

Alaska Department of Transportation & Public Facilities

Research, Development & Technology Transfer



Annual Report FFY 2015

Research Development and Technology Transfer Alaska Department of Transportation & Public Facilities

The Research Development and Technology Transfer (RD&T2) Section within the Division of Design and Engineering Services of the Alaska Department of Transportation & Public Facilities (ADOT&PF) provides research management, library, technical assistance, training, and technology deployment services to ADOT&PF, local transportation agencies, and their partners.

RD&T2 provides services largely through the collaborative relationships with and financial support from the Federal Highway Administration. By leveraging resources and developing partnerships with a variety of transportation organizations and professionals, RD&T2 taps into a vast network of expertise and resources and eliminates duplication of effort. RD&T2 also provides an avenue for multidisciplinary support from a network of engineering, management, leadership, law, planning, and the environment.

This is a report of the research, development, and technology transfer activities carried out by the ADOT&PF and its partners. This report covers federal fiscal year 2015, beginning October 1, 2014, and ending September 30, 2015.

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Alaska Technology Transfer

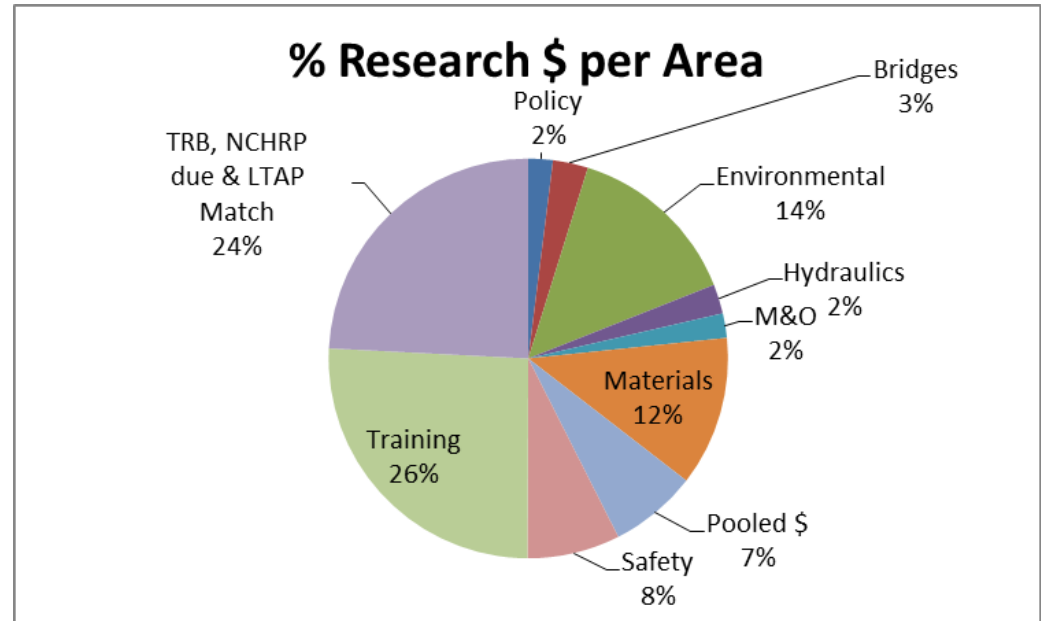
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RD&T2 received funding from the Federal Highway Administration's (FHWA) State Planning and Research Program (SP&R), Local Technical Assistance Program (LTAP), Surface Transportation Program (STP), and state matching funds (SM). Additionally, RD&T2 leverages funding with the Alaska University Transportation Center (AUTC), Pacific NW Transportation Consortium (PAC Trans) and the FHWA's Transportation Pooled Fund Program. There are other State Transportation Projects that have some research elements. These projects are not included in the fiscal summary

