

# Evaluation of Pavement Preservation Treatments in Cold Regions

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By

Jenny Liu, Ph.D., P.E.

Robert McHattie, MCE, P.E.

Anthony Mullin, MCE, P.E.

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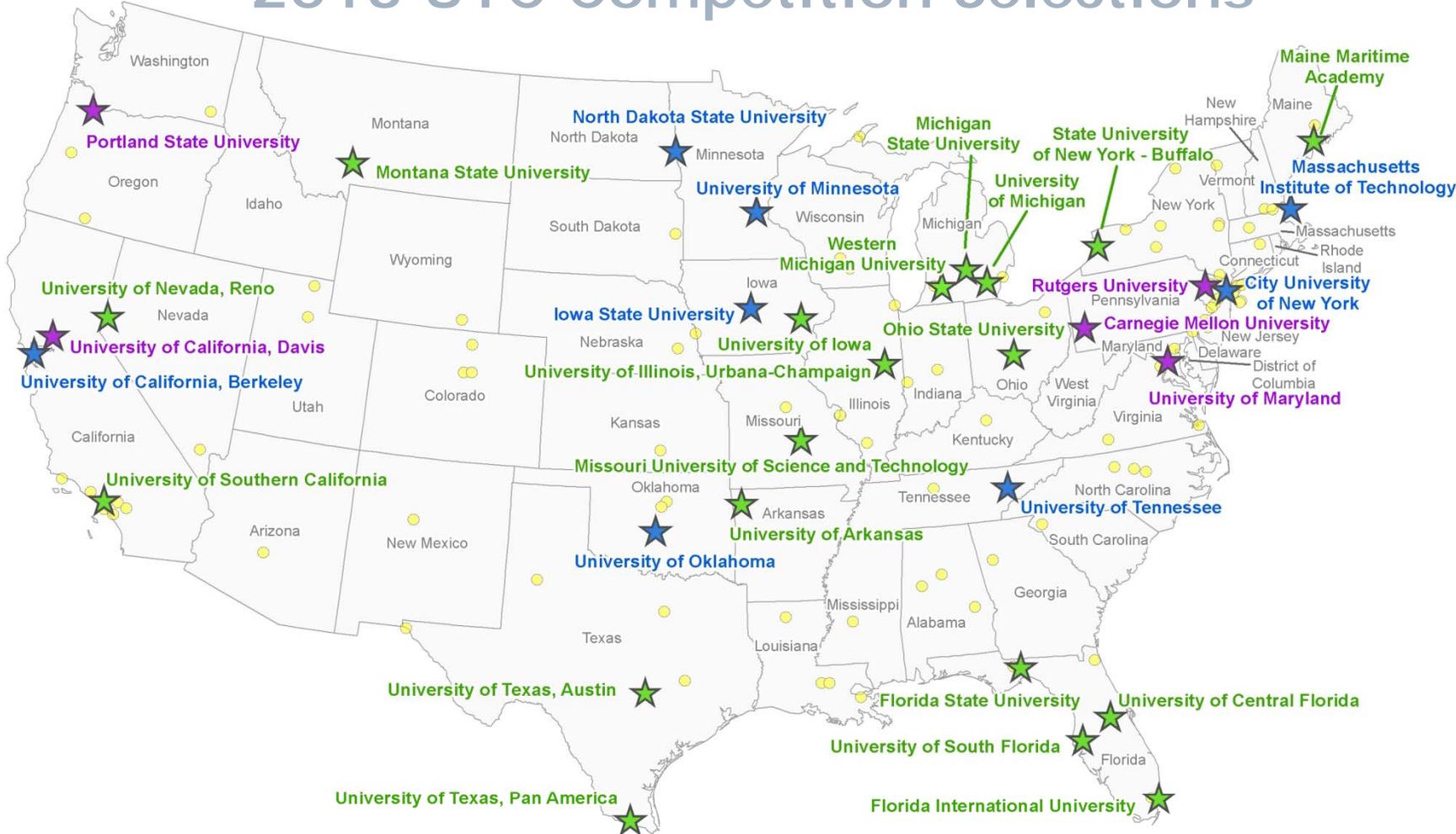
# Who are We?

