Southwest Anthony Henday Drive Noise Study

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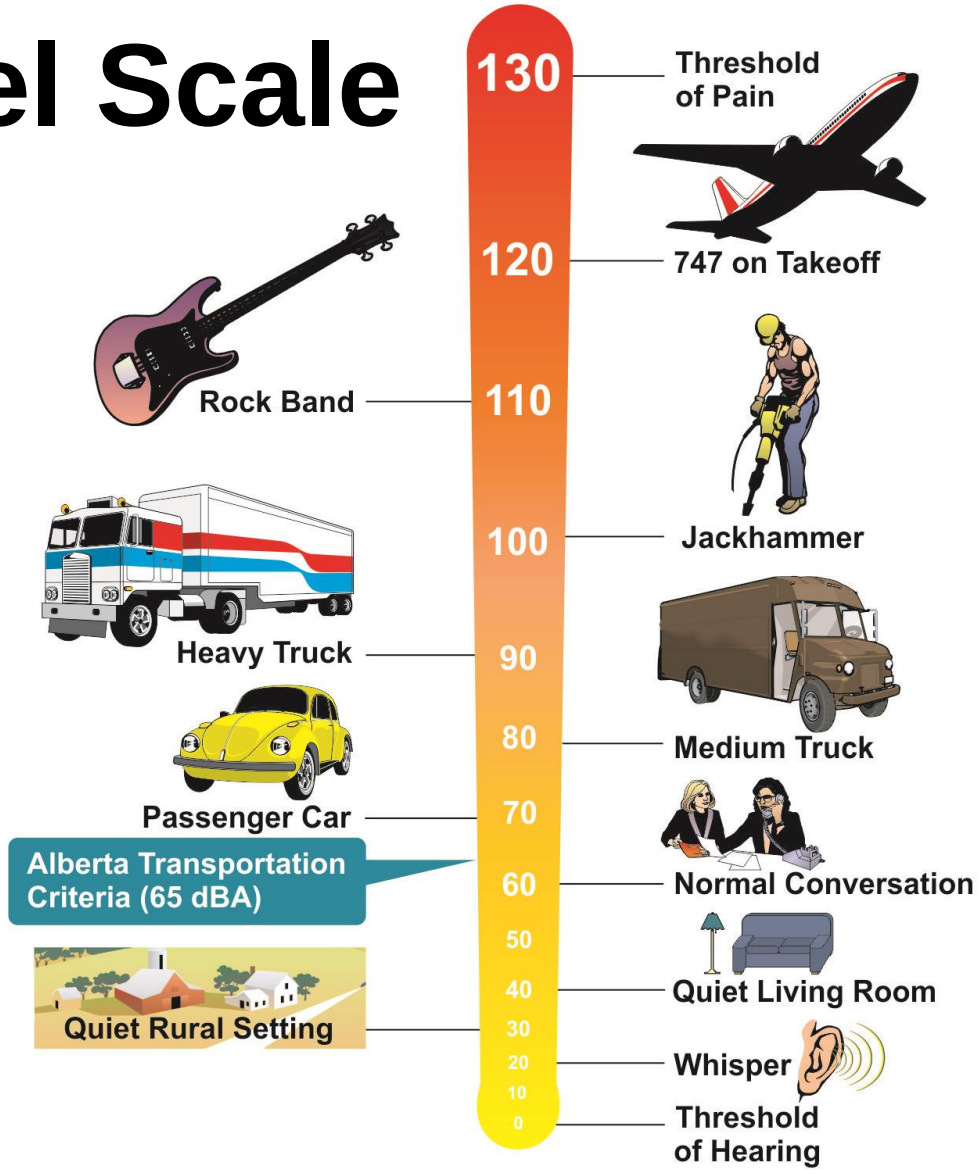
Introduction to Sound

Decibel Scale

- Noise is measured using a Decibel (dB) Scale
- The Decibel Scale is a base-10 logarithm scale (similar to Richter Scale)
  - Change of 1-2 dB - threshold for subjective change
  - Change of 3 dB - barely perceptible
  - Change of 5 dB - strongly perceptible
  - Change of 10 dB - considered twice as loud

