Attitudes to Noise from Aviation Sources in England (ANASE)

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Transportation Noise Update
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Time constraints

- A considerable amount of data was collected in the Phase 1 pilot studies and the subsequent Phase 2 main study.
- In a 30 minute presentation we can only present 'edited highlights'
- We have listed a number of discussion points at the end on which we would welcome any contributions from the floor
- Interested parties are strongly encouraged to download the full reports and other comments from the DfT website.

http://www.dft.gov.uk/pgr/aviation/environmentalissues/Anase/

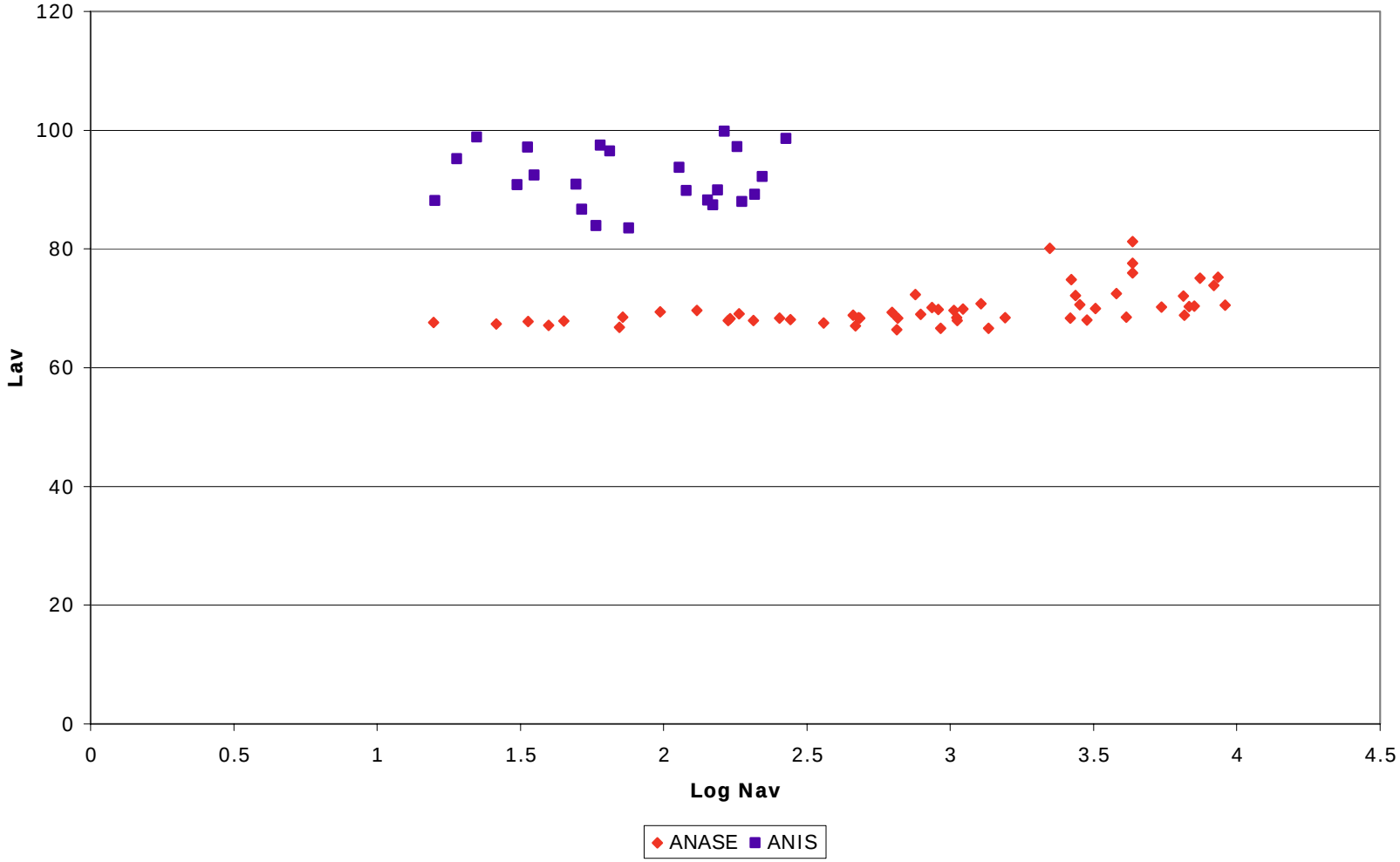
Background

- Aircraft noise assessment depends on reliable information about community response.
- The last major study in the UK was **ANIS** (aircraft noise index study) carried out in 1982 and reported in 1985.
- In 1990, based on ANIS results and other considerations, the UK government changed from the **NNI** (noise and number index) to **Leq** for measuring long term average aircraft noise sound levels around airports.
- In 1990, the **57 Leq contour** was defined as the '***onset of annoyance***', superceding the broadly equivalent **35 NNI contour** as the previous indicator of '***low annoyance***'.

Changes since 1982

- Quieter aircraft - with much increased rate of climb for modern twin-jets.
- Significant increase in numbers of events.
- Attitudes to aircraft noise may have changed as people have in general become richer and many people now have increasing expectations, etc.
- Increasing technical debate about the validity of LAeq for representing average sound levels of intermittent noise sources such as aircraft noise.

Average sound level (Lav) and log number of events (Nav) for ANIS (1982) and ANIS (1985)



ANASE objectives

- Re-assess attitudes to aircraft noise in England.
- Re-assess their correlation with the Leq noise index.
- Examine (hypothetical) willingness to pay in respect of nuisance from such noise, in relation to other elements, on the basis of ***stated preference*** evidence.

Further objectives agreed during detailed study design

- Fully random sampling across all large English civil airports to ensure statistical representativeness.
- Questionnaires conforming to current industry best practice.
- Noise modelling fully compliant with ECAC.CEAC Doc 29.

ANASE timescales

- Extensive pilot studies carried out from 2001 to 2004.
- The main study design benefited from an expert steering group and international peer review.
- Main study fieldwork 2005-2006.
- Publication on DfT web-site October 2007 after further extensive review.

