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Monitoring of Road Traffic Sound Levels

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Introduction & Background

- 1980's, Ontario Ministry of the Environment, now the Ministry of the Environment and Climate Change (MOECC) and National Research Council (NRC) developed
  - assessment criteria
  - Acoustical Engineering analysis procedures
  - to assist Municipalities
  - to ensure sufficient mitigation of traffic noise
  - incorporated into new housing developments
- Procedures adopted by Municipalities across Ontario
- Still in use after 30 years

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Types of Noise Studies

- Noise Feasibility Study
  - Basic information about the site
  - Simple street layout
  - Orientation of buildings, fronting, flanking or homes backing onto street

- Detailed Noise Study
  - Grading information is available
  - Lotting information is detailed
  - Architectural drawings available
    - showing detailed floor plans and building elevations

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Prediction Methods for Noise Studies

- Traffic volumes obtained from municipality or Region or from accepted traffic studies
- Volumes may be current traffic counts or projected/forecasted volumes
- Data is projected to a minimum of 10 years

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Approvals Process

- Once a site is approved for development
  - Grading, location of acoustic barriers, earth berms and location of homes is completed by various engineering firms
  - Reviewed by Acoustical Engineer to refine the heights and extent of the acoustic barrier

- Before building permit
  - Acoustical Engineer reviews the detailed floor plans and building drawings to provide recommendations for
    - Exterior wall construction
    - And window constructions

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Approvals Process continued

- After construction
  - Site inspection is performed
    - Acoustic barrier at correct height? Correct extent? No gaps.
    - Recommended exterior wall constructed?
    - Appropriate windows with recommended STC installed?
  - Acoustic Engineer certifies that recommendations in noise study have been completed
  - Developer receives back securities held by the municipality

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Why Did We Monitor?

- Complaint by a homeowner
  - road traffic is audible inside their home
  - it interferes with their enjoyment of their property
  - disturbed sleep

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- Study involved the following
  - simultaneous monitoring of traffic sound levels
  - inside and outside multi-storey residential dwelling
  - located beside an arterial roadway
  - medium density row townhouse development

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Purpose of the Study

- to confirm the accuracy and applicability of the Engineering prediction methods used to design building envelopes for residential dwellings located near busy roadways across the Province of Ontario.

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Criteria

Table I: MOECC Road Traffic Noise Criteria (dBA)

Area	Daytime $L_{EQ\ (16\ hour)}$	Night-time $L_{EQ\ (8\ hour)}$
Outside Bedroom Windows	55 dBA	50 dBA
Inside Living/Dining Rooms	45 dBA	45 dBA
Inside Bedrooms	45 dBA	40 dBA

Home Builder

- A good builder
- Wanted a resolution to the situation
- Paid for hotel for the occupants of the townhouse during the monitoring period
- Representative present during deployment and retrieval of sound meters