Decibel Scale



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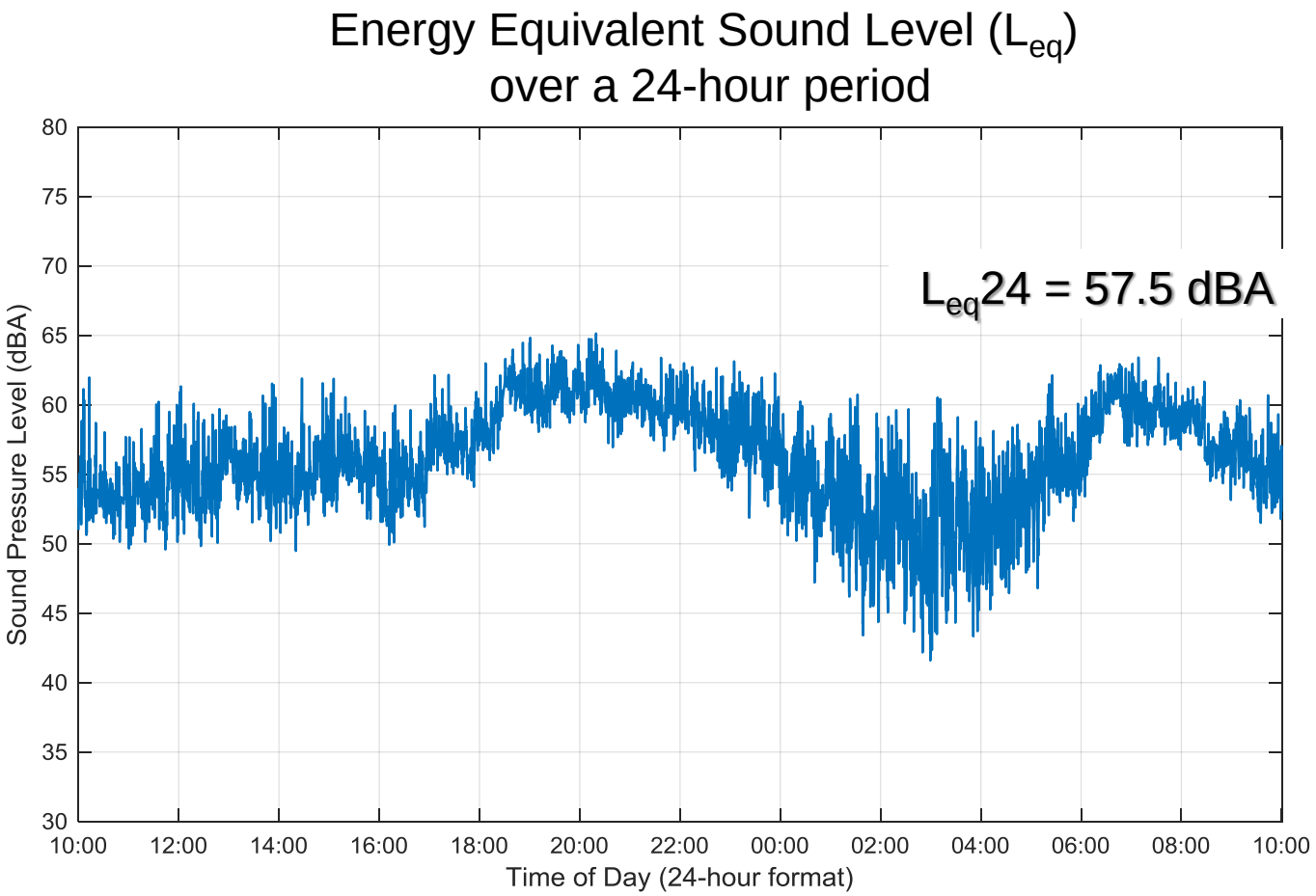
A-Weighting Scale (dBA)

- An “A-Weighting” scale (dBA) is being used to measure sound in the SW AHD noise study
  - A-weighting matches human hearing
- Human hearing is not linear at different frequencies (i.e. pitch)
- Human hearing **reduces** the volume of both low and high frequency (pitch) sounds compared to middle frequency sounds