ANASE sampling

- 20 Airports in scope for study
- All Census Output Areas > 65 LAmax included in sample ~ 3,000,000 people
- Areas identified in terms of event sound level (Lav) and number of movements (Nav)
- Further stratification of Heathrow / non-Heathrow
- Random sampling within stratification plan

Sound levels measurement

- INM v6.2 models developed for each airport
- Event sound levels calibrated against field measurements at 19 sites
- Numbers of events determined from air traffic data provided by airports
- Adjusted to reflect long-term modal splits at each airport
- 65 LAmax used as cut-off
- Models estimated values of SEL, LAmax, Lav, Nav and Leq

ANASE interviews

- 60 full[1] interviews at 36 sites
- 15 restricted[1] interviews at 40 sites (20 low noise, 20 irregular[2] air traffic)
- 2,733 interviews completed at 76 sites
- For the Stated Preference questions the full interviews required audio-visual demonstration of aircraft types included in the scenarios tested
- Individual responses weighted to remove sample bias:
  People per household
  Age (using Census data)

1 Full interviews include stated preference questions, restricted interviews exclude stated preference questions

2 Leq not calculated for irregular air traffic

ISO annoyance

- ISO/TS 15666 specifies standardised annoyance questions – to be placed as early as possible in the questionnaire

"Thinking about the last 12 months or so, when you were at home, how much does noise from aircraft bother disturb or annoy you: Not at all, Slightly, Moderately, Very, Extremely?"

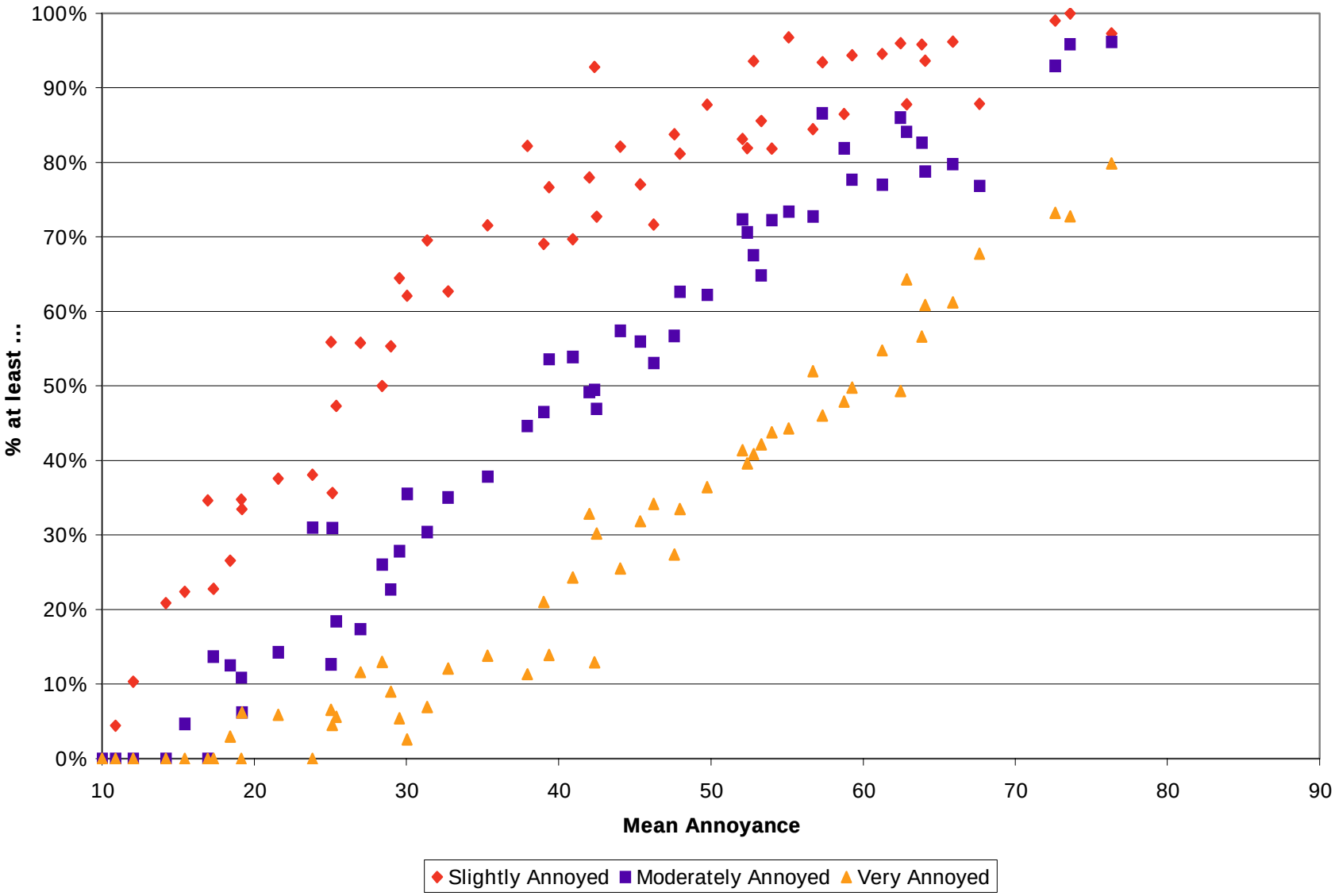
- The ISO 11 point numeric annoyance scale was also included – the data was highly correlated with the 5 point semantic scale.
- All further analysis based on the 5 point semantic scale