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- ❑ Center for Environmentally Sustainable Transportation in Cold Climates (CESTiCC)
  - Consortium of three universities, led by UAF, and including Montana State University and Washington State University



# 2013 UTC Competition Selections



Alaska
<p>University of Alaska Fairbanks</p>

Hawaii

Puerto Rico

-  National Centers
-  Regional Centers
-  Tier 1 Centers
-  Consortium Member

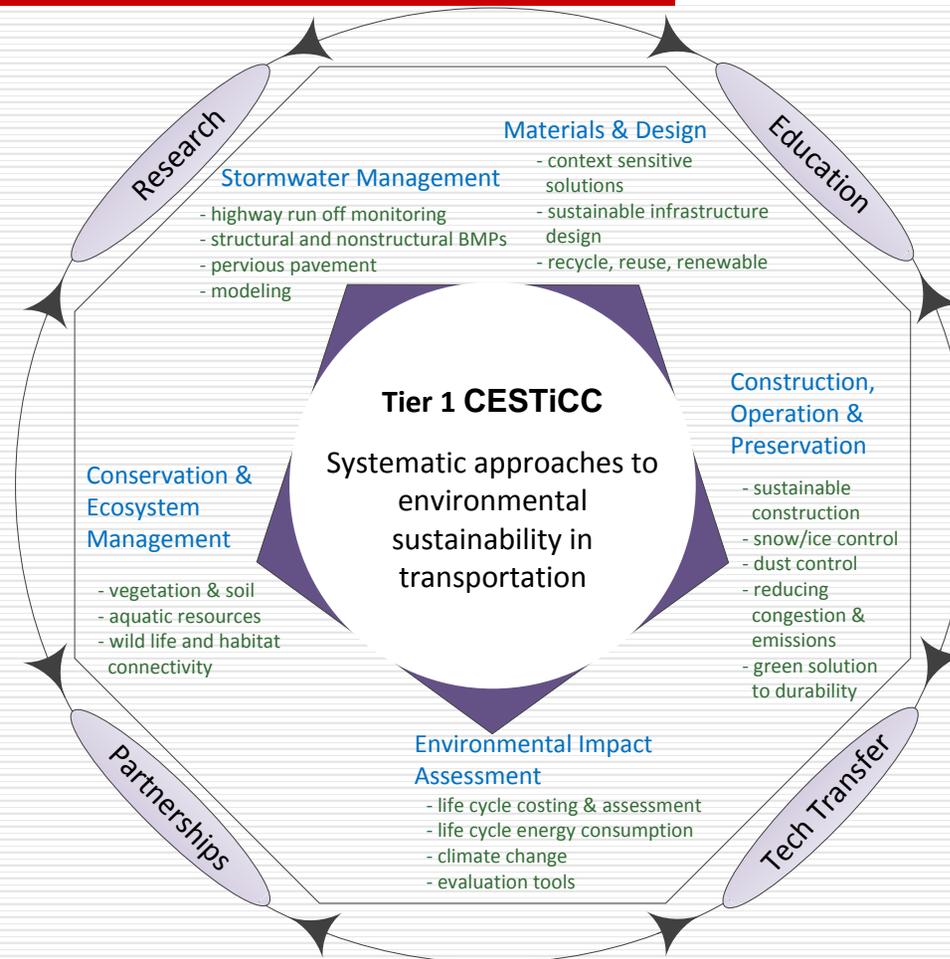
# CESTiCC Goal

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- ❑ US DOT strategic goal: Environmental Sustainability
  - to systematically engineer environmentally sustainable transportation infrastructures in cold climates, considering the entire life cycle of transportation planning, design, materials selection, construction, maintenance and operations, preservation, and recycling through the collaboration of academia, industry and other stakeholders by cross-disciplinary research, education, and technology transfer activities



# Center Focal Areas



# Five Thrust Areas

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- ❑ Advancing innovative sustainable materials and design for transportation infrastructure use in cold regions,
- ❑ Managing stormwater runoff in cold climate through improved training, monitoring, advanced technology, and pervious concrete,
- ❑ Reducing environmental impacts during construction, operations and preservation through effective design, management and preservation strategies,
- ❑ Improving the sustainability and conservation of ecosystems adversely affected by surface transportation infrastructure in cold climates, and

Environmental impact assessment.