FFY 2015 RD&T2 Fiscal Summary	2015
Revenues	
SP&R Program Funds (STIP ID#6451)	\$ 2,000,000
NHI Funds (STIP ID#6452)	\$ 350,000
State Funds (outside of match \$)	\$ 0
Local Technical Assistance Program	\$ 300,000
Reinvested Project Closures	\$ 45,000
Total	<u>\$ 2,695,000</u>
Expenditures & Obligations	
NCHRP Dues	\$ 351,999
TRB Core Services	\$ 103,616
T2 SP&R Match	\$ 155,615
Pooled Fund Studies	\$ 179,000
Technology Transfer / LTAP	\$ 650,000
Research Project (old projects increases)	\$ 175,000
Research Project Programming (New Obligations)	\$ 911,000
Total	<u>\$ 2,526,230</u>

Research Funding Distribution in FFY15

<i>Research Funding Distribution Category</i>	<i>Total</i>
Administration & Policy	\$50,000
Alaska Marine Highway System	\$0
Bridges	\$72,000
Environmental	\$358,000
Geotechnical & Foundations	\$0
Hydraulics & Hydrology	\$60,000
Maintenance & Operations	\$50,000
Materials & Construction	\$306,000
Pooled Fund Studies	\$179,000
Safety & Traffic	\$190,000
Technology Transfer Training (LTAP, Rapid Technology Transfer & NHI)	\$650,000
TRB, NCHRP & LTAP Match Contributions	\$611,230
Grand Total (17 Projects Programmed)	\$2,526,230



Acronyms

ADOT&PF	Alaska State Department of Transportation & Public Facilities
AUTC	Alaska University Transportation Center
CRREL	Cold Regions Research & Engineering Laboratory
FHWA	Federal Highway Administration
GF	General Fund (State of Alaska)
LTAP	Local Technology Assistance Program
M&O	Maintenance & Operations
MSU	Montana State University
NCHRP	The National Cooperative Highway Research Program
NCSU	North Carolina State University
NHI	National Highway Institute

PacTrans	Pacific Northwest Transportation Consortium
RD&T2	Research, Development & Technology Transfer
SHRP	Strategic Highway Research Program 2
SP&R	(FHWA) State Planning & Research
STIP	Statewide Transportation Improvement Program
STP	(FHWA) Surface Transportation Program
TRB	Transportation Research Board
UAA	University of Alaska Anchorage
UAF	University of Alaska Fairbanks
UofI	University of Idaho
WTI	Western Transportation Institute

14 New Projects Starts in FFY2015 using SP&R Funds			
Title	AKSAS Project #	Category	Total Current Project Funding
Technology Transfer Program CY2015 (LTAP)	60537	Training & Tech Transfer	\$300,000
National Highway Institute (NHI) CY2015	63990	Training & Tech Transfer	\$350,000
<u>Rapid Research Response FFY 2014-16</u> Bald Eagle Monitoring Completed in FFY15	64006	Environmental	\$33,000
Optimizing Highway Patrol Investments	63068	Safety	\$70,000
Frequency and Potential Severity of Red Light Running in Anchorage2	76293	Safety	\$120,000
Field Evaluation of Precut Thermal Cracks	76291	Materials & Construction	\$72,000
Dust Control Product Mix Design & Quality	76307	Materials & Construction	\$144,000
Use of Steel Fiber Reinforced Rubberized Concrete in Cold Regions	76319	Materials & Construction	\$90,000
Pile Extension Pushover Software	76287	Bridges & Structures	\$72,000
Catastrophic Icefall Hazard Assessment	76317	Maintenance	\$50,000
Developing Guidelines for 2-Dimensional Model Review	76289	Hydraulics & Hydrology	\$60,000
Paperless NEPA	76283	Environmental	\$120,000
Peer Exchange – NEPA Assignment	76285	Environmental	\$30,000
RWIS Power Sources, Phase 2	76321	Administration & Policy	\$50,000
		TOTAL	\$1,736,000

