CELEBRATING 30 YEARS 1979 2009

# EFFECT OF DIAMOND GRINDING ON NOISE CHARACTERISTICS OF CONCRETE PAVEMENTS

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APPLIED RESEARCH ASSOCIATES, INC.
An Employee Owned Company

# OBJECTIVES

- To determine the effect of diamond grinding on the tire/pavement noise characteristics of unground and diamond ground concrete pavements.
- To identify candidate routes to monitor the long-term sustainability of favorable noise characteristics of concrete pavements.

# What Is a Decibel (dB) Level ?

| dB | Pa | |
|---|---|---|
| 180 | 20,000 | Space shuttle (@ 100')  |
| 120 | 20 | Rock concert  |
| 100 | 2 | Jet plane (@ 1000')  |
| 80 | 0.2 | Truck (@ 30')  |
| 60 | 0.02 | Normal conversation  |
| 40 | 0.002 | Whispering  |
| 20 | 0.0002 | Quiet bed room  |
| 0 | 0.00002 | |

| Change in Sound Level (dB) | Change in Perceived Loudness |
|---|---|
| 3 | Just perceptible |
| 5 | Noticeable difference |
| 10 | Twice (or 1/2) as loud |
| 15 | Large change |
| 20 | Four times (or 1/4) as loud |

