

Road noise auralisations – Communicating noise

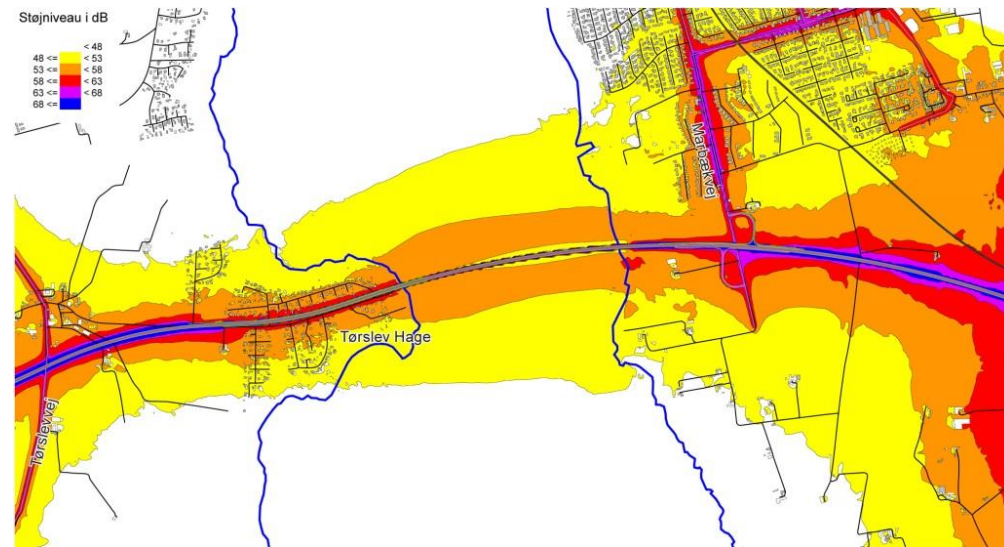
Jakob Fryd, Danish Road Directorate

Summary

- Auralisations for communication purposes
- Motivation for making binaural auralisations of road noise
- Requirements (recordings, calculations and playback)
- Web presentations and listening examples
- Experience and conclusions

What is a auralisation?

- Definition (introduced in 1991): *the process of rendering audible, by physical or mathematical modelling, the sound field of a source in a space, in such a way as to simulate the binaural listening experience at a given position in the modelled space.*



Why auralisations?

- Huge need for explaining and communicate noise matters and impacts
- Written or oral explanations or illustrations of noise exposure presented on noise maps can hardly explain noise impacts
- Auralisations can be used as an supplement to noise impact assessments and noise maps, eg.
 - Public hearings eg. EIA (Environmental Impact Assessment) of a new road project,
 - Balancing of expectations with the public in connection with noise barrier projects
 - Explaining and understanding general acoustic phenomena and terms
 - Evaluating noise measures
- Target audience: Noise affected citizens, decision makers, technicians/road planners etc.

Requirements and considerations

Overall ambition: The auralisations must sound like real vehicles (no “synthetic” pass-bys) and credibility must be high

Means:

- Based on recordings of real vehicle pass-bys
- Corrections by accurate sound propagation calculations
 - Nord2000 propagation model
 - Careful and detailed modelling of source points
- Recorded soundscape as reference/background
- Calibrated playback

Recordings

- Binaural recording is a method of recording sound with the intent to create a 3-D stereo sound sensation for the listener of actually being at the place of the recordings.
- This effect is created using a technique known as "dummy head recording", wherein a mannequin head is outfitted with a microphone in each ear.

