Application of the New FHWA Measurement Handbook: Multi-modal Noise Sources

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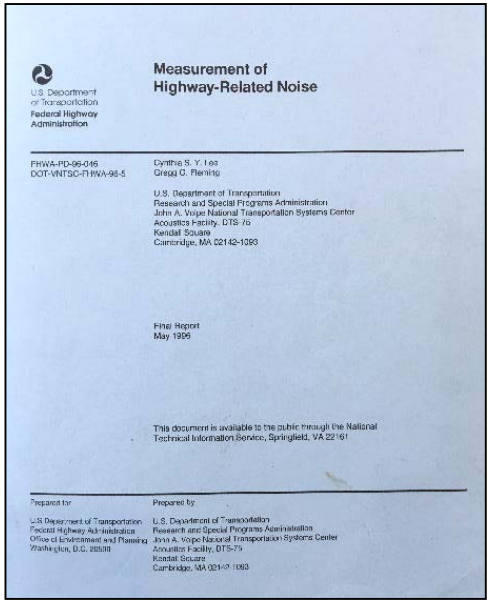
New FHWA Measurement Handbook

- Transportation agencies measure different aspects of highway noise
  - To determine or predict community impacts during urban planning
  - To conduct research that supports their programs
- Updated best practice guidance based on 1996 document
- Includes new material



U.S. Department of Transportation
Federal Highway Administration

Measurement of Highway-Related Noise

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New FHWA Measurement Handbook

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- Expected release: Imminent

Section 5: Including Other Noise Sources for Highway Noise Projects

- Types of projects to which guidance applies
  - Type I or Type II projects near train or aircraft operations
  - Construction near train or aircraft operations

Section 5: Including Other Noise Sources for Highway Noise Projects

- Project applications for methods in section
  - Establish existing noise to determine substantial increase
  - Determine worst noise hour
  - Establish existing noise to validate the FHWA TNM
  - Determine contributions for identifying impacts
  - Determine contributions during abatement analysis

Section 5: Including Other Noise Sources for Highway Noise Projects

- Measurements
  - Are aircraft and train events during existing noise measurements typical/representative?
    - Can check aircraft/train schedules if available
  - If not, may need to remove/add aircraft or train noise
  - Seek current FHWA and agency guidance on inclusion or not for existing noise level and determining worst hour
  - Exclude for validating TNM

Section 5: Including Other Noise Sources for Highway Noise Projects

- Combining noise sources

$$L_{combined} = 10log_{10}\left(10^{\frac{L_{highway}}{10}} + 10^{\frac{L_{train}}{10}} + 10^{\frac{L_{air}}{10}}\right) \quad (dB)$$

$L_{combined}$ = combined noise level [applying the $L_{eq}(h)$, L_{dn} (DNL), or L_{den} metric]

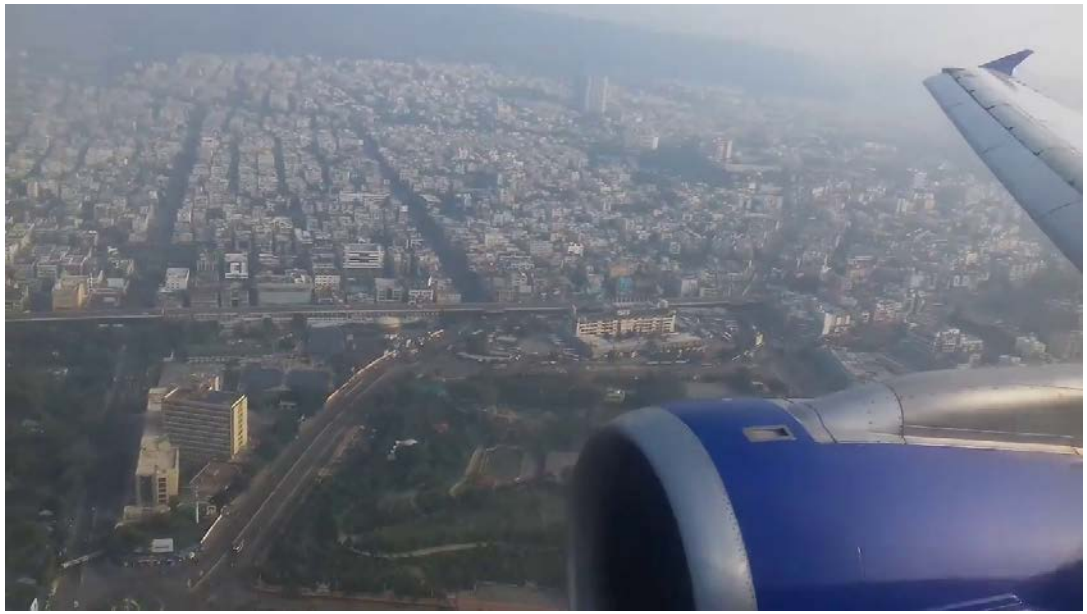
  - Conversion from $L_{eq}(h)$ to DNL provided in appendix
  - To determine highway noise impacts, assumption is DNL=$L_{eq}(h)$ + 2 → FHWA may provide further guidance

Application to Real Project

- Type I Highway Improvement Project
  - Major highway
  - Adding lanes
  - Near several major airports
  - Four sections adjacent to commuter and/or freight rail

Guidance Question

- Are receptors within airport noise contours? No
- However, some receptors are under approach flight paths to busy airport (altitude ~5,000 feet)
- Can hear the airplanes, levels ~51-65 dBA Leq