# EXECUTION

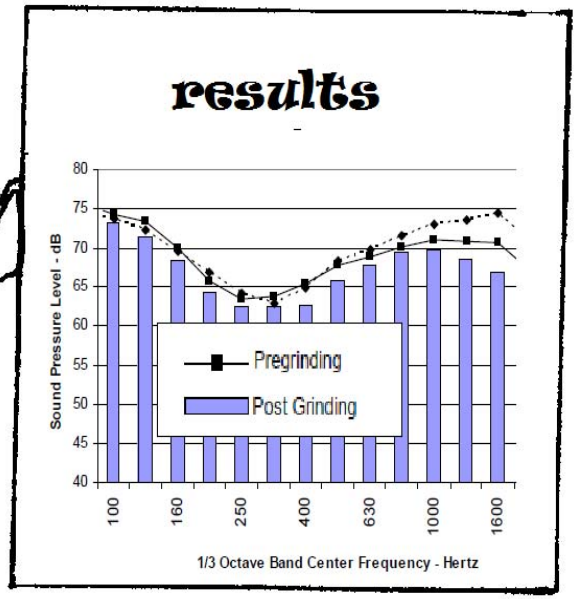
Pre-Ground

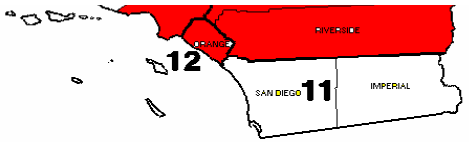
81 Sections

Post-Ground

42 Sections

Δ dBA
Effect of Grinding on Noise



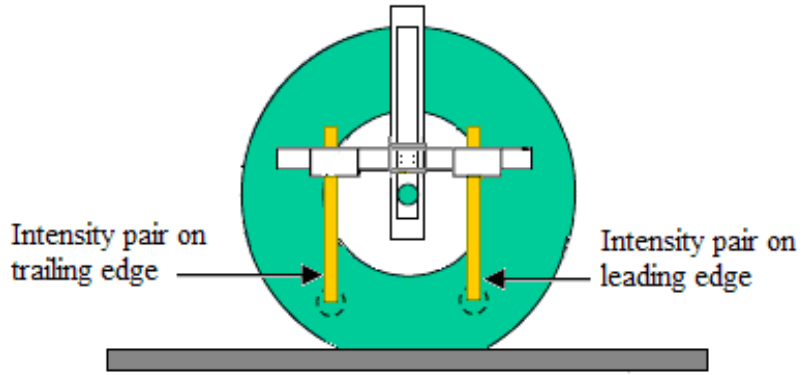



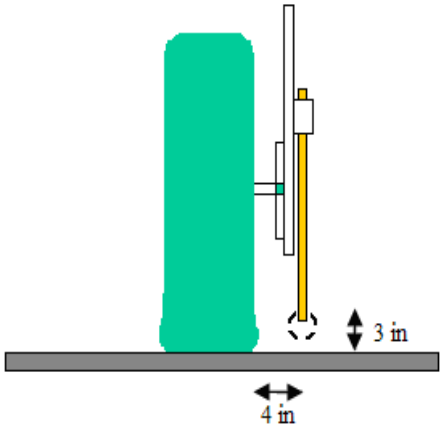

6 Routes — 42 Sections

# Test Protocol

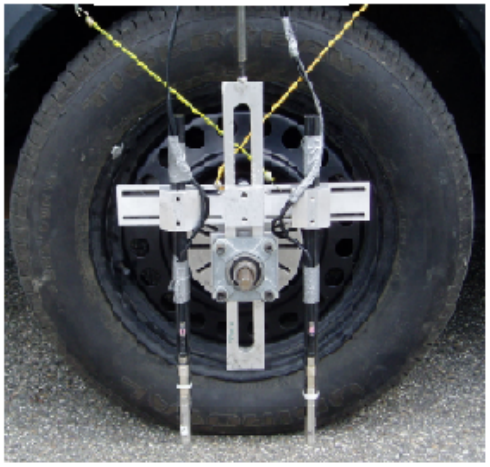
- Constant speed = 60 ± 2 mph
- Michelin Standard Reference Test Tire (SRTT)
- Cold tire pressure = 30 psi
- No significant grades
- Dry pavements only