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# Mission

- Research
- Dissemination /Implementation
- Education
- Workforce Development
- Outreach
- Technology Transfer
- Diversity



# Outline

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- Introduction
- Evaluation of pavement preservation treatments
- Field evaluation of crack sealing of AC pavement in Alaska
- On-going research and opportunities
- Summary



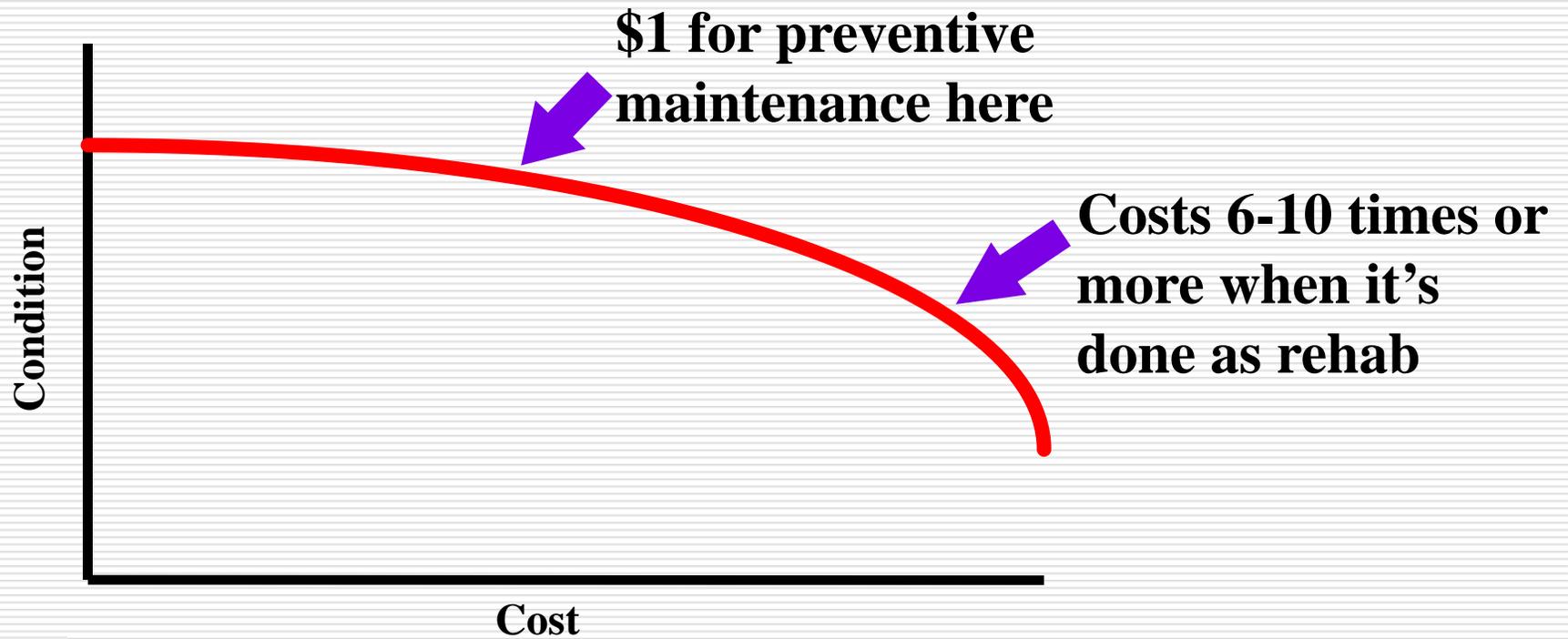
# Introduction – Pavement Preservation

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- ❑ Representing a proactive approach in maintaining existing highways. With timely preservation, we can provide the traveling public with improved safety and mobility, reduced congestion, and smoother, longer lasting pavements.
- ❑ Non-structural, lowest life cycle cost, minor rehabilitation, preventive maintenance and routine maintenance.



