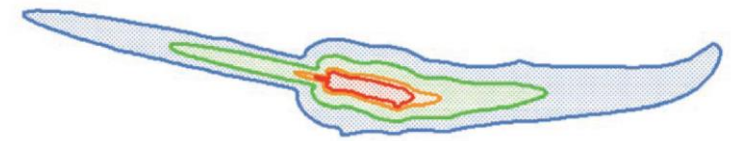
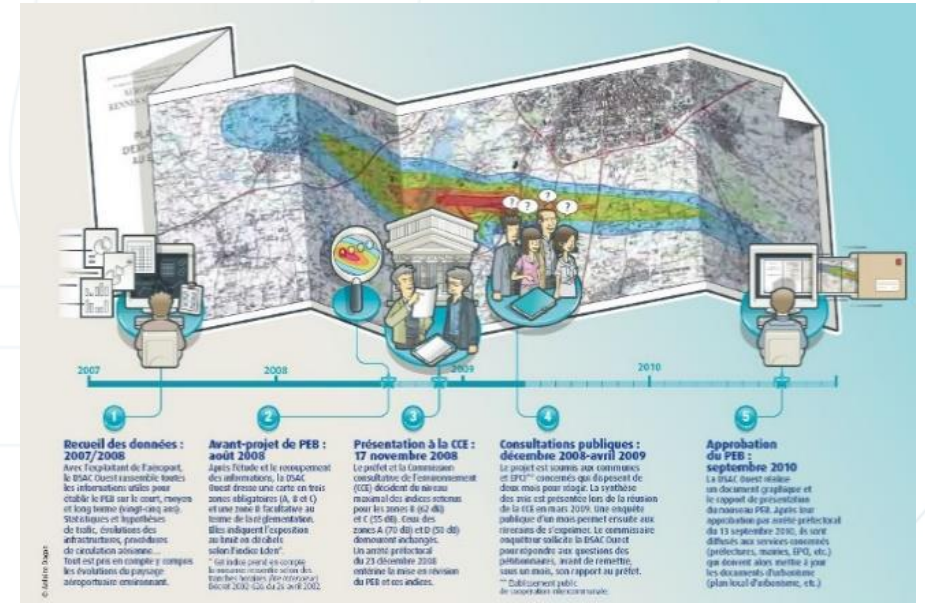
The PEB is currently being revised to take into account the latest regulatory changes.

The development of a PEB must take into account all the short, medium and long-term prospects for the development and use of the airport concerned. These assumptions mainly concern:

- the number of movements;
- air traffic trajectories;
- the evolution of the fleets operated;
- the distribution of traffic between day, evening and night;
- airport infrastructure.

The PEB is a graphic document on a scale of 1/25,000th which delimits four areas of discomfort quantified by the Level day evening night (Lden) index. These areas are

	Zone A	Zone B ^a	Zone C	Zone D ^b
Cas général	$L_{den} \geq 70$	$70 > L_{den} \geq (62 \text{ à } 65)$	$(62 \text{ à } 65) > L_{den} \geq (55 \text{ à } 57)$	$(55 \text{ à } 57) > L_{den} \geq 50$
Aérodromes visés à l'article R.112-2 du code de l'urbanisme	$L_{den} \geq 70$	$70 > L_{den} \geq (62 \text{ à } 65)$	$(62 \text{ à } 65) > L_{den} \geq (52 \text{ à } 57)$	$(52 \text{ à } 57) > L_{den} \geq 50$
Aérodromes militaires listés par arrêté ¹⁰	$L_{den} \geq 70$	$70 > L_{den} \geq (62 \text{ à } 68)$	$(62 \text{ à } 68) > L_{den} \geq (55 \text{ à } 64)$	$(55 \text{ à } 64) > L_{den} \geq 50$



Légende : ■ Zone D ($L_{den} 50$) ■ Zone C ($L_{den} \dots$) ■ Zone B ($L_{den} \dots$) ■ Zone A ($L_{den} 70$)

Schéma type de PEB.

Zones A and B are essentially unbuildable. In zone C, certain constructions are authorized under certain conditions. In zone D, which is compulsory on the 11 largest lots, new accommodation is authorized provided that it is soundproofed.

The adoption of a PEB gives rise to a long and complex administrative procedure, given the stakes in terms of town planning and development. The procedure includes in particular a consultation of the municipalities concerned as well as a public inquiry.



Is there any spatial planning policy?

France



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

Plan de Gene Sonore (PGS)

The PGS delimit the zones in which the local residents can benefit, under certain conditions, from the isolation program aid.

12 airports are concerned by this program. It is all the airports with more than 20,000 mvts/year of more than 20 tons (Lille-Lesquin, Paris-Orly, Paris-Le Bourget, Paris CDG, Nantes Atlantique, Beauvais – Tille, Lyon Saint Exupery, Nice Cote d’Azur, Marseille Provence, Toulouse Blagnac, Bordeaux Merignac, Bale Mulhouse)

The PGS are established on the basis of the traffic estimated in the short term (n+1), the applicable air traffic procedures and the infrastructures which will be in service the year following the date of publication of the PGS approval order.

They are drawn up under the authority of the coordinating prefect (in conjunction with the DGAC), sent for their opinion to the municipal councils of the municipalities concerned, to the consultative committee for assistance to local residents and to ACNUSA

3 areas are defined under which aids allocated are defined.

	Zone I – Very high noise disturbance	Zone II – high noise disturbance	Zone III – moderate noise disturbance
Airports – Groupe I	>Lden 70	Lden 70 > X > Lden 65 (or Zone B (PEB)	Zone II > X > Lden 55

What measures are taken to reduce aircraft noise and who leads these initiatives?

France



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

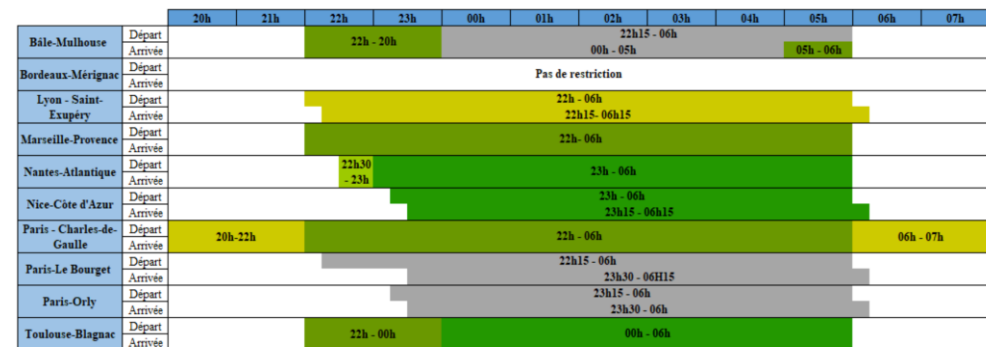
Noise limit enforcement

Action Plans (Plan de Prévention du Bruit dans l'Environnement - PPBE) are created for airport, led by DGAC and defined with the different stakeholders. Public consultation and environment impact can be drafted. These plans define the actions to be taken and are renewed periodically.

The following table summarise the type of measures and leaders for Le Bourget. Similar measures and initiatives are taken for the other airports

Measures	Leader
Control the urbanization around the airport • Establish the noise exposure plan; • Monitor the development of urban planning around the airport.	DGAC Préfectures DDT, UT DRIEA Mairies
Install soundproofing • Promote the system; • Set up information campaigns	DGAC ADP
Develop noise abatement flight procedures • Note the approach altitudes;	DGAC
Monitor the evolution of noise • Develop the noise monitoring network; • Annual publication of sound environment curves; • Follow SURVOL and DEBATES studies	ADP DGAC Préfecture de Région Îlede-France
Prioritize consultation	Préfectures DGAC ADP

Main restrictions are in place for the airports concerned by the EU regulations that are summarised in the following table



Aucun vol Interdit aux aéronefs de marge acoustique cumulée inférieure à : 13 EPNdB 10 EPNdB 8 EPNdB 5 EPNdB

*Situation fin mai 2020 pour les aéroports soumis aux obligations de la directive n°2002/49/CE



What measures are taken to reduce aircraft noise and who leads these initiatives?

France



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

Others measures can be found led by the government or the airport itself

Operating restrictions at aerodromes

Detailed measures per airports can be found <https://www.ecologie.gouv.fr/aeroports-restrictions-environnementales>.

Some operating restrictions and fees charges are based on the cumulative noise margin of the aircraft.

To find out the cumulative margin of the aircraft, the DGAC provides airlines with a quick calculator of margins and acoustic groups of aircraft online. <https://caramel.aviation-civile.gouv.fr/>

Restrictions taken at Charles de Gaulles are shown in the figure behind.

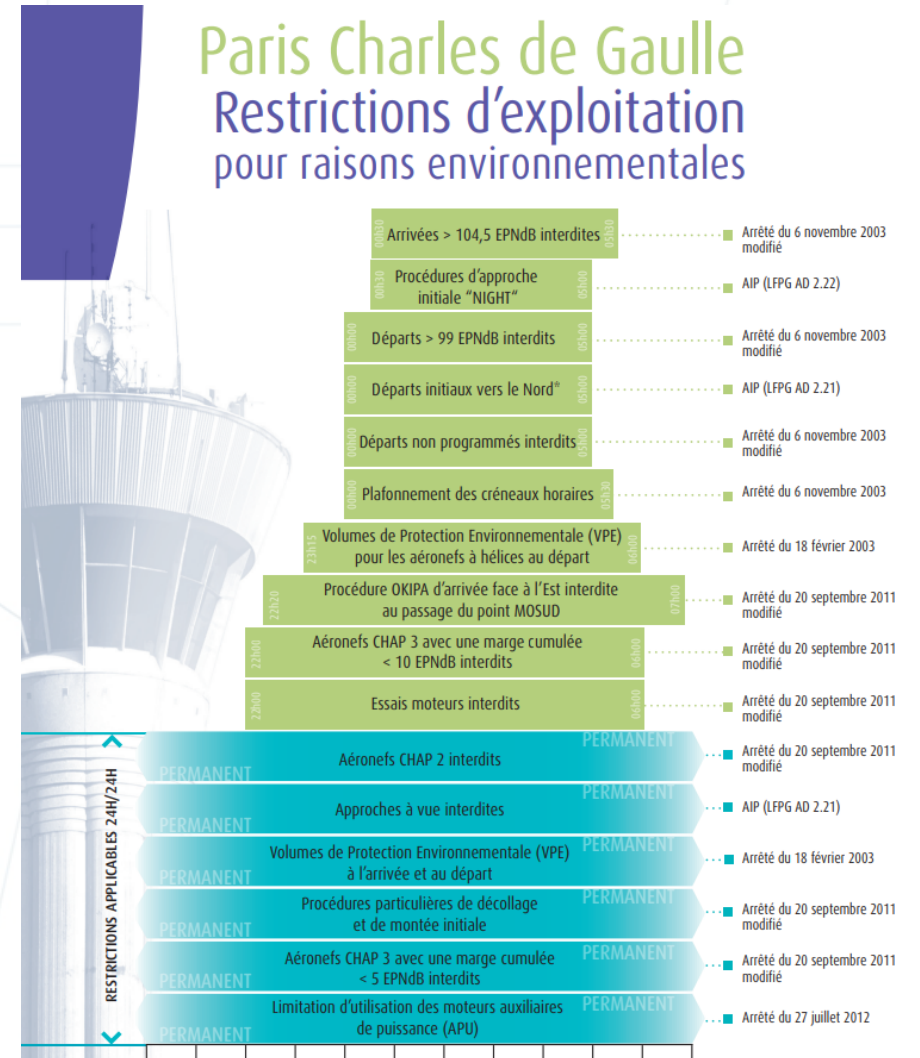
Indicator IGMP at Charles de Gaulle Airport

<https://www.ecologie.gouv.fr/lenvironnement-sonore-sur-plateforme-paris-cdg>

Introduced by the order of January 28, 2003, the global weighted measured indicator (IGMP) was put in place to better assess the sound environment on the Paris-Charles de Gaulle platform. This indicator may not exceed, for a given calendar year, the value of 100, which corresponds to the energy calculated for the reference year (and corresponds to the average for the years 1999 to 2001)

Lille Airport has voluntarily imposed a limit in terms of movement for night flights

Paris Charles de Gaulle Restrictions d'exploitation pour raisons environnementales



How is new data and knowledge dealt with?

France



Country context

Measurement and noise limits

Government goals

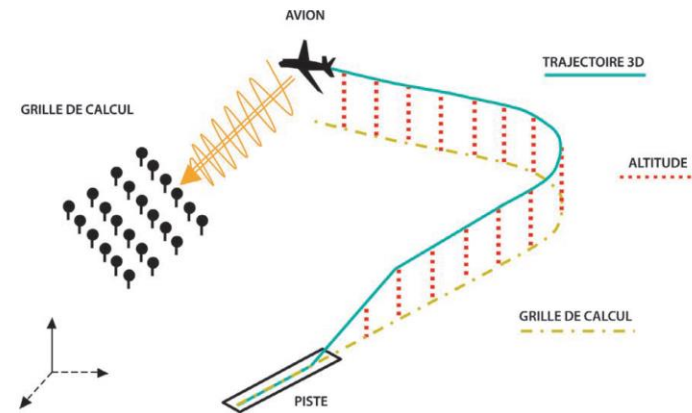
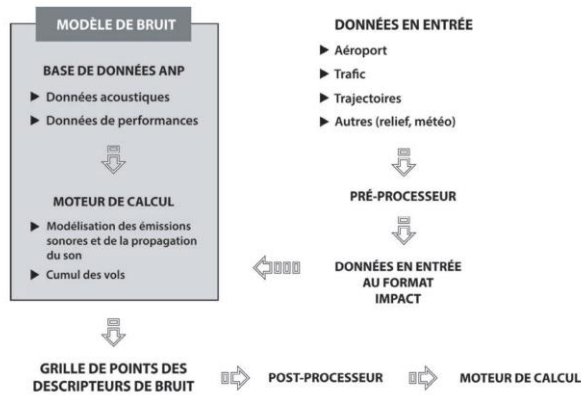
Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

- Aircraft noise modeling around aerodromes is based on three components:
 - A noise calculation method implemented in a computer program using **Eurocontrol tool - IMPACT**;
 - The **ANP database** of aircraft necessary to finely characterize the noise emissions of each aircraft;
 - Data relating to infrastructure, traffic, trajectories and operating conditions specific to each aerodrome
 - For helicopters the ANP database is still not developed, so INM is used.



- In the past, INM was used and plans are renewed periodically. When the decision has been made to change tool, a study to evaluate the difference on results with the two tools has been made. This study has assessed that differences in the output can be considered as acceptable. Therefore, plans will be renewed according to their current planning.

Are noise limits enforced? And how are individual residents protected?

France



Country context

The Noise exposition plans are based on long term development plan, with a very conservative approach and is to prevent operational restrictions due to aircraft noise by denoting land around airports as non-suitable for development of noise sensitive buildings.

Measurement and noise limits

Government goals

When purchasing a building or residence within the noise contour, the buyer should receive the information on noise exposition and these information are publicly available.

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

Country context - 1



Country context

Measurement and noise limits

Government goals

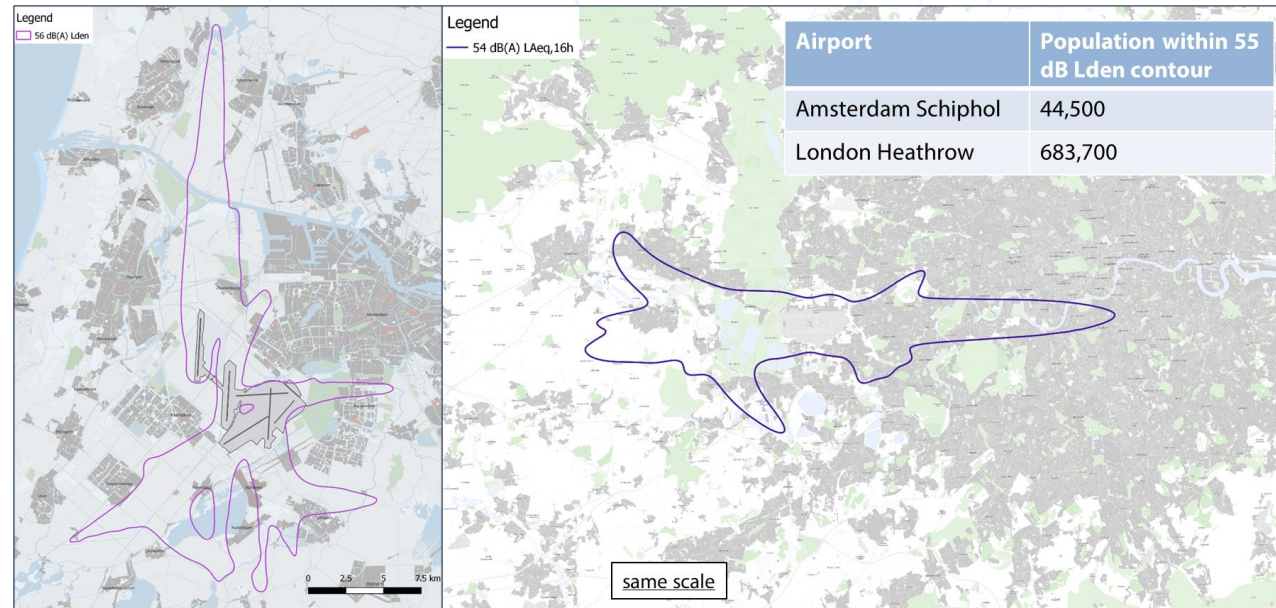
Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- England has a high population density, higher than most European countries, which makes it inevitable that aircraft noise will be a particular issue compared to other countries.
- The UK government is directly responsible for the noise management at London Heathrow, Gatwick and Stansted airport. All other airports are best handled by the airport itself with local authorities and the surrounding population.
- The Noise Roadmap being developed by Sustainable Aviation, sets out the UK aviation industry's blueprint for managing noise from aviation sources to 2050. The UK was also instrumental in securing an agreement on a tougher international noise standard in the ICAO Committee on Aviation Environmental Protection (CAEP).



Country context - 2

UK



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- Whilst the aviation industry brings significant benefits to the UK economy, there are costs associated with its local environmental impacts which are borne by those living around airports, some of whom may not use the airport or directly benefit from its operations.
- The UK government recognises that noise is the primary concern of local communities near airports. The extent to which noise is a source of tension between airports and local communities varies depending on factors such as the location of an airport in relation to centres of population and the quality of its relations and communications with its local communities. Many UK airports thus make considerable efforts to engage their local communities and that the relationship is well managed.
- The UK government aim to strike a fair balance between the negative impacts of noise (on health, amenity (quality of life) and productivity) and the positive economic impacts of flights. As a general principle, the UK government therefore expect that future growth in aviation ensures that benefits are shared between the aviation industry and local communities. This means that the industry must continue to reduce and mitigate noise as airport capacity grows. As noise levels fall with technology improvements the aviation industry is expected to share the benefits from these improvements.
- The UK government has made its intentions clear that its policy on aviation noise will be consistent with agreed international approaches and will remain compliant with relevant European laws. The UK government also fully recognises the ICAO Assembly 'balanced approach' principle to aircraft noise management.

How is noise impact measured? Are there any noise limits?