Aircraft noise examples

- Three sites in vicinity of flight path, ~5000-ft altitude
- Background noise
  - > 60 dBA, little to no effect from aircraft
  - ≤ 52 dBA, definite effect from aircraft

Aircraft event levels (max, dBA)	Minutes without aircraft (Leq, dBA)	Short-term measured Leq (dBA)		
		with aircraft	without aircraft	delta (with – without)
51-56	48-52	53.3	49.9	3.4
60-65	60-63	61.8	61.6	0.2
?	64-65	64.6	64.5	0.1

Guidance Question

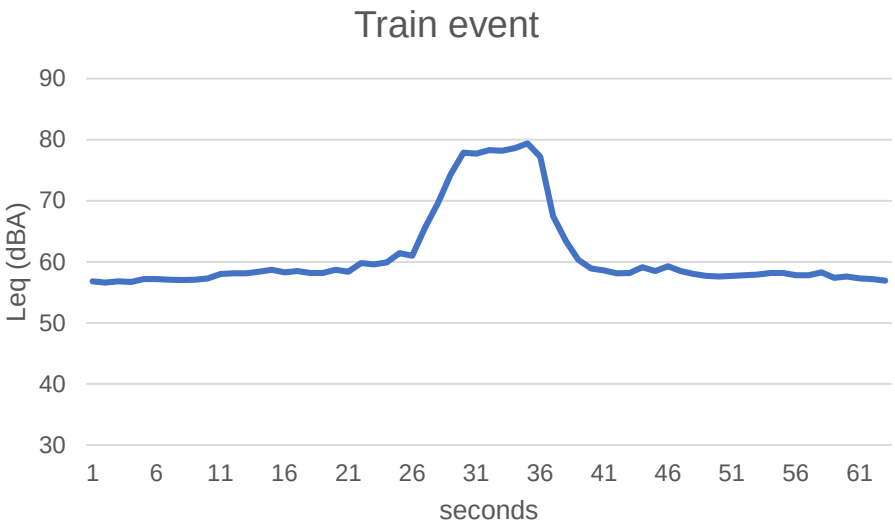
- Are train tracks within FTA screening distances? Yes
- Receptors as close as 30 feet from tracks, whole sections of neighborhoods within screening distances
- Sound level estimates from FTA Guidance

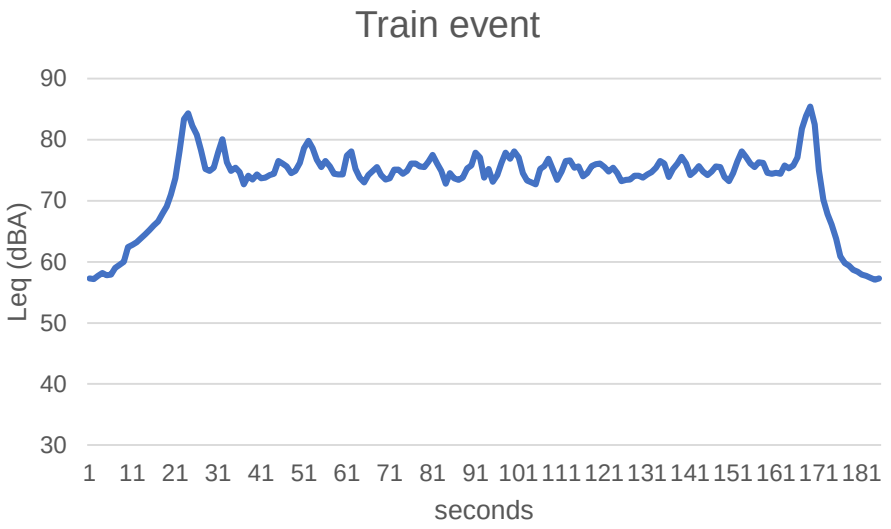
Distance from Noise Source (ft)	Sound Level Estimate L_{dn}, dBA
10 to 30	75
30 to 60	70
60 to 120	65
120 to 240	60
240 to 500	55
500 to 800	50
800 and up	45

Four sections affected by rail

Existing Noise Measurements

- Microphone placement
  - Placed some at homes near noise sources to easily identify train events
  - Events measured for example project:





Train noise inclusion

- As measured

OR, without train noise, then add back in with …

- Source measurements with applicable train schedule
  - Lmax or SEL ideally for 10 train pass-by events
  - Use with schedule to calculate loudest hour train noise
- Predictions with applicable train schedule
  - Simplified manual method (provided in appendix)
  - FTA general assessment or detailed analysis / FRA CREATE
  - HUD DNL calculator

Train noise example

- Loudest hour measured
  - 2 commuter rail: 71.8, 79.3 dBA max
  - 1 freight: 88 dBA max

Train noise source	Loudest hour Leq (dBA)		
	with trains	without trains	delta (with – without)
Measured	64.9	58.2	6.7
Predicted, simplified manual method, published freight max	74.9	58.2	16.7
Predicted, simplified manual method, measured freight max	64.9	58.2	6.7
Predicted, FTA detailed analysis	65.7	58.2	7.5

Summary

- Get direction from agency on inclusion of other noise sources
- Screen for potential effects of train and aircraft noise sources
- Remove events from noise measurements as appropriate
- Add events to noise measurements as appropriate
- Consider train and aircraft noise sources during mitigation analysis

Questions?