A Traffic Noise Assessment Comparing Two Modeling Tools: Traffic Noise Model 2.5 & Olive Tree Lab 3.3

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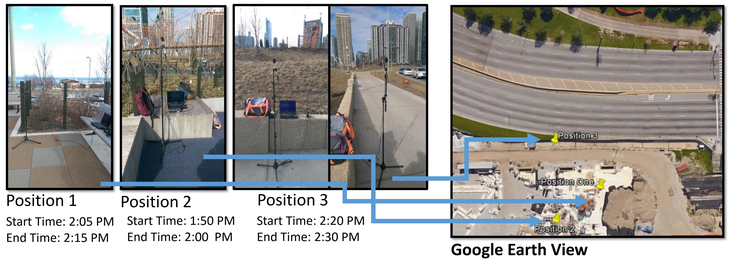
Abstract/ Intro

Any federally-funded traffic noise projects must use the Traffic Nosie Model (TNM) provided by the Federal Highway Administration (FHWA). I wanted to compare the FHWA-mandated model (TNM) to the Olive Tree Lab (OTL) model with a simple noise study. The results from the TNM and OTL models were to be compared to actual test data acquired from on-site testing. The purpose of this study is to see if federally-funded projects could benefit from other methods of modeling.

Noise measurements were taken from 3 different locations from an area that included a sub-section of Maggie Daley Park, called the Slide Crater, which abuts Lake Shore Drive. These measurements were used to compare the TNM and OTL models to each other.

Results concluded that TNM's extensive library of different vehicle types (e.g., bus, car, motorcycle) and their speeds was a major resource, and OTL's ability to create and save your own noise source was one of OTLS's major forte.

Testing

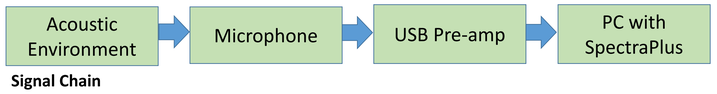


Position 1
Start Time: 2:05 PM
End Time: 2:15 PM

Position 2
Start Time: 1:50 PM
End Time: 2:00 PM

Position 3
Start Time: 2:20 PM
End Time: 2:30 PM

Google Earth View



Signal Chain

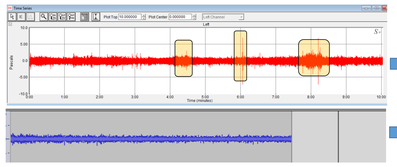
The same microphone was used for all 3 different positions. Leq recordings from all 3 different microphone positions were gathered consecutively in order to be able to record from the same traffic-hour.

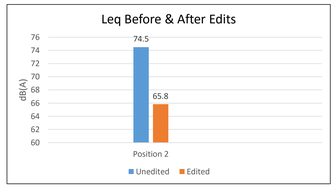
1) Calibrate ECM 8000 microphone and establish signal flow.
2) Document meteorological conditions (e.g., wind speed, wind direction, and temperature).
3) Document traffic flow and volume (e.g., speed, vehicle type).
4) Record 10 minute Leq at 3 different locations using SpectraPlus
5) Use data to build Traffic Noise Model and Olive Tree Lab model

Analysis

TNM 2.5

An example of a wave-file from SpectraPlus is the recording from within the Slide Crater, receiver position 2. Receiver position 2, recorded **substantial** human activity noises. The highlighted segments are examples of substantial human noise such as loud talking, bangs or screeches from slides, and wind. These sounds were edited out using Audacity to attain accurate ambient noise levels from microphone position 2.



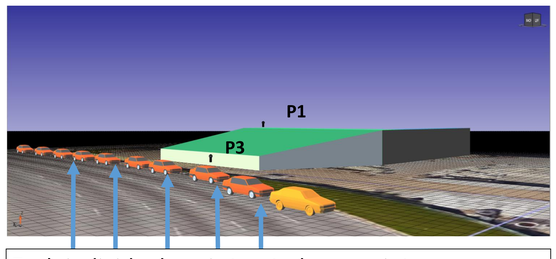


After all edits were concluded, a 36 second wave-file was attained. This new wave file was uploaded to SpectraPlus to calculate its Leq.