ANIS annoyance scale

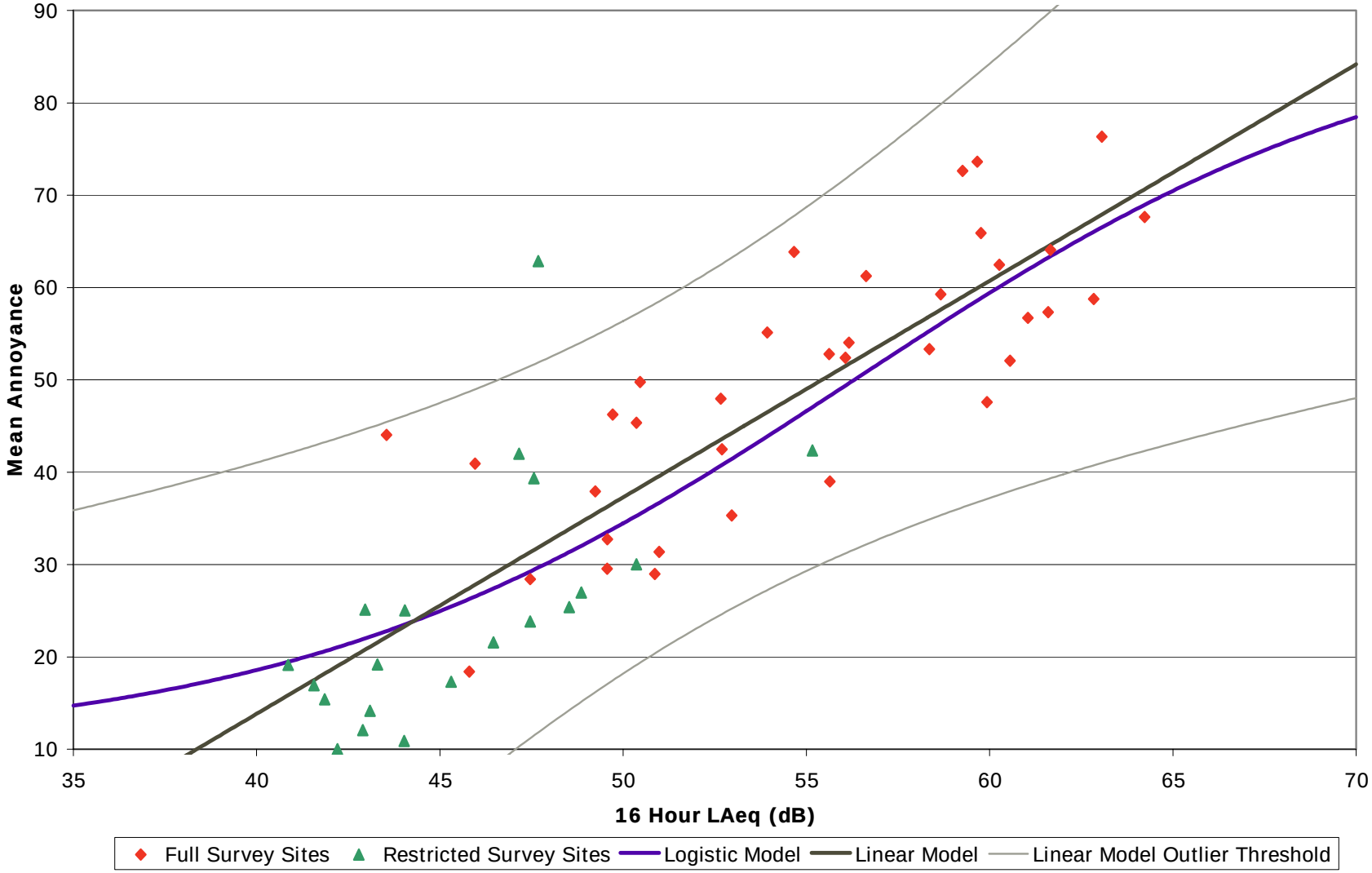
ANIS scale		ISO scale	
Very much annoyed	87.5	Extremely annoyed	90
Moderately annoyed	62.5	Very annoyed	70
A little annoyed	37.5	Moderately annoyed	50
Not at all annoyed	12.5	Slightly annoyed	30
Not heard	12.5	Not at all annoyed	10

- Numeric transforms used to facilitate statistical analysis and comparison
- Meidema and Oudshorn method used to transform semantic scale points to numeric equivalents

