LOW VOLUME ROADS - BALANCING LIMITED FUNDING WITH PAVEMENT REHABILITATION NEEDS

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UCPRC UNIVERSITY of CALIFORNIA Davis • Berkeley PAVEMENT RESEARCH CENTER

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Overview

- Introduction
- Road investigation
- Improvement strategies
- Conclusions

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Introduction

- Defining "low-volume"
- The US road network (*2019 FHWA Highway Stats, excluding privately owned*):
  - 4.125 million miles
  - 3.407 million miles categorized as minor arterial, minor collector, or local
    - i.e., lower volume roads
  - 1.219 million miles are unpaved
    - Unpaved road network is growing due to "unpaving", both intentional and passive

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Introduction

- Problems with managing low volume roads
  - Money, money, money
    - Spending priorities based on traffic, not on all the strategic values (food, raw materials, energy)
  - Expertise, skills, and risk of innovation
  - Understanding evolution of the road
  - Inappropriate strategy choices
  - Lack of maintenance (worst-first funding model)
  - Inappropriate specifications and poor enforcement of them
- This all equals more miles than money to maintain them
- So what can we do?

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Introduction

- Start with answering the following:
  1. What have we got?
     - Site investigation
     - Budget
  2. What do we want?
     - Expectations
  3. What can we afford?
     - Reality
  4. How can we innovate to stretch budgets?
- Choose a strategy that balances rehabilitation/ reconstruction with preservation/maintenance
  - Keep good roads good, invest savings in new improvements
  - Worst-first approach is not a good strategy!

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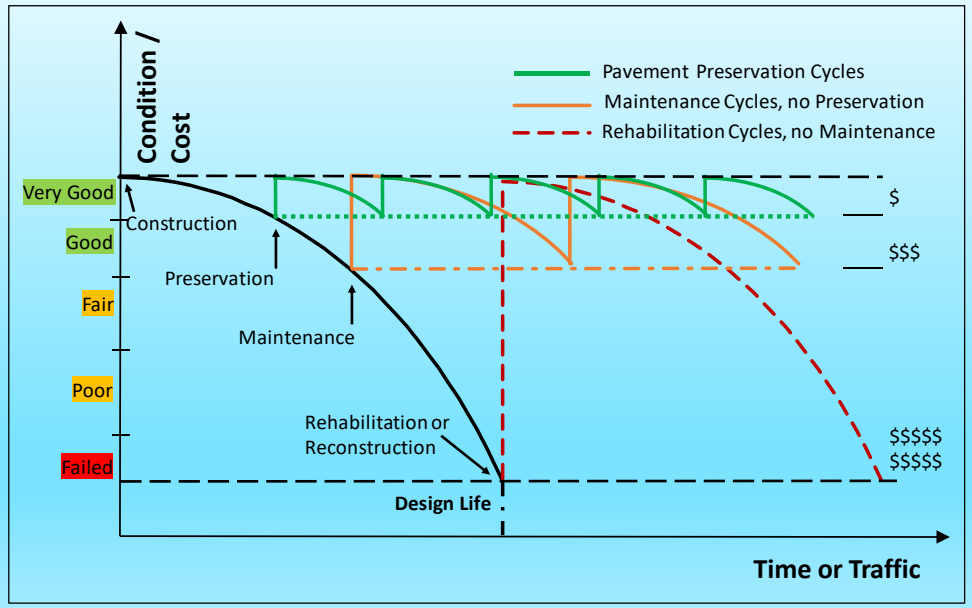
Introduction



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10 Steps to Making a Good LVR Decision

1. Investigate
2. Analyze
3. Identify sustainable options
4. Ask others
5. Narrow the choices
6. Review pros and cons of each
7. Choose an option
8. Prepare to defend the choice
9. Do it
10. Preserve/maintain it

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Investigation

- Key part of the process. Don't skip it!
- Provides information on the existing pavement structure and why it looks like it does
- Findings are used to determine an appropriate strategy
- Costs are negligible
- It's not rocket science, just rocks, a bit of science, and lot's of common sense!

