# Quieter Pavements – Options & Challenges for Washington — Brief Sheet

Washington State Department of Transportation — February 15, 2005

## Why are we looking at pavement and traffic noise?

- Many residents want solutions that will reduce noise for homes high and low, near and far – not just those close to the roadway. Standard sound barriers typically shield residents within 300 feet from the roadway.
- Requests for quieter pavement have come up in the central Puget Sound area on State Route 520, Interstate 90, and Interstate 5.
- New quieter pavements are in development that may be effective in Washington. We are looking to see if the new pavements withstand the test of safety and time to comply with state law. RCW 47.05 requires us to choose pavements with the lowest lifecycle cost.
- The Federal Highway Administration is changing its policy to allow pavement as a source of noise mitigation in the near future. We have an opportunity to control some of the noise at the source (the pavement) instead of blocking it with a wall. It is likely that pavement as noise mitigation will be allowed if after additional research and pilot projects:
    - we certify that we can achieve certain initial noise reductions,
    - the noise reductions meet a certain lifespan, and
    - we commit to replacing the pavement with one of similar noise reducing qualities in the future.

## What did we find in this phase 1 evaluation?

There is no magic solution. Each pavement has strengths and weaknesses. For example, dense grade asphalt is quieter than average when it is first installed, creates lower, more soothing frequencies from tires, and maintains many these of benefits throughout most of its lifespan.

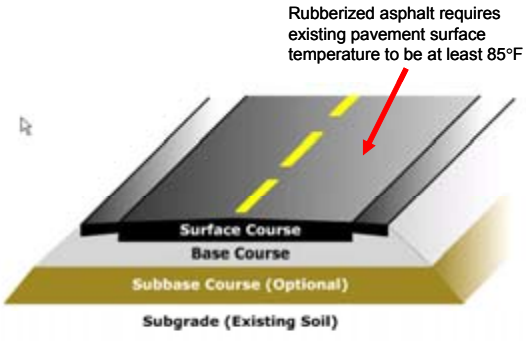
### Comparing Pavement

| Pavement Option | Initial Noise – New Pavement | | | Long-Term Noise | | | Pavement Lifespan (life to removal) | Long-Term Pavement Cost |
|---|---|---|---|---|---|---|---|---|
| | Sound Quantity (decibel change from avg) | Dominant Frequency or Pitch | Rating | Sound Quantity (decibel change from avg) | Dominant Frequency or Pitch | Rating | | |
| Open Graded Asphalt | -2 dB | Lower | Good | 0 to -2 dB | Middle /Higher | Fair/Poor | Short (4 to 10 years) | High |
| Dense Graded Asphalt | -1 dB | Lower | Good | 0 to -1 dB | Lower | Fair | Medium (14 to 18 years) | Moderate |
| Concrete | 0 to +2 dB | Depends on surface finish | Fair | Depends on studded tire damage | Higher | Poor | Long (40 to 50 years) | Moderate |
| Rubber Asphalt | (specific dB comparison unavailable) | Lower | Good | Unknown | Middle | Fair | Nighttime temperatures restrict material placement | High |

There are pavements with better initial noise reducing properties, like open graded asphalt and rubber asphalt. Unfortunately our climate and the use of studded tires affects the lifespan and noise reducing capability of these pavements in the long-term. For the decibel comparisons in the table above, please note that we cannot ordinarily hear a change in noise less than three decibels (dB) but we may be able to pick up frequency changes even when the total amount of sound does not change.

## Rubber pavements are new to Washington, how do they work?

- Rubber pavement is usually created when mixed with pieces of recycled tires. The rubber adds greater flexibility to the road, but can make it more susceptible to studded tire wear.
- Rubber pavements are successful in Arizona and California, but may be impossible to install in most of Washington due to our lower ground summer temperatures at night. We need 85 degrees Fahrenheit over a long and predictable period of time to adhere it to the road.




- Our studded tires have worn down test sections of open graded pavements in the past in as little as four years, but perhaps new innovative mixes could improve the lifespan. More study is needed.

## Additional issues that affect our choices

- The noise reductions for open graded asphalt and rubberized asphalt are temporary or unknown. The open spaces in these pavements act to capture and reduce noise energy. Pavement openings can fill up with dirt and sand after a few years and noise reduction is lost. Open graded asphalt and rubberized asphalt on heavily used roads currently cost more over time and break up faster than standard asphalt pavements. When tried on I-5 in Tacoma, open graded asphalt rutted in as little as 4-6 years.
- Studded tires are a major reason for early pavement failure. Tire studs pick at the edges of the openings causing faster development of ruts in the road, potentially resulting in safety concerns due to ponding water and hydroplaning.

- Pavements are only part of the answer to noise reduction, if they are used. Noise walls, earth berms, buffer zones, or other efforts are still needed to obtain the noise reduction requirement of at least seven decibels to provide a meaningful noise reduction for residents. A change in pavement type does nothing to reduce noise from the noticeably loud engines and exhaust systems of buses and heavy trucks.

## Where does traffic noise come from & how does pavement affect noise?

At speeds of 50 or more miles per hour most of the noise you hear comes from tires on pavement. The remaining noise comes from engine, exhaust and mechanical noises from cars and trucks. Under 50 mph, e.g., on local and arterial streets, engine and exhaust noise are more dominant than tires.

- Total noise produced depends on various factors, including:
  - Amount of traffic – more traffic equals higher noise levels
  - Percentage of trucks – higher percentages of trucks create more noise
  - Age and wear of the pavement – older, bumpier pavements tend to be noisier
  - Type of pavement – asphalt, concrete, or other mixes
  - Speed of traffic – the higher the speeds, the higher the traffic noise
- Traffic noise comes from different types of vehicles and different locations on the vehicles. The sources help explain why pavement type can reduce some noise, but not all of it. The noise sources on vehicles include:
  - Cars – noise is emitted from zero to two feet above the roadway, primarily from tire-road connection. Typical noise levels are 72 to 74 decibels (A-weighted for human hearing or dBA) at 55 mph at a distance of 50 feet.
  - Medium trucks – noise is emitted from two to five feet above roadway and comes from a combination of the tire-roadway connection and engine exhaust noise. Typical noise levels are 80 to 82 dBA at 55 mph at 50 feet.
  - Heavy Trucks – noise is emitted from six to eight feet above the roadway and comes from a combination of the tire-roadway connection, engine noise, and exhaust stack noise. Typical noise levels are 84 to 86 dBA at 55 mph at 50 feet. Exhaust stacks are located above the vehicle, generally at a height of 12 to 15 feet above the ground.

## What happens next?

- In phase 2 we will continue a more in depth evaluation of pavement options available in the United States and other applicable countries. It will be completed in the summer of 2005.
- For a potential phase 3 we will work to identify funding opportunities to test new pavement materials and surface textures against which we can measure the differences in noise from our current roadway surfaces.

## Where to go for more information?


- Material questions Tom Baker (360) 709-5401 (bakert@wsdot.wa.gov)
- Noise questions Mia Waters (206) 440-4541 (watersy@wsdot.wa.gov)