Country context

Measurement and noise limits

Government goals

Spatial planning policy

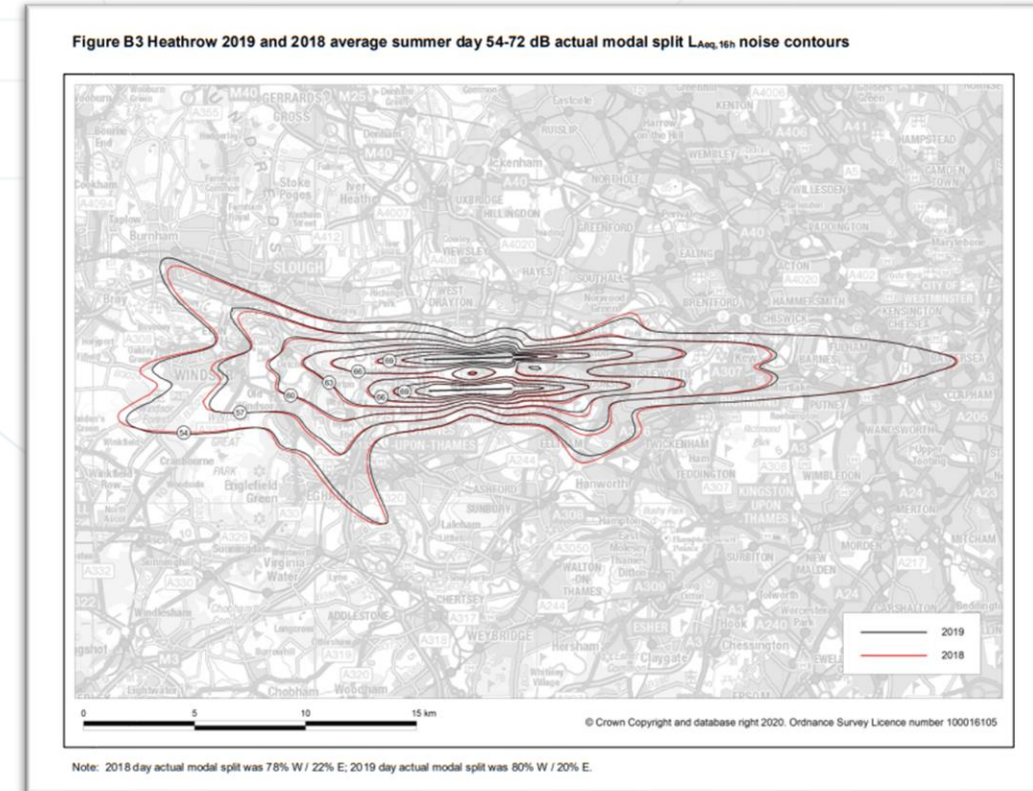
Mitigation measures

New data and knowledge

Noise limit enforcement

- The Aviation Policy Framework of 2013 is the guiding document relating to aircraft noise in the UK requiring airports to produce annual noise exposure maps, using the 54 to 72 dB $L_{Aeq,16hr}$ contour for informational and monitoring purposes. The 54 dB $L_{Aeq,16hr\ daytime}$ contour is (currently) considered the limit for significant community annoyance, the Lowest Observed Adverse Effect Level (LOAEL). Other than for informational purposes, it is used for cost-and-benefit analyses for possible changes to the use of airports.
- Airports also report noise exposure using multiple other metrics in their annual reports, including annual L_{day} , $L_{evening}$, L_{night} , L_{den} , $L_{Aeq,6.5hr\ night}$, N65 and N70 annual 16-hour day and N60 annual 8-hour night noise contours. The UK CAA also proposed to report overflight metrics for two scenarios: noise changes between 2006 and 2019 and noise changes between 2018 and 2019.
- Fixed noise monitoring stations are used to measure aircraft noise around the airport. A live web application is available to the public for Heathrow, Gatwick and Stansted to access information about noise levels around the airport. See <https://webtrak.emsbk.com/lhr4> for more information

London Heathrow LAeq, 16 hour daytime contours for an average summerday (from 54 dB and higher)



Does government set noise goals? How do airports/ANSPs/airlines deliver?

UK



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- As well as setting the overall national policy framework for aviation noise, the Government has powers under the Civil Aviation Act 1982 to set noise controls at specific airports which it designates for noise management purposes.
- For many years, Heathrow, Gatwick and Stansted Airports have been designated for these purposes and will continue to hold that status. These airports remain strategically important to the UK economy and are therefore considered appropriate for the UK government to take decisions on the right balance between noise controls and economic benefits, reconciling the local and national strategic interests.
- Other airports not currently designated for noise management purposes have powers to set their own noise controls and the UK government encourages appropriate controls to be agreed locally. For example, local authorities will want to consider whether to set such controls as a planning condition on new airport development. Noise controls at the designated airports (LHR, LGW, and STN) provide examples for other airports to consider as appropriate. Airports also ensure that the effectiveness of their measures to tackle noise is reviewed on a regular basis.
- The UK government also instructs local authorities and airports to use the Lowest Observable Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Level (SOAEL) metrics when analyzing changes in the noise situation. This is part of the Transport Analysis Guidance (TAG) methodology to calculate adverse effects of changes in operations

Is there any spatial planning policy?

UK



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- Land-use planning and management is one of the elements of the ICAO balanced approach which should be explored when tackling noise problems at an airport. In line with the UK's noise policy, the UK's National Planning Policy Framework (NPPF) says that planning policies and decisions should aim to avoid a situation where noise gives rise to significant adverse impacts on health and quality of life as a result of new development, and to mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development.
- The NPPF expects local planning policies and decisions to ensure that a new development is appropriate for its location and the effects of pollution – including noise – on health, the natural environment or general amenity are considered. This does not rule out noise-sensitive development in locations that experience aircraft noise. In the same way that some people consider themselves annoyed by aircraft noise even though they live some distance from an airport in locations where aircraft are at relatively high altitudes, other people living closer to an airport seem to be tolerant of aircraft noise and may choose to live closer to the airport to be near to employment or to benefit from the travel opportunities.
- There can also be other good economic or social reasons for noise-sensitive developments to be in such areas. However, reflecting UK's noise policy, the NPPF is quite clear that the planning system should prevent new development being put at unacceptable risk from, or being adversely affected by, unacceptable levels of noise pollution. Local planning authorities therefore have a responsibility to ensure that the land use element of the balanced approach is implemented in the context of their local plan policies, including any on noise. People considering moving to an area which may be affected by existing aircraft noise also have a responsibility to inform themselves of the likely impacts before moving to the area, and airport operators should ensure that all necessary information to inform such decisions is easily accessible.

What measures are taken to reduce aircraft noise and who leads these initiatives

UK 

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- The Aviation Policy Framework aims to limit, and where possible, reduce the number of people in the UK significantly affected by aircraft noise
- The main drivers to achieve this are planning decisions (limiting the impact of noise in any new development) and to work with the aviation industry to encourage the development of quieter aircraft and support airport operators in enforcing noise policies.
- London Heathrow, Stansted and Gatwick are also using the Noise Quota Count system (in place since 1993). Stimulating noise reduction for airlines. The quieter the aircraft, the less 'points' you use. When the airport's quota has been fully used up, no more night-time movements are allowed to take place. The total Noise Quota Count points allocated to each airport operating the system stimulates year-on-year noise reduction. The airports use day-by-day limits for night flights to comply to the night noise restrictions.
- The CAA also uses manage airspace - all of which can help limit and reduce the impact of aircraft noise.
- Airports, airlines, CAA and community groups work together in a noise forum (at least for Heathrow and Gatwick) to research opportunities to reduce nuisance of aircraft noise near airports.

How is new data and knowledge dealt with?

UK



Country context

Measurement and noise limits

Government goals

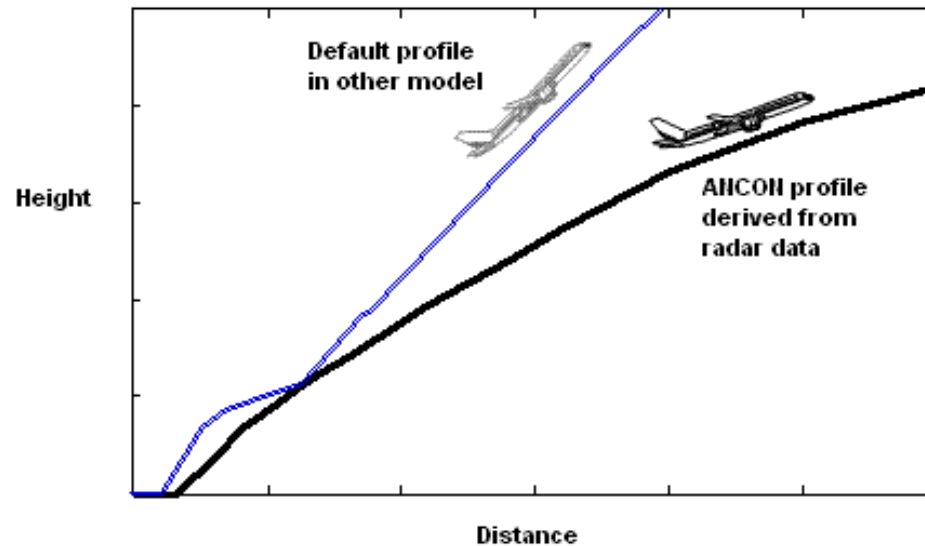
Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

- In the UK, noise modelling is performed by the CAA using the ANCON noise model. The UK Civil Aircraft Noise Contour Model (ANCON) is fully compliant with ECAC Doc 29 4th Edition and uses measurements to update the noise database used for noise modelling.
- ANCON's noise database is checked and updated on an annual basis by taking several hundreds of thousands of noise measurements around Heathrow, Gatwick and Stansted airports each year. In particular, the database contains extensive noise information for the majority of aircraft types that operate from UK airports, unlike other noise models. It is unknown whether the data has led to any changes in noise policy.
- The ANCON noise model is therefore a UK specific noise model relying on a steady stream of local measurements to enrich the noise calculations



Are noise limits enforced? And how are individual residents protected?

UK



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

- While the National Planning Policy Framework (NPPF) requires noise to be considered for new developments, there are no noise limits for land-use planning and management. New developments in noise sensitive areas (69 or 63 dB $L_{Aeq,16hr}$) are therefore not explicitly prohibited.
- Individuals are protected by the regulations in the Aviation Policy Framework. The regulations & compliance to the regulations are determined and monitored by the Department for Transport for Heathrow, Stansted and Gatwick. For other airports, local governmental bodies decide what regulations apply. These regulations are derived from UK specific studies, such as the Survey of Noise Attitudes (SoNA) study, showing the correlation between aircraft noise and annoyance (and underlying diseases). The most important regulations are:
 - The Government wishes airports to consider using the powers available to them to set suitable noise controls such as departure noise limits, minimum height requirements, noise-preferential routes and adherence to continuous descent approach, and where appropriate to enforce these with dissuasive and proportionate penalties. Both the controls and the levels of penalties should be reviewed regularly (at least as often as the Noise Action Plan where applicable) in consultation with local communities and consultative committees, to ensure they remain effective. For the noise-designated airports, the Department's Aircraft Noise Management Advisory Committee will review the departure and arrivals noise abatement procedures, including noise limits and use of penalties, to ensure that these remain appropriately balanced and effective.
 - The Government continues to expect airport operators to offer households exposed to levels of noise of 69 dB $L_{Aeq,16h}$ or more, assistance with the costs of moving.
 - The Government also expects airport operators to offer acoustic insulation to noise-sensitive buildings, such as schools and hospitals, exposed to levels of noise of 63 dB $L_{Aeq,16h}$ or more. Where acoustic insulation cannot provide an appropriate or cost-effective solution, alternative mitigation measures should be offered.
 - If no such schemes already exist, airport operators should consider financial assistance towards acoustic insulation for households. Where compensation schemes have been in place for many years and there are few properties still eligible for compensation, airport operators should review their schemes to ensure they remain reasonable and proportionate.
 - Where airport operators are considering developments which result in an increase in noise, they should review their compensation schemes to ensure that they offer appropriate compensation to those potentially affected. As a minimum, the Government would expect airport operators to offer financial assistance towards acoustic insulation to residential properties which experience an increase in noise of 3dB or more which leaves them exposed to levels of noise of 63 dB $L_{Aeq,16h}$ or more.
 - Any potential proposals for new nationally significant airport development projects following any Government decision on future recommendation(s) from the Airports Commission would need to consider tailored compensation schemes where appropriate, which would be subject to separate consultation.
 - Airports may wish to use alternative criteria or have additional schemes based on night noise where night flights are an issue. Airport consultative committees should be involved in reviewing schemes and invited to give views on the criteria to be used.



Country context - 1

Australia 

Country context

- Measurement and noise limits
- Government goals
- Spatial planning policy
- Mitigation measures
- New data and knowledge
- Noise limit enforcement



Australian airspace and international airports

Australia responsible for 11% of global airspace, divided into two FIRs

Busiest airports are Sydney, Melbourne & Brisbane

New parallel runways under development at Melbourne & Perth plus one recently commissioned in Brisbane

Long distances and lack of alternatives supports a strong domestic market

Movements expected to grow strongly post-pandemic

Country context - 2

Australia 

Country context

Measurement and noise limits

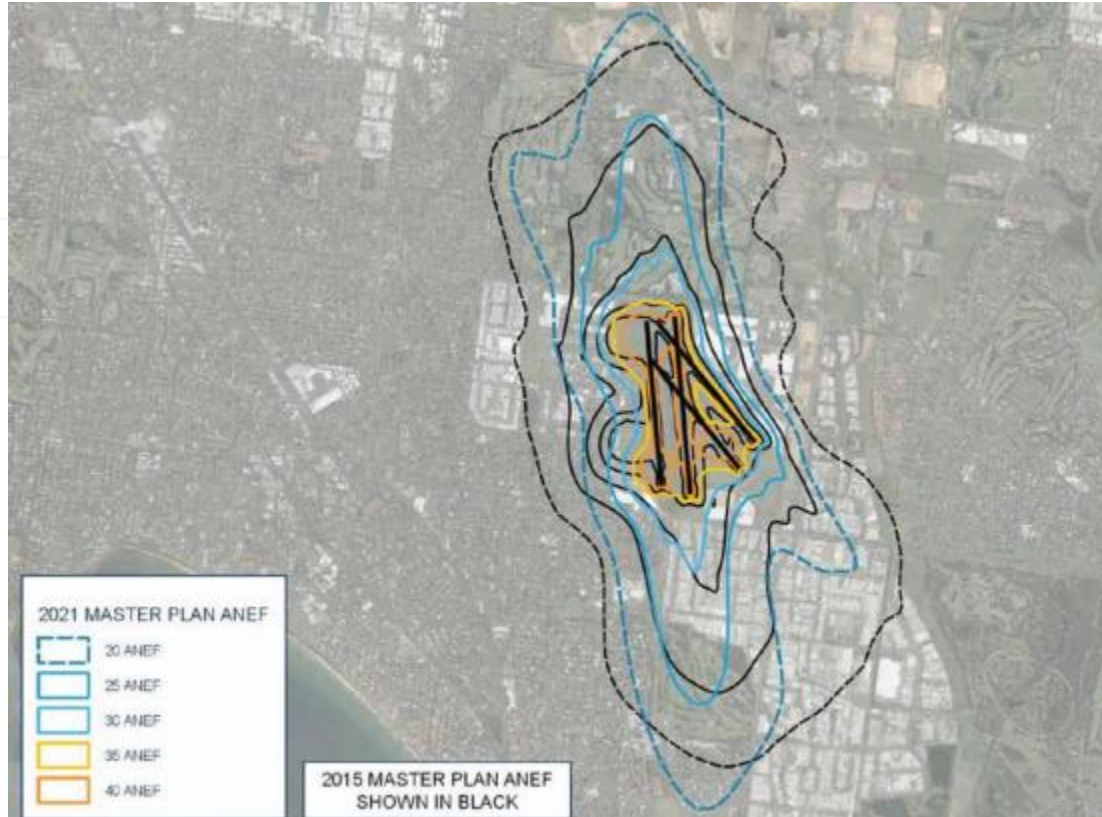
Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement



Moorabbin Airport (Melbourne) noise contours

There are also busy training / GA airports in Sydney, Melbourne, Brisbane, Adelaide & Perth. These have become surrounded by urban development.

All airports with significant traffic in controlled airspace are privately operated on government owned land, managed through a long-term lease and are subject to planning and noise obligations through the leasehold agreements.

Aircraft noise management in Australia is the responsibility of Airservices Australia (ANSP) covering:

- Noise complaints handling and reporting
- Noise monitoring equipment operation and reporting
- Community consultation (in conjunction with airports)
- Establishment, promulgation and management of noise abatement programs and fly-neighbourly agreements

How is noise impact measured? Are there any noise limits?

Australia



Country context

Measurement and noise limits

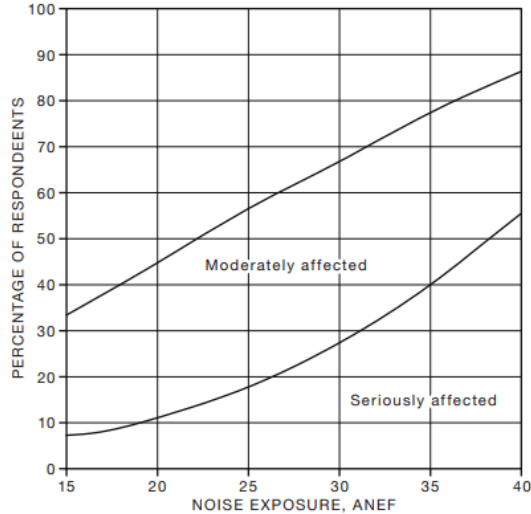
Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement



NOTE: This graph was derived from the National Acoustic Laboratories Report No. 88.

FIGURE A1 RELATIONSHIP BETWEEN NOISE EXPOSURE FORECAST LEVEL AND COMMUNITY REACTION IN RESIDENTIAL AREAS

In 1982, the ANEF (Australian Noise Exposure Forecast) was established, following an extensive study by the National Acoustic Laboratories (NAL) into the community impact of aircraft noise.

The ANEF combines two factors (noise level and frequency of operations) by a mathematical formula, with additional weighting applied to flights between 1900-0700.

Actual noise level measurement in the ANEF formula is Effective Perceived Noise Level (EPNdB) which is also used in the noise certification process for new aircraft. EPNdB is derived from a complex algorithm but based on three basic principles:

- Level of noise
- Frequency distribution (How often noise occurs)
- Time variation (How long noise lasts)

$$ANEF_{ij} = EPNdB_{ij} + 10 \log_{10}(N_d + N_n) - 88$$

where

$ANEF_{ij}$ = noise exposure due to aircraft type i on flight path j

$EPNdB_{ij}$ = noise level of aircraft type i on flight path j

$N_d N_n$ = number of flights during the day and night respectively, of aircraft i on flight path j

The figure '88' is an arbitrary constant chosen so that ANEF numbers typically fall in a range where they are unlikely to be confused with other noise settings



How is noise impact measured? Are there any noise limits?

Australia 

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

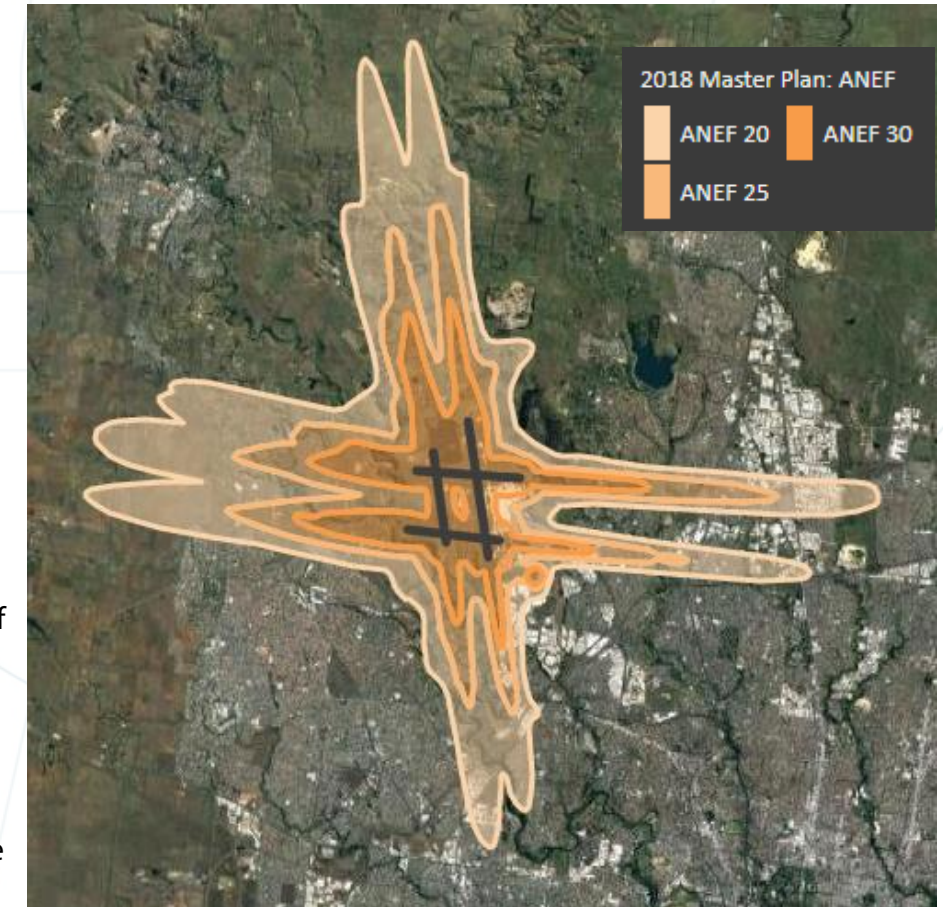
Noise limit enforcement

BUILDING SITE ACCEPTABILITY BASED ON ANEF ZONES
(To be used in conjunction with Table 3.3)

Building type	ANEF zone of site		
	Acceptable	Conditionally acceptable	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (Note 1)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (Note 1)	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

AS 2021:2015 Acoustics, Aircraft noise intrusion, building siting and construction is the Australian regulatory standard governing construction of noise sensitive buildings near airports. To date, this is the only statutory requirement governing aircraft noise management in Australia.