# Effective Pavement Preservation



# Introduction – Pavement Preservation

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- ❑ A sound pavement preservation program to optimize paving funds
- ❑ AKDOT&PF would like to utilize effective pavement preservation techniques and better serve the public road system in Alaska
- ❑ Many pavement preservation techniques may not be suitable in cold regions
- ❑ Recent research efforts to developing guidelines for pavement preservation treatments and for building pavement preservation program platform for Alaska



# Evaluation of Pavement Preservation Treatments

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## Objectives

- Evaluate road sections in Alaska that have received a preservation treatment.
- Identify the types of treatments.
- Identify treatment performance.
- Which treatments should be considered for future use and state of the practice.



# Evaluation of Pavement Preservation Treatments

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- ❑ A total of 44 road sections were evaluated
- ❑ Five cities/towns: Anchorage, Fairbanks, Northpole, Juneau, and Gakona
- ❑ Pavement Surface Evaluation and Rating (PASER) manual for asphalt roads was used to evaluate the distresses for the road sections
- ❑ Five preservation treatments have been used to date in Alaska including: thin HMA overlays (8), chip seals (25), slurry surfacing (2), crack sealing (8), and pre-saw cut joints (1)



# Thin HMA Overlays

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Before application  
(PASER rating – 5)



After application  
(PASER rating - 9)

(Cross Way, North Pole, 2011)



# Thin HMA Overlays

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Debarr Rd, Anchorage – Tight transverse crack spaced 40 ft.  
Thin overlay placed one year ago. ADT approximately 21,000.



# Thin HMA Overlays

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- ❑ One of the most popular preservation treatment used in Alaska (used in each of the three regions)
- ❑ Typical HMA overlay thickness is 2 inches
- ❑ Central Region (Anchorage) uses this treatment to mitigate existing rutting
- ❑ Northern Region (North Pole) attempts to address thermal cracking, permafrost degradation, and other distresses



# Slurry Surfacing (Eielson AFB)

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Before application  
(PASER rating – 7)



After application  
(PASER rating – 9)



# Slurry Seal

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(Applied in summer 2005; Photo taken August 2011)

# Slurry Surfacing

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- ❑ Microsurfacing applied at Eielson in 2003: approximately eight years old with a smooth surface, no rutting and no cracking
- ❑ Slurry seal applied in 2003: minor thermal cracking
- ❑ Both performed well in Northern Region



# Chip Seal



19<sup>th</sup> St by Arctic intersection, Anchorage – Chip Seal placed 2001. Transverse cracking from thermal stresses and longitudinal from frost.



# Double Chip Seal

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Farmers Loop, Fairweather to Summit, Fairbanks, chip seal 2008, photo taken in 2011, PASER rating - 7

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# Chip Seals

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- ❑ A total of 25 road sections with chip seal surveyed
- ❑ Different areas exhibited different problems: transverse cracking and permafrost degradation in Fairbanks area, and bleeding and cracking in Anchorage area.
- ❑ When placed correctly for areas with good drainage and low traffic, the chip seals performed well (Duben St., Anchorage)