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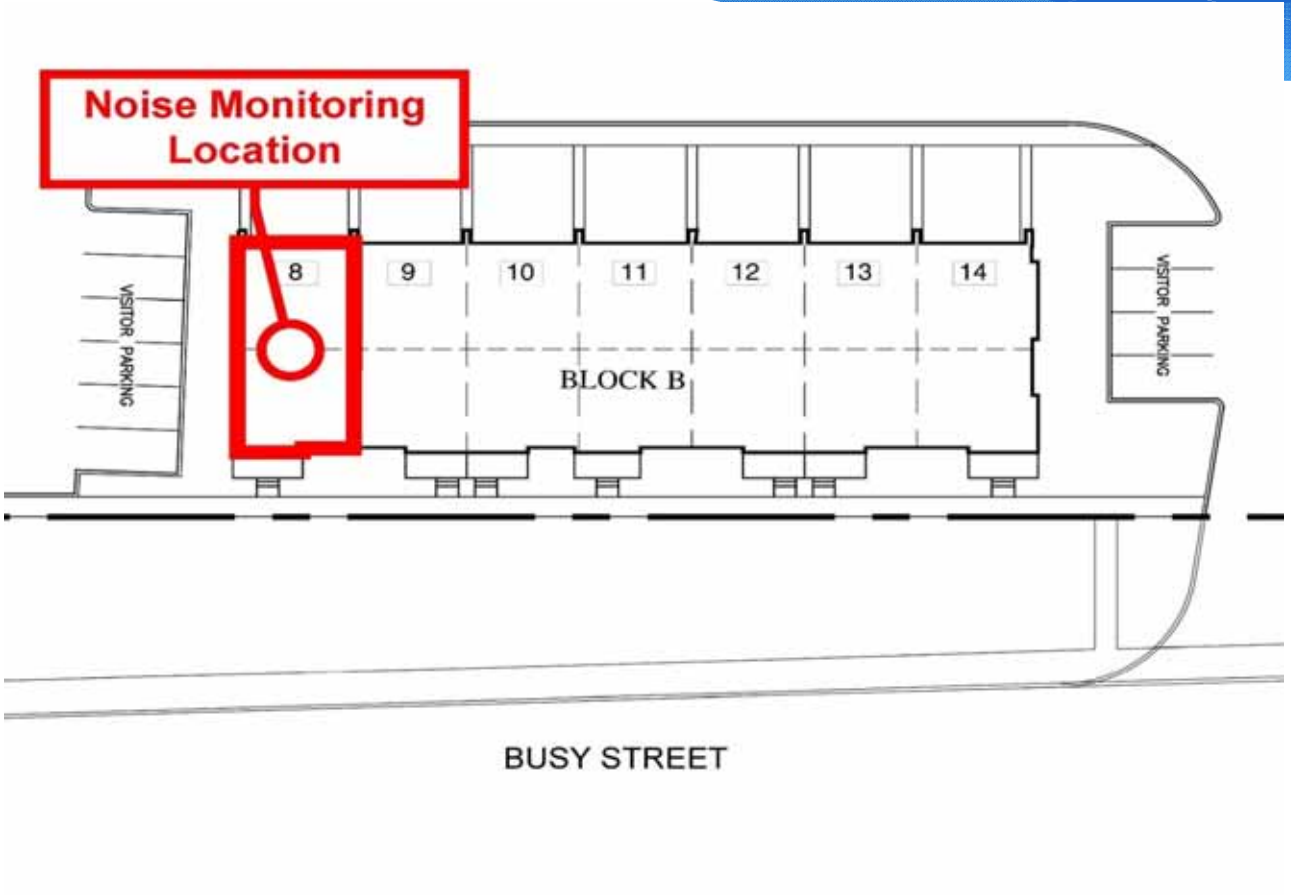

- Daytime future predicted sound level of 68 dBA $L_{EQ(16\ hour)}$
- Nighttime future sound level of 62 dBA $L_{EQ\ (8\ hour)}$
- at front of building facing the roadway

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Sound Level Monitoring

- simultaneously conducted at four locations:
  - outside at ground level
  - inside in the first floor den
  - inside in the second floor living room
  - inside in the third floor bedroom

- All of the measurement locations had direct exposure to Busy Street.
- The Sound Level Meters are maintained in yearly laboratory calibration and were field calibrated before and after the measurements.