Every airport on government land is required to produce an ANEF every 5 (major airport) to 8 (regional airport) years as part of a Master Plan. An ANEF must be endorsed by Airservices Australia. The ANEF 20 contour denotes the extent of planning / building permission for noise sensitive locations. Therefore, if the ANEF contour increased to encompass an existing location such as a home, school or hospital the airport / Airservices would be required to remedy the situation (change operating modes / provide attenuation / movement caps / etc). However, as almost all ANEFs are designed for the ultimate capacity of the airport from the outset and aircraft are getting quieter these contours almost never extend outwards.



ANEF – Melbourne Airport (2018)

How is noise impact measured? Are there any noise limits?

Australia



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

Noise Above Contours – N-Contours

ANEF has value from an airport planning perspective but there is not a strong correlation between ANEF contours and incidence of aircraft noise complaints.

An alternate measurement for understanding this relationship are noise-above contours which indicate the number of events above a certain noise level.

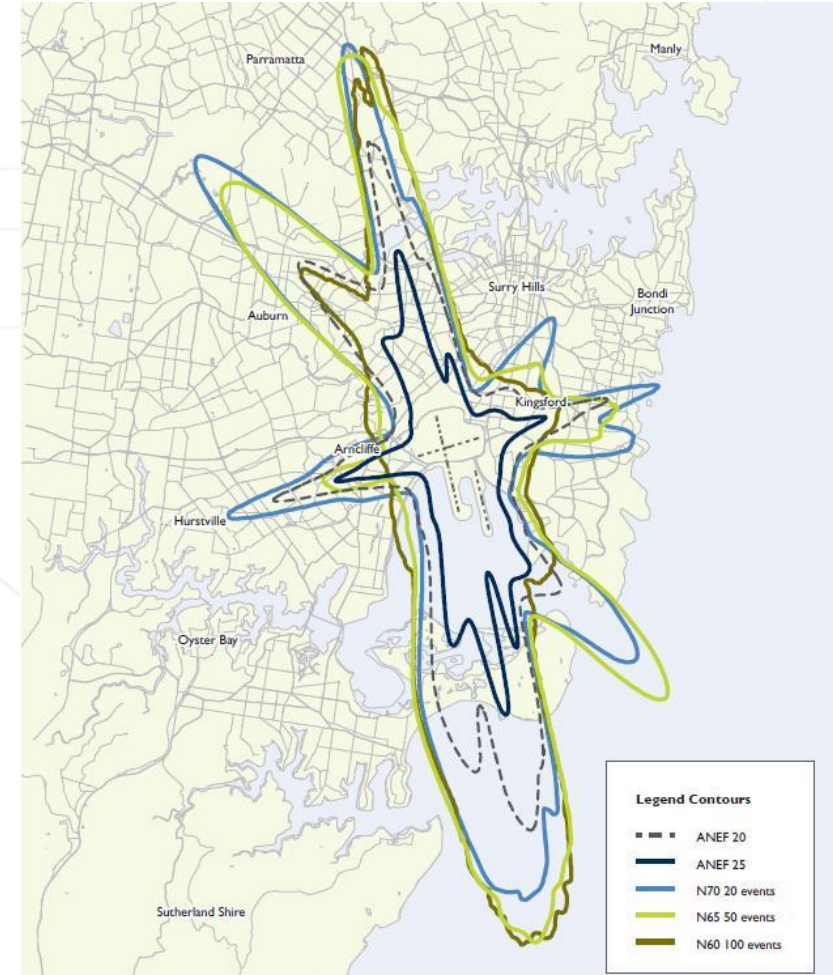
For instance, N70 20 events (see diagram) is the contour boundary where a person on the ground could expect to experience aircraft noise above 70 dB more 20 times in a day. (70 dB is chosen as the sound level that may disrupt a conversation indoors)

Typically, airports will produce the following N-contours:

- N70 – 20 events
- N65 – 50 events
- N60 – 100 events

These are not related to any specific targeted measure but represent the level at which a statistically relevant increase in noise complaints is recorded.

There is no regulatory control based on N-Contours. However, they are considered by Airservices and authorities in determining the need for mitigation measures. Beyond the statutory planning requirement of the ANEF there is no obligation to take mitigation measures above any limit value. The most effective method for communities to get results is to apply pressure to elected representatives.



ANEF vs N-Contours – Sydney Airport



Does government set noise goals? How do airports/ANSPs/airlines deliver?

Australia



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

The National Airports Safeguarding Advisory Group (NASAG) is an industry advocacy group providing guidance to the Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) on a range of issues affecting aviation safety.

This is delivered through the National Airports Safeguarding Framework and provides support and guidance to state, territory and local government bodies to:

- Improve safety outcomes by ensuring aviation safety requirements are recognised in land use planning decisions
- Improve community amenity by minimising noise sensitive developments near airports, including through the use of additional noise metrics
- Improve aircraft noise-disclosure mechanisms

Currently DITRDC is soliciting feedback from stakeholders regarding whether the NASF guidelines should become part of the regulatory landscape.

Following the publication of Aviation White Paper, Flight Path to the Future in 2010, the Australian Noise Ombudsman was established as an independent reviewer of Airservices Australia and the Australian Defence Force management of aircraft noise including:

- Complaint handling
- Community consultation
- Presentation and distribution of aircraft noise related information

In relation to aircraft noise the Australian Government continues to manage aircraft noise with a light touch.

Does government set noise goals? How do airports/ANSPs/airlines deliver?

Australia 

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

In Australia, changes to airport operations to accommodate noise impacts usually occur as the result of political influence stemming from organised community action.

In 1996, advocacy by community groups in Sydney resulted in the Minister for Transport and Regional Development issuing a directive to Airservices Australia to implement an operational plan that shared the noise generated by Sydney Airport, meaning that mitigation measures taken from that moment on must ensure that noise is evenly distributed over population and terrain, so that not a single community is predominantly impacted by the noise generated by Sydney Airport. In the case of Sydney Airport, noise sharing considerations take priority over efficient operations.

This resulted in the implementation of the Long Term Operating Plan (LTOP) in addition to hourly caps on aircraft movements and an operational curfew.

Curfews also exist at other airports – Adelaide, Essendon & Gold Coast.

Noise Abatement Programs (NAP)

Where possible, Airservices, airports and operators will participate in a NAP where specific geographic areas will be avoided at certain times to reduced impacts. A NAP will become part of the airport data package in AIP.

Fly Neighbourly Agreements (FNA)

For smaller and regional airports, local Councils will work with Airservices and operators to develop an FNA whereby pilots avoid certain combinations of activities and locations, such as low-level flying or acrobatics

Diagram of LTOP Runway Modes and flight paths

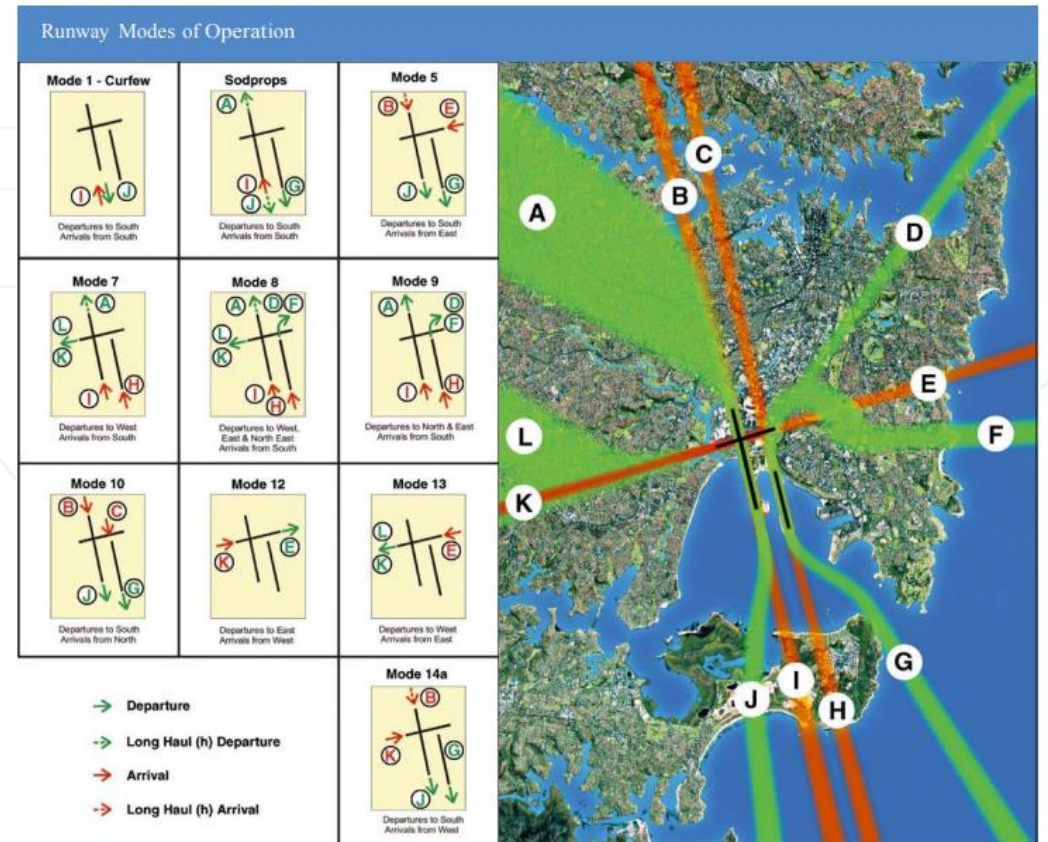


Illustration of the 10 different ways of using the Airport's three runways, called Runway Modes of Operation, under the Long Term Operating Plan (LTOP). The associated flight paths for aircraft arriving and departing from Sydney Airport are labelled A to L.

LTOP – Sydney Airport (1997)



Is there any spatial planning policy?

Major airports in Australia are required to deliver a Master Plan every five years including:

- Traffic movements & passenger numbers
- Operational plans (runways, taxiways, flight paths, etc.)
- Aircraft types

This data forms a significant portion of the input to the ANEF which can be expressed, and clearly labelled, as one of the following:

- Standard: 20-year forecast
- Long-Range: A stipulated period beyond 20 years
- Ultimate capacity: Maximum utilisation of the operational runways

The format chosen is dependent on the airport's planning strategy for safeguarding land for future operations.

Once endorsed, the ANEF is usually available in a GIS compatible format for:

- Land-use planning authorities
- State and territory agencies
- Property developers
- Landowners close to, or within the contour boundaries

What measures are taken to reduce aircraft noise and who leads these initiatives?

Australia



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

Airports

Airport infrastructure is expensive, and many business cases are underpinned by forecast movements and passenger numbers. Operational restrictions are a major threat to profitability and most major airports will be proactive in managing community engagement on aircraft noise.

Local and state government

Representative governments are sensitive to issues that can win or lose seats. Some successful governments campaign on reducing or managing aircraft noise. Strategies adopted by governments can include, but are not limited to:

- Attenuation programs (double glazing, insulation, etc) – i.e., Adelaide
- Lobbying for operational restrictions – i.e., Sydney, Brisbane
- Noise abatement programs or Fly neighbourly agreements – i.e., Port Macquarie, Melbourne
- Covenants on land titles - i.e., Busselton

Community Groups

Although not invested with a great deal of political power, or regulatory support, organised community action has delivered the most meaningful changes to airport noise. Well supported, organised and media savvy aircraft noise campaigns put pressure on elected representatives. In the right political environment this has resulted in the implementation of measures to reduce aircraft noise or provide respite.

How is new data and knowledge dealt with?

Australia 

Country context

Measurement and noise limits

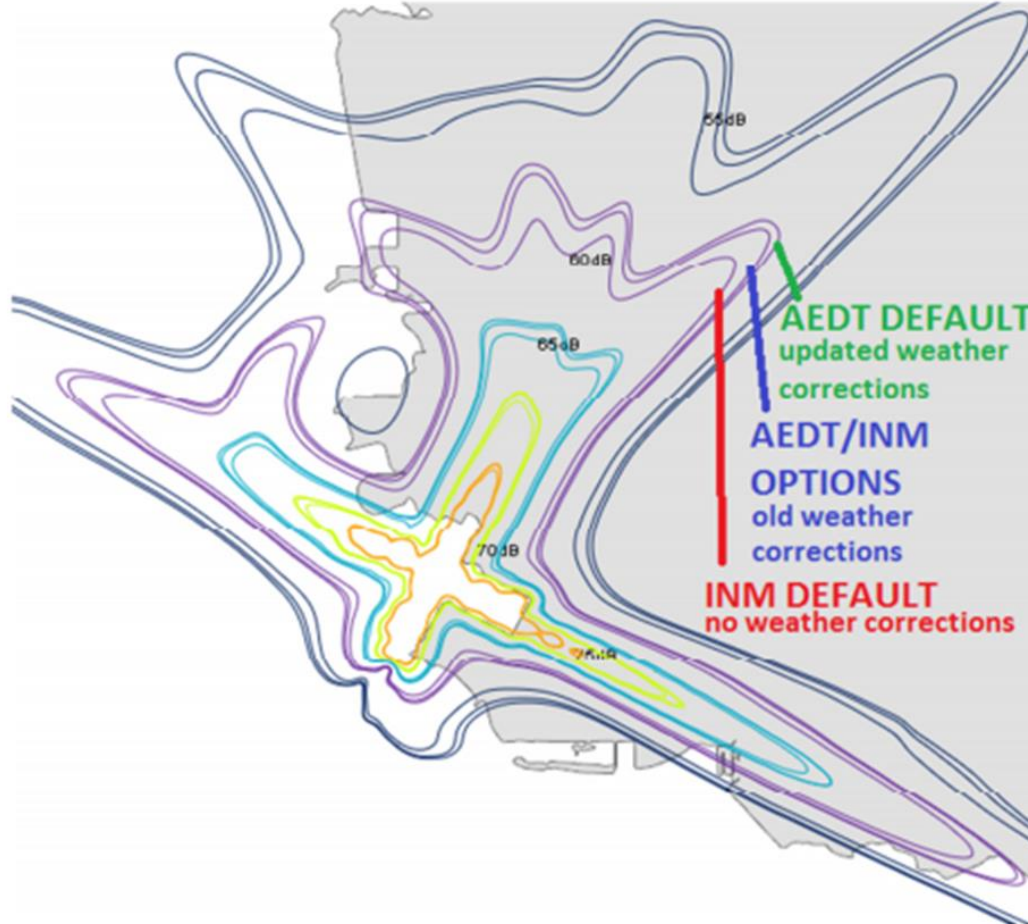
Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement



Airservices Australia has moved from using INM for aircraft noise modelling to AEDT and has mandated the same for developers of ANEF models. This has only had a minimal input on the contour profiles for the ANEF model.

However, N-Contours were previously produced by a bespoke software product called TNIP (developed by the Dept. of Transport), using INM outputs to produce the contour diagrams.

TNIP does not work with AEDT and has not been upgraded (as of Jan 2022). Subsequently, noise modelling consultancies are using different contouring tools and algorithms to plot the noise-above data points produced by AEDT.

A prescribed methodology / tool is required to ensure a consistent output for N-Contours.

Are noise limits enforced? And how are individual residents protected?

Australia



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

The nature of the ANEF system is to prevent operational restrictions due to aircraft noise by denoting land around airports as non-suitable for development of noise sensitive buildings.

As ANEFs are created based a 20-year forecast, or even a maximum runway capacity basis, the buffer zone around airports nearly always exceeds the extent of likely noise events. This safeguards the airports future operations from encroachment.

Actuals noise limits are not directly enforced.

If aircraft noise is determined to be excessive through the receipt of noise complaints or monitoring stations located near airports, then mitigations maybe implemented. It is the adherence to the mitigation strategies that is subsequently policed by Airservices (i.e., aircraft operators arriving / departing outside a stipulated time or ignoring the requirements of a noise abatement procedure may be sanctioned).

Country context

Switzerland 

Switzerland's 7 busiest airports by passenger traffic in 2019

Country context

Measurement and noise limits

Government goals

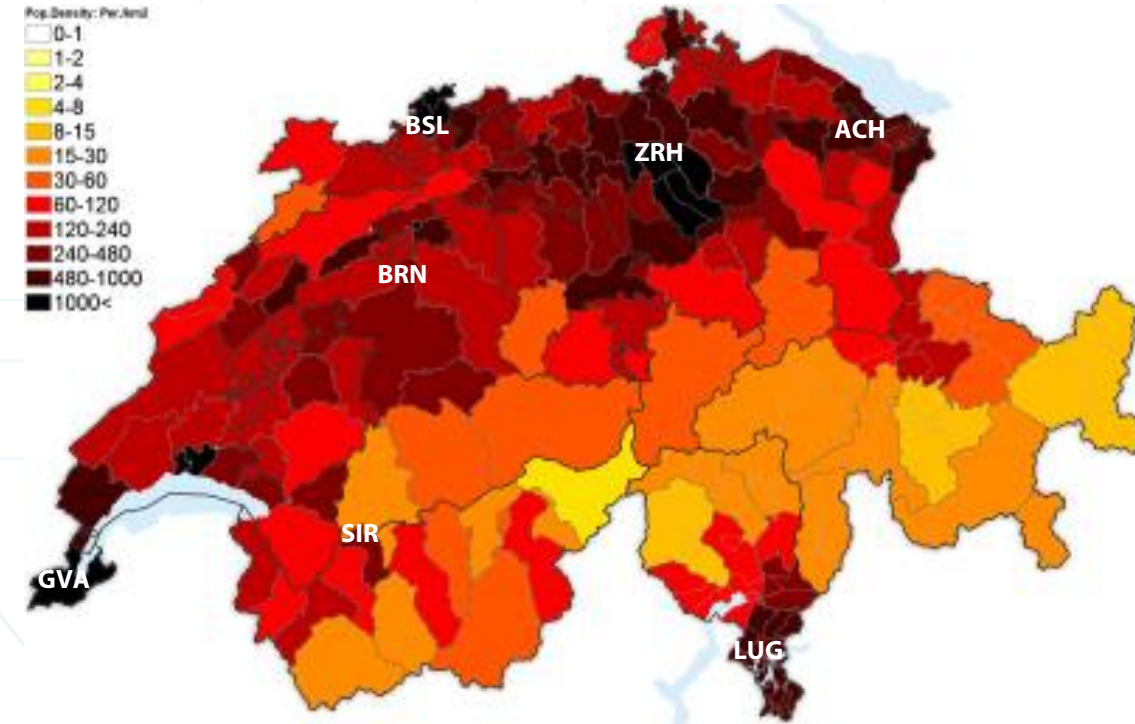
Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

	Airport	Passengers	Movements
National	Zurich	31.478.748	275.325
	Geneva	17.826.513	186.043
	Basel-Mulhouse	9.068.206	99.270
Regional	St Gallen	107.637	26.496
	Lugano-Agno	56.201	18.794
	Bern-Belp	22.233	41.121
	Sion	2.381	38.808



Population Density



Country context

Switzerland 

Country context

Measurement and noise limits

Government goals

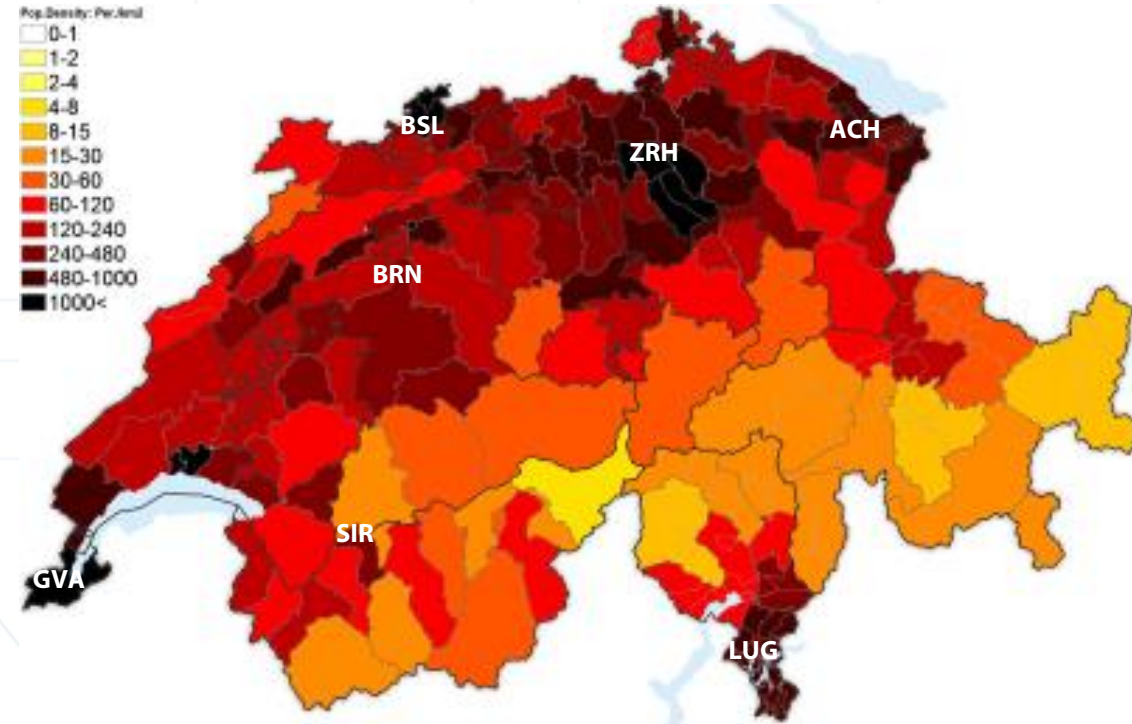
Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- In Switzerland, the number of highly annoyed residents around airports continues to grow. Local residents have long complained that the steadily increasing number of flights has disturbed their sleep, health and property prices.
- Most busy airports, such as Zurich, Geneva and Basel, are located near the country border, requiring Swiss regional and national administrations and institutions to work in close cooperation with their French and German counterparts



Population Density



How is noise impact measured? Are there any noise limits?