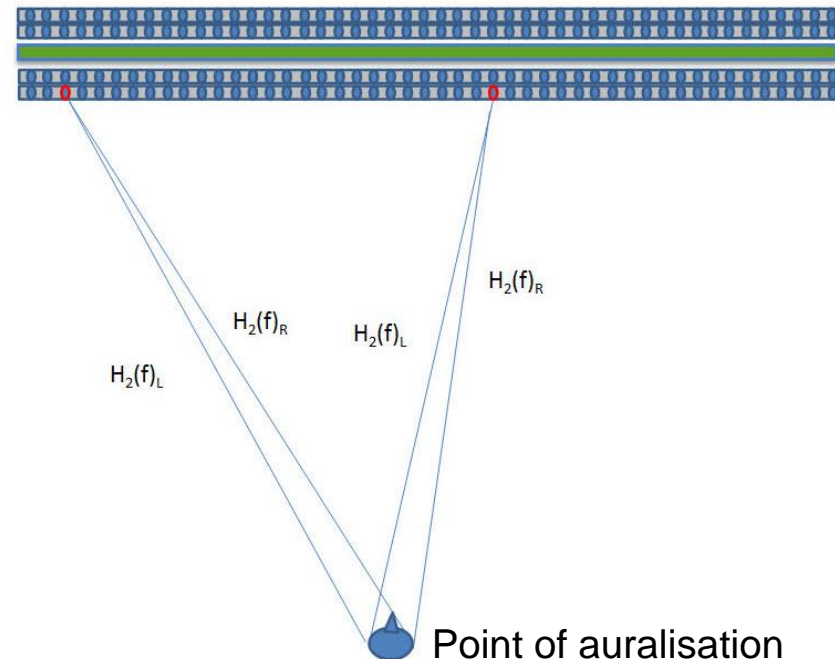
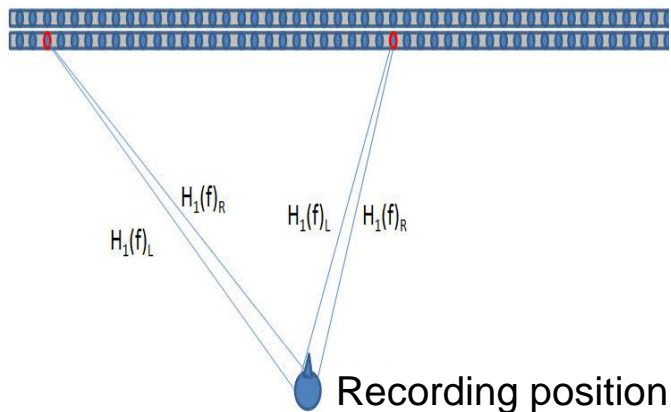


Requirements - recordings

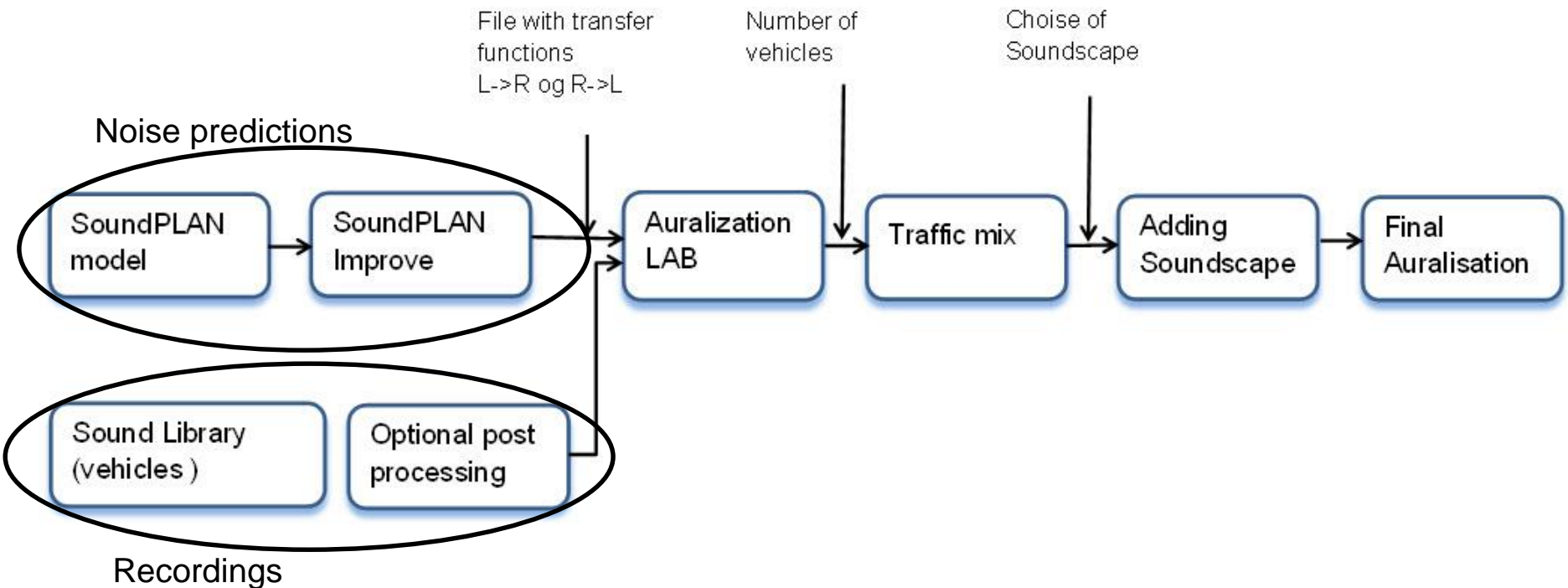
- Vehicles:
 - Single vehicle pass-by
 - Constant speed
- Road:
 - Straight road (500-1000 m) with no gradient
 - Reference surface (SMA 11 or similar)
- Surroundings: Flat uniform terrain, no obstacles
- Very low background noise (evening and night recordings)