# OBSI Measurement Equipment



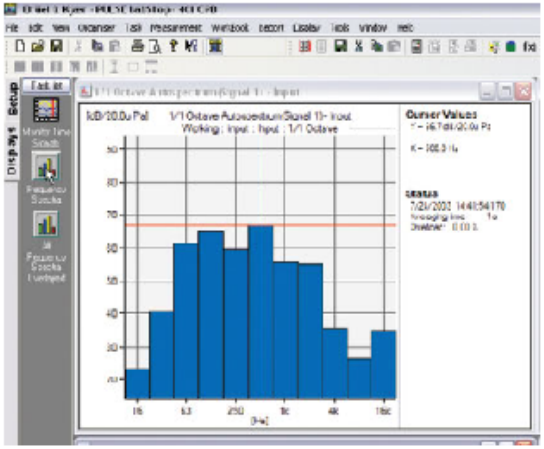




Microphone pair & mounting fixture



B&K analyser

Pulse software



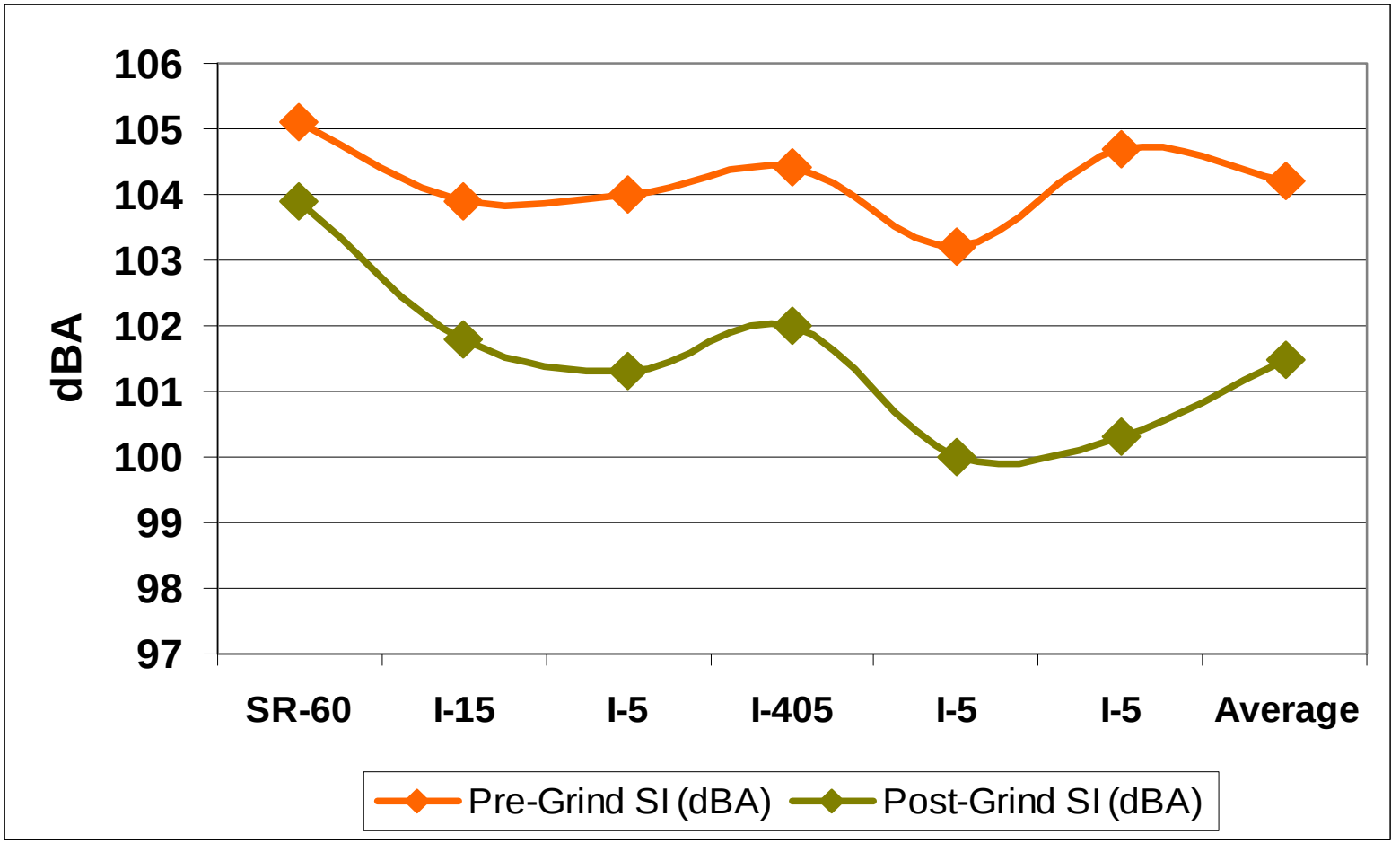
# TEST SITES




# TEST RESULTS

| Site No. | Route | County | Pre-Grind SI (dBA) | Post-Grind SI (dBA) | Reduction (dBA) |
|---|---|---|---|---|---|
| 1 | SR-60 | SBD | 105.1 (↑) | 103.9 | 1.2 |
| 2 | I-15 | RIV | 103.9 | 101.8 | 2.1 |
| 3 | I-5 | ORA | 104.0 | 101.3 | 2.6 |
| 4 | I-405 | ORA | 104.4 | 102.0 | 2.5 |
| 5 | I-5 | KER | 103.2 | 100.0 | 3.2 |
| 6 | I-5 | SAC | 104.7 | 100.3 | 4.4 |
| **Average** | | | **104.2** | **101.5** | **2.7** |