Switzerland

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

The Rating Sound Level L_r is calculated in accordance with the Swiss Noise Abatement Ordinance (NAO). This is determined separately for heavy aircraft with a maximum take-off weight (MTOW) > 8.618 kg and for light aircraft with MTOW \leq 8.618 kg.

For **light aircraft**, the rating sound level L_{rk} is the sum of the equivalent continuous A-weighted sound level L_{eqk} and the level correction K :

$L_{rk} = L_{eqk} + K$, in which the equivalent continuous sound level L_{eqk} is determined for the average number of hourly aircraft movements (number of movements n) for a day with average peak operations. Aircraft movements are all landings and takeoffs of light aircraft. Go-arounds count as two flight movements. The level correction K is calculated from the annual number of aircraft movements N as follows:

- $K = 0$ for $N < 15\,000$
- $K = 10 \times \log(N/15\,000)$ for $N \geq 15\,000$

For **heavy aircraft**, noise is calculated separately for the following time periods, so that noise of individual aircraft is not weighted over the entire night and thus more relevant for the specific time of night:

- Day hours (06:00 to 22:00)
- First night hour (22:00 - 23:00)
- Second night hour (23:00 to 00:00)
- Last night hour (05:00 to 06:00)

For heavy aircraft, the daytime rating sound level is the sum of the equivalent continuous A-weighted sound level L_{eqg} arising from aircraft operations between 06 and 22 hours, averaged over one year:

$L_{rg} = L_{eqg}$

How is noise impact measured? Are there any noise limits?

Switzerland

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

The noise rating sound level for the total traffic noise during the day is calculated by adding the energy levels of large and small aircraft according to the following equation:

$$Lr_t = 10 \log \left[10^{\frac{Lrk}{10}} + 10^{\frac{Lrg}{10}} \right]$$

The noise exposure level for noise at night, expressed as L_{rn} , from large aircraft traffic is the equivalent continuous A-weighted sound level L_{eqn} , each averaged over one hour, arising from aircraft operations during the first, the second and the last night hours, averaged over one year:

- $L_{rn1} = L_{eqn1}$ for the first night hour (22:00 to 23:00)
- $L_{rn2} = L_{eqn2}$ for the second night hour (23:00 to 00:00)
- $L_{rn3} = L_{eqn3}$ for the last night hour from (05:00 to 06:00)

L_{den} is only calculated for airports close to the country border, when required

Number above metrics are not used in Switzerland

How is noise impact measured? Are there any noise limits?

Switzerland

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

Exposure limit values include impact thresholds, planning values and alarm values. These are set according to the noise characteristics, the time of day and the sensitivity to noise of the buildings and areas to be protected. In particular, rooms sensitive to noise are:

- a) rooms in dwellings with the exception of kitchens without dining facilities, washrooms and storerooms;
- b) rooms in industrial buildings that are regularly occupied by persons for sustained periods of time, with the exception of those for farm animals and those with high levels of industrial noise.

According to Art.7 “Emission limitation measures for new stationary installations” of the Swiss NAO, noise emissions from new stationary installations shall be limited as directed by the enforcement authorities insofar as:

- a) this is technically and operationally feasible and economically acceptable; and
- b) the noise exposure level resulting from the installation alone does not exceed the **planning values**.

However, the enforcement authorities shall relax the requirements in cases where compliance with the planning values would place a disproportionate burden on the installation and there is an overriding public interest, particularly regarding questions of spatial planning. The impact thresholds must not, however, be exceeded.

Where a stationary installation that already exists is modified, the noise emissions from the installation as a whole must be limited at least to the extent that the **impact thresholds** are not exceeded (Art. 8 of Swiss NAO of 1986). Unlicensed private installations must not, however, exceed the **alarm values**.

If, as a result of relaxing the requirements, the alarm values for public or licensed stationary installations cannot be complied with, the enforcement authorities shall require the owners of existing buildings exposed to noise to soundproof the windows of rooms sensitive to noise. With the approval of the enforcement authorities, building owners may take other soundproofing measures in the building provided these reduce the noise within the rooms to the same extent.

How is noise impact measured? Are there any noise limits?

Switzerland

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

According to the Swiss Noise Abatement Ordinance of 1986 – Annex 5, exposure limit values for noise from civil aerodromes are:

Exposure Limit Values for Light Aircraft Traffic Noise, expressed as Lrk:

Sensitivity level	Planning value	Impact threshold	Alarm value
	Lrk in dB(A)	Lrk in dB(A)	Lrk in dB(A)
I	50	55	65
II	55	60	70
III	60	65	70
IV	65	70	75

In land use zones according to Articles 14 ff. of the Spatial Planning Act of 22 June 1979/39, the following sensitivity levels apply:

- sensitivity level I in zones with higher noise abatement requirements, notably in leisure zones;
- sensitivity level II in zones in which operations that emit noise are not permitted, notably in residential zones and zones for public buildings and installations;
- sensitivity level III in zones in which operations emitting a certain level of noise are permitted, notably in residential and industrial zones (mixed zones) and agricultural zones;
- sensitivity level IV in zones in which operations emitting a high level of noise are permitted, notably in industrial zones.

Parts of land use zones rated as sensitivity levels I or II may be assigned the next higher level if they are already exposed to noise.

How is noise impact measured? Are there any noise limits?

Switzerland

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

According to the Swiss Noise Abatement Ordinance of 1986 – Annex 5, exposure limit values for noise from civil aerodromes are:

For the total traffic noise from civil aerodromes used by heavy aircraft, the following exposure limit values apply in addition to the exposure limits expressed as Lrk:

Day Time Exposure Limit Values

Sensitivity level	Planning value	Impact threshold	Alarm value
	Lrt in dB(A)	Lrt in dB(A)	Lrt in dB(A)
I	53	55	60
II	57	60	65
III	60	65	70
IV	65	70	75

Night Time Exposure Limit Values

Sensitivity level	Planning value	Impact threshold	Alarm value
	Lrn in dB(A)	Lrn in dB(A)	Lrn in dB(A)
I	43	45	55
II	47/50 ¹	50/55 ¹	60/65 ¹
III	50	55	65
IV	55	60	70

¹The higher value applies for the first night hour (22-23 hours)

The alarm value is used for priority identification when noise insulation programs are carried out.

Does government set noise goals? How do airports/ANSPs/airlines deliver?

Switzerland

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

On 28 June 2017, the Swiss Government established a 3-points strategic national plan aiming to limit noise at source to promote population health, especially in the urban environment. For air traffic, the first strategic point aims to reduce noise emissions as part of an international cooperation relationship. The second strategic point of the plan of measures provides for the promotion of areas of tranquility and refreshment as part of the development of the settlements. In the third point, the Confederation is contemplating the modernization of noise monitoring and the diffusion of the relevant information in order to increase the public's awareness of the problem.

The Swiss Noise Abatement Ordinance (NAO) of 1986 defines exposure limits for traffic noise and other technical noise sources. It limits permissible emissions at the source and contains building restrictions for areas exceeding the noise limits.

Switzerland just opened a discussion for new noise limits for street, rail, aviation etc., partially started due to the relation to the new WHO-guidelines.

The national commission on noise abatement has published its report in December 2021 and proposes to at least double the effected area when taking a noise limit. This project will be ongoing for the next few years.

Is there any spatial planning policy?

Switzerland

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

The federal sector plan for infrastructure planning is the first step in spatial planning. It ensures space for airports to develop business plans. Cantons, municipalities etc. have to take this into account. FOCA is responsible for setting up the federal sector plan for infrastructure planning. The noise plan of the airport may not be greater than the spatial planning. The airport is allowed to fill the noise contour terrain in spatial planning, displayed in the Swiss noise kataster.

In land use zones according to Articles 14 ff. of the Spatial Planning Act of 22 June 1979, the following sensitivity levels apply:

- Sensitivity level I in zones with higher noise abatement requirements, notably in leisure zones;
- Sensitivity level II in zones in which operations that emit noise are not permitted, notably in residential zones and zones for public buildings and installations;
- Sensitivity level III in zones in which operations emitting a certain level of noise are permitted, notably in residential and industrial zones (mixed zones) and agricultural zones;
- Sensitivity level IV in zones in which operations emitting a high level of noise are permitted, notably in industrial zones.

Parts of land use zones rated as sensitivity levels I or II may be assigned the next higher level if they are already exposed to noise.

The cantons shall ensure that sensitivity levels are assigned to the land use zones in the building regulations or land use plan of the communes.

Defined noise contours may be exceeded a maximum of 2 years in a row. If the noise contours are exceeded for a longer time period, measures must be taken by the airport in the form of a yearly report that states the problems at hand, the measures already taken and future expectations and handed in to FOCA.

Is there any spatial planning policy?

Switzerland 

Country context

Measurement and noise limits

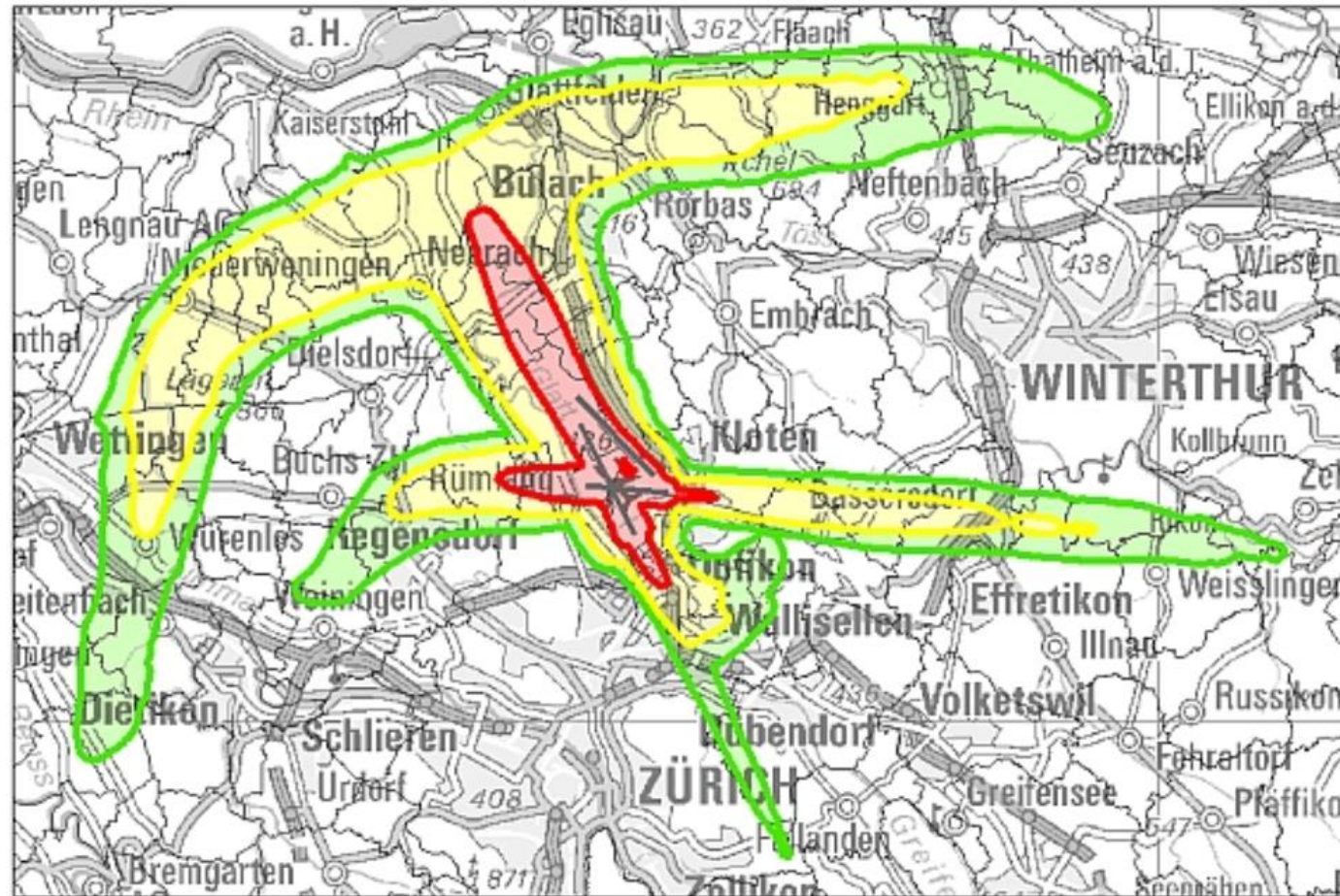
Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement



Example of limit value curves around Zurich airport with exceedances of planning value (green), impact threshold (yellow) and alarm value (red).

What measures are taken to reduce aircraft noise and who leads these initiatives?

Switzerland

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- All measures taken are in line with the Balanced Approach by ICAO
- Arrival and departures are designed to least impact communities.
- The government is the leader for the measures that concern the use of certain aircraft types, noise and emission taxes (even differentiated in time) and night curfews.
- Airports are the leader for local measures, such as limitations e.g. no take-offs in the second night hour in Basel (enforced in February 2022) based on chapter 3 minus 15.
- Zurich is special in runway use protocols. It operates different use modes depending on the weather, but the main driver is restrictions in German regulation that limit landings from the north.
- In 2018, an official report stated that the noise was sometimes considerably above permitted levels between 10pm and midnight at Zurich Airport. The Federal Office of Civil Aviation decided to limit the number of time slots for planes at ZRH and ordered a freeze on landings after 9pm and for take-offs after 10:20pm to reduce the noise for residents living near the airport.
- In order to improve dialogue with local residents, Genève Aéroport has developed an interactive platform concerning aircraft movements and emitted noise. This platform is rich in information (noise measurement, legal provisions, actions taken, information on movements, etc.) and is a privileged link between the airport and local residents.
- Moreover, takeoffs and landings of non-commercial flights are allowed at Genève Aéroport between 06:00 and 22:00. For commercial flights, takeoffs and landings are possible from 06:00 until 00:30. No departure slot is granted after 22:00 and no arrival slot after 00:00. Thus, departures between 22:00 and 00:30 and arrivals between 00:00 and 00:30 are movements planned in case of delay.

How is new data and knowledge dealt with?

Switzerland

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

- The Swiss Federal Laboratories for Material Science and Technology (EMPA) has developed engineering models FLULA2 and sonAIR for aircraft noise calculation. FLULA2 is an official tool to calculate yearly aircraft noise exposure in Switzerland. sonAIR is a next-generation aircraft noise calculation program that is being tested at the airports of Zurich and Geneva.
- FLULA2 is based on a sound source database from measurement campaigns, such as those at Zurich airport in 1991 and 1996. FLULA2 is complemented with various supplementary programs to process input data for calculations as well as to post-process.
- sonAIR comprises of a source model describing the sound emission and directivity as a function of flight configuration (power setting and aeroplane configuration, i.e., flaps, slats and landing gear). The source model is combined with EMPA's sound propagation model sonX. The model is based on acoustic measurements of air traffic in the vicinity of Zurich Airport in 2013 and 2014 and is constantly being actualized. sonAIR was funded within the Special Financing of Civil Aviation by the Federal Office of Civil Aviation (FOCA). Additional funding was provided by EMPA, Flughafen Zürich AG, Aéroport International de Genève (AIG), Office of Transport of the Canton of Zurich (AFV), as well as Skyguide within the framework of CHIPS.
- The use of noise measurements as model input has not yet led to changes in noise policy.
- Noise modelling is different for each airport. In Geneva, the development of the aircraft fleet in the next 10-15 years is taken into account. In Zurich, only actual current traffic is being used. A number of Swiss airports are developing together with Research Centres new technologies and systems in order to optimise approach procedure to an airport; among these, it is currently under development the Low Noise Augmentation System (LNAS) in order to support pilots as they perform the complex procedures required for a low-noise approach.
- An annual control calculation of noise pollution takes place that is based on real individual flights.

Are noise limits enforced? And how are individual residents protected?

Switzerland



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

- The cantons are responsible for the enforcement of the Noise Abatement Ordinance, intended to protect against harmful and disturbing noise.
- The Federal Department of the Environment, Transport, Energy and Communications (DETEC) is responsible for enforcing the provisions governing emission limitation measures, improvements and the determination and control of noise exposure levels where the provisions relate to buildings and installations (under Article 37 of the Air Navigation Act of 21 December 1948) that are used for operation of an aerodrome and are implemented by means of a planning approval procedure. In other cases, the Federal Office of Civil Aviation is responsible for enforcement. (*The Federal Office of Civil Aviation (FOCA), responsible for aviation development and the supervision of civil aviation activities in Switzerland, is part of DETEC.*)
- Complaints concerning aircraft noise are submitted to the cantons or the airports.
- If airports are not able to stay within defined noise contours in force, they have to make a new demand to FOCA for enlargement of the contours, which is a complex legal process. There is the possibility for the community to react and complain in this process. Airports with commercial flights can be granted exemptions by FOCA, but noise protection measures (such as insulation programs) must be taken.
- There are clear rules in place under which conditions delayed aircraft can land at an airport and is written in reports that airports send to FOCA on a monthly/yearly basis, along with complaints.
- In 2003 Genève Aéroport established a concept of soundproofing of nearby housings and takes over the related cost.
- At various airports in Switzerland, the landing charges payable include a component dependent on the noise generated by the aircraft. To this end, aircraft are broken down into noise classes.
- If a residential property is located within the Noise Disturbance Plan (PGS), the building permit was issued before the Noise Exposure Plan (PEB) was approved and the property has not already been soundproofed, then one is eligible for noise protection aids. Applications are submitted to the airport.

Country context - 1

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

Italy is characterized by widespread and extensive forms of urbanization: even medium-sized cities are very close to each other and small towns occupy both the plains and the hills, in some areas almost seamlessly. The population as well as economic activities, albeit with significant differences between north, center and south, are very distributed and, especially activities related to tourism, have important concentrations along the very extensive coasts and in the Alps.

The analysis of the airport sites from satellite images shows settlements created quickly and often in disorder, sometimes with important points of friction with the urbanized territory, evidently arranged to meet the immediate needs of spaces and operational areas. It is frequently noted that existing buildings are superimposed on facilities instead conceived to be ordered and balanced, contained in homogeneous perimeters, originally planned for the foundation of the airports (some of which were born as military) and the relative connections with the territory.

The Italian airport system now has a total of 113 airports (11 exclusively military and 102 open to civil traffic).