# Crack Sealing

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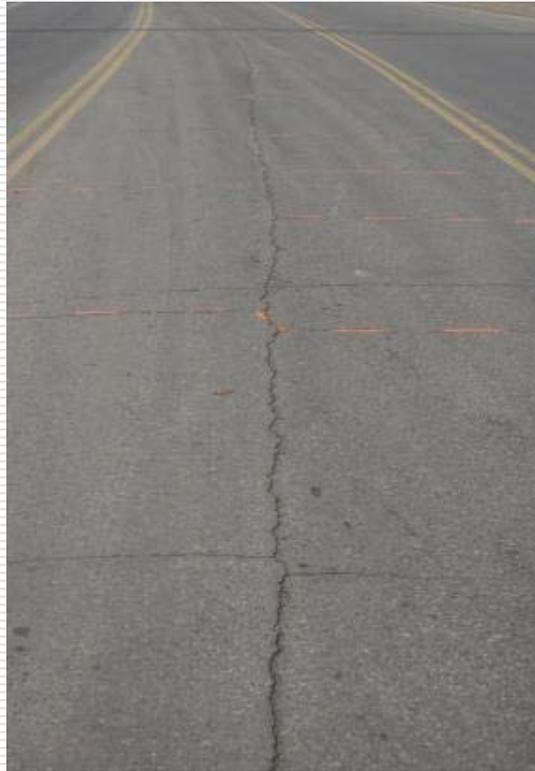


Old Seward Highway, Anchorage, crack sealing in 2011, Photo taken in 2011, PASER rating – 4



# Crack Sealing (South Cushman, Fairbanks)

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Before



After



# Crack Sealing

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- A very common practice in Alaska.
- No matter if crack sealing projects surveyed are newly or previously applied, cracks of different types with different severity levels can be seen.
- Hard to tell old cracks occurring previously or new cracks after cracking sealing is applied.



# Pre-saw Cut Joints

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Philips Rd, Fairbanks, pre-saw cut joints in 2000,  
photo taken 2011, PASER rating – 6

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# Pre-saw Cut Joints

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- ❑ Made on a new section of HMA with approximately 50 ft spacing without sealing pre-cut joints.
- ❑ In over a decade there is no substantial deterioration to warrant any rehabilitation work. There are not any substantial cracks in between most pre-cut joints.
- ❑ Pre-cuts initiate stress concentrations at the cut locations while relieving stresses at other locations in the pavement.



# Summary of Service Lives

Treatment	Service life, years		Treatment	Service life, years	
	Literature	Survey		Literature	Survey
Crack Sealing	3-8	3.4	Microsurfacing	3-9	6.0
Patching	4	3.6	Thin Overlays	5-12	6.8
Fog Sealing	-	3.4	Bonded Wear Courses	7-12	7.1
Chip Sealing	3-10	5.6	Interlayers		6.8
Slurry Seals	3-5	4.6	In-place Recycling	6-15	7.8
AST/BST	-	6.0			



# Field Evaluation of Crack Sealing Treatment in Alaska

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Is this Particular Practice  
Economically Worthwhile?

Sealant Use Noticed in Several  
Salt Lake City, Utah  
Parking Lots & Side Roads



# Background

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- ❑ Crack Sealing is the most common preservation technique.
- ❑ Much M&O funding is spent on sealing cracks
- ❑ Effective sealing of cracks is difficult in Alaska's environment.
- ❑ Years of observations suggested that sealing effort may be reduced.
- ❑ We needed to evaluate thermal crack sealing in a meaningful way.



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# Was the study economically important to Alaska?

Based on Parks Highway data:

~ \$2,600 per centerline mile per year for sealing  
(Alaska has ~ 5,000 centerline miles of paved road)



# Objectives

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- ❑ Define areas where sealing is best done or avoided.
- ❑ Collect data with photo's, qualitative data, and quantitative data.
- ❑ Provide recommendations on which thermal cracks to seal or not seal and for what situations.