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Investigation Steps

- Separate training presentation module!
- Desktop study
  - Review all available information
- Walk the road
  - Cause of distresses, drainage, safety issues
- DCP testing
  - Existing structure and subgrade conditions
- Material sampling
  - What can be reused, what is needed
- Laboratory testing
  - Gradation and plasticity
- Develop options based on results

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Improvement Strategies

- Suggestions focus on constrained budgets for severely distressed roads
- Paved roads
  - Conventional overlay (often too late)
  - In-place recycling with no additive
  - In-place recycling with additive
  - Convert to engineered unpaved
- Unpaved roads
  - Upgrade to engineered unpaved
  - Weatherproof with surface treatment (chip seal, etc.)

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Strategies for Low-Volume Paved Roads

- Limited age-related distresses
  - Preservation/maintenance treatment (microsurfacing, chip seal, rubberized chip seal, cape seal, overlay, geosynthetic + surface treatment, etc.)
  - Fix causes of problems (often water)
- AADT < 150 with severe distresses
  - Consider converting/upgrading to an engineered unpaved road
  - Performance spec plus chemical treatment (balanced mix design)
  - Can be surfaced when funds permit
  - Guidance available

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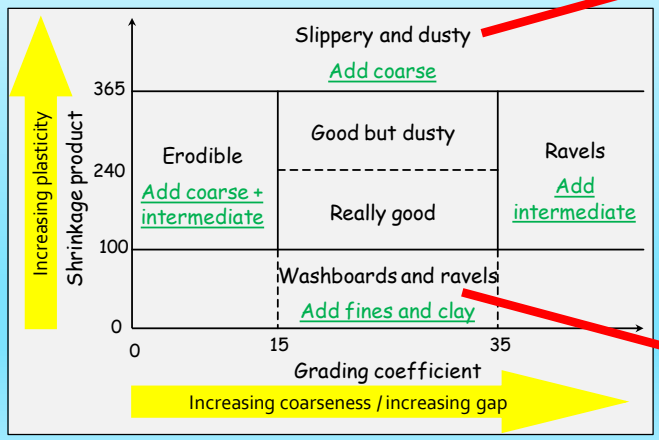
Performance Spec (Balanced Mix Design)

- Check against specification and/or use performance prediction chart



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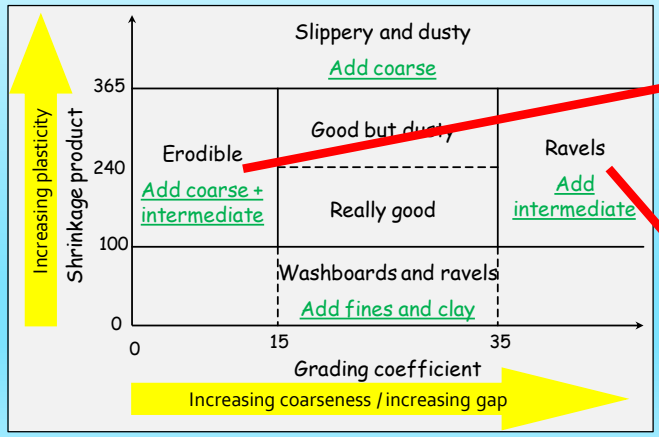

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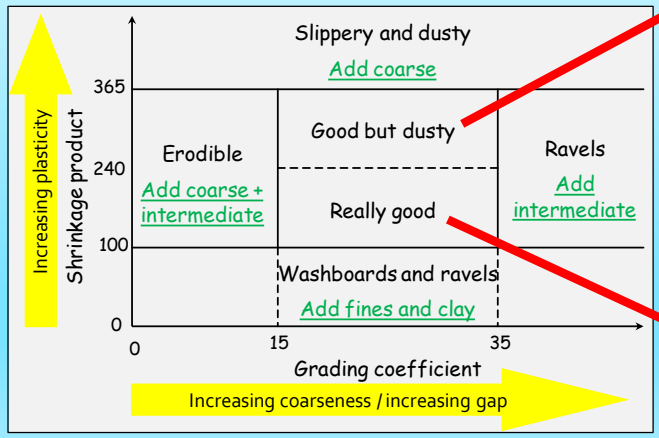