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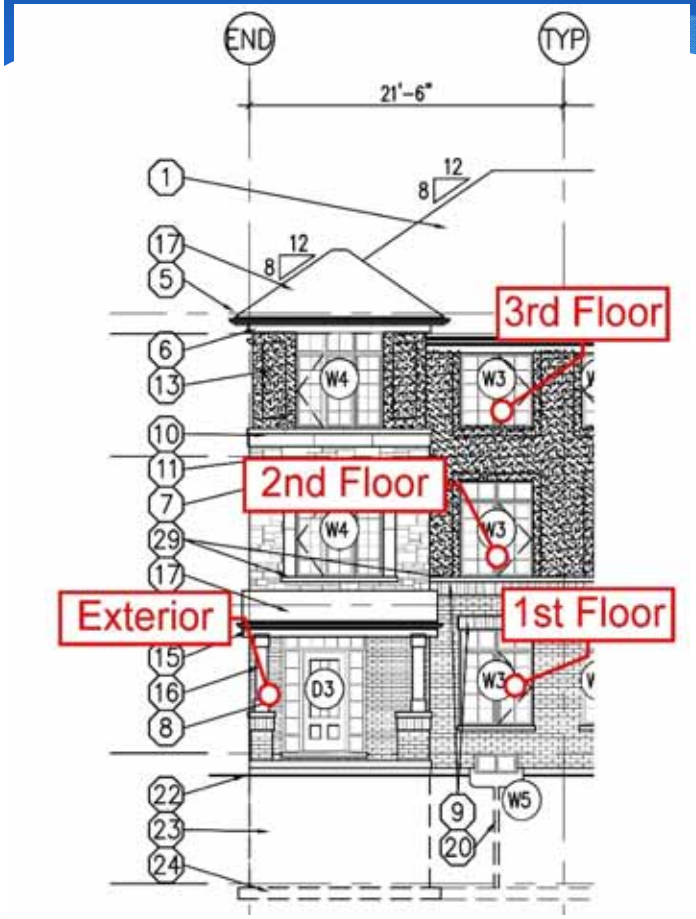