Auralisation method

- Transfer functions of recording and auralisation position constitutes the full corrections to the sound file (two source heights)
- Each point – corrections in 1/3 octave levels (Nord2000)



Overall auralisation process



Playback considerations

- Two levels of accuracy

Well controlled



Less controlled situation
(e.g. web presentation)



Web presentation - examples



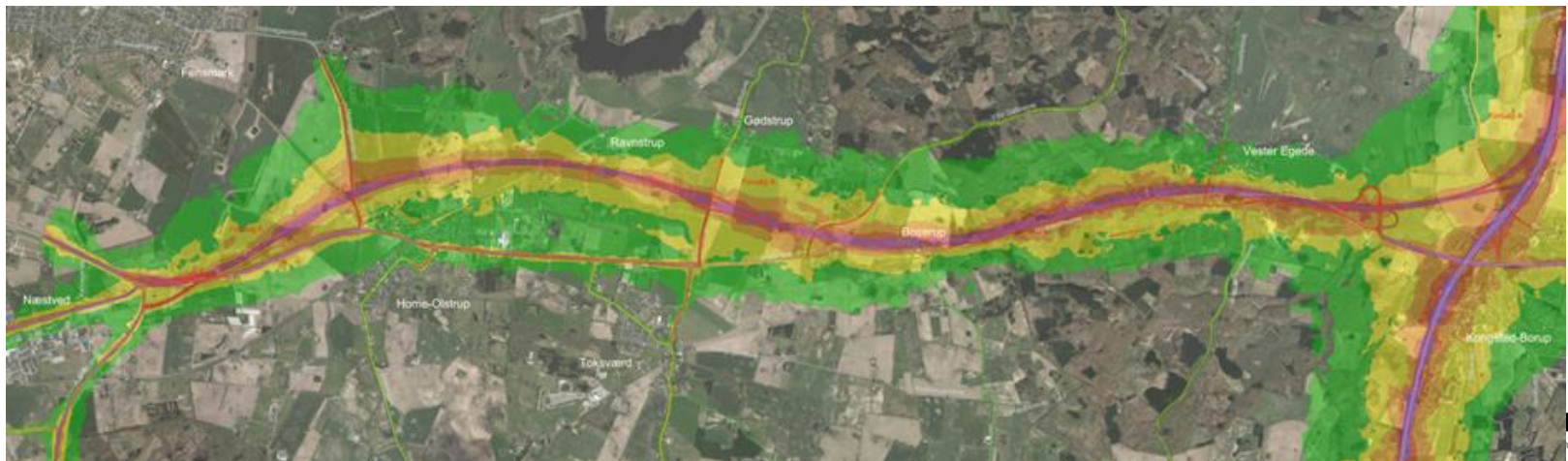
[road noise auralisations](#)

Experience - Danish Road Administration

- Auralisations used during EIA process, noise barrier projects etc.
- Public meetings
- Line inspections, decision making, communication etc.