The National Civil Aviation Authority (ENAC) acts as the only authority for technical regulation, certification, supervision and control in the civil aviation sector in Italy in compliance with the powers deriving from the Navigation Code. To protect the environment, ENAC monitors the implementation of circulars and regulations aimed at limiting the environmental impact of airport operations and reducing noise and atmospheric pollution produced by aeronautical activities.

According to the 2019 Annual Air Traffic Report published by Assaeroporti (the Association of Italian Airports which represents 29 Airport Operators for 37 airports), the following traffic data were achieved in terms of passengers, movements and cargo:

- Total passengers: 193,1 MLN
- Total movements: 1,6 MLN
- Total cargo: 1,1 MLN

Country context - 2



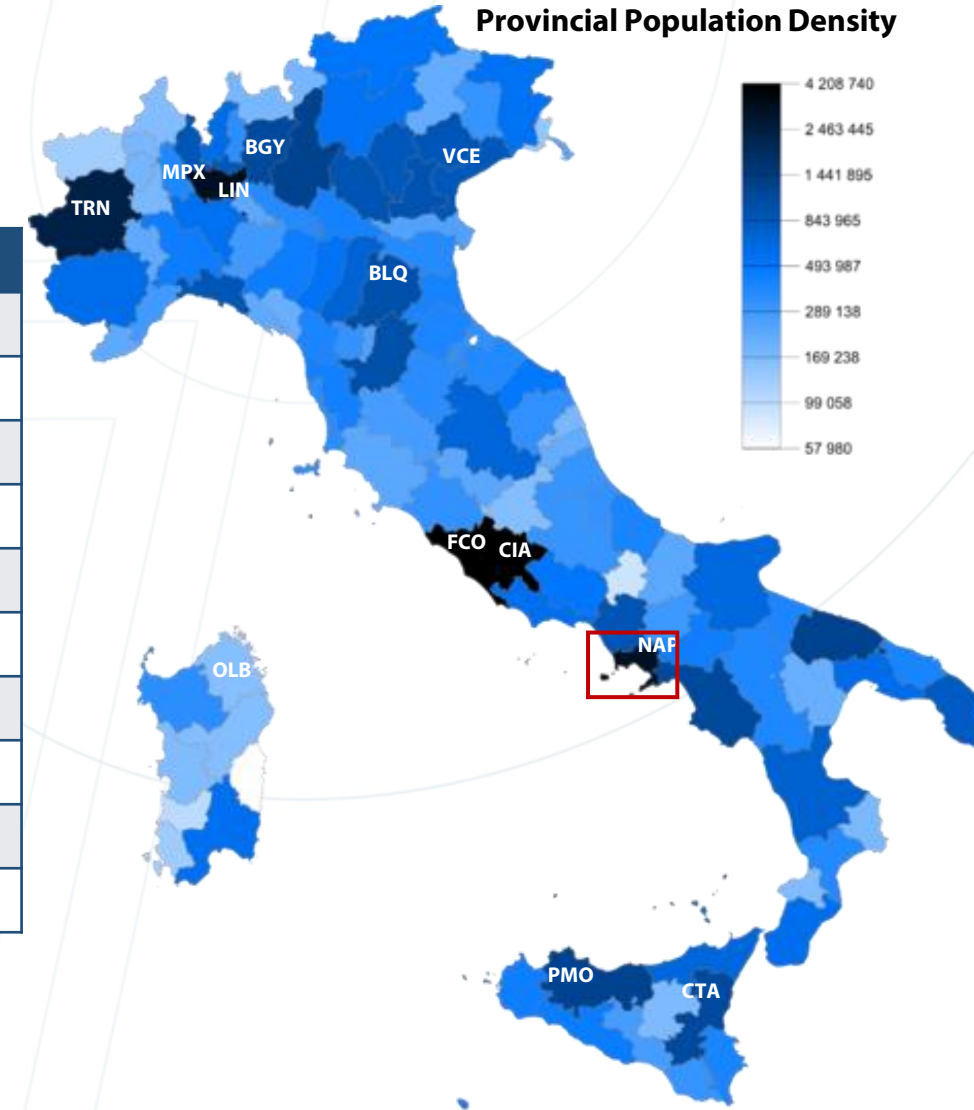
Country context

- Measurement and noise limits
- Government goals
- Spatial planning policy
- Mitigation measures
- New data and knowledge
- Noise limit enforcement

In 2019, the 10 busiest Italian airports have been:

Airport	Passengers	Movements	Cargo [tons]
Rome Fiumicino	43.532.573	309.783	194.526,81
Milan Malpensa	28.846.299	234.054	558.481,48
Bergamo	13.857.257	95.377	118.964,00
Venice	11.561.594	95.232	63.970,20
Naples	10.860.068	82.577	11.750,39
Catania	10.223.113	75.070	5.748,80
Bologna	9.405.920	77.126	48.832,51
Palermo	7.018.087	54.243	1.166,00
Milan Linate	6.570.984	85.730	7.586,01
Rome Ciampino	5.879.496	52.253	18.447,56

<https://assaeroporti.com/dati-annuali/>



Country context - 3

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

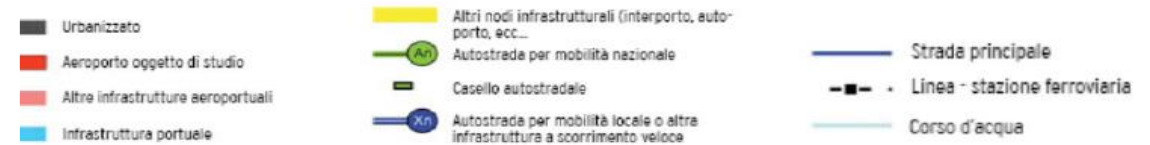
Noise limit enforcement

In the next slides, emphasis will be given to a particular case - Naples Airport - to more effectively represent the policy adopted in Italy for the containment of airport noise.

Naples International Airport (ICAO Code LIRN) is a civil airport open to military traffic. The airport is located north east of the city of Naples about 3.24 NM from the city center; the airport grounds, fall within the territories of the municipalities of Naples and Casoria and occupy a total area of 233 ha.

The airport area consists of both urbanization areas such as those falling within the municipality of Naples, and areas, falling within the municipality of Casoria, characterized by the presence of numerous shopping centers and road and motorway junctions.

<https://ambiente.aeroportoedinapoli.it/>



How is noise impact measured? Are there any noise limits?

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

Italian legislation requires the use of metric LVA, which stands for “evaluation level of airport noise”. This metric is very close to the DNL metric, in fact it weights day, evening and night aircraft operations with the same factors used by LVA. The difference is that DNL is calculated on a yearly basis for an average day and LVA on a 3 weeks basis, chosen in three selected periods. The LVA index is defined by the following formula:

Where:

N number of days of the observation period
LVA_j daily value of the airport noise level.

$$L_{VA} = 10 \cdot \log \left[\frac{1}{N} \sum_{j=1}^N 10^{L_{VAj}/10} \right] dB(A)$$

The daily airport noise level is calculated considering all aircraft operations (flyover and on the ground) occurring during the day. It is determined by the following formula:

$$L_{VAj} = 10 \cdot \log \left[\frac{17}{24} 10^{L_{VA,d}/10} + \frac{7}{24} 10^{L_{VA,n}/10} \right] dB(A)$$

Where:

LVA_d and LVA_n represent airport noise levels measured during daytime (defined from 06.00 to 23.00) and night-time (defined from 23.00 to 06.00), calculated as follows, where SEL_i is level of the analyzed sound event - the night period is 10dB(A) more disturbing than the day period:

$$L_{VA,d} = 10 \log \left[\frac{1}{T_d} \sum_{i=1}^{N_d} 10^{SEL_i/10} \right] dB(A)$$

$$L_{VA,n} = \left[10 \log \left(\frac{1}{T_n} \sum_{k=1}^{N_n} 10^{SEL_k/10} \right) + 10 \right] dB(A)$$

Twenty-one (21) days are used for the assessment of the LVA index, corresponding to the abovementioned three weeks. From the following three periods must be chosen, the busiest week, in terms of overall movements:

- 1st October – 31st January
- 1st February – 31st May
- 1st June – 30th September.

How is noise impact measured? Are there any noise limits?

LVA index define three different Noise Limit for different surrounding area of Airport defined as zones: "A", "B" and "C" (see Spatial Planning Policy).

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

On the right, the three Zones A, B and C, defined for Naples Airport (approved in 2004), are shown.

[\[https://ambiente.aeroportodinapoli.it/\]](https://ambiente.aeroportodinapoli.it/)



How is noise impact measured? Are there any noise limits?

The legislation also issued a decree “**Norms for monitoring systems**”, to supervise noise pollution around airports and to classify airports on the basis of the measured noise levels. The decree establishes that noise monitoring systems should be located within the airport surrounding and should be linked with the airport meteorological meteor station in order to correlate relative meteorological conditions to each flight operation (as set out in the decree dated 31/10/97).

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

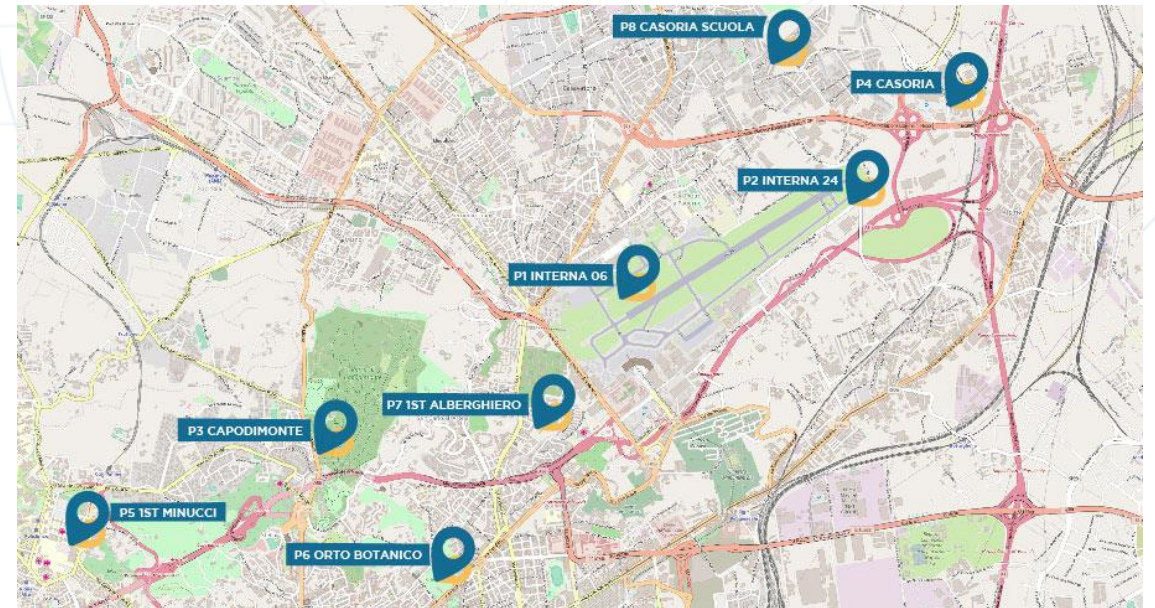
Mitigation measures

New data and knowledge

Noise limit enforcement

These systems should also be able to correlate the evaluated noise with the radar track as well as the flight data of the aircraft generating the noise. The monitoring systems should must be able to calculate underlying noise, to supply LVA values and to plot noise contours.

Naples Airport Monitoring Noise System Is currently comprised of a network of 8 stations (terminals), some of them are located inside the airport complex and some in the areas surrounding the airport under departure e arrival procedures.



<https://ambiente.aeroportodinapoli.it>

Does government set noise goals? How do airports/ANSPs/airlines deliver?

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

Periodically, the National Civil Aviation Authority (ENAC), in synergy with the Italian Minister of Infrastructure and Transport, prepares and approves the National Airport Plan (PNA) with the aim of highlighting new development opportunities for the country underlining existing criticalities, emerging needs, possible solutions, response methods, network architecture and the role of individual airports. Given the role and objectives of the PNA, the SEA assessment must be carried out within the approval process as it provides the tools to integrate environmental considerations in the formulation of development plans for the territory starting from their early stages.

The noise objectives may concern one or more of the following elements (ENAC APT 26):

- a) minimization of the population affected by the phenomenon;
- b) minimization of the extension of the areas affected by the phenomenon;
- c) minimization of noise in areas characterized by the presence of sensitive receptors such as hospitals, schools, assistance centers.

In this regard, Airlines must comply with the anti-noise procedures established for the specific airport, while the Airport Operators must provide for the installation, management and maintenance of the airport noise monitoring system, and prepares, assuming the costs, the noise abatement plans.

Does government set noise goals? How do airports/ANSPs/airlines deliver?

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

The Ministerial Decree 31.10.97 defined the establishment of a commission at each of the airports open to civilian traffic (commonly called "Commission Art. 5") chaired by the competent director of the airport district (ENAC) and composed of a representative for each of the following subjects: region, province and municipalities involved; Regional Agency for Environmental Protection; ENAV, Air carriers, Airport management companies.

The goal of the commissions was to define the noise abatement procedures that are to be adopted with a provision of the airport manager .

Furthermore, the commissions should have unanimously defined the zones A, B and C discussed above.

The Commissions took years to define the anti-noise procedures and then zones A, B and C, thus becoming **permanent** organs. The main limits of the Art. 5 commissions has been:

- i) Don't having foreseen a ban on new buildings within zone A
- ii) Don't having incorporated the limits imposed by areas A, B and C into the Noise Planning of Town
- iii) The lack of direct representation of disturbed citizens within the commission

This last point has led to the birth of citizen committees (called No FLY) which have opposed airport development activities over the years, seeing airport management companies as a counterpart to be opposed. Airport management companies have had difficulty in managing relations with communities and even ENAC in its "superpartes" role has shown limits in interacting with a non-institutional subject such as that of citizen committees.

The committees were therefore able to formalize their points of views effectively only within the Environmental Impact Assessment process that accompanies the airport master plan.

Is there any spatial planning policy?

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

Specific Airport Commissions chosen by the Italian Institute for Civil Aviation (ENAC) are instituted to define three airport limit zones (“aree di rispetto”) surrounding each airport area:

Zone	LVA limit [dBA]	Allowed activities
Outside	60	No limitations
A	65	No limitations
B	75	Agricultural, livestock breeding, industrial, trading, tertiary (no residential areas)
C	No limit	Only activities due to the airport infrastructure

Outside the airport zoning, the airport, in addition to guaranteeing a level of LVA lower than 60 dBA, contributes, together with the other noise sources, to the absolute level of input which is to be compared with the limits of the municipal acoustic zoning (dictated by DPCM 14-11-1997).

If the noise limits set for the limit zones are exceeded, the interventions envisaged by the Legislative Decree n. 13 of January 17, 2005 (transposition of the EC Directive 2002/30) are based on the methodology of the Balanced Approach as defined by ICAO.

What measures are taken to reduce aircraft noise and who leads these initiatives?

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

To reduce the noise impact produced by aircraft, the most used methodology is the Balanced Approach, which consists of simultaneously adopting various types of measures that help to keep noise pollution levels within acceptable values. The Balanced Approach is divided into the following components:

1. The reduction of noise at the source
2. Land use planning and management
3. Noise abatement procedures
4. Operational restrictions*

Some of these initiatives are implemented by individual airports and then submitted for approval by regulatory bodies.

In Italy, the Legislative Decree 13/2005 imposes operating restrictions on Italian airports with traffic exceeding 50,000 movements referring to the average of the previous three years. The airports subject to the operational restrictions are:

- Rome Fiumicino
- Milan Malpensa
- Milan Linate (no night mov allowed + 16 is the max number of mov/h)
- Venice
- Rome Ciampino (recently the Noise Reduction Plan approved by the Ministry of the Environment imposed a limit of 65 commercial movements per day for the airport)
- Catania
- Naples
- Bergamo
- Bologna

* A long legislative dispute involved the Airports vs. ENAC and Ministry of Environment to ban the night flights. There is currently no general law to restrict night flights

How is new data and knowledge dealt with?

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

The impact of new data and technologies on the territory surrounding each airport is analysed through the Environmental Impact Assessment (EIA) procedure which must be included in each airport Master Plan.

In addition, the generation of noise conflict maps is indispensable as a support to action plans. The conflict map is the fundamental element used to identify the areas where the noise limits are exceeded, and it derives from the comparison between the "airport noise zoning" in force and the noise levels detected or estimated in the event that the reference traffic scenario that characterizes the airport should undergo changes.

As previously mentioned, the definition of the anti-noise procedures and of the subsequent zones A, B and C was a long process. The noise abatement procedures initially defined with forecasting software are implemented for an interim period through specific NOTAM.

Only after this trial period are they adopted definitively. Therefore, a new procedure modeled with provisional SW "ante operam" is subsequently verified "post operam" with the data of the real flight paths.

How is new data and knowledge dealt with?

Italy



Linate Airport – “Commision Art. 5” Five years of Work

Country context

Measurement and noise limits

Government goals

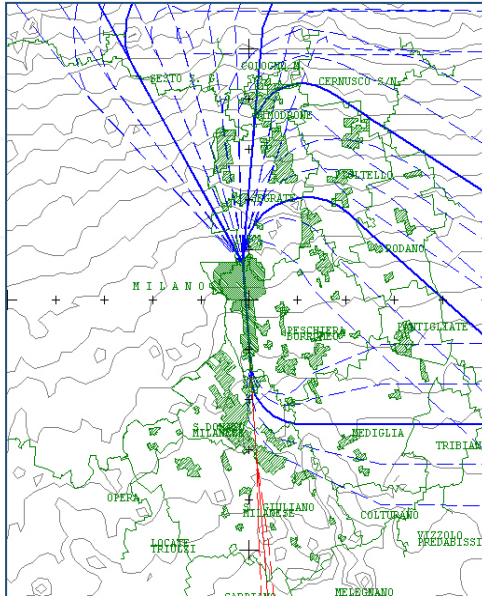
Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

STEP-1 2006



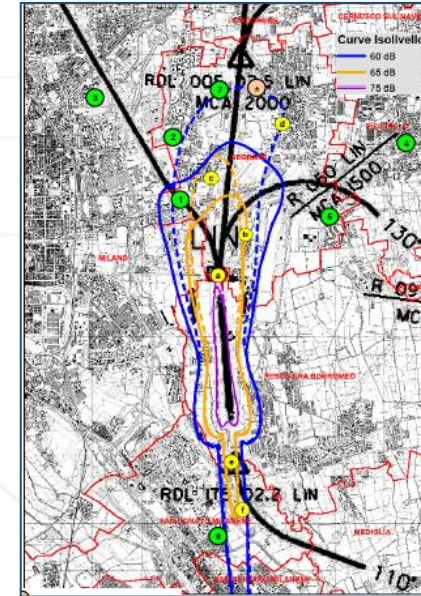
After two years of works the Noise Abatment Procedures have been approved
INM Model n° 18
Route by destination with ECAC dispersion

STEP-2 2007



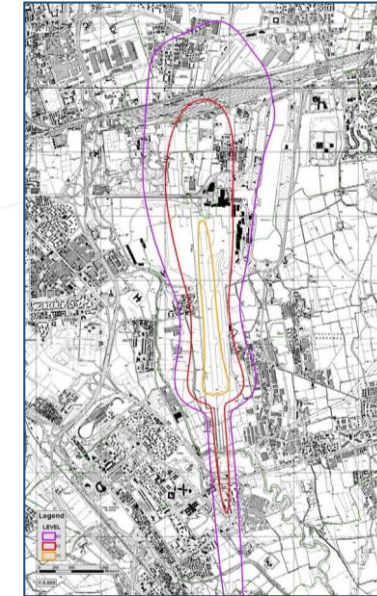
Publication of the New Procedure in the AIRAC cycle (AIP) valid for six months

STEP-3 2008

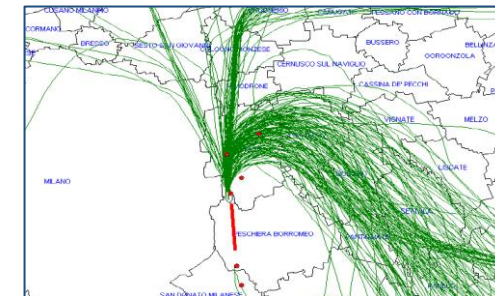


Ante Operam Vs. Post Operam INM Model with real radar Tracks.

STEP-4 2009



The Linate Airport Commission approved the acoustic zoning.



How is new data and knowledge dealt with?