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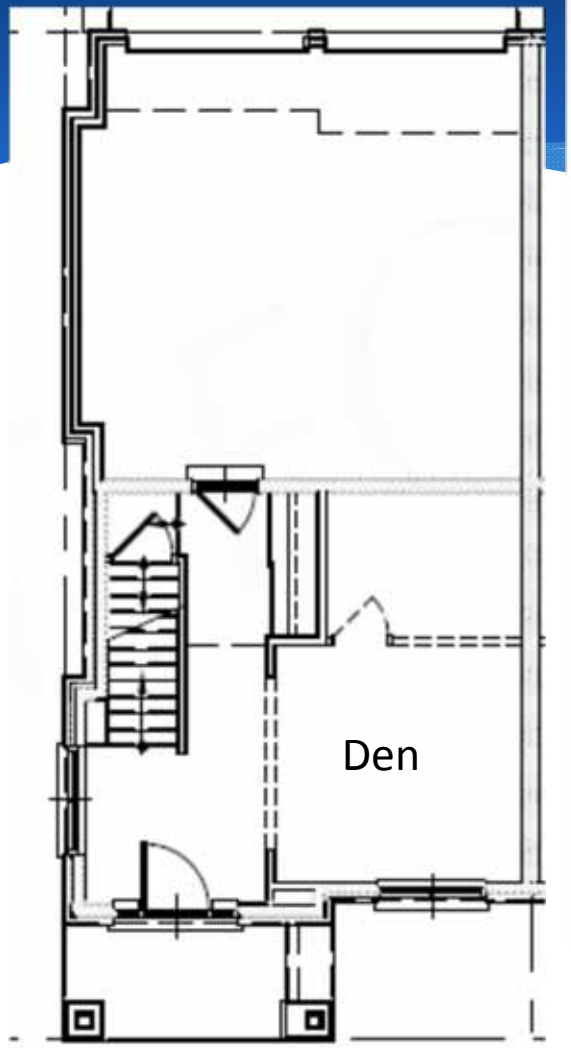
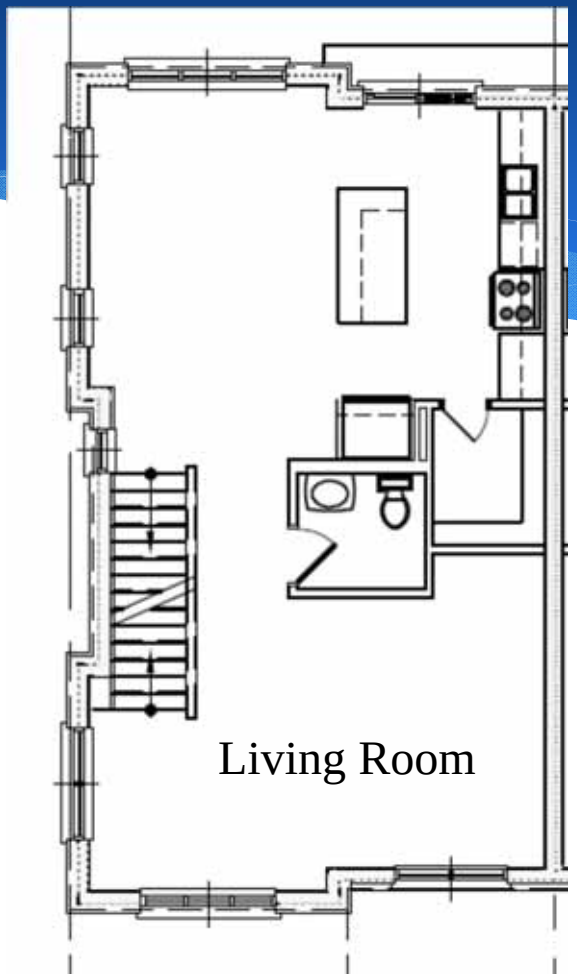
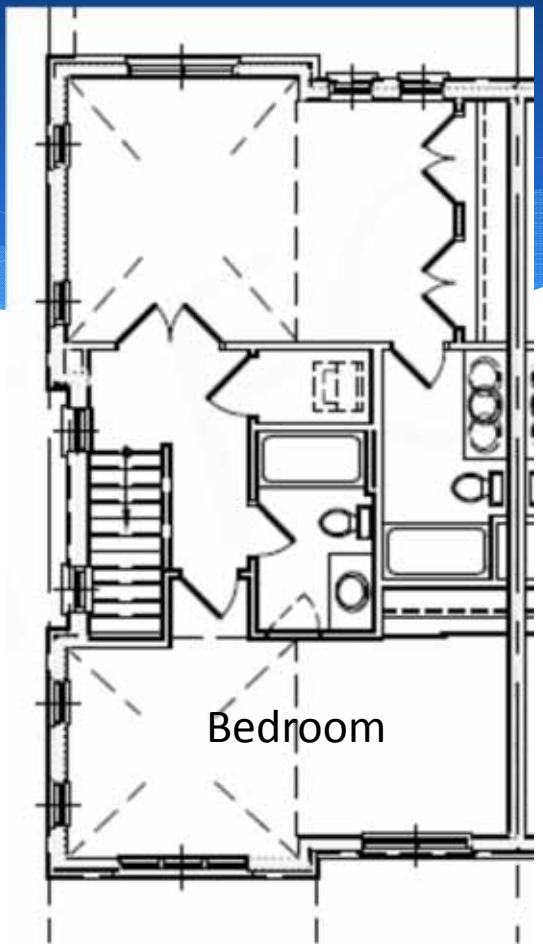
Floor plans



Ground Floor



Second Floor



Third Floor

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Analysis of Results

- Sound level meter
  - Able to record sounds inside home
  - Data related to unusual sounds can be identified and removed as necessary