Fluctuating Sounds



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Energy Equivalent Sound Level

- Over time, sound is measured using the Energy Equivalent Sound Level (L_{eq})
  - Takes into account noise fluctuations
  - A short burst of loud noise is perceived to be as annoying to the average person as sustained noise at a lower level (i.e., loud air brakes for a short time versus continuous, low-level traffic noise)
  - One number represents all this data over a given time period
  - Uses Logarithmic Average of sound (not arithmetic)

Energy Equivalent Sound Level

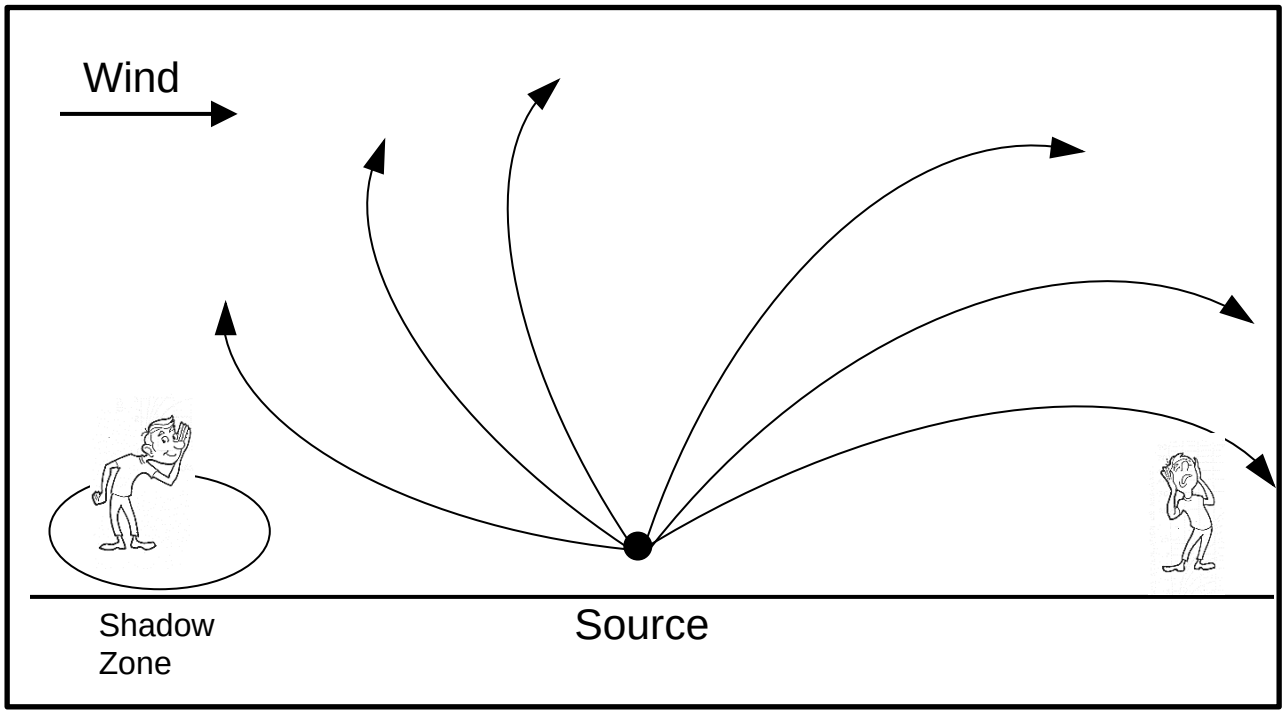
- The SW AHD noise study uses a 24-hour time period for the Energy Equivalent Sound Level (L_{eq})
  - Sound is continuously measured by the noise monitor and the L_{eq} is logged every 15 seconds for the entire 24-hours.
  - The L_{eq} is determined largely by louder sound levels.
  - The purpose of this method is to reflect the way that people respond to sound.

