Traffic Noise

Introduction to Traffic Noise Analysis and Abatement

NW Bethany Blvd Improvement Project

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Introduction to Acoustics

- What is Noise?
  - Disturbing sound
  - Measured with Decibels
- How do We Quantify Noise?
  - Lmax – maximum 1-second sound level
  - Leq – preferred measurement descriptor
    - *Energy average sound level*
- General Rules of Acoustics *(generally accurate)*
  - Reduction vs. distance (double distance =3 dB)
  - Speed and Noise (10 mph = 3 dB)
  - Volumes and Noise (half/double = 3 dB)
- Human Perception of Changes in Traffic Noise Levels
  - 3 dBA change is minimum most people can perceive
  - 5 dBA clearly perceptible to most people
  - 10 dBA increase perceived as a doubling

Typical Sound Levels

Noise Source or Activity	Sound Level (dBA)	Subjective Impression	Relative Loudness (human judgment of different sound levels)
Jet aircraft takeoff from carrier (50 feet)	140	Threshold of pain	64 times as loud
50-horse power siren (100 feet)	130		32 times as loud
Loud rock concert near stage, Jet takeoff (200 feet)	120	Uncomfortably loud	16 times as loud
Float plane takeoff (100 feet)	110		8 times as loud
Jet takeoff (2,000 feet)	100	Very loud	4 times as loud
Heavy truck or motorcycle (25 feet)	90		2 times as loud
Garbage disposal (2 feet) **Pneumatic drill (50 feet)**	80	**Moderately loud**	**Reference loudness**
Vacuum cleaner (10 feet), Passenger car at 65 mph (25 feet)	70		1/2 as loud
Typical office environment	60		1/4 as loud
Light auto traffic (100 feet)	50	Quiet	1/8 as loud
Bedroom or quiet living room Bird calls	40		1/16 as loud
Quiet library, soft whisper (15 feet)	30	Very quiet	
High quality recording studio	20		
Acoustic Test Chamber	10	Just audible	
	0	Threshold of hearing	

Sources: Beranek (1988) and U.S. EPA (1971).

Traffic Noise Impact Criteria

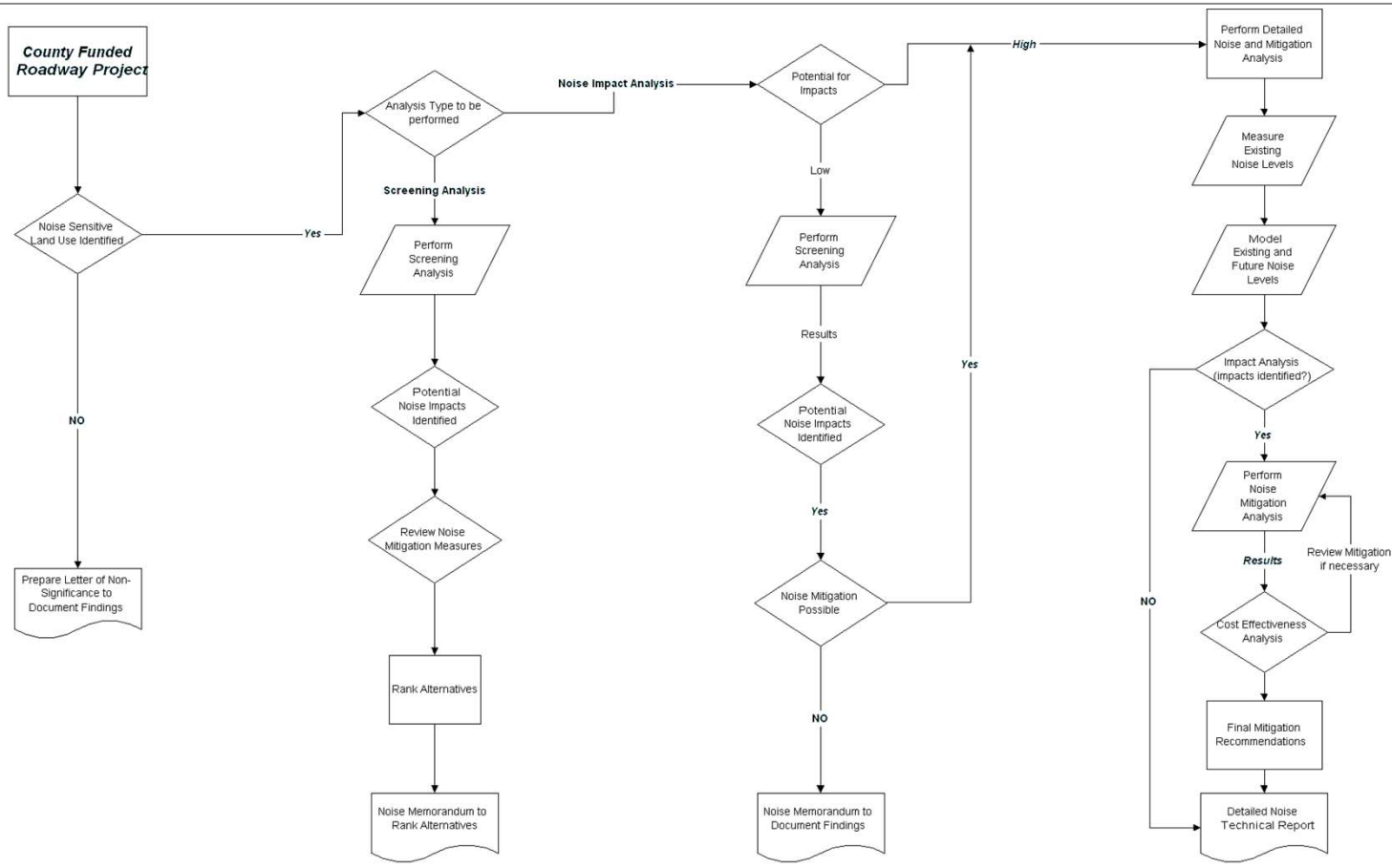
- FHWA Criteria for Noise Abatement
  - Code of Federal Regulations (23 CFR 772)
  - Approach or exceed 67 dBA Leq
  - Substantially exceed existing noise levels
  - Local jurisdictions define *approach* & *substantial*
- Washington County Absolute Impact Criteria
  - Defines approach as 1 dBA
  - Therefore abatement considered at 66 dBA Leq
- Washington County Substantial Increase
  - Considers a 15 dBA increase over the existing noise levels a substantial increase
- Noise Abatement Considered
  - For all identified impacts