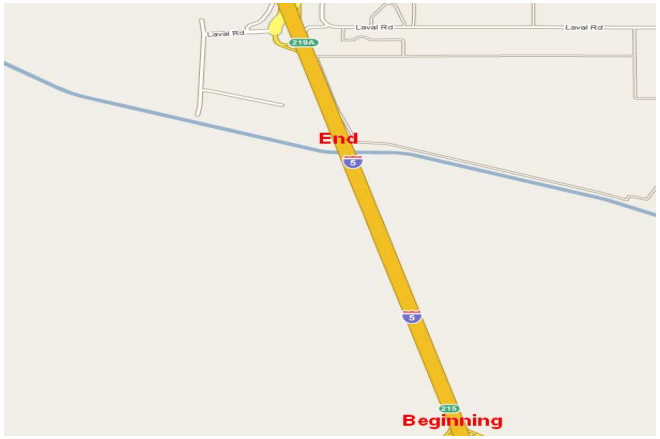
# TEST RESULTS — GRAPHICAL



# Detailed Spectral Analysis

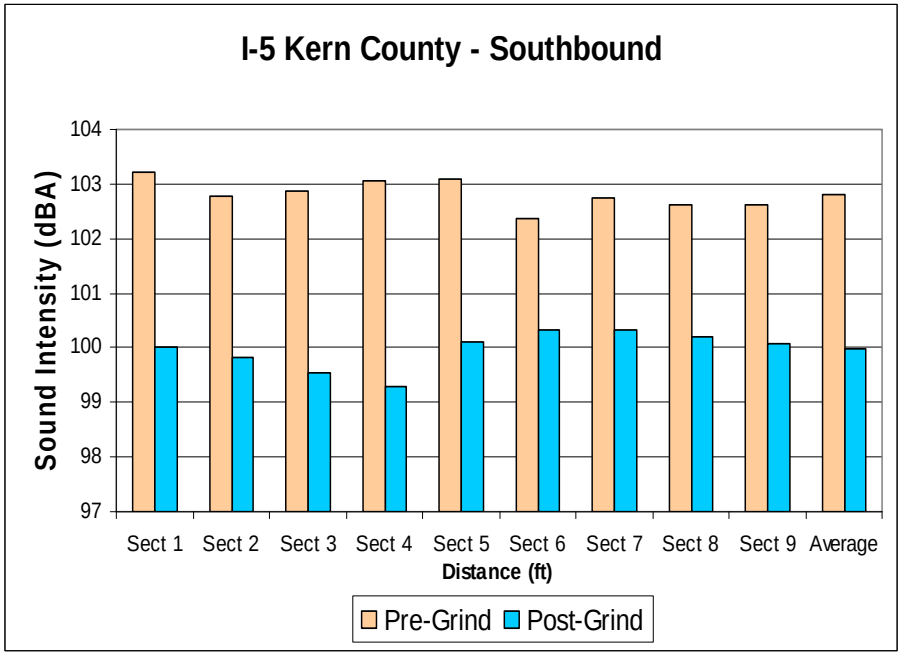
## I-5 Kern County

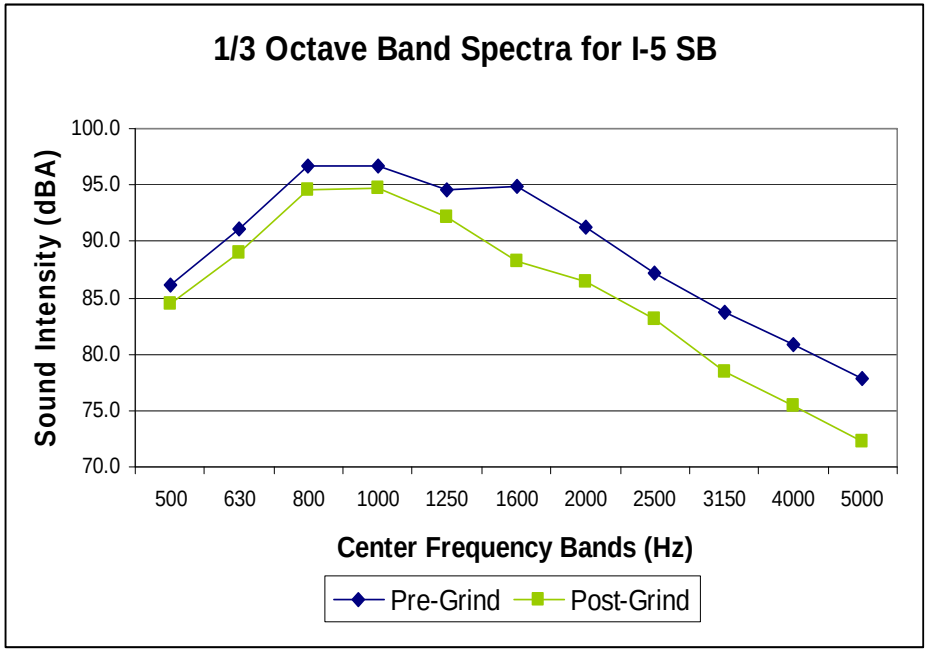
- Total No. of Sections = 14
- All data collected within one month.