Factors that Affect Noise

- Certain conditions affect how noise travels and is perceived
  - Wind
  - Temperature
  - Topography
  - Ground cover
- These conditions influence how and when noise monitoring can take place

Factors that Affect Noise - Wind

- Single biggest reason for day-to-day fluctuations in urban noise
- Decreased noise level upwind, increased noise level downwind
- The difference between sound upwind/downwind can be +10 dBA



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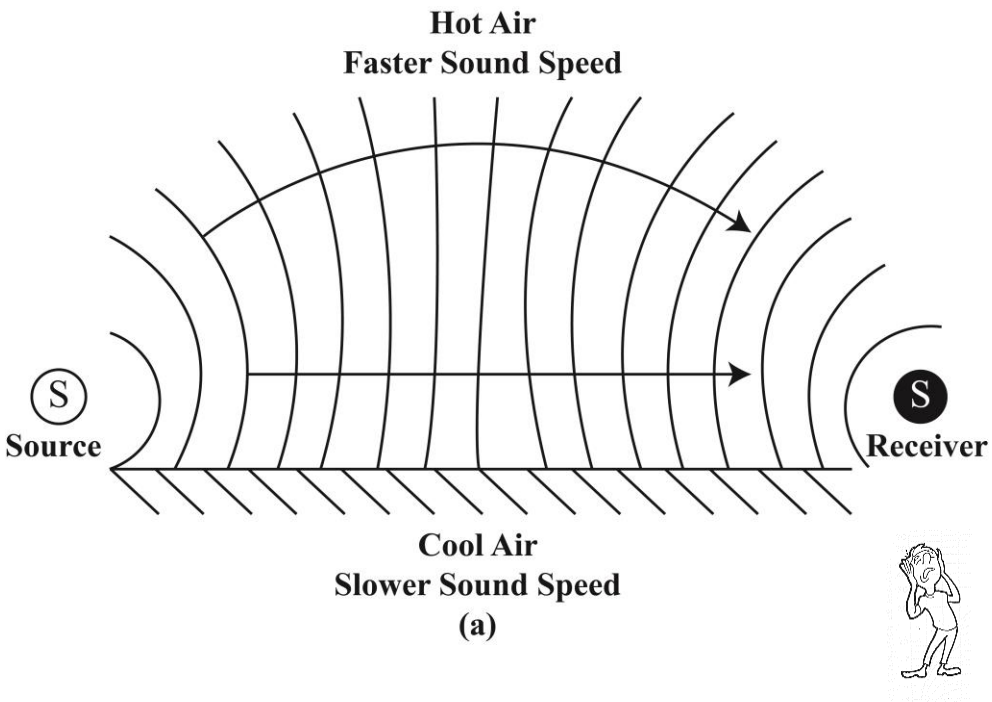
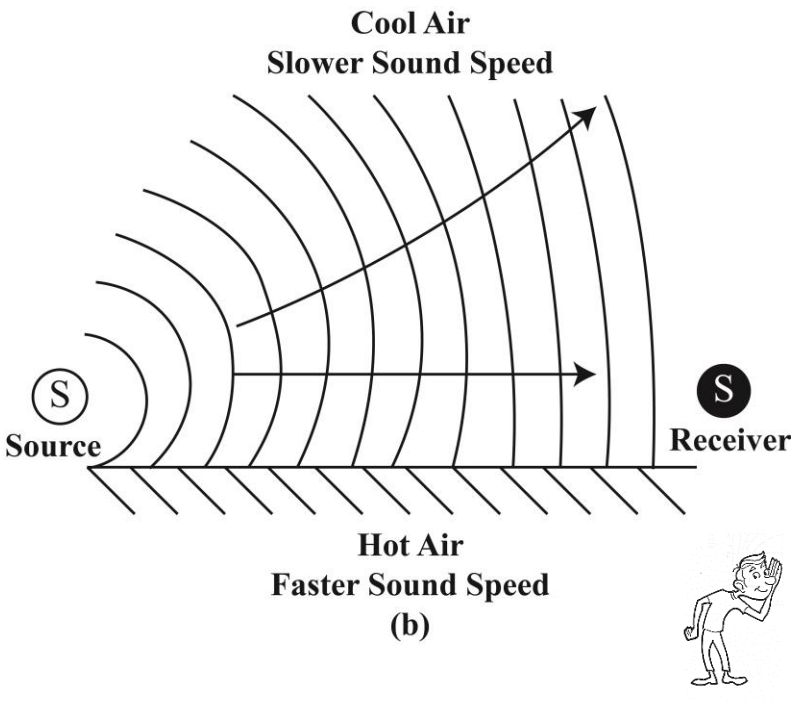
Factors that Affect Noise - Temperature