EIA – new motorway – noise impacts



Public meeting

- Impossible to perform sound examples in front of a crowd of 600 people
- People were invited to a special sessions about noise 1,5 hour before the public meeting
- In a separate room with seating for 25 people the auralisations were played via headphones with a simultaneous presentation on a screen.
- More than 120 personer were through the session.



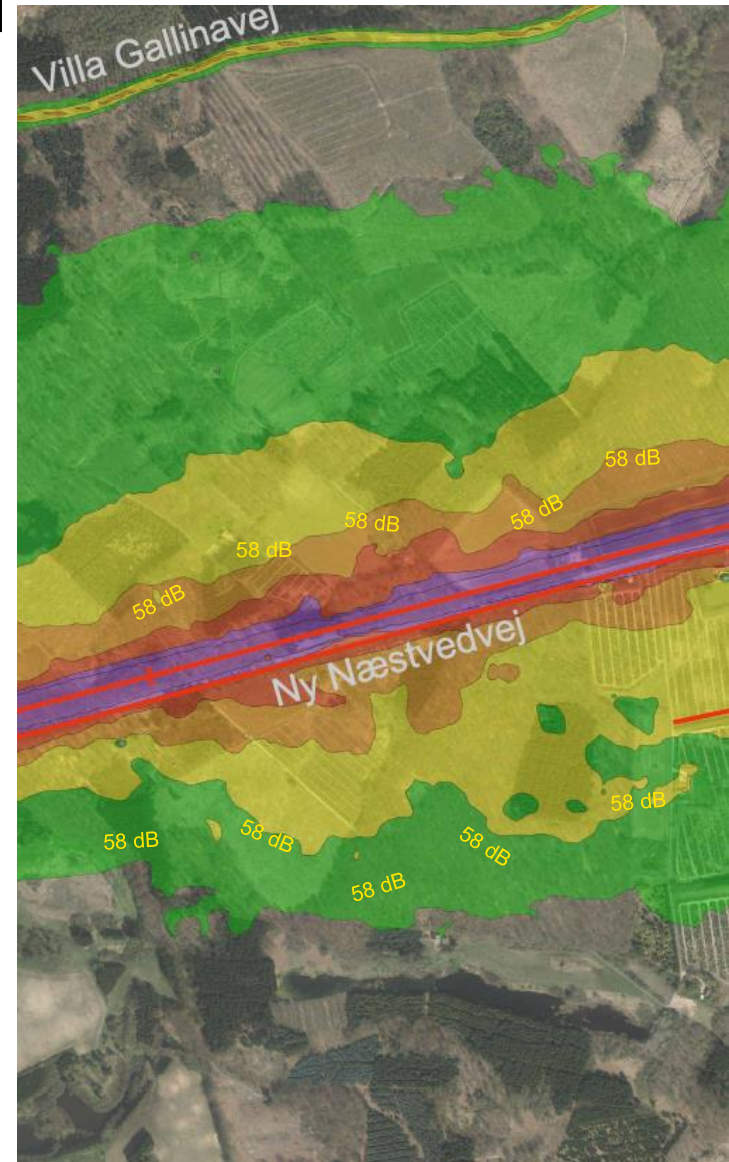
How does the motorway sounds?

- Welcome to our demonstration of road noise
- We have prepared examples of how the motorway will sound in 3 points along line A (the northern solution)
- The examples can in principle be used along the other lines in the same distances to the road