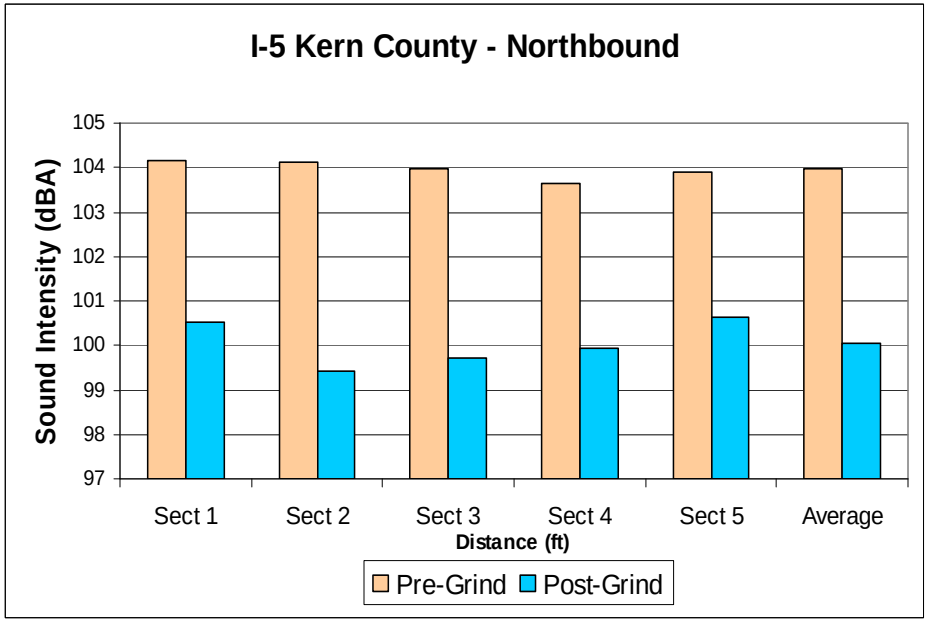

| Noise Levels (dBA) | | |
|---|---|---|
| | NB | SB |
| Pre-Grind | 104.0 | 102.8 |
| Post-Grind | 100.0 | 101.1 |

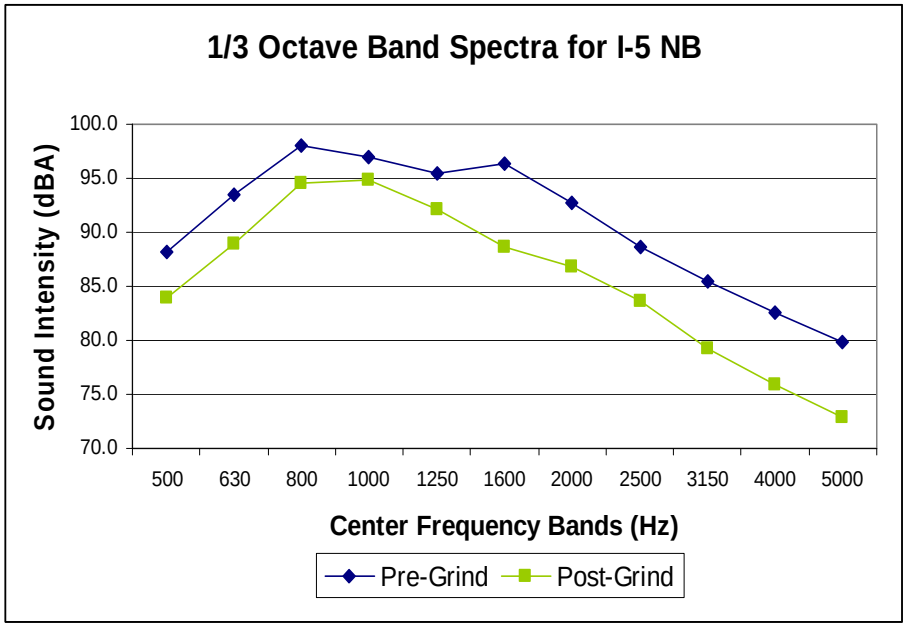
# I-5 Kern County – Octave Band Analysis



# I-5 Kern County – Octave Band Analysis



# CONCLUSIONS – I

- There is an audible reduction in SI levels after grinding.
- The highest reduction was 6.7 dBA
- The lowest reduction was 1.2 dBA (an anomaly)
- On an average the reduction was approx. 3 dBA
- The highest reductions occurred in the 1600 Hz 1/3 octave band—the “whining” band.
- The lowest reductions occurred in the 1000 Hz 1/3 octave band—a relatively low but still audible band.

# CONCLUSIONS – II

- Diamond grinding is very effective in significantly reducing the annoying “whining” noise generally associated with tined concrete pavements.
- Diamond grinding projects in California last an average of 17 years before further maintenance or rehabilitation is needed (based on reductions in IRI).
- Long-term OBSI tests can also determine the longevity of noise reductions during this 17 year period.
- Many more advantages are also achieved through diamond grinding of candidate projects (fuel efficiency, skid resistance, life extension, lower user costs, etc).

# QUESTIONS OR COMMENTS ?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