- Normal gradient (i.e. colder temp. at higher elevation) generally has neutral effect on sound
- Temperature inversion (i.e. warmer temp. at higher elevation) can reflect sound back towards ground
- Difference can be +10 dBA
- Temperature inversion occurs when wind is calm

Factors that Affect Noise - Temperature





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Factors that Affect Sound Travel

- Rain
  - Falling rain (or snow) has little effect on sound travel
  - Wet road surface has different sound “quality” than dry
- Topography
  - Hills can provide sound attenuation
  - Valleys can provide sound amplification
- Ground Cover
  - Grass, grain crops, foliage can absorb sound
  - Snow cover can absorb or reflect sound

Traffic Noise

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Sources

- Dominated by tire noise at speeds greater than about 50 km/h
- Engine noise (from front grill and reflections off road)
- Exhaust noise (higher up for large trucks and busses)
- Turbulent wind noise

Variables

- Road surface type and conditions
- Vehicle type and condition (passenger vehicles, trucks, buses and motorcycles)
- Tire configuration
- Number of vehicles, vehicle speeds
- Engine load

Levels

- Distance reduces noise — the further you are away from the noise, the quieter it is
- 2x traffic volume results in a 3 dBA increase (barely subjectively noticeable)
  - Double the traffic volume does not result in double the noise
- 10x traffic volume results in a 10 dBA increase (subjectively twice as loud)

Current Noise Study

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Policy

Alberta Transportation Noise Attenuation Guidelines for Provincial Highways:

"For construction or improvements of highways through cities and other urban areas, Alberta Transportation will adopt a noise level of ***65 dBA L_{eq}24*** *measured* ***1.2 m above ground level and 2 m inside the property line*** *(outside the highway right-of-way).*

The measurements should be adjusted to the ***10-year planning horizon****, as a threshold to consider noise mitigation measures."*