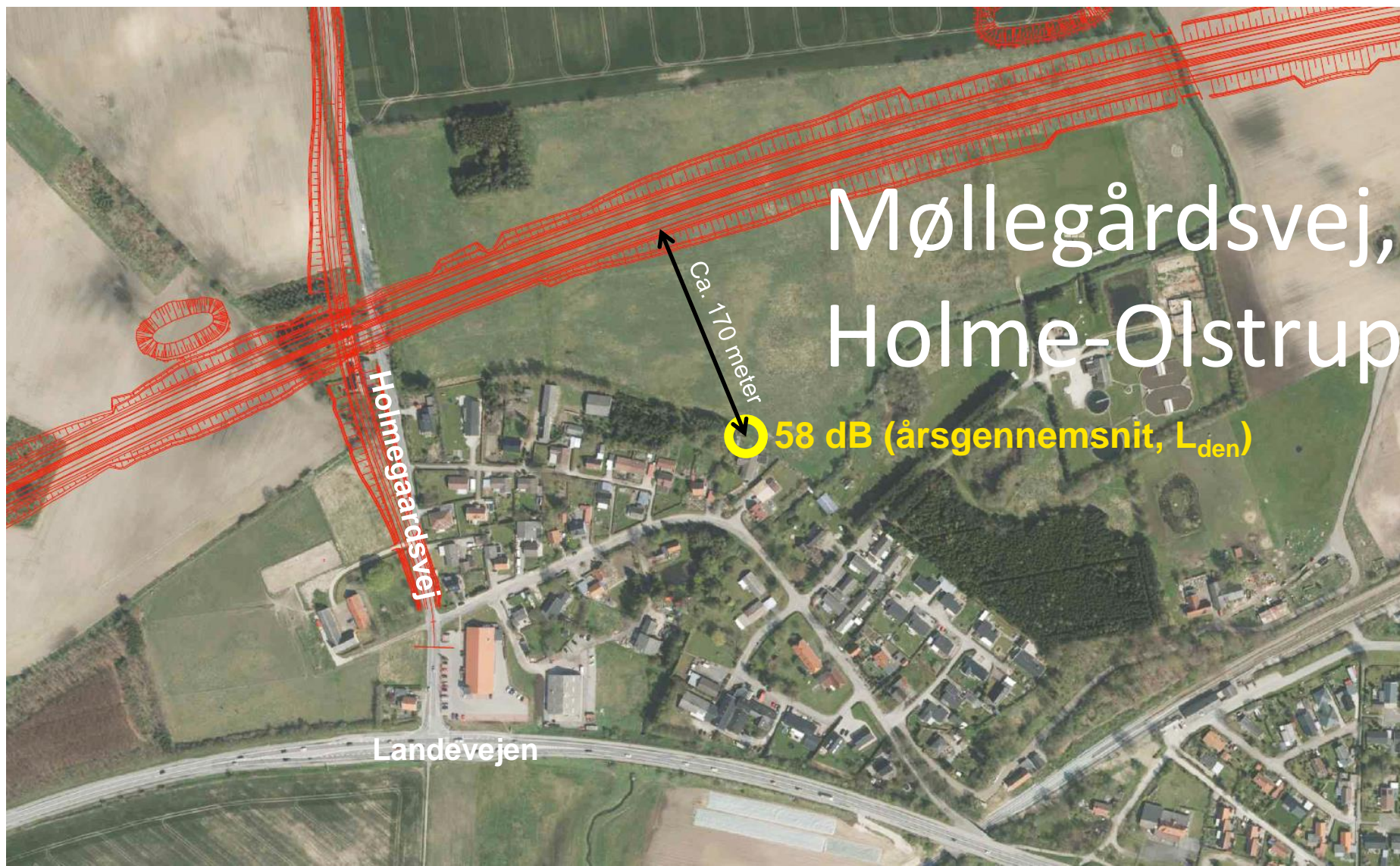
Introduction to noise limit values and noise maps

- Noise limit value for dwellings = 58 dB (Lden)
- What is shown on a noise map
 - Noise contour lines
 - 1,5 m above terrain
- Noise levels are given as average values over the year (Lden)
- Noise changes during the day (there is more noise in the daytime than at night)
- The noise changes over the year (for example, there is more noise when the wind direction comes from the road)
- Examples are based on traffic in the afternoon and evening - without wind.