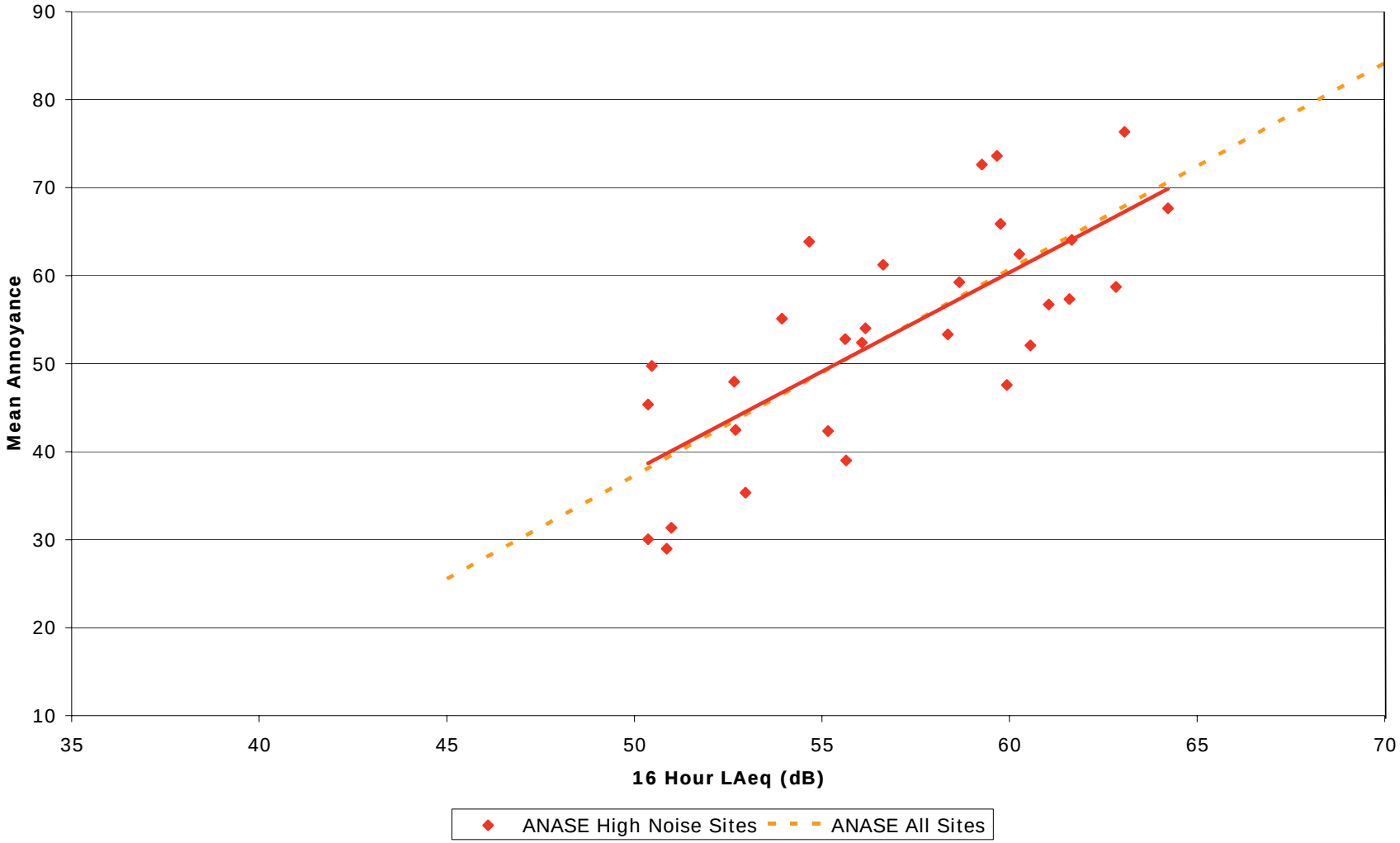
ANASE results



ANASE exposure-response relationships



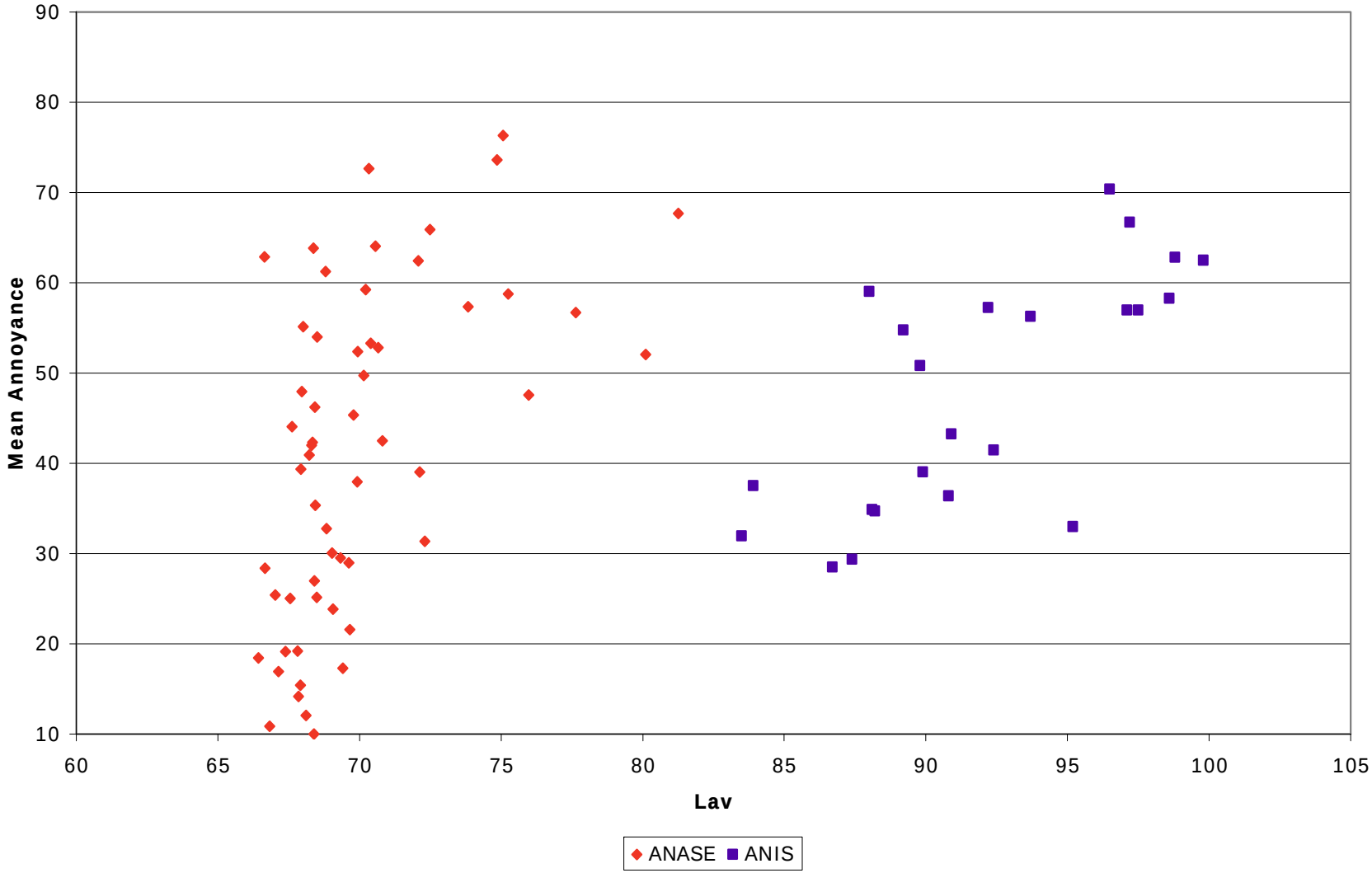
ANASE higher noise sites



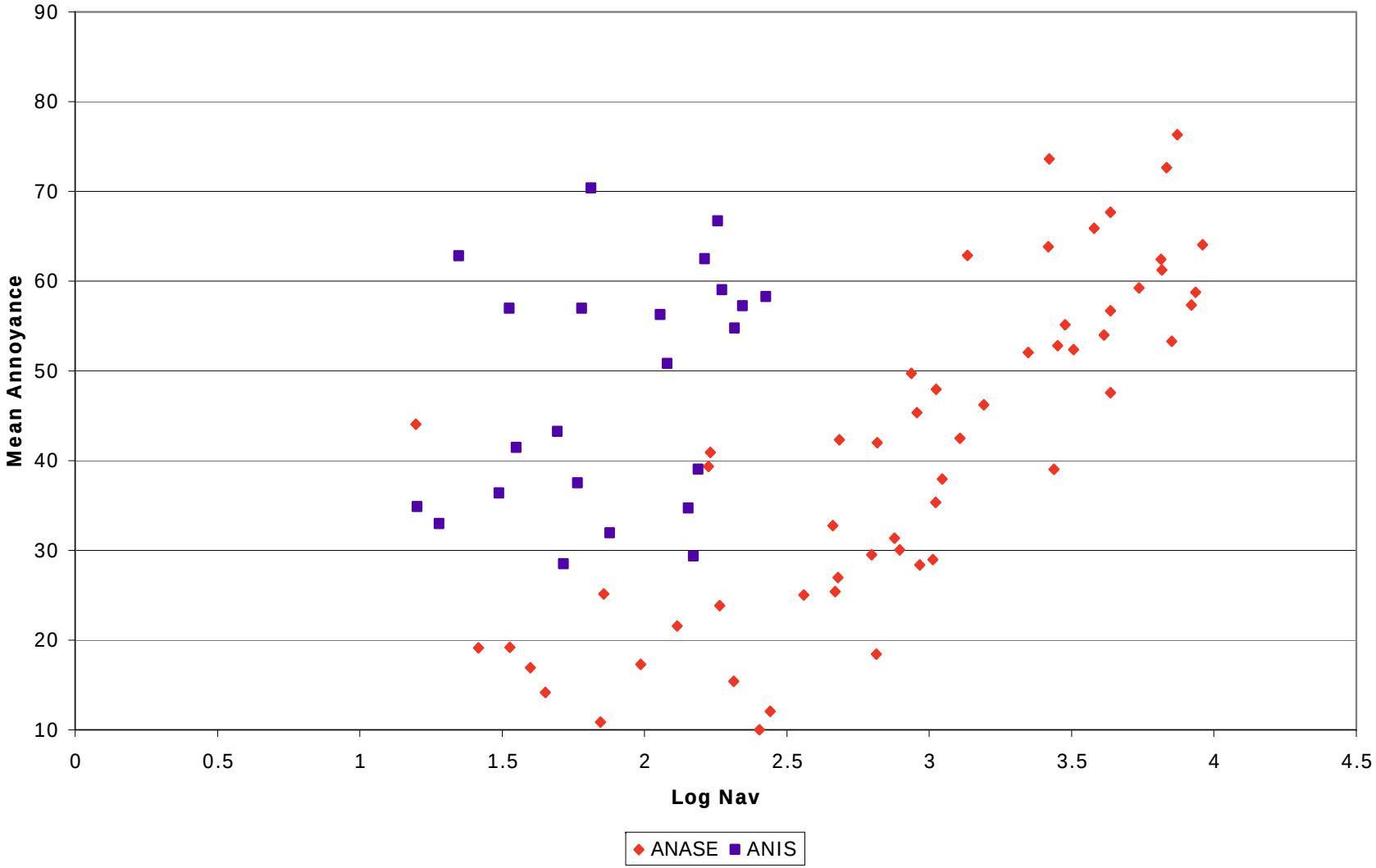
Re-assess attitudes to aircraft noise in England