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Policy

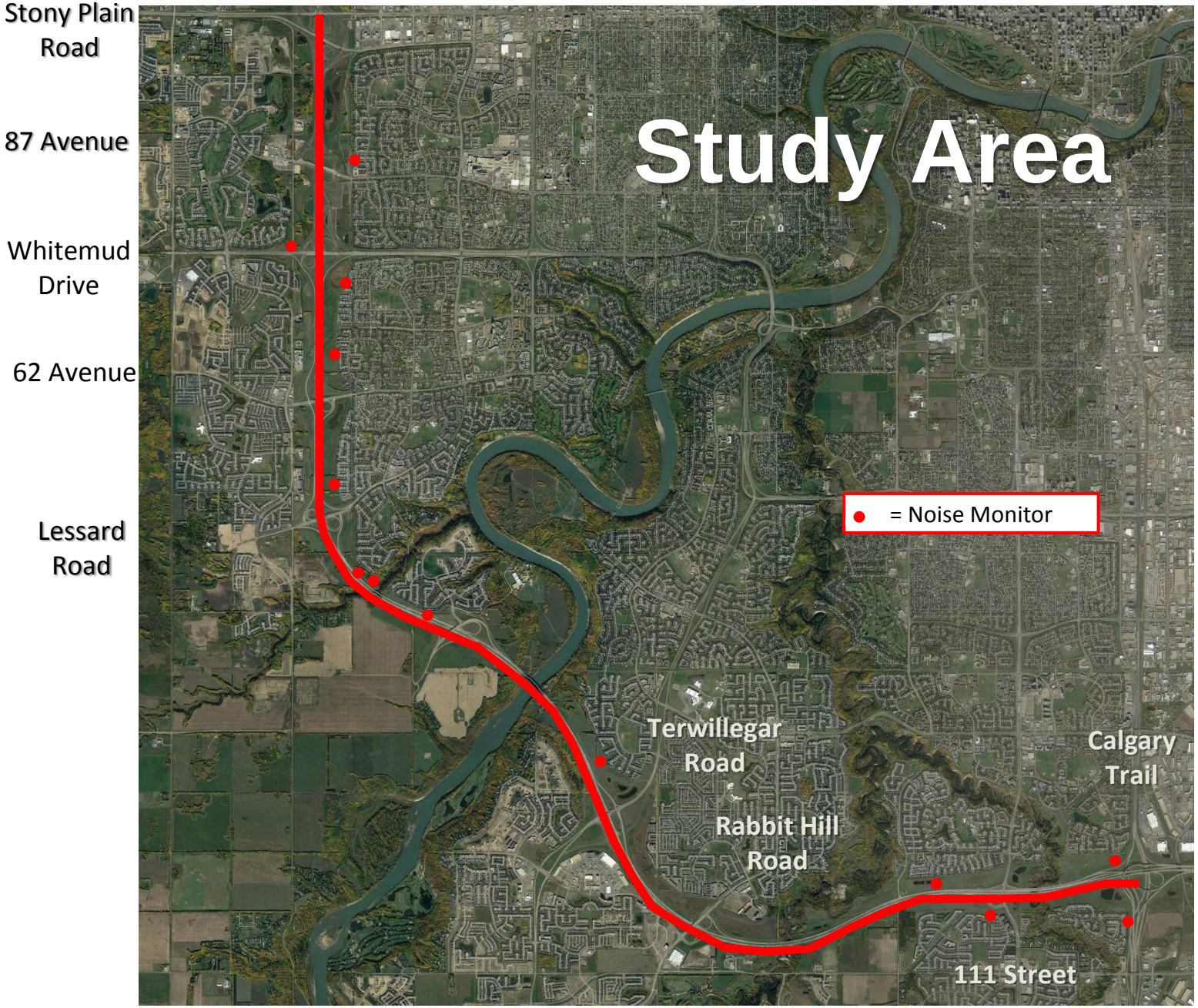
- Noise levels are measured objectively (1.2 m above ground level and 2 m inside the property line) to ensure all are treated fairly
- Alberta Transportation's noise policy is similar to that of the City of Edmonton

Noise Study Purpose

- Initiated by Alberta Transportation (AT) based on Ministerial commitment to conduct the study in 2016, prior to the original 2018 timeline.
- Current noise levels will be compared to 2007 and 2013 noise monitoring results, and against AT's noise level guidelines.

Noise Monitoring

- Where
  - 13 locations throughout study area
  - Same locations as 2007 and 2013
- When
  - 24-hour monitoring period
  - Downwind conditions
  - Four separate monitoring periods to cover all locations under appropriate wind conditions


Stony Plain Road
87 Avenue
Whitemud Drive
62 Avenue
Lessard Road
Study Area
= Noise Monitor
Terwillegar Road
Rabbit Hill Road
Calgary Trail
111 Street

Current Noise Study: Monitoring

- How
  - dBA and frequency data recorded every 15 seconds
  - Simultaneous digital audio recording for “isolation” analysis
  - Portable weather monitoring station obtains accurate local meteorological conditions
- Why
  - For the calibration and verification of the noise model

Modelling

- Computer noise model of entire study area considers:
  - Traffic on SW AHD, as well as all intersecting Edmonton roads and interchanges
  - Elevation contours
  - Residential property lines
  - Residential and commercial structures
- Noise levels are calculated at 1.2 m elevation, 2 m inside property line
- Colour noise maps are calculated for entire study area
- Sensitivity analysis is created to account for fluctuations in traffic volumes, heavy trucks, speed

Noise Study Timeline

- Noise monitoring began a few weeks ago, however, due to construction in the area, monitoring at all locations could not be completed.
- Next spring (as soon as weather permits) monitoring will resume at all locations. Sites completed in 2016 will be redone to ensure a standardized baseline.
- Monitoring will take approximately 6 weeks to complete.
- Following monitoring, the noise modeling and analysis will be completed. The final report is expected in late summer.

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