Richardson  
Hwy, left  
Sterling Hwy,  
Right

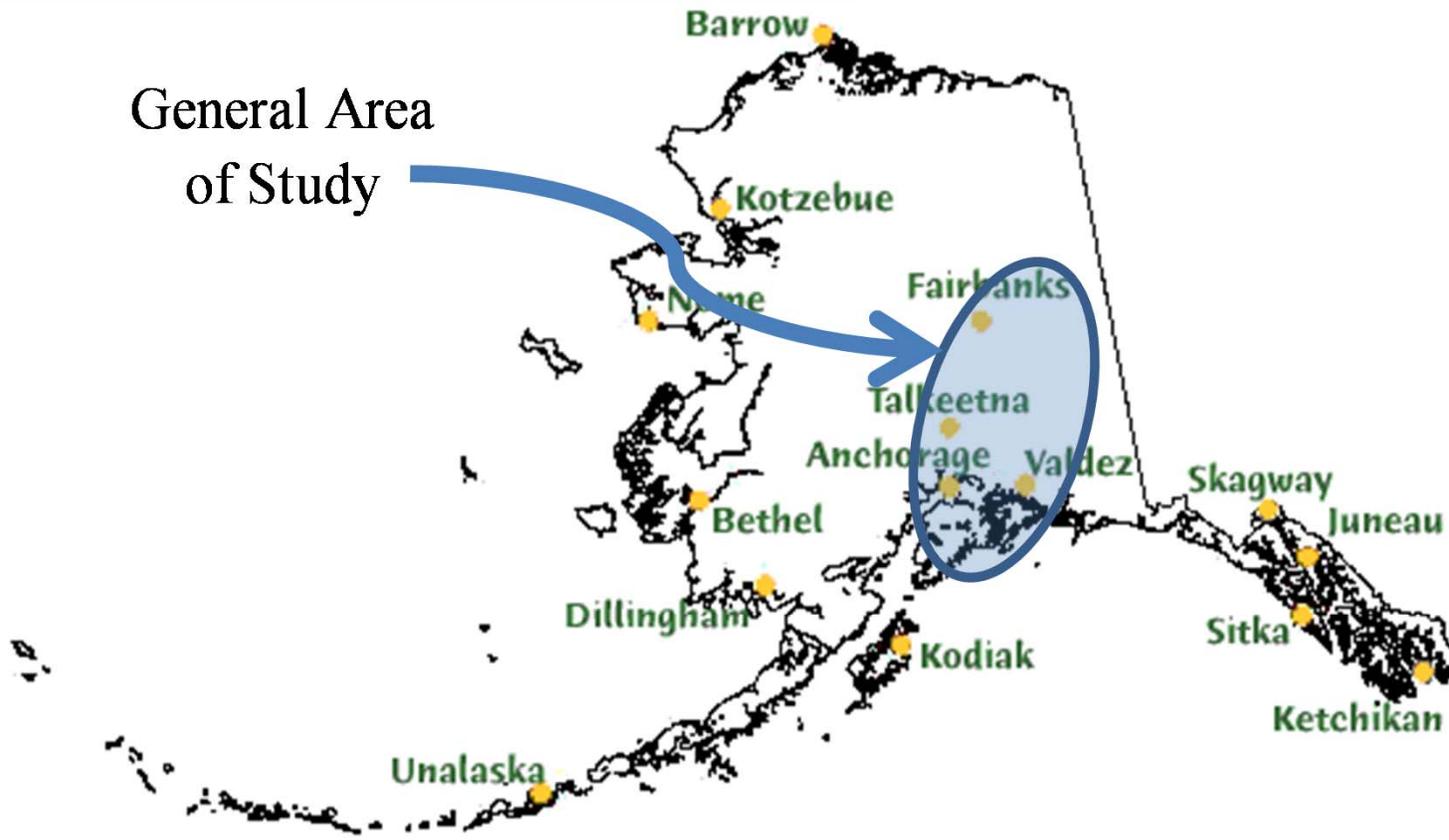


# Field Site Selection

- ❑ AC pavement with a minimum pavement surfacing age of 20 years
- ❑ 91 sites located in non-urban areas on the interconnected network of roads comprising Alaska's main highway system
- ❑ Alaska, Elliot, Glenn, Parks, Richardson, Steese, Sterling, Tok Cutoff



# General Area of Study



Source of Alaska Map: Larry Pearson, Alaska Scenes



# Site Selection – Actual Locations



# Data Collection Methods

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- PASER – qualitative, rating from 1 (failed road, total reconstruction) to 10 (newly constructed road)
  
- LTPP – quantitative
  - Count the number of thermal cracks at low, medium, and high severity.
  - Measure the lengths of thermal cracks at low, medium, and high severity.
  - Measure the length of effectively sealed thermal cracks at low, medium, and high.
  