Traffic Noise Abatement

- Noise Abatement Considered
  - Considered, not required
  - Must meet local criteria for reasonable and feasible mitigation
  - Also set by local jurisdiction
- Must be Reasonable and Feasible
  - Reasonable: Cost Effective Method
    - $20,000 per residence
    - Up to $25,000 noise > 71 dBA, increase > 15 dB
  - Feasible: Constructible and Noise Reduction
    - Be constructible (safety, ROW, etc…)
    - Reduction of 5 dBA or more
    - Other issues (on structure, ground, etc…)

Draft Analysis Methodology Decision Process

Figure 1: Flow Chart of Noise Analysis Methodology Decision Process



NW Bethany Blvd Noise Study

Traffic Noise Analysis Methods

- Followed *Washington County Traffic Noise Analysis Manual, March 2002*
- Met with project design team and county personnel
- Visited corridor and identified sensitive land uses use and noise sources
- Received traffic data and design files from project team
- Measured noise levels, count traffic, obtain travel speeds
- Model existing and future traffic noise levels

Work Still in Process

- Perform detailed data analysis and comparison
- Identify (refine) locations above the abatement criteria
- Consider noise mitigation where required
- Review mitigation, must be reasonable and feasible
- Review project construction noise
- Author noise report and mitigation memorandum

Noise Monitoring

- Noise levels monitored at 8 locations:
  - M1. Bethany Blvd at Avondale Dr – 73 dBA Leq
  - M2. 15720 NW Barkton (rear) – 71 dBA Leq
  - M3. 15775 NW Oak Hills Dr – 57 dBA Leq
  - M4. Bethany Blvd at Oak Hills Dr – 69 dBA Leq
  - M5. Bethany Blvd at Audrey Dr – 73 dBA Leq
  - M6. Audrey Dr at Ramona Dr – 59 dBA Leq
  - M7. 15745 NW Telshire Ln – 63 dBA Leq
  - M8. 3190 NW 159th Pl – 60 dBA Leq

Site M4 Noise Monitoring

Notes on monitoring

- *Traffic counts performed during monitoring*
- *Monitoring used to verify model*
- *Modeling used to determine impacts*

Noise Modeling

- Noise Model
  - Federal Highway's Traffic Noise Model
  - Input to the model includes:
    - Traffic: cars, medium trucks, heavy trucks for existing and year 2030
    - Speed: posted speed limit
    - Structures: existing buildings, concrete walls, etc.…
    - Ground zones: water, grass, paved areas
    - Topographical conditions: hills, elevations, etc.