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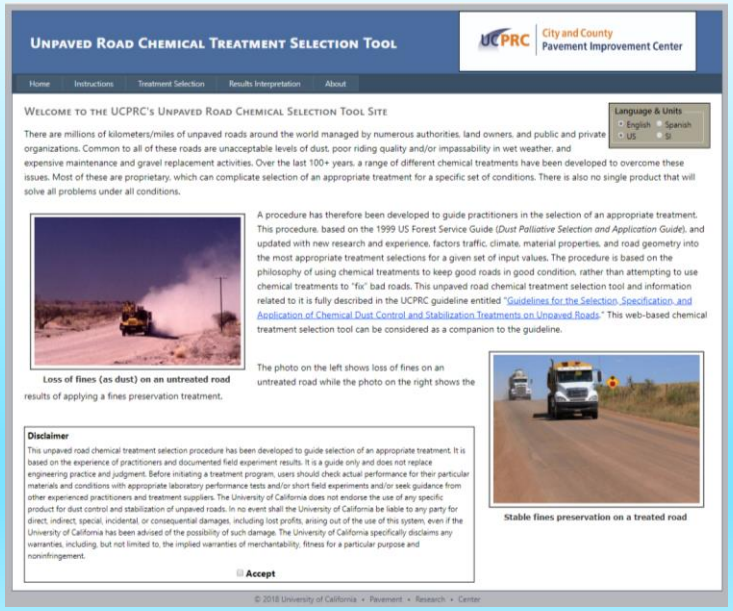

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Lakes Highway District, ID

- 2012 FHWA Scan Tour
- Systematic upgrade of network over a period of years
  - Preserve existing, use savings to upgrade next on the list
- Costs (2012)
  - Untreated average maintenance cost
    - Annual $12,500/mile
  - Treated average maintenance cost
    - Year 1 - $6,400/mile
    - Subsequent years - $4,650/mile
    - Rate of gravel loss reduced by >50%

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Strategies for Low-Volume Paved Roads

- AADT > 150 with severe distresses, limited trucks (<100k ESALs)
  - Usually too late for overlay, and reconstruction cost is prohibitive
  - Consider full-depth, in-place recycling (FDR) with no additive
  - Select recycle depth to achieve blend of existing materials to achieve good gradation
  - Add supplemental RAP if needed
  - Cover with appropriate surface treatment
  - Guidance is available

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FDR-N (pulverization)

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FDR-N (pulverization)

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Strategies for Low-Volume Paved Roads

- AADT > 150 with severe distresses, trucks (>100k ESALs)
  - Consider full-depth, in-place recycling with appropriate additive
  - Select recycle depth to achieve blend of existing materials to achieve good gradation (10 to 12 in.)
    - Add supplemental RAP if needed to increase structural capacity and/or improve drainage
  - Select additive based on material properties
    - Engineered materials (RAP and AB): emulsified or foamed asphalt
    - Marginal materials: cementitious
  - Cover with appropriate surface treatment or thin overlay

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FDR-FA

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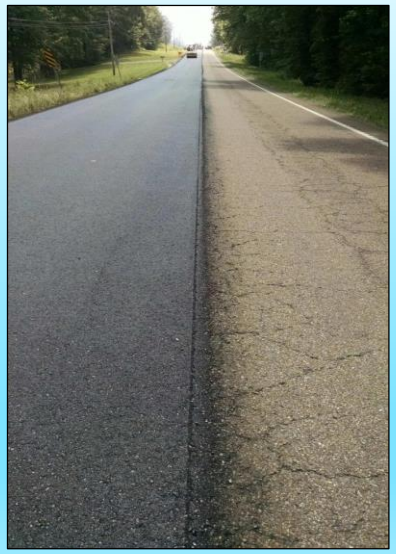
Key Recycling Construction Steps