- Special Thermal Crack Evaluation (STCE) – photos and expert opinion



# Two Types of Thermal Cracks in STCE

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Major



Lessor



# Data - STCE

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- Does the condition of the thermal cracks themselves tend to deteriorate with time?
  - Theory says they should be affected by repeated vehicle loadings.
  - This question is addressed by comparing the condition of thermal cracks in wheel path versus non-wheel path areas on old pavements.



# Data - STCE

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- Do thermal cracks negatively influence other aspects of pavement performance?
  - This is assumed to be the case in all pavement preservation literature.
  - The question is addressed by examining the pavement for signs of fatigue cracking, potholing, excess rutting, or other signs of structural softening in the vicinity of thermal cracking on old pavements.



# Data - STCE

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- Is sealing of thermal cracks necessary?
  - Standard practice says yes.
  - This question is addressed by comparing the condition of sealed cracks versus non-sealed cracks on old pavements.



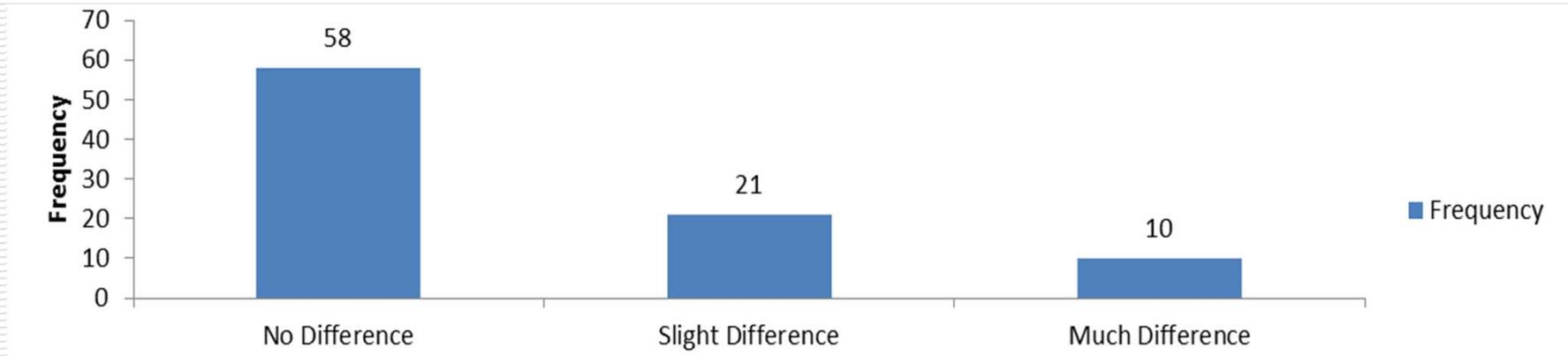
# Data - STCE

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- Major thermal cracks and lessor thermal cracks are examined as two separate thermal crack types.
- Does traffic affect thermal cracking – wheel path vs. non-wheel path?
- Does thermal cracking cause other pavement distresses such as fatigue cracking and potholes?
- Is the overall condition of the pavement maintained or improved by sealing thermal cracks?