Italy



Country context

It should be noted that zones A, B and C, even if they are often confused with the respective isophonic at 60, 65 and 75 dB (A), are different from them and represent a sort of acoustic planning that the municipalities should absorb within their acoustic zoning plans.

Measurement and noise limits

Often the Commissions have not applied this concept by confusing isophonics and Zones A, B and C.

Government goals

In the event of overruns of the airport zoning, it is the airport's responsibility to comply with the regulatory limits by submitting an acoustic recovery plan pursuant to the 2000 Ministerial Decree.

Spatial planning policy

However, the complexity of the procedures, the overlap of Italian regulations with European ones*, the number and different objectives of the bodies in charge have effectively prevented the implementation of these recovery plans (to date only Ciampino airport has been able to approve an Acoustic Restoration Plan after a long dispute which, as mentioned, limited the maximum number of daily movements to 65). More often, individual citizens or citizens' committees have resorted to both administrative and civil courts to oppose airport management companies and Commission (this is the case of Bergamo airport for which *Legambiente* and some committees of citizens challenged the approval of the airport's zoning plan at the competent TAR, having their requests recognized and, on the practical side, affirming the principle according to which "*being the airport zoning a Plan pursuant to art. 5 paragraph 1 letter e) of Legislative Decree 152/2006, and having an immediate and prevailing preceptive effect on municipal urban planning, it must always be preceded by VAS*" (Strategic Environmental Assessment as precisely in Legislative Decree 152/2006, initially introduced at European level with Directive 2001/42 / EC).

Mitigation measures

New data and knowledge

Noise limit Enforcement

*Currently, the European legislation implemented in Italy does not provide for restrictions to the values of Lden reached. In fact, it is a rule of an exclusively cognitive nature of the population and the exposed areas. It does not provide for acoustic limits, nor limitations to the use of the territory, nor for example any type of sanction if the number of exposed inhabitants has not been reduced or the "action plan" has not been followed up, which often results in a list of "good intentions", since the verification of the declared results is not foreseen.

At the moment there is no provision to replace the LVA metric with the European LDEN metric

How is new data and knowledge dealt with?

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

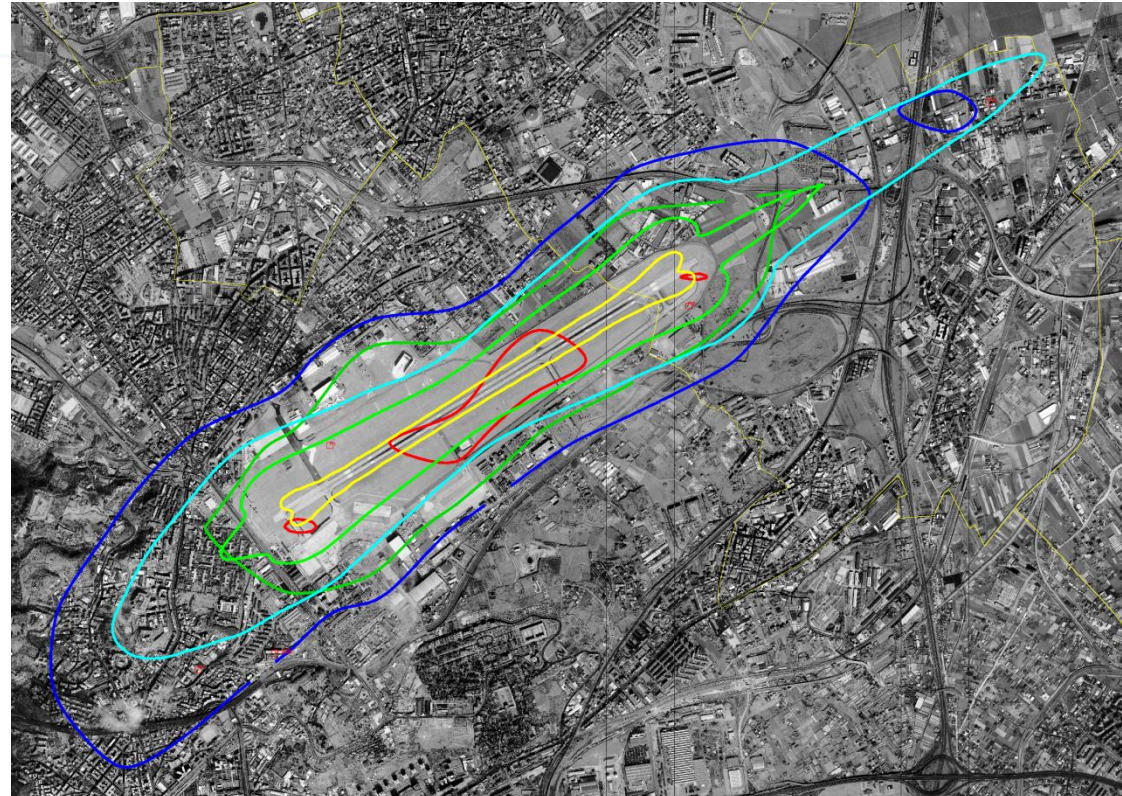
New data and knowledge

Noise limit Enforcement

The compatibility decree (2008) of the Environmental Impact Assessment for Naples Airport - which accompanied the airport master plan - required an update of the acoustic zoning at least every two years and the relative comparison with the approved zoning (2004).

Below we can see the comparison of noise zoning of 2012 with approved zoning of 2004:

<https://ambiente.aeroportodinapoli.it>



How is new data and knowledge dealt with?

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

Milan Bergamo Airport • SACBO S.p.A.

The addition of new less noisy aircrafts will be considered for the reduction of noise levels, creating a buffer for the development of more flight activity.

If it is observed that the acoustic climate is reducing, the airport acoustic zoning will not change. By focusing on taking advantage of the change in the acoustic climate, in particular on the development of flight activity, it will be needed to take into account the environmental matrices in order to evaluate the effects, considering that the main environmental component (noise) should not cause any critical issues.

The modelling tools will be used to supply a rough estimation regarding the acoustic effects produced by flight activity. If noise limits are not respected, on-site investigations with tools to measure noise levels will verify the overcome of those limits.

If a new modelling tool introduces noise level variations, those changes will be taken into account in the predictive evaluations, but they will not be so “dominant” that will significantly influence the choices that have been made in the past.

Regarding the evaluation of model variations, great attention is given to the comparison with the on-site measured noise levels. A real calibration is not performed, since the values between the model and the on-site measures were always good, but the comparison between the measures permits to know the behaviour of the models and it helps for data interpretation. So, if the results lead to a noise reduction and if the measured levels follow the same trend, then no critical issue is identified.

Are noise limits enforced? And how are individual residents protected?

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

- Law:

The Regional Agencies for the Protection of the Environment (ARPA) have the task of periodically checking the efficiency of the airport noise monitoring system by means of a series of checks on the instrumentation. If the noise limits set for the limit zones are exceeded, the required interventions have been analysed in the previous slides.

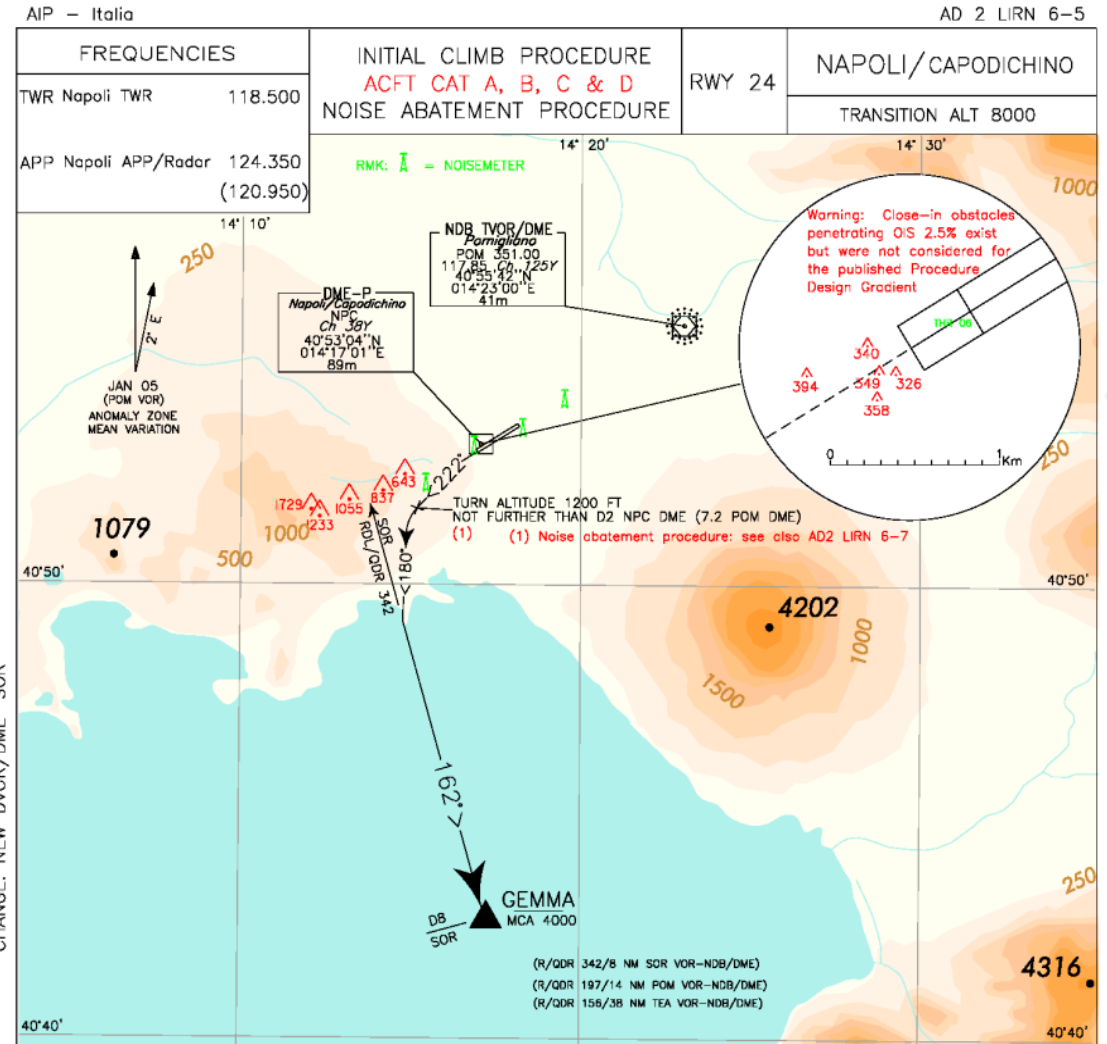
- Voluntary:

Some initiatives to reduce noise are implemented by individual airports.

For example, SACBO (BGY's Airport Operator) has in the past published tenders for the implementation of mitigation interventions in favor of the residents who live adjacent to the airport and are exposed to significant noise levels above 65 dB(A).

Naples Airport introduced (2005) a Noise abatement procedure for take-offs in the direction of the city of Naples with some gates to respect. In case of violation of procedure ENAC after a process of "validation" of radar tracks made a sanction to Airlines that not respect the procedure.

<https://www.enav.it/>



Are noise limits enforced? And how are individual residents protected?

Italy implemented in 2005 with decree n ° 194 the Directive 2002/49 / EC of the European Parliament relating to the assessment and management of environmental noise.

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

The L_{den} index represents a common indicator for the different European countries and for the different transport infrastructures and differs significantly from the LVA previously described.

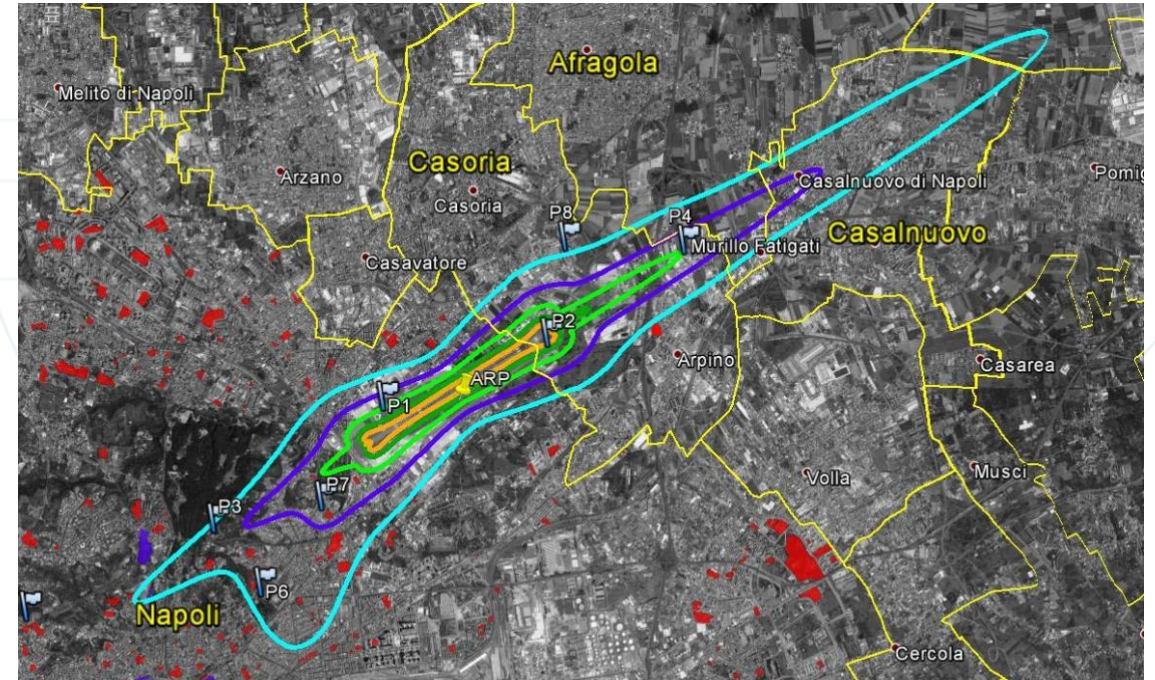
On the right is showed the L_{den} index (2016) for the Naples airport.

<https://ambiente.aeroportodinapoli.it>

The Italian decree n° 194 doesn't impose any restrictions or limits of compliance. However, a common index can give a useful evaluation of situation at the European level.

The graphs below (relating to the acoustic mapping of 2006) show how the various Italian airports are classified with respect to the major European airports.

<http://eea.eionet.europa.eu>



Are noise limits enforced? And how are individual residents protected?

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

The decree DM 29/11/00 “Criteria for the predisposition, from the society and the entities that handle public transportation services or the related infrastructures, of the action plans for noise abatement and containment” requests that during the verification of the noise limits in zones related to the infrastructures an Action Plan must be prepared for decreasing noise levels below the limits.

The deadlines for airports handlers regarding the Action Plan are:

- 18 month for the evaluation and verification of the criticalities.
- 18 month for preparation of an Action Plan.
- 5 years for implementing it.

There are some issues regarding the decree:

- It considers just one Action Plan.
- When an Action Plan is prepared, noise receptors will wait 8 years in order to have the noise levels reduced.
- For airport infrastructures the legislation does not define noise limits that have to be respected inside residential houses, making difficult the application of the single Action Plan that is under direct control of the airport handler.
- The aspects related to the noise abatement procedures, like routes and air traffic distribution, are applied before the definition of the activity limits by the Airport Committee, and so the airport handler can't change them, as stated in the DM 31/10/97, meanwhile the addition of new modern aircraft is responsibility of the air-carriers, which update will take an amount of time that is not compatible with the implementation of the plan. At the end the airport handler is only capable of defining noise abatement procedures or to perform noise mitigation at the receptor end.

Are noise limits enforced? And how are individual residents protected?

Italy



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

Outside the Acoustic Zoning, the airport handler must make sure that L_{va} values do not overcome 60 dB. From the Municipality responsibility, the airport infrastructure is considered in the overcome of the “Municipality acoustic classification limits”.

An element that should protect airport handlers is that the municipalities have to absorb the Airport Acoustic Zoning inside their own Acoustic Zoning, by modifying their Acoustic Zoning in order to make it compatible with Airport zoning.

The National legislation considers a generic compatibility between the two acoustic zoning. Meanwhile, from the regional legislation it is stated that under the B zone a “Class V” must exist and that under the A zone at least a “Class IV” must exist. The common sense wants that immediately under the routes there is a “IV class” also outside the acoustic zoning or at least an “extended Class III”.

Citizens are protected with forecast evaluations of the acoustic impact that are requested for new buildings, both residential houses and infrastructures.

Regarding the evaluation for the construction of new residential buildings under air-traffic routes outside the acoustic zoning, this should lead to a result that is more incompatible than compatible, but the evaluations are “requested and not binding”.

A citizen can report the overcome of the noise limits to the Municipality, the Municipality has to verify the overcome of the limits, through the ARPA agency, so that it will be possible to activate the preparation of the Action Plan, if it is not already activated.

Country context - 1



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

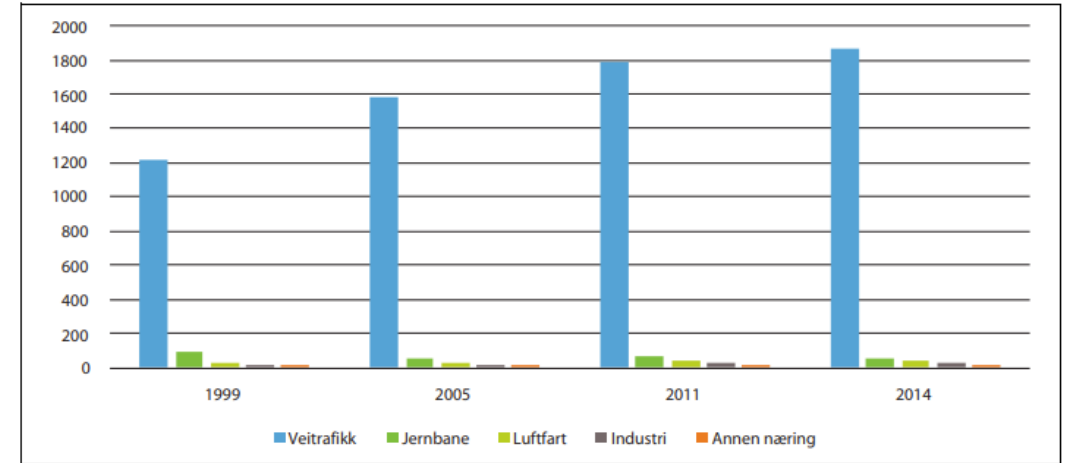
Noise limit enforcement

Avinor is a fully stated own company with the ministry of transport as it's only shareholder. They own and operate 43 civil airports in Norway. Only a handful of airports are privately owned. Because of long distances within the country and to other european and international destinations, air travel is a common occurrence. It has been a government strategy for several decades to connect remote parts of the country using short runway airfields and subsidizing certain routes.

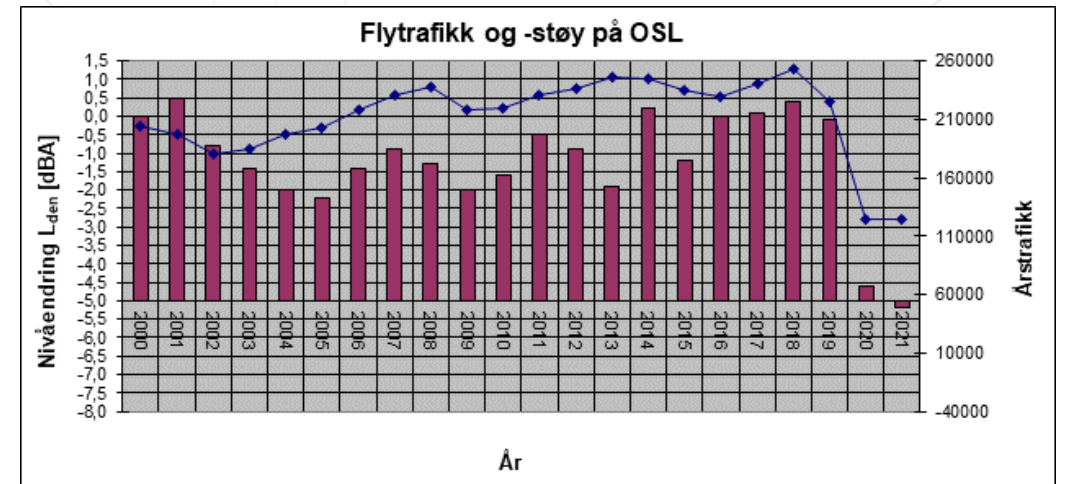
Oslo airport is by far the most trafficated airport with 20% of all aircraft movements (2021). Pre-pandemic this was around 30%

A large part of Norways populations is exposed to noise through industry and transport infrastructure. Around 40% of the population lives in areas where they can be bothered by noise. However, by far the most nuisance comes from road traffic. Only around 43 500 of people or 0.8% of the population live in areas with 55 dB(A) L_{den} stemming from aviation noise.