OTL

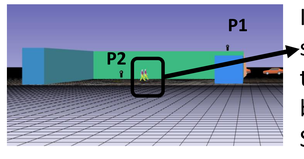
OTL Average Car Data

Freq (Hz)	Estimated Level at 1m (dB)
25	89.6
31.5	89.6
40	89.6
50	83.4
63	83.4
80	80.3
100	80.4
125	80.3
160	80.3
200	74.8
250	74.8
315	74.8
400	72.4
500	72.4
630	72.4
800	72.2
1000	72.2
1250	72.2
1600	73.4
2000	71
2500	71
3150	65.2
4000	65.2
5000	65.2
6300	58.1
8000	58.1
10000	58.1



Each individual car is treated as a point source.

To compare both TNM and OTL, I decided to use OTL's own average car data as the noise source for the Lake Shore Drive Traffic. Lake Shore Drive traffic in the chosen geographical area is not continuous due to a red light. That was accounted for in the model by using point sources instead of a line source.



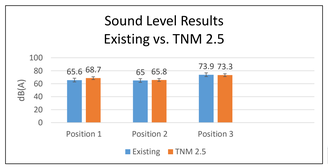
Inside the Slide Crater, two speech sources were added to represent the ambient background noise of the Slide Crater.

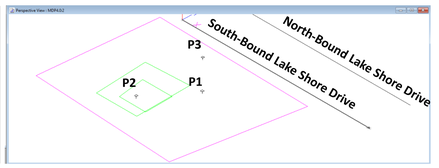
Results

Both TNM and OTL were able to calculate accurate results with little insignificant deviation from the measured data.

TNM 2.5

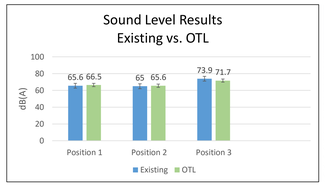
TNM used it's extensive library including vehicle categorization and speeds to calculate the results.

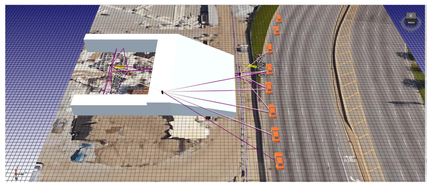




OTL 3.3

OTL was able to calculate accurate results using its own noise source of average-car-data.





Conclusions

Both TNM and OTL provided models with accurate results, however, their methods were different. TNM provides the user with the type of information to input. OTL provides sets of tools leaving the user with the decision of the tools to use and what information to input. TNM could potentially benefit from additional tools, such being able to use custom noise sources. This would be particularly useful for pavement studies as TNM has limited pavements to use in it's model.

Pros	Cons
Custom database/ library	Limited traffic noise sources
3D Graphics	
Frequency band & single Leq value(s)	

Pros	Cons
Streamlined	
Single Leq value	Single Leq Value
Extensive source Library	2D Graphics

Future Research

- A more complex geometrical model could be used to compare TNM and OTL.
- Roadway pavement study using TNM and OTL.
- Further testing could be used to acquire a noise source for Lake Shore Drive to input into an OTL model.

References & Acknowledgments

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References: *City of Tucson Kolb Road: Connection to Sabino Canyon Road* (pp. 1-68, Rep. No. 142714). (2011). Tucson, Arizona: HDR Engineering, United States, US Department of Transportation, Federal Highway Administration. (2010). *Highway Traffic Noise: Analysis and Abatement Guidance* (pp. 1-75), *SpectraPLUS FFT Spectral Analysis System Users Guide* (5.0th ed.). (n.d.). SpectraPlus, Federal Highway Administration, Department of Transportation, 23 C.F.R. § 772 (2015).