12 Active Research Projects Started in FFY2014				
Title	T2 Project #	AKSAS Project #	Category	Total Current Project Funding
Experimental Feature Spray Applied MMA Bridge Deck Waterproofing Membrane	T2-14-06	64317	Bridges & Structures	\$29,000
Experimental Feature Wavetronic Radar Detection through Experimental Features	T2-14-07	64321	Safety & Traffic	\$35,000
Revisions to the Alaska Flexible Pavement Design Software	T2-14-08	N/A	Materials & Construction	\$105,000 (State)
Seismic Load Path Effects in RC Bridge Columns	T2-14-09	64203	Bridges & Structures	\$365,000
Geotechnical Asset Management Thermal Modeling	T2-14-11	64230	Geotechnical & Foundations	\$145,000
Characterization of Alaska Hot-Mix Asphalt containing Reclaimed Asphalt Pavement (RAP)	T2-14-12	64234	Materials & Construction	\$155,000
Underwater Pile Driving Noise Study	T2-14-13	64236	Environmental	\$65,000+ 175,000
Haines Debris Flow Source Study	T2-14-14	64238	Geotechnical & Foundations	\$63,000
Rapid Research Response FFY 2014-16 Fly Ash Mix Design	T2-14-15	64006	Materials & Construction	\$26,000
Modeling Passing Lane Behavior on Two Lane Highways	T2-14-16	83980	Safety & Traffic	\$340,000
Seismic Repair of Reinforced Concrete Bridge Substructures	T2-14-17	83974	Bridges & Structures	\$240,000 +40,000
AASHTOWare Investigation	T2-14-18	83988	Administration & Policy	\$350,000

13 Active Research Projects Started in FFY2013

Title	T2 Project #	AKSAS Project #	Category	Total Current Project Funding
Transportation Asset Management Program	T2-13-03	80880	Administration & Policy	\$1,333,078 (STIP)
Rapid Technology Transfer	T2-13-06	76550	Technology Transfer Training	\$190,000 (State)+ \$185,000 (State)
Unstable Slope Management - Phase II	T2-13-08	62467	Geotechnical and Foundations	\$1,700,000 (STIP)
Testing & Screening Surfacing Materials for Alaska's Yukon River Bridge	T2-13-09	60533	Bridges & Structures	\$137,000 (SP&R) \$50,000 (M&O) \$30,000 (SP&R)
Experimental Feature Tencati Wicking Fabric Design	T2-13-10	64319 (61105)old	Materials & Construction	\$30,000 (SP&R)
Reinforced Concrete Filled Pipe Piles in Soils	T2-13-11	62725	Bridges & Structures	\$330,000 (SP&R)
Evaluate Pre-sawn Transverse Thermal Cracks 3-yr monitoring	T2-13-13	63031	Materials & Construction	\$75,000 (SP&R)
Wicking Fabric Design Specification	T2-13-14	63041	Materials & Construction	\$125,000 (SP&R)
Value of Depressed Medians on Divided Highways in Alaska	T2-13-15	63039	Safety & Traffic	\$150,000 (SP&R)
Optimizing Highway Patrol Investment Levels	T2-13-16	63068	Safety & Traffic	\$100,000(SP&R)
Geotechnical Asset Management - Stage II	T2-13-18	63076	Geotechnical and Foundations	\$80,000 STIP
Experimental Feature: Polyester Concrete For Approach Slabs	T2-13-19	61105	Materials & Construction	\$51,000 (SP&R)
Improving Quality Workshop	T2-13-21	60541	Administration & Policy	\$30,000 (SP&R) \$30,000 (AUTC)

4 Active Research Projects Started FFY2010 - FFY2012				
Title	T2 Project #	AKSAS Project #	Category	Total Current Project Funding
Maintenance Decision Support System (MDSS)	T2-12-13	80839	Maintenance & Operations	\$225,000 (SP&R) +26,585 (State)
Use of LiDAR to Evaluate Slope Safety	T2-12-15	61972	Planning & Design	\$115,000 (SP&R) +\$25,000 (SP&R)
Geotechnical Asset Management Program	T2-12-21	80900	Geotechnical & Foundations	\$1,933,055 (STIP)
Phase II: Development of an Unstable Slope Management Program Research	T2-10-04	63440	Geotechnical & Foundations	\$1,150,000 (STIP)