People living around Stavanger, Trondheim, Bodø and Tromsø are generally far less annoyed by aircraft noise than what's found in international literature. Inhabitants around Oslo airport are less tolerant, but still more tolerant than similar airports internationally.



Amount of people (1000x) exposed to noise above 55 dB(A) L_{den} .
Blue = road traffic Green = railways Light green = Aviation Gray = Industry Orange = Others



Change in noise and traffic level between 2000-2021



Country context - 2



Country context

Measurement and noise limits

Government goals

Spatial planning policy

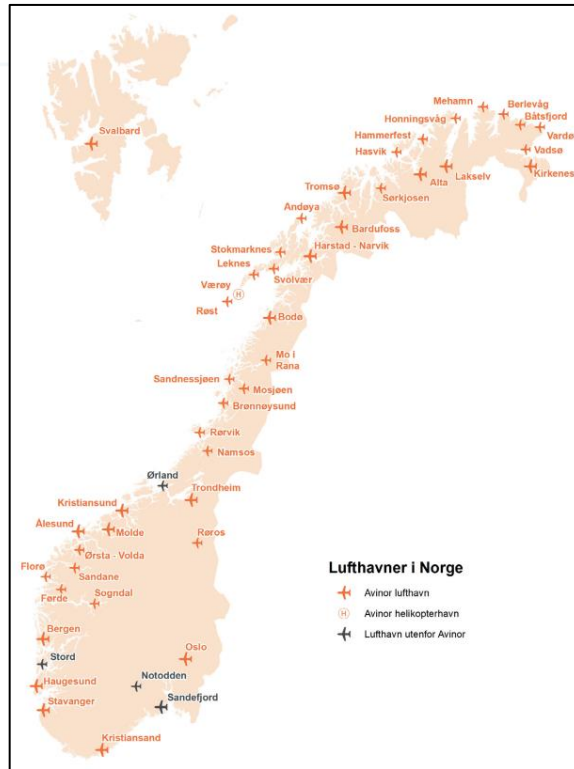
Mitigation measures

New data and knowledge

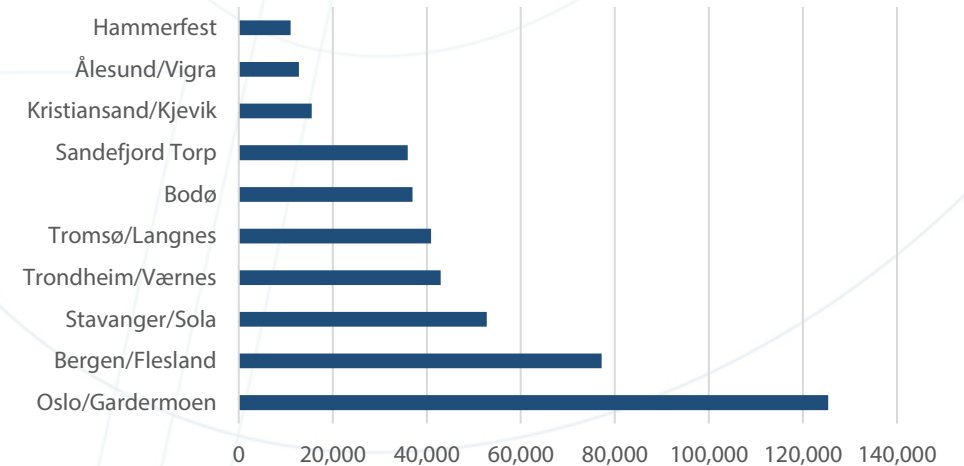
Noise limit enforcement

At more than half off all aiports there are no one exposed to nuisance from airports. This can be explained by Norway’s extensive STOLport network (Short Takeoff and Landing) where there is a limited number of movements with smaller aircraft.

Because of the extensive maritime activity on the west coast Norway is one of the few countries where helicopter noise causes significant nusiance. To ferry people offshore heavier transport helicopters are used.



Aircraft Movements 2021



How is noise impact measured? Are there any noise limits?



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

Two noise metrics are used for regulatory purposes, the L_{den} and the L_{5AS} . The latter being used as a nighttime noise metric. For *outdoor* noise from aviation two noise contours are created called the «yellow zone» and the «red zone». The yellow zone is defined by the for $L_{den} > 52$ dB and $L_{5AS} > 80$ dB while the red zone $L_{den} > 62$ dB and $L_{5AS} > 90$ dB

These zones are used for spatial planning purposes and are defined in «T-1442/21 Retningslinje for behandling av støy i arealplanlegging» (Guidelines for the management of noise for spatial planning)

The noise zone maps are calculated based on the current traffic situation and a future prognosis 10-20 years ahead. The union of the two scenarios is sent over to the municipality (kommune). A custom version of the INM software is used for the calculations which is more accurate with topographic variations.

Forurensningsloven (The Pollution Control Regulations) mandates the mapping of *indoor* noise down to 35 dB $L_{pAeq,24h}$ for dwellings, kindergardens, educational facilities and health facilities. If the noise level is above 42 dB $L_{pAeq,24h}$ for existing buildings noise reducing measures must take place.

An improved version of INM called NORTIM is used for noise calculations.

Tabell 1: Grenseverdier for soneinndeling ved støykartlegging. Alle grenseverdier gjelder innfallende lydtryknivå. Forutsetninger for beregning av grenseverdiene er gitt i veiledning til retningslinjen.

Støykilde	Støysone					
	Gul sone			Rød sone		
	Utendørs støynivå	Utendørs støynivå, lørdag og søndag/helligdag	Utendørs støynivå i nattperioden kl. 23 - 07	Utendørs støynivå	Utendørs støynivå lørdag og søndag/helligdag	Utendørs støynivå i nattperioden kl. 23 - 07
Veg	$L_{den} > 55$ dB		$L_{5AF} > 70$ dB	$L_{den} > 65$ dB		$L_{5AF} > 85$ dB
Bane	$L_{den} > 58$ dB		$L_{5AF} > 75$ dB	$L_{den} > 68$ dB		$L_{5AF} > 90$ dB
Luftfart	$L_{den} > 52$ dB		$L_{5AS} > 80$ dB	$L_{den} > 62$ dB		$L_{5AS} > 90$ dB



Does government set noise goals? How do airports/ANSPs/airlines deliver?



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

The government has set a goal of reducing noise with 10% compared to 1999 levels using the noise metric SPI (noise nuisance index) from industry, road traffic, railways, construction and motorsport. The metric only considers a specific geographic area and of dwellings exposed to noise in 1999. It does not take into account population growth, relocation, or new dwellings in other noise exposed areas. Therefore, the metric doesn't reflect the true magnitude of noise nuisance over time.

This noise goal has however not resulted in specific noise reducing policies for airports. Avinor does provide the data for the central government to calculate the metric.

SPI is calculated by multiplying the amount of people exposed to difference noise levels with the average nuisance level for that noise level. Nuisance level is categorized from "low nuisance", "some nuisance", "high nuisance" and "very high nuisance". The index takes into account different noise levels, units and the properties of the noise source.

The government has also set a goal of reducing the amount of people exposed to 38 dB(A) indoors close to roads, airports and railways with 30% within 2020 compared to 2005. However, until 2019 the noise *increased* 30%, mainly from road traffic. The noise from airports decreased by mainly changing the departure and approach routing into the Oslo Airport, use of quieter aircraft and sound isolating dwellings.

It's mainly the Norwegian CAA (luftfartstilsynet) together with Avinor that work together to reduce noise, with the ministry of transport as their reporting body.

Is there any spatial planning policy?



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

- The main document relating spatial planning and noise exposure is «T-1442/21 Retningslinje for behandling av støy i arealplanlegging» (Guidelines for the management of noise for spatial planning). This document defines the yellow and red noise zones for different types of noise sources. It's used both for existing noise sources as well as the establishment of new ones.
- It's the responsibility of the owner of the noise source to create noise exposure maps showing the yellow and red noise zones.
- There is a political initiative to build houses around traffic hubs, including airports. However noise concerns have not been fully addressed yet.

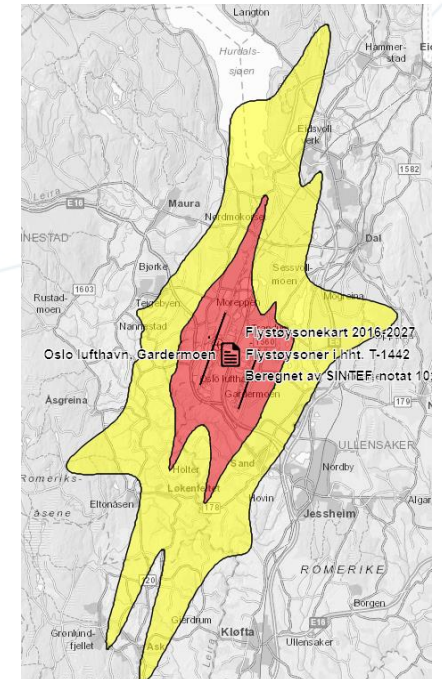
Red zone

- Not suitable for noise sensitive use purposes such as schools, kindergartens, dwellings, cottages, and new buildings with a noise sensitive purpose.
- New buildings with a noise sensitive nature should not be allowed in this zone.
- Existing dwellings should get the option of a buy-out. If undesired by the owner, the house must be sound isolated to achieve an indoor noise level of $L_{Aeq24} 42$ dB. However, buy-outs are preferred since dwellings are unwanted in the red zone.

Yellow zone

- An assessment zone where new buildings with a noise sensitive purpose can be constructed if noise mitigation gives satisfactory noise conditions.
- Sound isolation is a commonly used tactic for existing buildings in this zone.
- The municipality should weight the pros and cons of establishing new a noise sensitive buildings.

Oslo Airport



What measures are taken to reduce aircraft noise and who leads these initiatives?

Norway 

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

The main way noise is managed in Norway is almost exclusively through laws, regulations and guidelines for different sources of noise, including air transport. Regulation is mainly directed towards the owner of the noise source. For airports, Avinor as the owner of most airports in Norway is responsible for following the noise regulations, creating the noise exposure maps and paying for mitigating measures. Economic incentives are seldomly used as means to reduce or manage aircraft noise.

There are no limitations on the size of the noise contour, but Avinor still strives to limit noise through its own initiatives. They believe this will cause good relationships with their neighbours and that the regulator will be more lenient with any future noise regulations.

There is special noise regulation for Oslo Airport, the largest airport in Norway by a large margin. It regulates runway use, restricts what part of the airspace can be used during day and nighttime. It also restricts use of certain aircraft based on their noise certification. It also allows for the use of curved approaches.

Nighttime flights (between 24:00 and 06:30) must pay an additional 50% of their start or landing fee.

Avinor's work on reducing aircraft noise generally extends further than what the government mandates. One of their strategic goals is to reduce noise for people living around their airports. Some of the measures they can consider based on expected future noise nuisance can be:

- Changing procedure for departure and landing
- Changing preferential runways
- Restricting certain types of aircraft
- Increasing the amount of curved approaches

How is new data and knowledge dealt with?



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

The spatial planning regulations stipulate the owner of the noise source to update the noise zone maps every 10 years to see if the current situation or future prognosis has changed.

Noise analysis must always be done with the latest version of the NORTIM software to make sure the latest aircraft types are included. The regulation states that the software uses the aircraft database of FAA which it recognizes is being constantly updated, but does not state how to deal with major changes to the noise contours. Noise data of certain aircraft types have been adjusted to reflect on ground measurements.

By measuring the noise impact of certain noisy helicopter types, the calculation methods have been adjusted to be accurate.

Oslo airport has their own version of NORTIM called RADTIM which used the flightpath and noise monitoring system to accurately estimate flight paths and profiles for use in the noise calculations. The noise monitoring system has also been used to verify the noise calculations. Because the measured and calculated values have been found to correspond there has been no need to update the calculation models based on measurements.

Another version of the software REGTIM is used for regional airports while NORTIM is used for the remaining airports. Here the published AIP tracks are used as input. In REGTIM simplifications such as grouping of aircraft based on performance and noise are made.

Any changes to the calculation methods are discussed with the Norwegian CAA and EPA. For example the introduction of the fourth edition of ECAC document 29 was discussed.

Are noise limits enforced? And how are individual residents protected?



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit Enforcement

The high-level government goal of reducing noise using the SPI index was not met in 2020. However, the goal was not part of the law and therefore did not carry any legal obligations.

Noise limits are mainly enforced through the spatial planning policy. The noise exposure maps created are shared by the airport with the local municipality which is responsible for the arial planning. In the municipalities arial planning they will usually touch upon dwellings or other facilities that will need noise reducing measure to comply with the noise limits.

Also, when applying for or renewing an airport operating lisenche through the norwegian CAA (luftfartstilsynet) noise calculations according to the T1442/21 guidelines must be included. Local governments can also come with input, e.g. about the opening hours of the airport. The airport must also agree with the local governments about the departure and arrival routes to and from the airport.

Country context - 1



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

In Sweden, the Swedish Environmental Protection Agency has a designated responsibility for specifically coordinating the authorities' work regarding environmental noise.

Authorities that deciding, and publishing goals, limits and guidelines

- Swedish Environmental Protection Agency
- Governmental decisions
- Public Health Agency of Sweden
- Swedish National Board of Housing
- Environmental Court + appeals body

In Sweden it's normal to *calculate* noise exposure and then follow up with random measurements.

About 13 000 people are expose to $FBN = L_{den}$ over 55 dB(A) from civilian airports

Airborne noise calculations are often performed to be used as a basis for environmental assessments of airports and building planning around airports.

Swedavia is a Swedish state-owned company, which owns and operates ten of Sweden's busiest airports.

The Swedish Transport Agency, the Swedish Armed Forces and the Swedish Environmental Protection Agency have established a quality assurance document that contains the calculation method for aircraft noise which is to ensure a uniform application in Sweden. ECAC Doc 29 is the basis for these noise calculations.

Country context - 2



Country context

Measurement and noise limits

Passengers at the 10 busiest airports in Sweden 2021

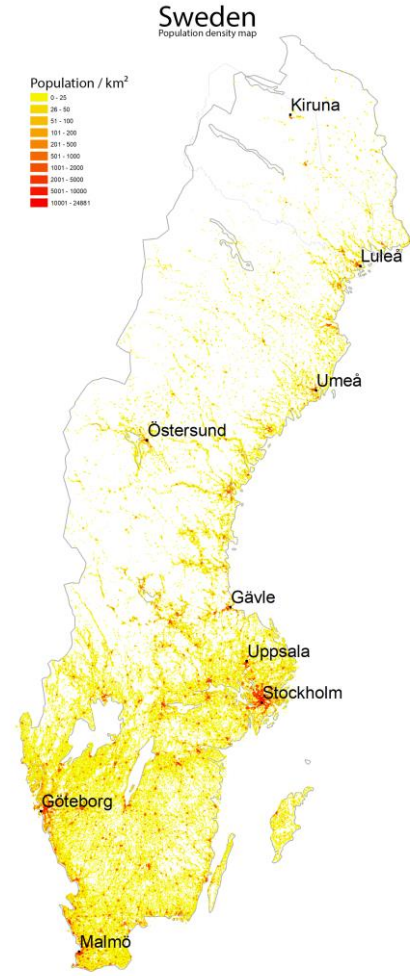
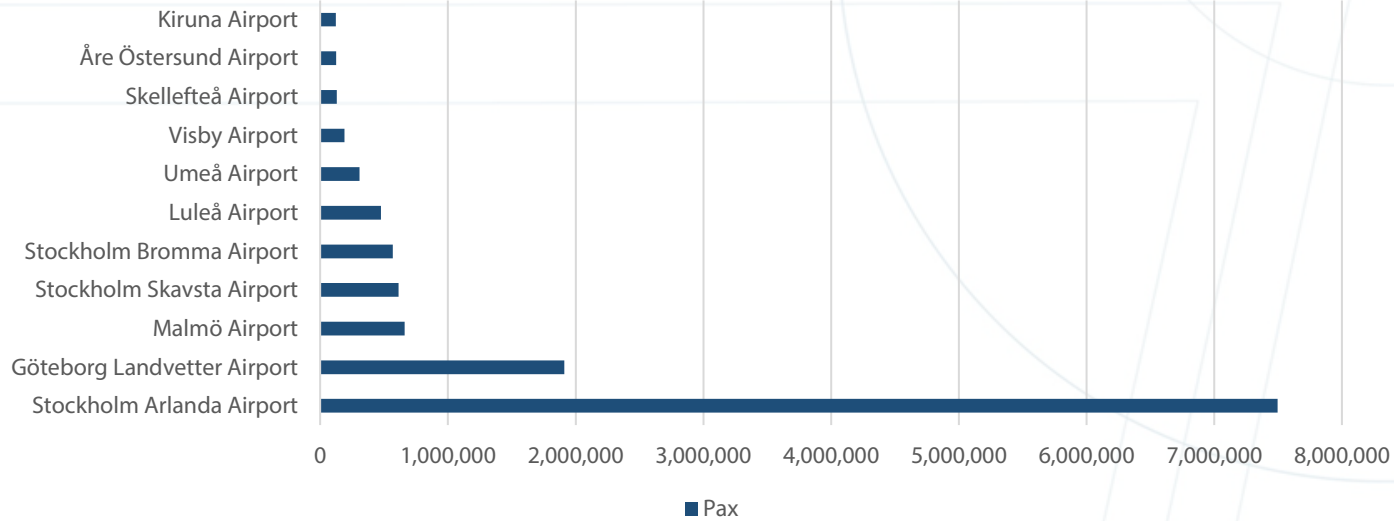
Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement



Population density of Sweden

How is noise impact measured? Are there any noise limits?



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

Sweden use the same noise metrics across all airports independent of size. However, because of data limitations at some airports traffic input is adapted for local availability of data. Also, different airports may have different limits based on the decision of the environmental courts.

Noise metrics used

- $L_{den} = FBN = FBN_{EU}$
- L_{Amax}
- L_{eq}
- L_{night} (Only used to report to the EU)
- $TFBN = TDENL$ (Only used at one airport)

Limits dwellings

- FBN 55dB(A) outdoors
- L_{Amax} 70 dB(A) outdoors, which may be exceeded N times, N=16 during average day/evening and 3 during average night according to a government regulation "Forordning (2015:216)". However, the value of N is set differently between airports depending on decisions from the Environmental courts.
- $L_{eq,24h}$ 30 dB indoors
- L_{Amax} 45 dB indoors. The value of N is set differently between airports depending on decisions from the Environmental courts.

Other areas

- Outdoor where silence is important FBN 40 dB(a)
- Indoors in hospitals, schools, offices, hotels and restaurant according to Swedish standard SS 25268:2007. Depends on type of room and noise class
 - Hospitals: L_{eq} 26-45 dB(A) and L_{Amax} (Fast) 41-60 dB(A)
 - Schools: L_{eq} 26-45 dB(A) and L_{Amax} (Fast) 35-60 dB(A)
 - Offices: L_{eq} 30-45 dB(A) and L_{Amax} (Fast) 45-60 dB(A)
 - Hotels and restaurants: L_{eq} 26-45 dB(A) and L_{Amax} (Fast) 41-60 dB(A)



Does government set noise goals? How do airports/ANSPs/airlines deliver?

Sweden 

Country context

Measurement and noise limits

Government goals

















Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

The parliament has approved 16 environmental goals for which one is having a “Good built environment”. One of the definitions of this goals it that “*people are not exposed to harmful air pollutants, chemical substances, noise levels and radon levels or other unacceptable health or safety risks*”. Based on these goals the regional and local governments create their own goals. However, the government has not directly set any noise goals regarding airport noise.

-  Reduced Climate Impact
-  Clean Air
-  Natural Acidification Only
-  A Non-Toxic Environment
-  A Protective Ozone Layer
-  A Safe Radiation Environment
-  Zero Eutrophication
-  Flourishing Lakes and Streams
-  Good-Quality Groundwater
-  A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos
-  Thriving Wetlands
-  Sustainable Forests
-  A Varied Agricultural Landscape
-  A Magnificent Mountain Landscape
-  A Good Built Environment
-  A Rich Diversity of Plant and Animal Life

Is there any spatial planning policy?