- Linear and logistic models fit annoyance data equally well
- Logistic preferred on grounds that it respects the bounds of annoyance in the data
- For practical purposes, analysis of the effects of further site variables done using linear models
- A wide range of socio-economic variables tested
- The best fit model has LAeq and mean income as the explanatory variables
- No threshold could be identified in the relationship between mean annoyance and LAeq (ie no value of LAeq at which mean annoyance showed a step increase)

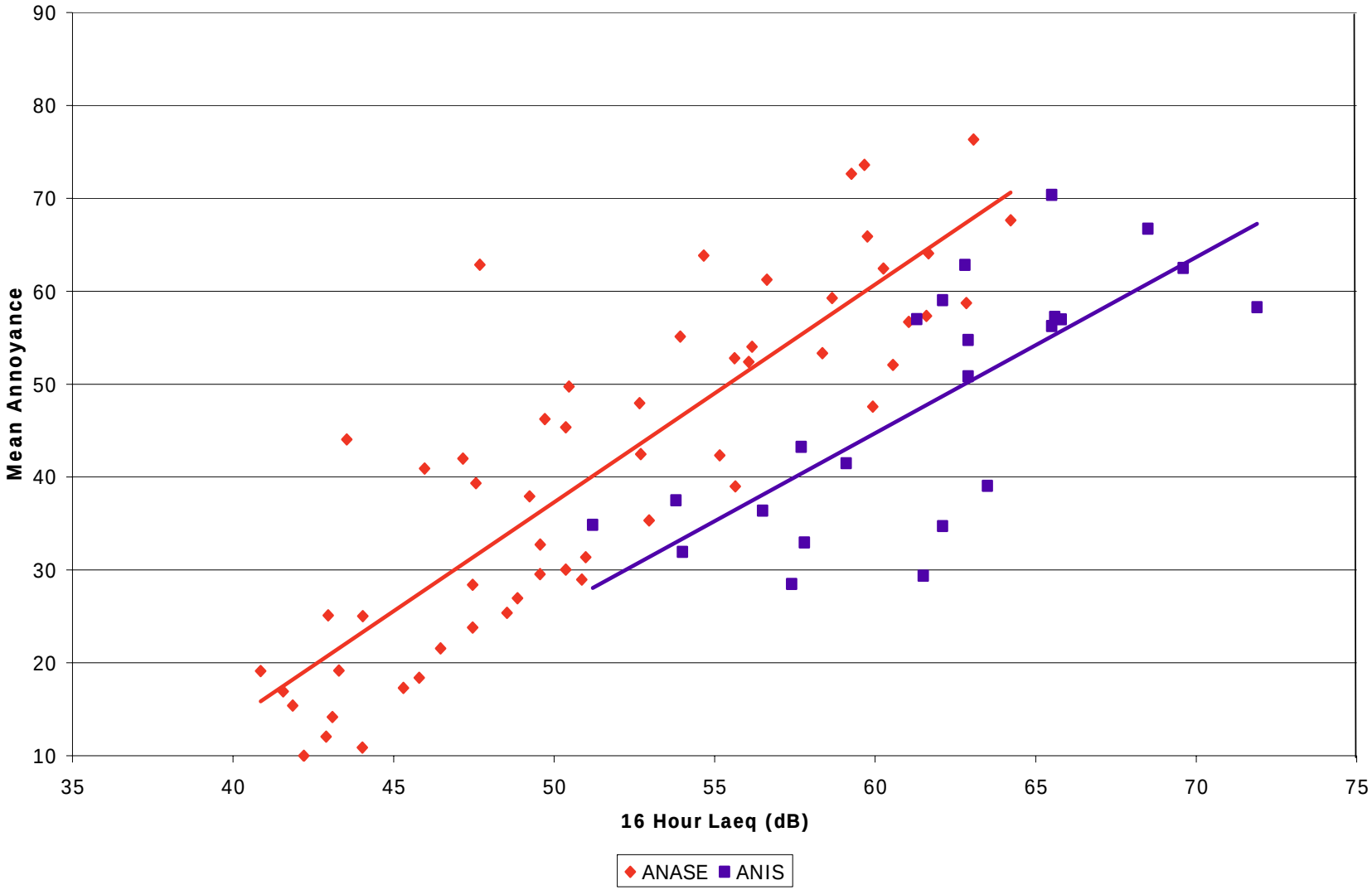
ANASE against ANIS - sound level



ANASE against ANIS – number of events



ANASE against ANIS - LAeq



Re-assess their correlation with Leq

- Explore relationship between mean annoyance, average sound level (Lav) and number of events (log Nav)

  $A = a + b\ Lav + c \log Nav$

- ANIS:

  $A = -158.3 + 1.99\ Lav + 12.5 \log Nav$

  Ratio (c/b) = 6

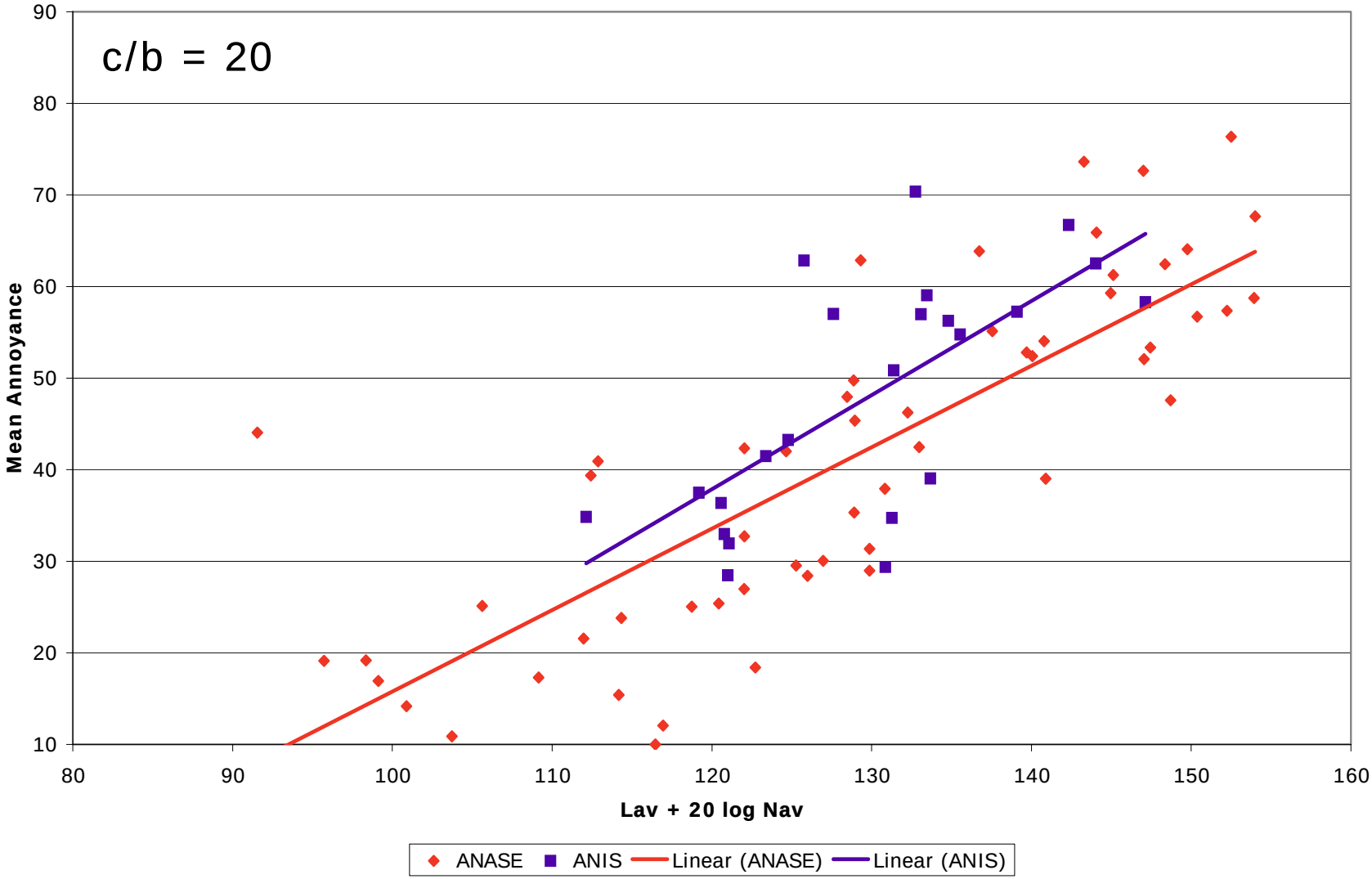
- ANASE:

  $A = -71.6 + 0.86\ Lav + 17.9 \log Nav$

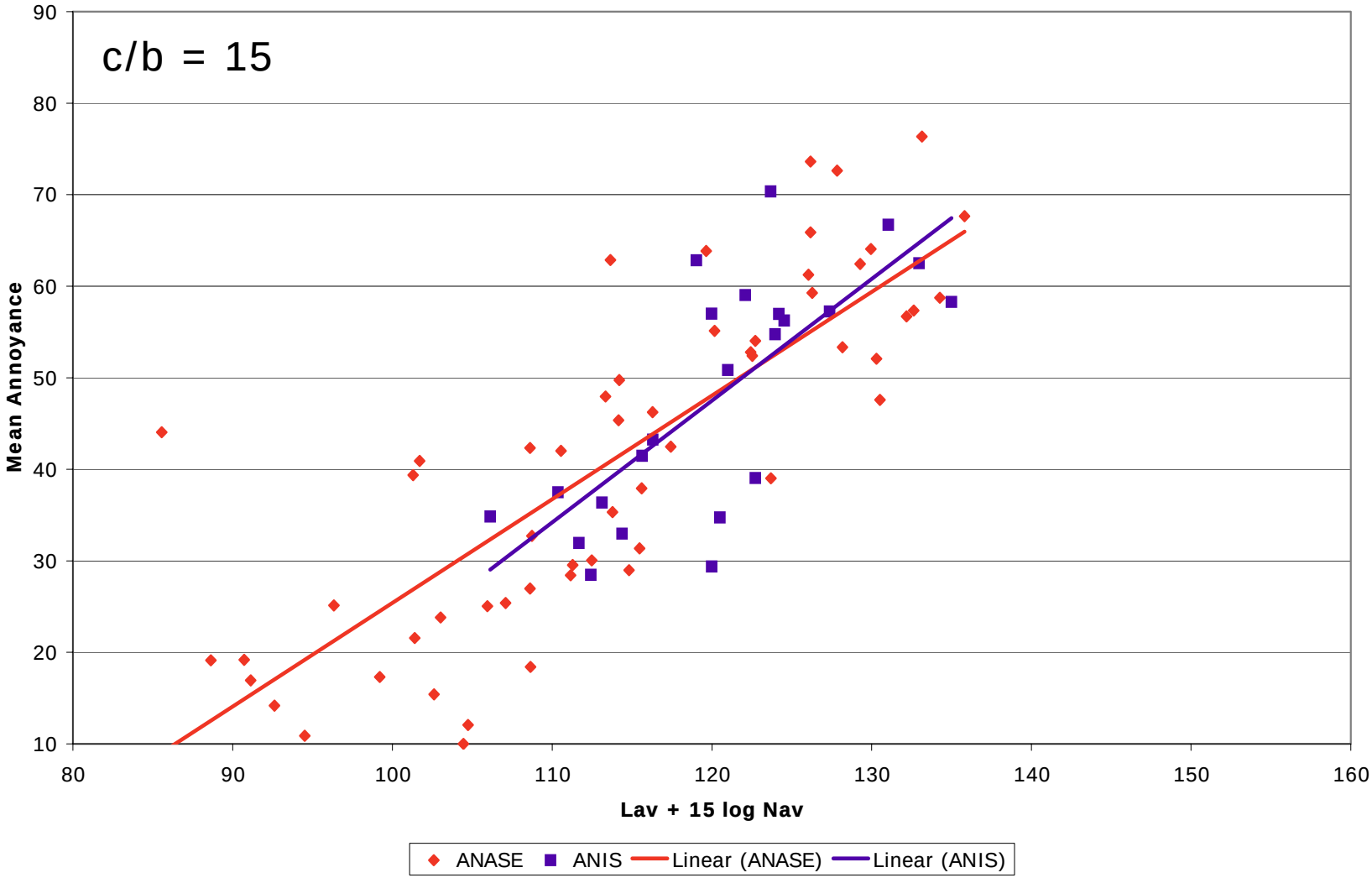
  Ratio (c/b) = 21

- c/b ratio not stable over time

Comparing ANASE and ANIS data



Comparing ANASE and ANIS data



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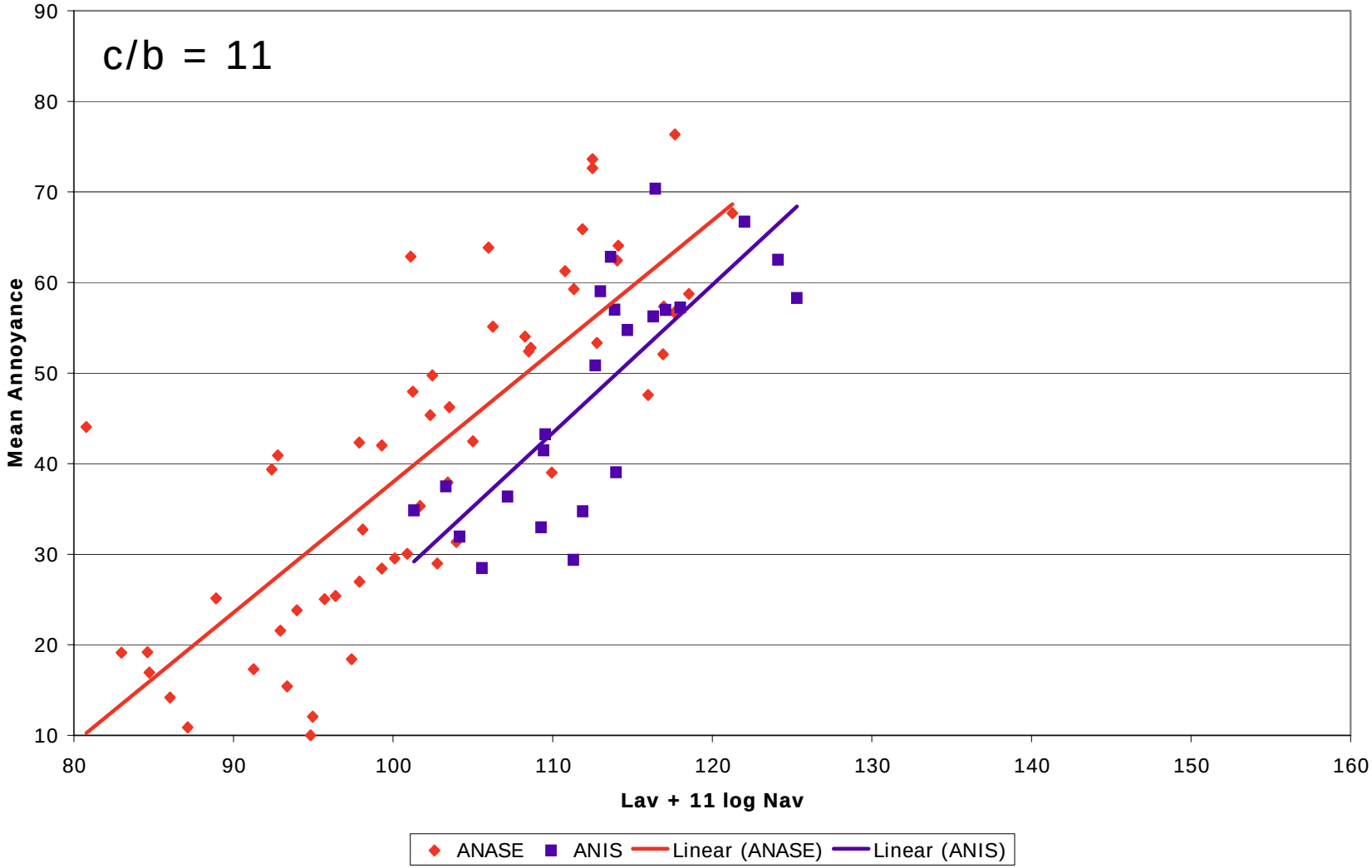
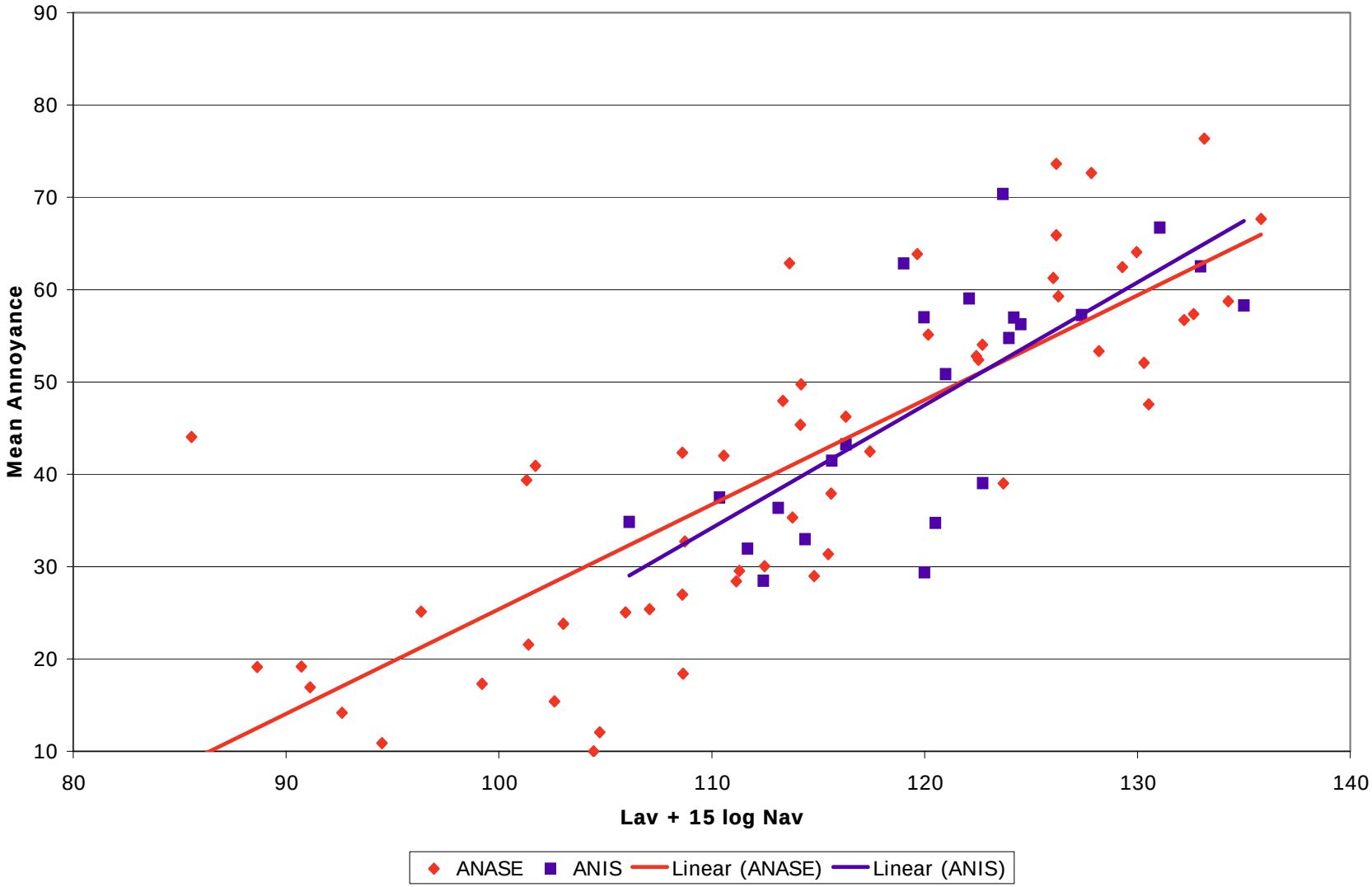