30 Projects Started FFY2006 - FFY2014 and closed in FFY15

Table 1/2

Title	T2 Project #	AKSAS Project #	Category	Total Current Project Funding
Plastic Strain Limits for Reinforced Concrete	T2-08-02	60855	Bridges & Structures	\$300,000 (SP&R)
Application of a Nontraditional Soil Stabilization Technology: Lab Testing of Geofibers and Synthetic Fluid	T2-08-16	60932	Materials & Construction	\$200,000 (State)
Lifecycle Bridge Costs	T2-08-18	60932	Bridges & Structures	\$150000
Foamed Warm Mix Asphalt Lab Testing: Experimental Features in Highway Construction	T2-10-01	61072	Materials & Construction	\$29,986 (SP&R)
Performance of Dust Palliatives on Unpaved Roads in Rural Alaska	T2-10-12	63701	Maintenance & Operations	\$40,000 (SP&R) \$40,000 (AUTC)
Geosynthetic Design Guidelines and Construction Specifications Review & Update	T2-11-02	76174	Materials & Construction	\$73,500 (GF) + \$16,000 (SP&R)
Structural Health Monitoring and Condition Assessment of Chulitna River Bridge	T2-11-08	60742	Bridges & Structures	\$ 203,000 (SP&R) +280,000 (SP&R)
Financial Impact of Fines in the Unbound Pavement Layers	T2-11-11	60642	Materials & Construction	\$90,000 (SP&R)
Deployment FFY 2012-FFY 2014	T2-11-18	61085	Varies	\$778,396 (SP&R) \$251,458 spent
Experimental Features FFY2012-FFY2014	T2-11-19	61105	Varies	\$500,000 (SP&R) \$231,000 Spent
FY 11 CTIP Unstable Slope Management Program (USMP), WFL	T2-12-01	54270	Geotechnical & Foundations	\$80,000 Western Federal Lands
Whittier Tunnel Signal System Investigation	T2-12-07	61862	Maintenance & Operations	\$150,000 (SP&R)
Whittier Tunnel Operations Study	T2-12-10	61908	Safety & Traffic	\$150,000 (SP&R) +50,000 (SP&R)
Estimating Future Flood Frequency and Magnitude in Basins Affected by Glacier Wastage	T2-12-11	61923	Hydraulics & Hydrology	\$80,000 (SP&R) \$15,000 (SP&R)
Investigation of High-Mast Anchor Bolts	T2-12-12	61925	Safety & Traffic	\$80,000(SP&R)

30 Projects Started FFY2006 - FFY2014 and closed in FFY15			Table 2/2	
Title	T2 Project #	AKSAS Project #	Category	Total Current Project Funding
Improving Passing Lane Safety and Efficiency for Alaska's Rural Non-Divided Highways	T2-12-14	61965	Safety & Traffic	\$60,000 (SP&R) \$60,000 (AUTC)
Rapid Research: Cordova Section Barge Study	T2-12-16	60533 LC300830	Alaska Marine Highway	\$45,000 (SP&R)
Review of Power Sources for Alaska DOT RWIS, Phase 1	T2-12-18	62084	Safety & Traffic	\$40,000 (SP&R)
Improving Engineering Education Delivery, Phase 1	T2-12-20	62133	Administration & Policy	\$30,000 (SP&R) \$30,000 (AUTC)
Development of GPS Survey Data Management Protocols and Policy	T2-13-02	61085	Materials & Construction	\$10,000 (SP&R)
LTAP Technology Transfer Program (LTAP)	T2-13-04	62407	Training & Tech Transfer	\$300,000 (SP&R)
NHI National Highway Institute	T2-13-05	62404	Training & Tech Transfer	\$350,000 (STP)
Long Term Monitoring of Ice-Rich Cut Slopes at Dalton Highway MP 9	T2-13-12	61105	Geotechnical and Foundations	\$40,000 (SP&R)
Evaluation Low Temperature Pavement Cracking	T2-13-17	60533	Materials & Construction	\$8,000 (SP&R)
Technology Transfer Program CY2014 (LTAP)	T2-14-02	63993	Training & Tech Transfer	\$300,000
National Highway Institute (NHI) CY2014	T2-14-03	63990	Training & Tech Transfer	\$350,000
Rapid Research Response FFY 2014-16 Behavioral Analysis of Existing Passing (support for T2-14-16)	T2-14-04	64006	Safety & Traffic	\$11,000 Canceled
Fiber Reinforced Polymer Composites for Culvert Linings	T2-14-05	64315	Materials & Construction	\$ 25,000 Canceled
Enhancing Research & Technology Deployment through Program Recording	T2-13-20	61085	Administration & Policy	\$30,000 (SP&R) Spent \$5,000