Preliminary Noise Modeling Results

- Assumed worst case – peak period traffic volumes moving at posted speed
- Analyzing noise at 53 receivers representing over 150 residences located within 300 feet from Bethany Blvd
- Existing noise levels range from 56 to 72 dBA Leq
- Future No-Build noise levels increase by 1 to 3 dBA over the existing levels, to 58 to 74 dBA Leq
- Future Build noise levels increase by 3 dBA over the existing levels, to 58 to 76 dBA Leq
- Currently, 27 receivers meet impact criteria
- Under the No-Build, 35 meet impact criteria
- Year 2030 Build, 36 meet criteria

Noise Abatement Measures

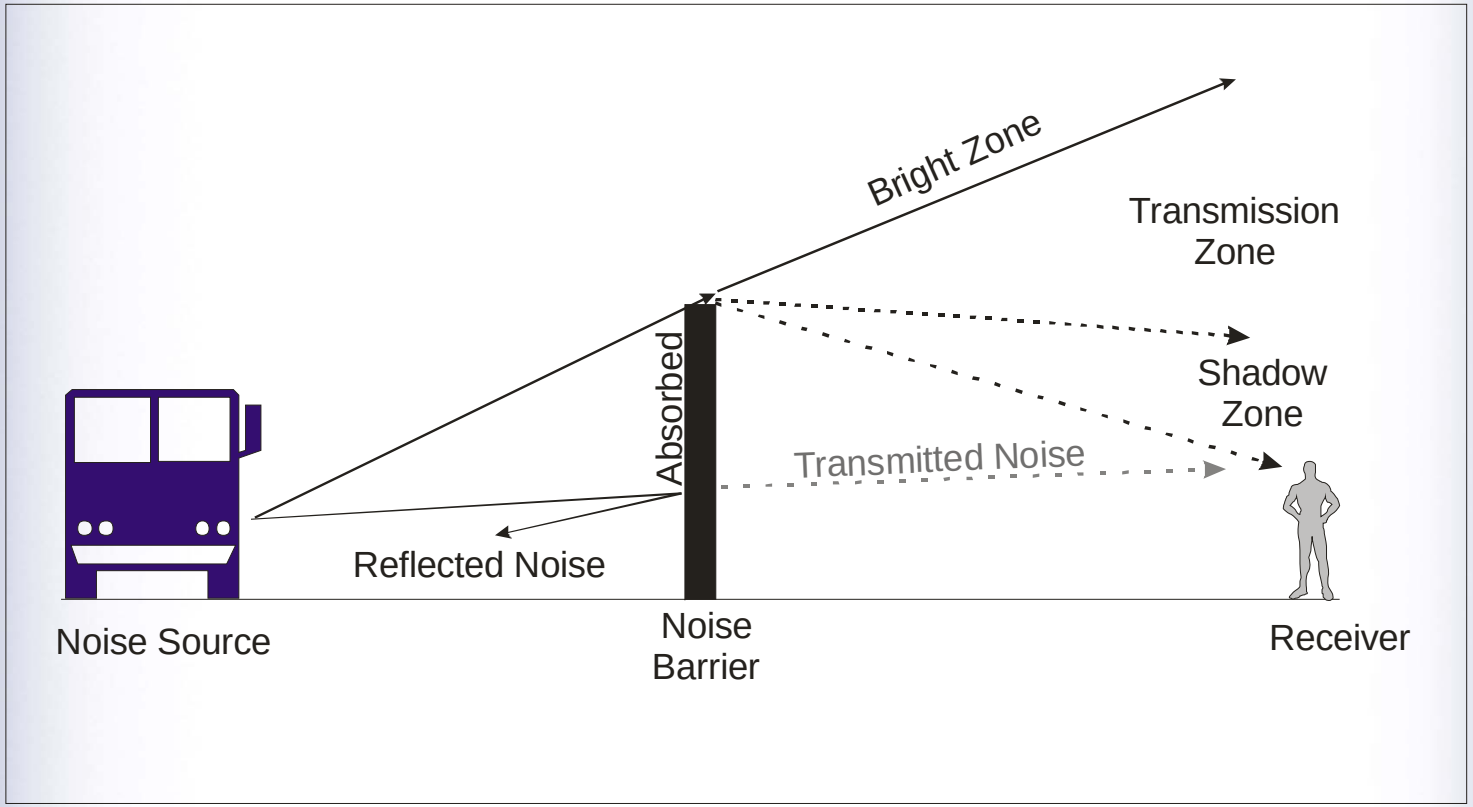
Project Design Measures:

- Traffic Management Measures
  - Speed Restrictions (*up to 3 dB/10 mph*)
  - Vehicle Restrictions *(heavy trucks are louder)*
- Design Measures
  - Depressed Highways
  - Lids
  - Special Pavement
  - Retaining Walls

Noise Mitigation Measures

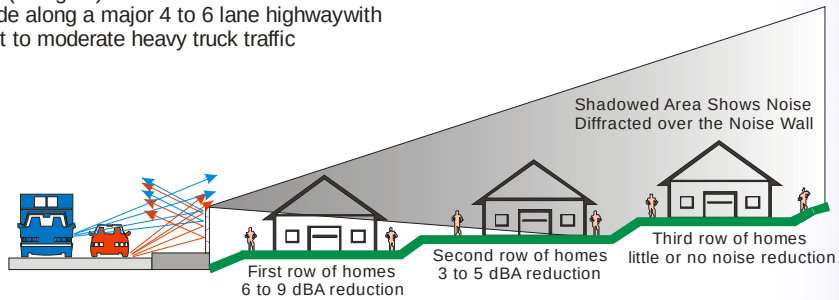
- Noise Barriers
  - Sound Walls
  - Earth Berms

How Do Sound Walls Work?

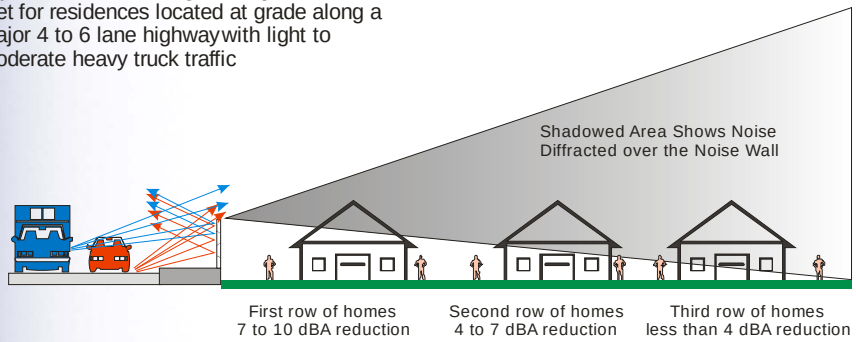


Examples of Typical Wall Heights Based on Receiver Elevation

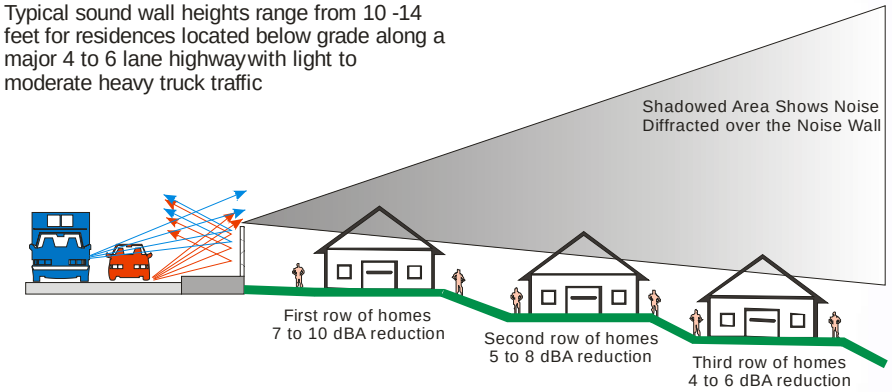
Typical sound wall heights range from 14 -18 feet (or higher) for residences located above grade along a major 4 to 6 lane highwaywith light to moderate heavy truck traffic



Typical sound wall heights range from 12 -16 feet for residences located at grade along a major 4 to 6 lane highwaywith light to moderate heavy truck traffic



Typical sound wall heights range from 10 -14 feet for residences located below grade along a major 4 to 6 lane highwaywith light to moderate heavy truck traffic



Next Steps

- Update Noise Model
  - Additional Topographical Information
  - Details on backyard elevations
  - Update and revise noise predictions
  - Check curb lines, power line locations, utilities and any other issues that could impact noise wall locations
- Consider Traffic Noise Abatement
  - Evaluate noise mitigation measures
  - Residual noise impacts (near intersections)
  - Cost of mitigation (reasonable)
  - Noise reduction (insertion loss or feasible)
  - Compare to criteria
  - Work with county on alternatives
- Complete Noise Technical Report
  - Introduction to Acoustics
  - Methods of Analysis, Measured and Modeled Noise Levels
  - Impact analysis, including detailed tables and figures
  - Mitigation Analysis, including noise reduction, location, etc…
  - Construction Noise