Sweden 

Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

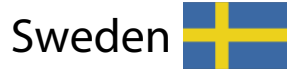
According to the Environmental code mitigating measures must be taken if noise limits are exceeded. Swedavia uses sound insulation as a measure when the indoor sound levels are beyond the limits.

According to the environmental code, the airports must annually evaluate the need for noise isolation measures based on the previous year's air traffic. If the noise contours grow or change, property that is currently outside the contour may need measures in the future. The property owner is then contacted by Swedavia.

Noise limits for new buildings are regulated in the Swedish regulation 2015:216

What measures are taken to reduce aircraft noise and who leads these initiatives?

Sweden follows the ICAO balanced approach with the following entities responsible for each part of the approach. The creation of aircraft noise policy is divided between these agencies, each responsible for their own domain.



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

New data and knowledge

Noise limit enforcement

ICAO balanced approach and measures

Responsible entity

Reduction of noise at source

Stringency in ICAO Noise standards (Annex 16)



Swedish Transport Agency



Operating Restrictions

For example prohibition against noisier aircraft, certain runway use, certain time of the day/night.



Environmental courts



Swedish Transport Agency

Noise Abatement Operational Procedures

Design of departure and arrival routes (laterally as well as profiles) could have an interdependency with accessibility and emissions. There are trial with curved approaches at several of Swedavia's airports.



Swedish CAA



Swedish Transport Agency

Land-Use planning and management

Noise insulation of houses, land-use planning.



Swedish Transport Administration



Environmental courts

How is new data and knowledge dealt with?

Sweden 

Country context

Swedavia creates tracks using ANOMS, a tool used to plan, monitor and manage noise at their airports. Because INM was being phased out Swedavia started evaluating AEDT, but no further updates on this development are found. There are a number of private airport owners which might use different tools.

Measurement and noise limits

However, there is no specific software which is mandated to use when calculating noise. As long as the quality assurance document (kvalitetssäkring av flygbullerberäkningar) is used as the basis for the calculation which is based on ECAC Doc 29. This ensures a uniform calculation method in Sweden.

Government goals

Spatial planning policy

Information on how any differences in input data or updates to aircraft noise models is dealt with could not be found.

Mitigation measures

New data and knowledge

Noise limit Enforcement

Are noise limits enforced? And how are individual residents protected?



Country context

Measurement and noise limits

Government goals

Spatial planning policy

Mitigation measures

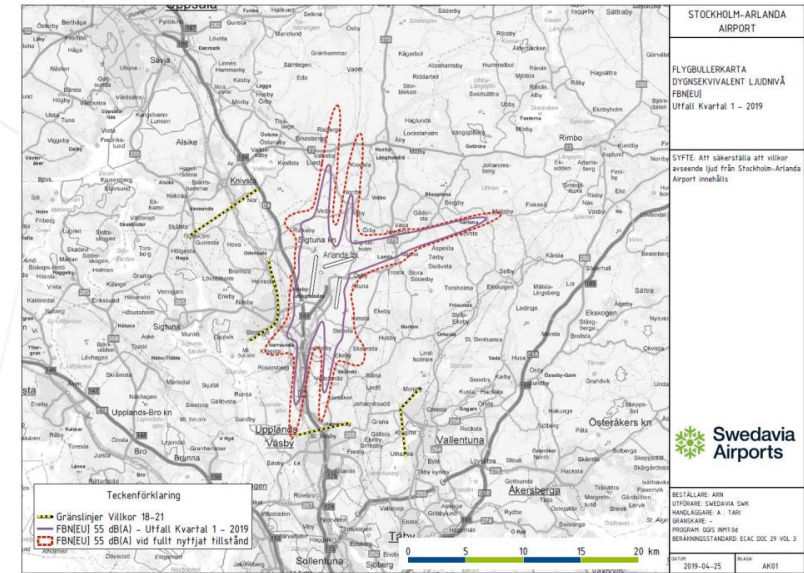
New data and knowledge

Noise limit Enforcement

A land and environmental court (MMD) is in Sweden a special court whose main task is to handle cases and matters in accordance with the provisions of the Environmental Code, the Property Development Act (1970: 988) and the Planning and Building Act (2010: 900) and are subordinate to the regular courts. This means the courts have jurisdiction of some limits regarding aircraft noise. For example, the Swedish Transport Administration considered the outdoor FBN noise limit to be 60 dB(A) which was overturned by the Environmental Court to 55 dB(A)

The limits vary from airport to airport depending on the environmental courts' decision. The number of times a certain metric can be exceeded both indoors and outdoors (L_{Amax}) can therefore change. The environmental courts are used to enforce the noise limits. If the airport wants to obtain a permit or change the current one, they must go through the court where any party is able to object to the proposed changes. Since environmental courts are part of the normal court system citizens can also petition the court.

The courts also specify the need for noise mitigation measures if the limits are exceeded, and the timeframe it these should be implemented.



Example of noise map made for Arlanda



Measurement & noise limits

	Germany	France	United Kingdom	Australia	Switzerland	Italy	Norway	Sweden
Noise index (primary)	$LA_{eq, day}$ $LA_{eq, night}$	L_{den}	$L_{Aeq, 16hr}$ daytime $L_{Aeq, 8hr}$ nighttime	ANEF	L_{rt} L_{rn} L_{rk}	L_{VA}	L_{den} L_{5AS}	$FBN_{EU} (L_{den})$ L_{eq} $L_{A, max}$
Threshold	55 dB(A) $LA_{eq, day}$ 50 dB(A) $LA_{eq, night}$ For information purposes: 50 dB(A) $LA_{eq, day}$ 40 dB(A) $LA_{eq, night}$	50 dB(A) L_{den}	54 dB(A) $LA_{eq, 16hr}$ 48 dB(A) $LA_{eq, 8hr}$ When assessing change: 51 dB(A) $LA_{eq, 16hr}$ 45 dB(A) $LA_{eq, 8hr}$	20 ANEF	53 dB(A) L_{rt} 43 dB(A) L_{rn} 50 dB(A) L_{rk}	60 dB L_{VA}	$L_{den} > 52$ dB $L_{5AS} > 80$ dB	55 $FBN_{EU} = L_{den}$
Noise index (secondary)	NAT $L_{A, max}$	L_{night}	L_{day} $L_{evening}$ L_{night} L_{den} $L_{Aeq, 6.5hr}$ night N65 _{16hr} day (annual) N70 _{16hr} day (annual) N60 _{8hr} night (annual)	N60, N65, N70		L_{den}		L_{night} TFBN = TDENL

Government goals (1/2)

	Germany	France	United Kingdom	Australia	Switzerland	Italy	Norway	Sweden
Scenario (Growth / Equal / Decrease)	Equal / decrease 10-yearly update of protection zones. Noise and annoyance levels may only be equal or lower than in the previous iteration	Not specified	Not specified	Not specified	Not specified	Not specified	Decrease	Not specified

Government goals (2/2)

	Germany	France	United Kingdom	Australia	Switzerland	Italy	Norway	Sweden
Goals	Not specified Transition to 'greener' government	Halve the noise perceived by the populations overflow in the Paris region Improve soundproofing assistance for local residents	Taking decisions on the right balance between noise controls and economic benefits, reconciling the local and national strategic interests Setting (and maintaining) noise controls at specific airports for noise management purposes Changes to compensation policies with the expectation that airport operators will offer households exposed to levels of noise of 69 dB $L_{Aeq,16hr}$ or more, assistance with costs of moving or full insulation	Driven by the result of political influence stemming from organised community action	Limit noise at source to promote population health, especially in the urban environment The national commission on noise abatement has published its report in December 2021 and proposes to at least double the effected area when taking a noise limit. The project will run for the next few years.	Highlighting new development opportunities for the country underlining existing criticalities, emerging needs, possible solutions, response methods, network architecture and the role of individual airports in the National Airport Plan (NPA) Minimization of the population affected by the phenomenon Minimization of the extension of the areas affected by the phenomenon Minimization of noise in areas characterized by the presence of sensitive receptors such as hospitals, schools, assistance centers.	Reducing noise with 10% compared to 1999 levels using the noise metric SPI Reducing the amount of people exposed to 38 dB(A) indoors close to roads, airports and railways with 30% within 2020 compared to 2005.	People are not exposed to harmful air pollutants, chemical substances, noise levels and radon levels or other unacceptable health or safety risks. Based on this main goal, regional and local governments create their own goals.

Spatial planning policy (1/3)

	Germany	France	United Kingdom	Australia	Switzerland	Italy	Norway	Sweden
Zones	<p>Daytime protection zone 1 (06:00-22:00)</p> <p>Daytime protection zone 2 (06:00-22:00)</p> <p>Nighttime protection zone (22:00-06:00)</p>	<p>Zone A: Unbuildable</p> <p>Zone B: Unbuildable</p> <p>Zone C: Constructions authorized under conditions</p> <p>Zone D: Constructions authorized after soundproofing</p>	<p>Local planning policies and decisions in line with UKs National Planning Policy Framework (NPPF)</p>	<p>Acceptable</p> <p>Conditionally Acceptable</p> <p>Not acceptable</p>	<p>FOCA forms a federal sector plan for infrastructure planning to ensure space for airports to develop business plans.</p> <p>Sensitivity level 1: Higher noise abatement requirements</p> <p>Sensitivity level 2: Ops emitting noise are not permitted</p> <p>Sensitivity level 3: Ops emitting certain noise level are permitted</p> <p>Sensitivity level 4: Ops emitting a high level of noise are permitted</p>	<p>Outside: No limitations</p> <p>Zone A: No limitations</p> <p>Zone B: Agricultural, livestock breeding, industrial, trading, tertiary (no residential areas)</p> <p>Zone C: Only activities due to the airport infrastructure</p>	<p>Yellow zone: Buildings with a noise sensitive purpose can be constructed if noise mitigation is satisfactory.</p> <p>Red zone: Not suitable for noise sensitive use purposes. Option of buy-out or insulation of indoor noise level of 42 dB L_{Aeq24}</p>	<p>Noise limits vary from airport to airport depending on the environmental courts' decision. The number of times a certain metric can be exceeded both indoors and outdoors (L_{Amax}) can therefore change</p>

Spatial planning policy (2/3)

	Germany	France	United Kingdom	Australia	Switzerland	Italy	Norway	Sweden
Noise limit daytime	<p>Daytime protection zone 1: 60 dB(A) $L_{A_{EQ}}$ for new / expanding airports</p> <p>65 dB(A) $L_{A_{EQ}}$ for existing airports</p> <p>Daytime protection zone 2: 55 dB(A) $L_{A_{EQ}}$ for new / expanding airports</p> <p>60 dB(A) $L_{A_{EQ}}$ for existing airports</p>	<p>Zone A: $L_{den} \geq 70$ dB(A)</p> <p>Zone B: $70 \geq L_{den} \geq 62-68$</p> <p>Zone C: $62-68 \geq L_{den} \geq 52-64$</p> <p>Zone D: $62-64 \geq L_{den} \geq 50$</p>	54 dB $L_{aeq, 16hr}$	Depends on building type. Between 20 and 40 ANEF.	<p>Planning value / Impact Threshold / Alarm value</p> <p>Sensitivity level 1: 53/55/60 dB(A) L_{rt}</p> <p>Sensitivity level 2: 57/60/65 dB(A) L_{rt}</p> <p>Sensitivity level 3: 60/65/70 dB(A) L_{rt}</p> <p>Sensitivity level 4: 65/70/75 dB(A) L_{rt}</p>	<p>Outside: 60 dB(A) L_{VA}</p> <p>Zone A: 65 dB(A) L_{VA}</p> <p>Zone B: 75 dB(A) L_{VA}</p> <p>Zone C: No limit</p>	<p>Yellow zone: $L_{den} > 52$ dB</p> <p>Red zone: $L_{den} > 62$ dB</p>	<p>Outdoor: 55dB(A) FBN</p> <p>70 dB(A) $L_{A_{max}}$ which may be exceeded 16 times.</p> <p>40 dB(A) FBN where silence is important</p> <p>Indoor: 30 dB $L_{eq, 24h}$</p> <p>45 dB $L_{A_{max}}$</p> <p>40 dB(A) FBN in hospitals, schools, offices, hotels and restaurants. Depends on type of room and noise class</p> <p>L_{eq} 26-45 dB(A) and $L_{A_{max}}$ (Fast) 41-60 dB(A) in hospitals</p> <p>L_{eq} 26-45 dB(A) and $L_{A_{max}}$ (Fast) 35-60 dB(A) in schools</p> <p>L_{eq} 30-45 dB(A) and $L_{A_{max}}$ (Fast) 45-60 dB(A) in offices</p> <p>L_{eq} 26-45 dB(A) and $L_{A_{max}}$ (Fast) 41-60 dB(A) in hotels and restaurants</p>

Spatial planning policy (3/3)

	Germany	France	United Kingdom	Australia	Switzerland	Italy	Norway	Sweden
Noise limit nighttime	<p>Nighttime protection zone: 50 dB(A) LA_{EQ} 6 x 68 dB(A) LA_{MAX} for new / expanding airports</p> <p>55 dB(A) LA_{EQ} (nighttime) 6 x 72 dB(A) LA_{MAX} (nighttime) for existing airports</p>	<p>Zone A: $L_{den} \geq 70$ dB(A)</p> <p>Zone B: $70 \geq L_{den} \geq 62-68$</p> <p>Zone C: $62-68 \geq L_{den} \geq 52-64$</p> <p>Zone D: $62-64 \geq L_{den} \geq 50$</p>			<p>Planning value / Impact Threshold / Alarm value</p> <p>Sensitivity level 1: 43/45/55 dB(A) L_{rt}</p> <p>Sensitivity level 2: 47/50/60 dB(A) L_{rt} <i>For first night hour:</i> 50/55/65 dB(A) L_{rt}</p> <p>Sensitivity level 3: 50/55/65 dB(A) L_{rt}</p> <p>Sensitivity level 4: 55/60/70 dB(A) L_{rt}</p>		<p>Yellow zone: $L_{5AS} > 80$ dB</p> <p>Red zone: $L_{5AS} > 90$ dB</p>	<p>Outdoors: $L_{Amax} 70$ dB(A) which may be exceeded 3 times</p>

Mitigation measures (1/2)

	Germany	France	United Kingdom	Australia	Switzerland	Italy	Norway	Sweden
ICAO Balanced Approach	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initiative leader	Airports	CAA / government / airports			The government for measures concerning aircraft types, noise and emission taxes and night curfews. Airports for local measures, such as limitations.	CAA / government / airports	CAA / Airport Operator	CAA / airports / transport agency / transport administration / environmental courts
Coordination / consultation / engagement	Airports liaise with airlines, ANSPs and local communities	French CAA, airport operators, regional authorities, ANSP, local communities	Noise forum with airports, airlines, CAA and community groups		Interactive platforms, e.g. for Genève Aéroport	CAA, ANSP, airports	Nordic workgroup for aviation environment (N-ALM) representing CAAs, ministries and airports of Nordic countries	Nordic workgroup for aviation environment (N-ALM) representing CAAs, ministries and airports of Nordic countries

Mitigation measures (2/2)

	Germany	France	United Kingdom	Australia	Switzerland	Italy	Norway	Sweden
Measures	<p>Low-noise take-off and landing procedures</p> <p>Regulations on night flights.</p> <p>CDO ops for several airports</p>	<p>Urbanisation control</p> <p>Sound-proofing</p> <p>Noise abatement flight procedures</p> <p>Noise evolution monitoring</p>	<p>Development planning decisions</p> <p>Quieter aircraft development encouragement</p> <p>Supporting airport operator in enforcing noise policies.</p> <p>CAA airspace management</p>	<p>Attenuation programs (double glazing, insulation)</p> <p>Lobbying for operational restrictions</p> <p>Noise abatement programs</p> <p>Fly neighbourly agreements</p> <p>Covenants on land titles</p>	<p>Noise abatement programs</p> <p>International cooperation relationship</p> <p>Promotion of areas of tranquility and refreshment for the development of settlements</p> <p>Modernization of noise monitoring</p> <p>Increase public's awareness</p> <p>Time slot limitation and freeze on take-offs and landings at night</p>	<p>Noise reduction at the source</p> <p>Land use planning and management</p> <p>Noise abatement procedures</p> <p>Operational restrictions</p>	<p>Noise reduction at the source</p> <p>Changing preferential runways</p> <p>Aircraft type restrictions</p> <p>Changing the opening hours of airports</p> <p>Transferring air traffic to other airports</p> <p>Special noise regulations for Oslo</p>	<p>Noise reduction at the source</p> <p>Land use planning and management</p> <p>Noise abatement procedures</p> <p>Operational restrictions</p>

New data & knowledge

Germany

The noise calculation method to determine the noise protection areas is prescribed in the Fluglärmschutzgesetz under "Instructions on the Calculation of Noise Protection Areas, ICN"

The German Act for Aircraft Noise Protection from 2007 is the product of all the latest knowledge (from as far back as 1971) on noise protection.

DLR will determine new calculation input parameters

Noise limit enforcement (1/3)

	Germany	France	United Kingdom	Australia
Protection	<p>No hospitals or elderly care homes in protection zones</p> <p>No construction of new dwellings in daytime protection zone 1 and nighttime protection zone</p> <p>Cost of soundproofing is covered for existing dwellings in daytime protection zone 1 and nighttime protection zone</p> <p>Compensation for installation of a ventilation system in dwelling rooms in nighttime protection zone primarily used for sleeping</p> <p>Different compensation schemes for sounds insulation depending on the protection zone a dwelling resides in</p>	<p>Denoting land around airports as non-suitable for development of noise sensitive buildings</p> <p>The buyer of a residence within the noise contour should receive information on noise exposition and the info must be made publicly available</p>	<p>NPPF requires noise to be considered for developments</p> <p>Developments in noise sensitive areas (69 or 63 dB $L_{Aeq,16hr}$) are not explicitly prohibited</p> <p>Individuals are protected by specific regulations that are in place for specific noise contours and are based on research</p>	<p>Denoting land around airports as non-suitable for development of noise sensitive buildings</p> <p>Noise complaints and monitoring stations may be used to implement mitigations</p>

Noise limit enforcement (2/3)

	Switzerland	Italy	Norway	Sweden
Protection	<p>Complaints are handled by the airports & cantons</p> <p>If airports are not able to stay within defined noise contours in force, they have to make a new demand to FOCA for enlargement of the contours. There is the possibility for the community to react and complain in this process</p> <p>Airports with commercial flights can be granted exemptions by FOCA, but noise protection measures (such as insulation programs) must be taken</p> <p>There are clear rules in place under which conditions delayed aircraft can land at an airport</p> <p>Noise protection aids are available under conditions and paid by airport operators</p> <p>A component of the landing fee is dependent on noise</p>	<p>The Regional Agencies for the Protection of the Environment (ARPA) periodically check the efficiency of the airport noise monitoring system</p> <p>Forecast evaluations are made to assess the acoustic impact on new buildings, both residential houses and infrastructures.</p>	<p>Municipalities, responsible for arial planning, will usually touch upon dwellings or other facilities that require noise reducing measures to comply with noise limits</p> <p>The airport must agree with local governments on departure and arrival routes</p> <p>To reduce noise exposure, several smaller airport have limited opening hours and limits on the number of air traffic movements</p>	<p>The environmental court has jurisdiction of aircraft noise</p> <p>If an airport wants to change the current ruling, they must go through the environmental court where any party is able to object to the proposed changes</p>

Noise limit enforcement (3/3)

	Germany	France	United Kingdom	Australia	Switzerland	Italy	Norway	Sweden
Enforcement	The Ministry has the power to reject or change a requested change in operation (e.g. reduce number of flights or operational changes) if deemed necessary for noise protection purposes (within the noise protection zones)	Unknown	Unknown	Adherence to mitigation strategies is policed by the ANSP. Incompliance may lead to sanctions	DETEC is responsible for enforcing emission limitation measures, improvements and the determination and control of noise exposure levels	ENAC sanctions airlines that, according to radar track validation, do not adhere to noise abatement procedures In the event of overruns of the airport zoning, airports must submit an acoustic recovery plan	Unknown	The environmental courts enforce noise limits The courts also specify the need for noise mitigation if the limits are exceeded and the timeframe in which it must be realised



To70 Aviation

Amsterdam, Brussels, Frankfurt, Geneva, London, Milan
Bangalore, Bangkok, Shanghai, Singapore
Brisbane, Melbourne
Medellín, São Paulo
Montreal