Fiscal Year in Review

The Research & T2 section began 15 projects during FFY 15, this added to the already 30 active Research and T2 projects started between FFY10 through FFY14. 30 projects were closed in FFY15. All projects started 2009 and before have either FHWA final voucher or are in the financial closure with FHWA.

The following four tables include project names and costs and are included to show increases and decreases to the initial research projects.

AKSAS #	Project Name	Initial Obligation	Program thruFFY15	Change
60855	Plastic Strain Limits for Reinforced Concrete	\$300,000	\$303,720	\$3,720
60932	Application of a Nontraditional Soil Stabilization Technology: Lab Testing of Geofibers and Synthetic Fluid*	\$200,000	\$200,000	\$0
60932	Lifecycle Bridge Costs	\$150,000	\$150,000	\$0
61072	Experimental Feature: Sasobit and Foamed Warm Mix Asphalt Techniques	\$70,000	\$70,000	\$0
63440	Phase II: Development of an Unstable Slope Management Program Research	\$600,000	\$1,150,000	\$550,000
63707	Stabilization of Erodible and Thawing Permafrost Slopes with Geofibers and Synthetic Fluid	\$132,000	\$132,000	\$0
63701	Performance of Dust Palliatives on Unpaved Roads in Rural Alaska	\$40,000	\$40,000	\$0
76174	Geosynthetic Design Guidelines and Construction Specifications Review & Update	\$89,500	\$89,500	\$0
60742	Structural Health Monitoring and Condition Assessment of Chulitna River Bridge	\$203,000	\$483,000	\$280,000
60642	Economic Impact of Fines in the Unbound Pavement Layers	\$90,000	\$90,000	\$0
54270	FY 11 CTIP Unstable Slope Management Program (USMP), WFL	\$80,000	\$80,000	\$0
61862	Whittier Tunnel Signal System Investigation	\$150,000	\$150,000	\$0
61908	Whittier Tunnel Operations Study	\$150,000	\$200,000	\$50,000
61923	Estimating Future Flood Frequency and Magnitude in Basins Affected by Glacier Wastage	\$80,000	\$95,000	\$15,000
61925	Investigation of High-Mast Anchor Bolts	\$80,000	\$80,000	\$0
80839	Maintenance Decision Support System (MDSS)-added state funds	\$225,000	\$251,585	\$26,585
61965	Improving Passing Lane Safety and Efficiency for Alaska's Rural Non – Divided Highways	\$60,000	\$60,000	\$0
61972	Use of Lidar to Evaluate Slope Safety	\$115,000	\$140,000	\$25,000