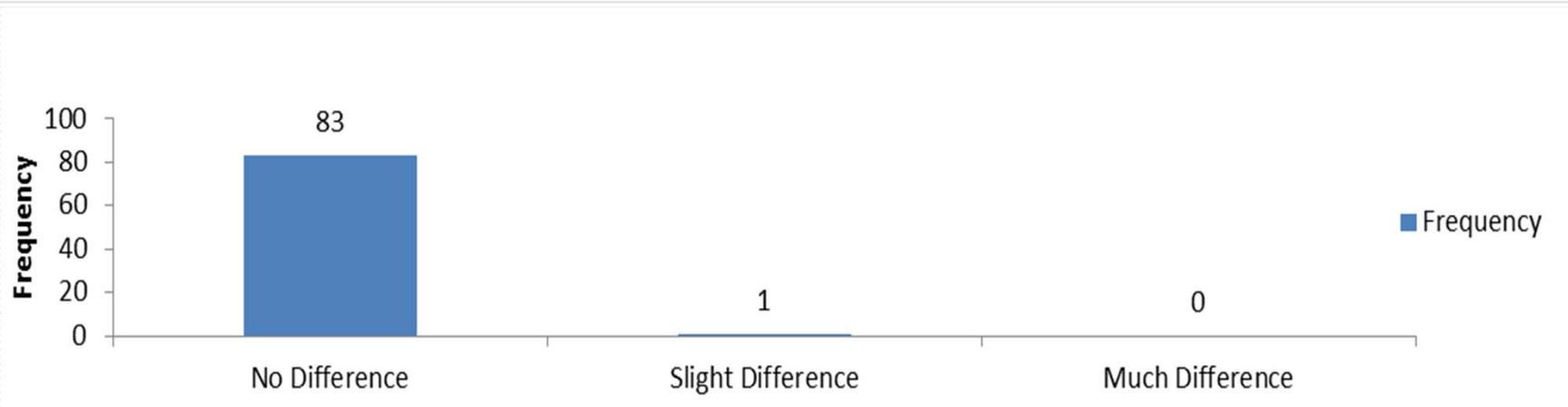
# Data Analysis



**Condition of major transverse cracks (wp Vs non-wp\*)**  
*(\* wheel path versus non-wheel path)*



# Data Analysis



**Condition of lessor thermal cracks (wp Vs non-wp)**



# Photo Interpretation

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Examples of major thermal cracks causing no other pavement distresses.



# Photo Interpretation

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Examples of lesser thermal cracks with no difference between wheel path vs non-wheel path



# Recommendations

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- Educate (need to be able to recognize thermal crack types)
- Do not seal lessor thermal cracks



## Recommendations (Cont'd)

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- ❑ Major thermal cracks on old pavements – do not seal if degradation is not apparent.



## Recommendations (Cont'd)

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- ❑ Major thermal cracks on newer pavements – seal every other crack.

Anchorage; 1yr, thin  
HMA overlay thermal  
cracks spaced 40ft



## Recommendations (Cont'd)

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- ❑ Major thermal cracks with severe bumps – apply band patch/seals, aids with leveling.



## Recommendations (Cont'd)

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- ❑ Areas showing signs of delamination – apply sealant if the section will not be reconstructed within the current construction season.



# On-going Research and Opportunities

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- ❑ Sustainable thermal crack maintenance
  - ❑ Control thermal cracks/build “better” thermal cracks



# On-going Research and Opportunities

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- ❑ Test sections at Richardson Hwy, 20 miles SE of Fairbanks, 2012



- ❑ Test sections at Parks Highway, 100 miles SW of Fairbanks, 2014
- ❑ Continuing evaluation of a more sustainable and generally improved form of thermal crack maintenance and preservation



# Summary

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- ❑ Pavement preservation treatments are widely used in cold regions. Five preservation treatments have been used to date in Alaska.
- ❑ Different treatments provided varied improvement of pavement life. Same treatments may be applied to different regions but to prevent or mitigate different failure modes. Use of some treatments should be considered job specifically.
- ❑ Crack Sealing is the most common preservation technique. However, significant maintenance funds can be saved or redirected by not sealing or by reduced sealing of thermal cracks in AC pavements depending on the forms of thermal cracks.
- ❑ Precutting treatment appears promising to control thermal cracks. Continuing evaluation and monitoring of test sections are needed to recommend an effective design methodology and construction practice for Alaska and cold areas of other northern states.



Thank you!

Questions?



# Contact

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## Collaborative Research, Outreach, and Tech Transfer

**Please contact: Jenny Liu, Ph.D, P.E.**

907-474-5764, [jliu6@alaska.edu](mailto:jliu6@alaska.edu)

Center website: <http://ine.uaf.edu/cecticc/>