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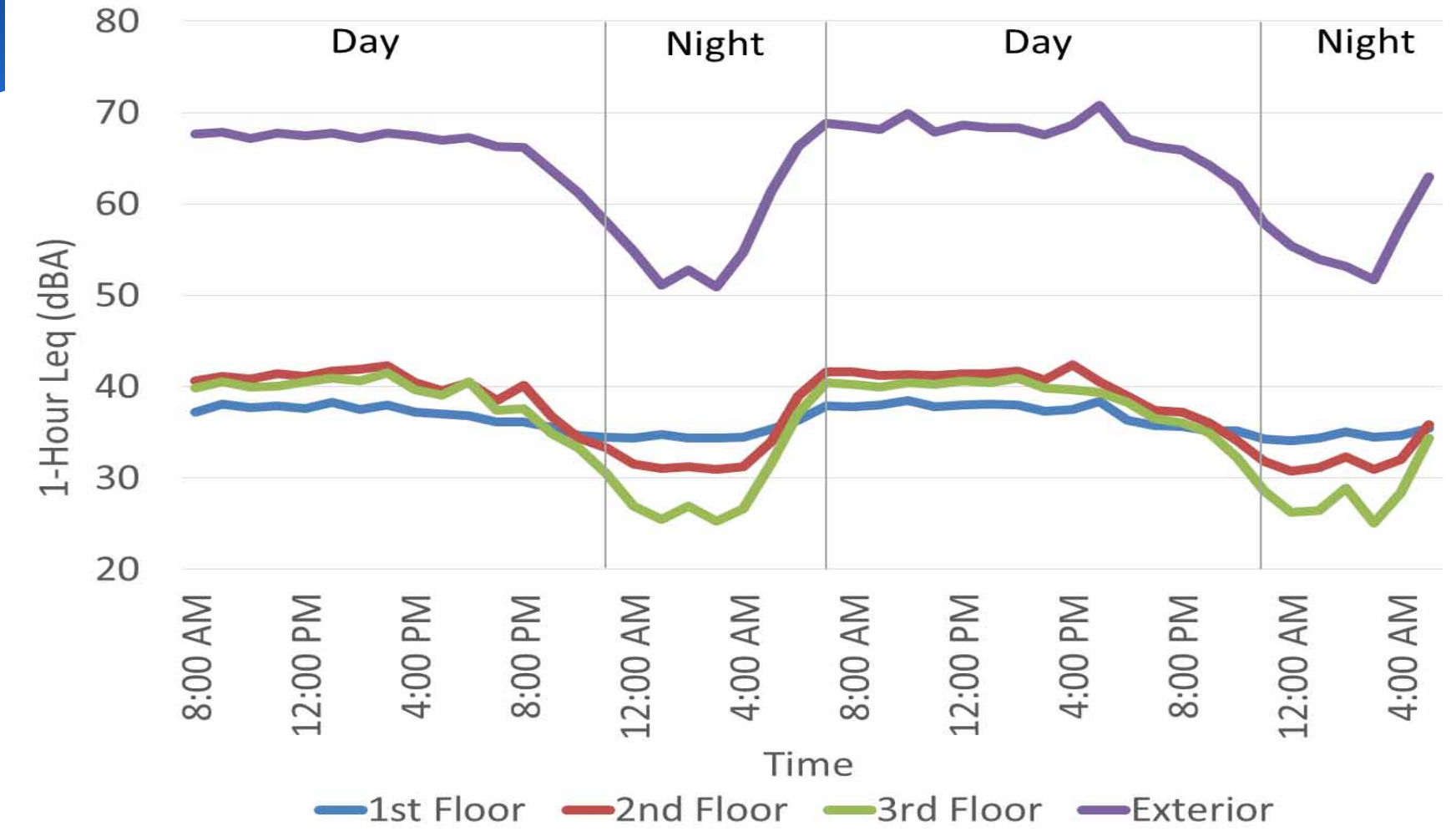
Measured Hourly Sound Levels, L_{EQ}, dBA



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Sound Level Results

Table 2: Measured Daytime $L_{EQ\ (16\ hour)}$ and Nighttime $L_{EQ\ (8\ hour)}$ Sound Levels

Monitor Location	Measured Sound Levels (Day/Night), dBA
Exterior	67 / 60
Inside 1st Floor Den	37 / 35
Inside 2nd Floor Living Room	40 / 34
Inside 3rd Floor Bedroom	40 / 31

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Conclusion

- During site visits, confirmed appropriate glazing was installed
- Results confirm accuracy of future sound level predictions
- Confirmed applicability of NRC calculation methods used to design the facades of residential buildings
  - (acoustical insulation, incorporation of reasonable degree of conservatism in terms of protecting the public and the interests of Municipalities and Home Builders alike).

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- Assessment methodologies based on statistical distributions of annoyance in humans do not result in 100% satisfaction.

- You cannot make all the people happy all the time.

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Thank-You!
Any Questions?

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