- Use an experienced contractor with agency oversight
- Know what you are recycling
  - LVRs are inherently variable
- Monitor all activities including recycled material
- Compact to refusal density (breakover)
- Clear/improve drains
- Fog seal prior to trafficking
- Surface as soon as feasible, with a tack coat
- Enforce QC/QA of surface placement
  - For every 1% air-voids above spec = 1 year less fatigue cracking life
- Preserve/maintain



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Do Recycled Pavements Last?

- FDR-FA constructed in 2002
  - 10 in. FDR-FA with 2.5 in. overlay
  - 6,000 AADT, 20% trucks
- Designed as 5-yr maintenance intervention
- RHMA-O in 2014
- No distress in 2020
- So yes!

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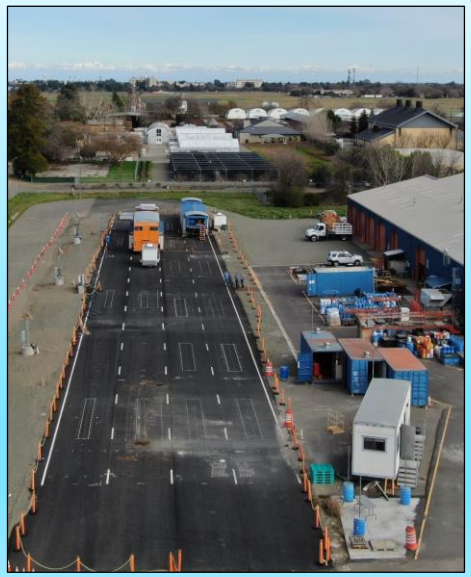
Do Recycled Pavements Last?



- FDR-FA tests
  - 10 in. FDR-FA with 2 in. overlay
  - Trafficked with HVS 24/7
  - Controlled temperature and water addition
- 34 million ESALs, 50% applied at 2.5x legal axle load limit
- No cracks, 0.25 in. rut
- So, yes!

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Conclusions

- Low-volume roads are managed with very constrained budgets
- There are many proven innovative ways to do a good job with less funds
- What ever you think of, someone has probably tried it already. Find out
- Preserve/maintain what you have; use savings to rehabilitate next priority
  - Worst-first is not an effective use of funds
- Recycling existing materials in-place is often the most cost-effective and sustainable option

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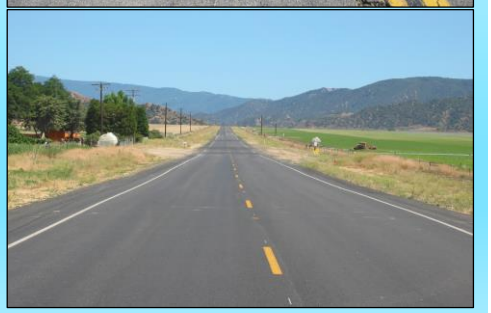
Why Recycle?

- ✓ Proven technology backed up by research
- ✓ More sustainable if designed & built correctly
- ✓ Uses all existing, paid for materials
- ✓ Requires limited new materials
- ✓ Minimizes trucking operations
- ✓ Shorter construction time, less traffic disruption
- ✓ Cost effective / lower life-cycle cost
- ✓ Removes distresses instead of covering them
- ✓ Strategies available for most pavement problems
- ✓ Selected strategies enhance structural capacity
- ✓ Extended pavement life
- ✓ Recycled roads can be recycled again
- ✓ Specifications are in place in most states
- ✓ Experienced contractors in most states



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