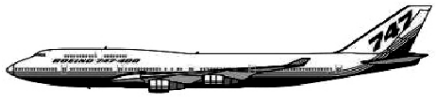
Consistent annoyance over time at k=15



SP Research: the Trade-offs (Example)

BOX A
.....the following planes fly overhead:

0 Jumbo



7 Under-wing

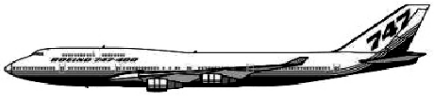
0 Tail-jet

7 Total aircraft

No grant

BOX B
.....the following planes fly overhead:

1 Jumbo



3 Under-wing

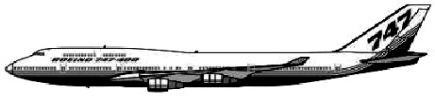
0 Tail-jet

4 Total aircraft

No grant

BOX C
.....the following planes fly overhead:

1 Jumbo



7 Under-wing

6 Tail-jet

14 Total aircraft

£200 grant every year

SP Results:
Annoyance by Aircraft Type & value of K

- There exists a direct relationship between disutility and increase in aircraft noise

- 1 jumbo = 3 underwings/turboprops
  = 4 tailjets

- The relative weight for log (Nav) should be around 20 (rather than 10 in Leq)

SP Results:
Time of Day Sensitivities

- Relative to daytime (0700-1500)
  - 2300-0300: **80%** more annoying
  - 0300-0700: **35%** more annoying
  - 1900-2300: **15%** more annoying
  - 1500-1900: **10%** more annoying
- Correlated with presence in the home

SP Results:
Aircraft Noise Event Values

- 'Cost' of each generic aircraft type, **at night**:
  - Jumbo: £12.78 per HH per month
  - Underwing: £4.48 "
  - Turboprop: £4.00 "
  - Tailjet: £3.52 "

- These are extremely high values cf HP & CVM
- Difficulty translating to £/dB … but 1 less jumbo has v. small effect on dB

Overview of results

- Reported annoyance has a strong relationship with LAeq
- For ANASE the equivalent level of annoyance as was observed in ANIS at 57 LAeq occurs at around 51 LAeq
- But LAeq is NOT the best proxy for reported annoyance *as* the relative effect of Noise & Number has changed over time
- The best-fit model for ANIS (1982) has a weight of 6 on log Nav, whilst the best-fit model for ANASE (2005) has a weight of 21 on log Nav
- Under today's conditions a weighting of 15 or more provides a better reflection of current opinion (see NNI)
- The SP research gave plausible time of day sensitivities but very high WtP values when scaled up to overall traffic figures

Discussion - 1

- Why do people report (apparently) higher levels of annoyance in 2005 (ANASE) than in 1982 (ANIS)?
- **Different annoyance scales** – all reasonable alternative numerical scalings increase the apparent difference
- **Income growth (**1982 to 2005) – had some effect
- **Equipment effect** – the CAA suggest that the loudspeakers necessary for the SP questions could have biased response upwards – there is no evidence for this
- **The (correct) weighting on number** – the difference in reported annoyance can be eliminated by using a 15 weight on log Nav

Discussion - 2

- **Arithmetic vs logarithmic averaging** – The lin average (Lav) provides a better estimate of subjective impressions than the log average, BUT LAeq should be calculated based on log average SEL. (For typical aircraft event distributions it makes little difference)
- **Non-specific response bias** - no evidence that ANASE data could have been affected any differently from any other similar survey
- **Errors in sound level measurements** – no evidence for this

No Policy Bias

- Phase 1 – asked the ISO Q along with other community annoyance Qs & invited resps. to re-consider their annoyance rating at the end of the interview
- Only 1 of 185 resps. changed their annoyance response
- There is no evidence of bias when comparing the Phase 1 & 2 approaches

Phase 1 (No equipment)		**Phase 2 (Noise equipment)**	
67	Windsor	54, 59 & 73	
52	Richmond	64	
50	Fulham	35	

ANASE CAA Estimates for Heathrow compared to ANIS