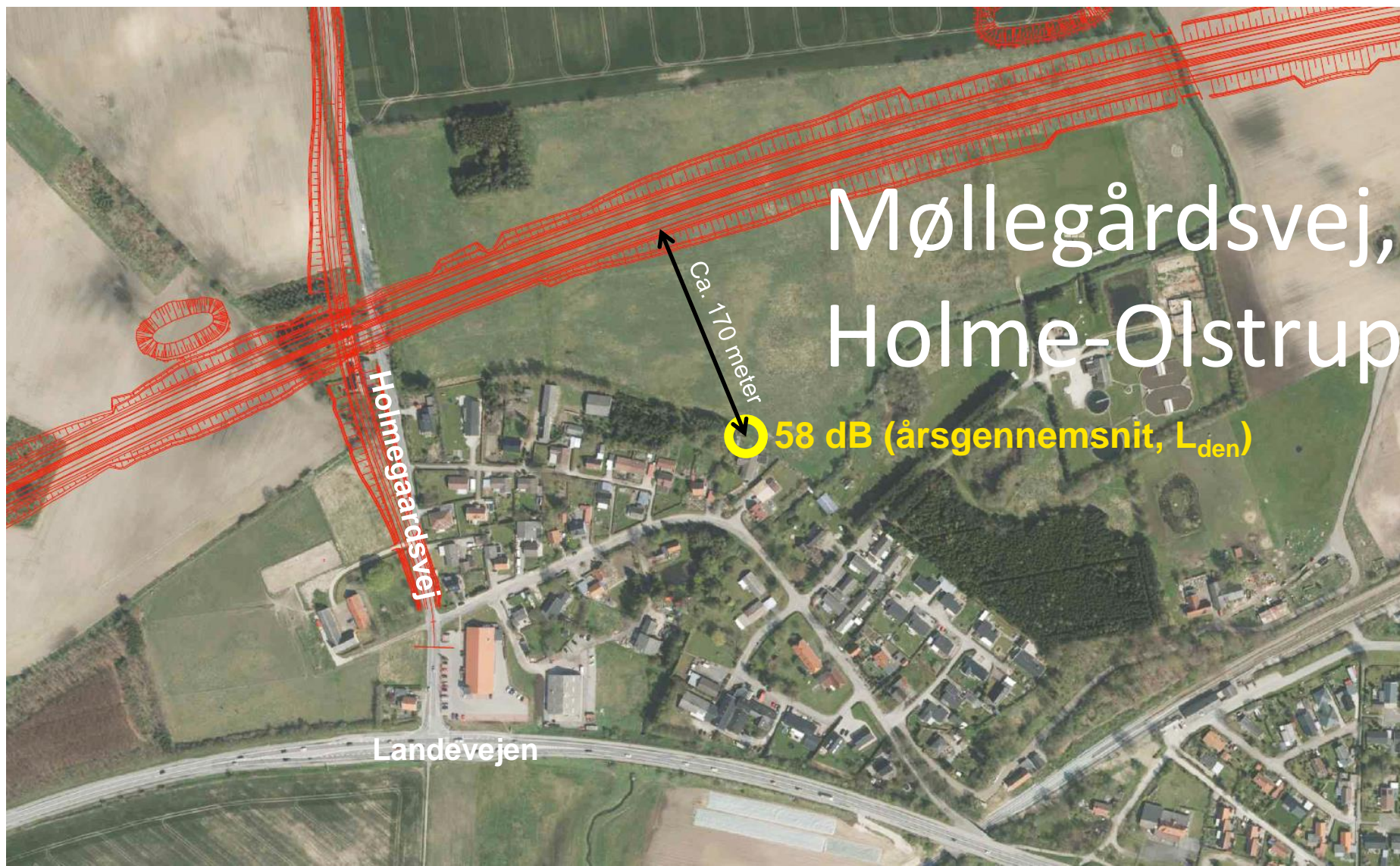
Sådan lyder motorvejen

Dag kl. 7-19



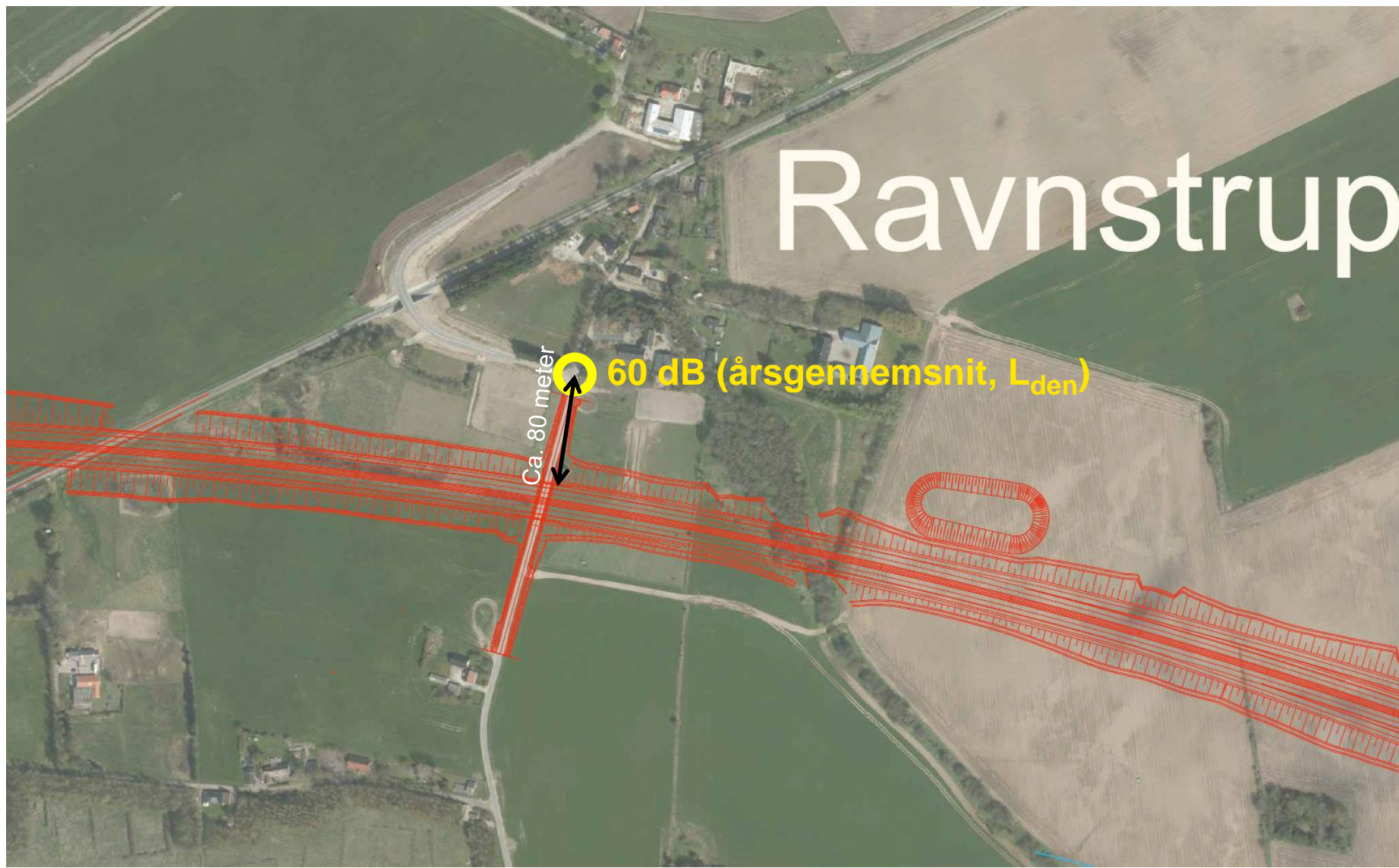
Sådan lyder motorvejen

Aften kl. 19-22

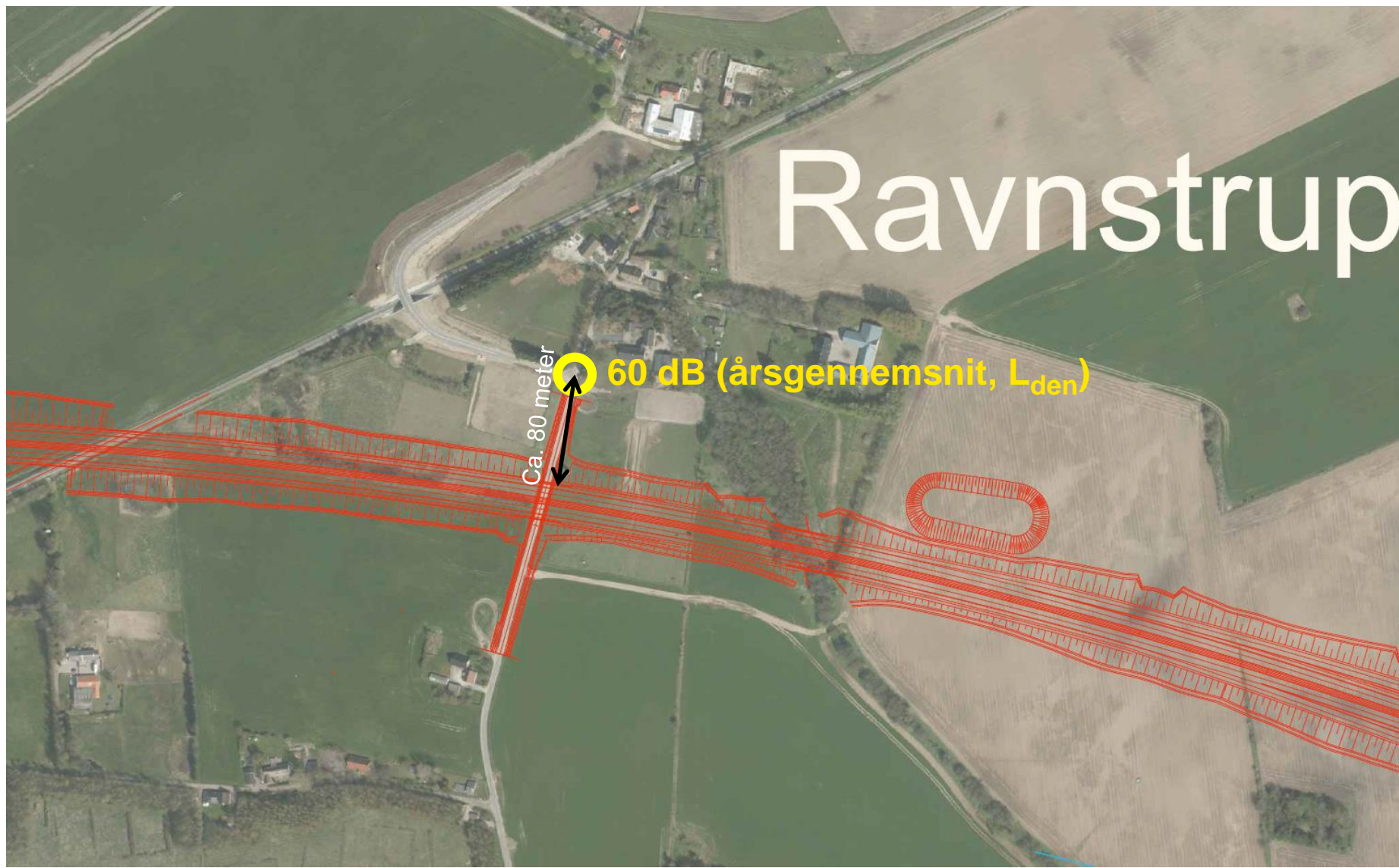


Sådan lyder motorvejen

Dag kl 7-19



Sådan lyder motorvejen Aften kl 19-22



Noise barrier project



http://www.vejdirektoratet.dk/DA/vejprojekter/stoejskaerm_Brandrupdam/Documents/Effekt%20af%20st%C3%B8jsk%C3%A6rm/Bramdrupdam.html

Experience, considerations and conclusions

- Noise is an important subject in connection with road planning and road projects
- What will the consequences be for the neighbours?
- Which means do we have in order to reduce traffic noise – and what are the effects?
- Need for communicating noise matters to road neighbours, stakeholders and decision makers
- Auralisations is a supplement to noise maps and noise impact assessments
- Auralisations and sound demo's is a step forward in communicating noise matters
- Auralisations is a part of future projects where noise is an important issue

Thank you for listening