AKSAS #	Project Name	Initial Obligation	Program thruFFY14	Change
60533	Rapid Research: Cordova Section Barge Study	\$45,000	\$45,000	\$0
62084	Review of Power Sources for Alaska DOT RWIS, Phase 1	\$40,000	\$40,000	\$0
62133	Improving Engineering Education Delivery, Phase 1	\$30,000	\$30,000	\$0
63076	Geotechnical Asset Management - Stage I	\$1,933,055	\$1,933,055	\$0
61085	Development of GPS Survey Data Management Protocols and Policy-CANCELED	\$10,000	\$0	(\$10,000)
80880	Transportation Asset Management Program	\$1,333,078	\$1,333,078	\$0
62407	LTAP Technology Transfer Program (LTAP) CY13	\$300,000	\$300,000	\$0
76550	Rapid Technology Transfer State funds	\$100,000	\$100,000	\$0
62467	Unstable Slope Management - Phase II	\$1,700,000	\$1,700,000	\$0
60533	Testing & Screening Surfacing Materials for Alaska's Yukon River Bridge-\$50K of change is State	\$112,000	\$217,000	\$80,000
62725	Reinforced Concrete Filled Pipe Piles in Soils	\$330,000	\$330,000	\$0
61105	Long Term Monitoring of Ice-Rich Cut Slopes at Dalton Highway MP 9	\$30,000	\$40,000	\$10,000
63031	Evaluate Pre-Sawn Transverse Thermal Cracks	\$75,000	\$83,000	\$8,000
60533	Evaluation Low Temperature Pavement Cracking	\$8,000	\$8,000	\$0
63076	Geotechnical Asset Management - Stage II	\$80,000	\$80,000	\$0
60541	Improving Quality Workshop	\$40,000	\$40,000	\$0

AKSAS #	Project Name	Program thru FFY14	Program thruFFY15	Change
63993	Technology Transfer Program CY2014 (LTAP)	\$300,000	\$0	\$0
63041	Wicking Fabric Design Specification	\$125,000	\$125,000	\$0
63039	Value of Depressed Medians on Divided Highways in Alaska	\$150,000	\$150,000	\$0
63068	Optimizing Highway Patrol Investment Levels	\$100,000	\$100,000	\$0
61105	Polyester Concrete For Approach Slabs	\$51,000	\$51,000	\$0
64319	Experimental Feature: Tencati Wicking Fabric Design	\$30,000	\$30,000	\$0
63990	National Highway Institute (NHI) CY2014	\$350,000	\$0	\$0
64315	Fiber Reinforced Polymer Composites for Culvert Linings CANCELED	\$25,000	\$0	(25,000)
64317	Spray Applied MMA Bridge Deck Waterproofing Membrane - Experimental Feature	\$29,000	\$29,000	\$0
64321	Wavetronic Radar Detection through Experimental Features	\$35,000	\$35,000	\$0
none	Revisions to the Alaska Flexible Pavement Design Software	\$105,000	\$105,000	\$0
64203	Seismic Load Path Effects in RC Bridge Columns	\$365,000	\$365,000	\$0
64230	Geotechnical Asset Management Thermal Modeling	\$145,000	\$145,000	\$0
64234	Characterization of Alaska Hot-Mix Asphalt containing Reclaimed Asphalt Pavement (RAP)	\$155,000	\$155,000	\$0
64236	Underwater Pile Driving Noise Study	\$65,000	\$240,000	\$175,000
64238	Haines Debris Flow Source Study	\$63,000	\$63,000	\$0
64006	Rapid Research Response FFY 2014-16 -Fly Ash Mixture	\$26,000	\$26,000	\$0
64006	Modeling Passing Lane Behavior on Two Lane Highways	\$340,000	\$340,000	\$0
83974	Seismic Repair of Reinforced Concrete Bridge Substructures	\$240,000	\$280,000	\$40,000
83988	AASHTOWare Investigation	\$350,000	\$350,000	\$0
60537	Technology Transfer Program CY2015 (LTAP)	0	\$300,000	\$0
63990	National Highway Institute (NHI) CY2015	0	\$350,000	\$0
64006	Rapid Research Response FFY 2014-16 Bald Eagle Monitoring Completed in FFY15	0	\$33,000	\$0

AKSAS #	Project Name	Program thru FFY14	Program thruFFY15	Change
63068	Optimizing Highway Patrol Investments	0	\$70,000	\$0
61923	Underwater Pile Driving Noise Study	0	\$175,000	\$0
76293	Frequency and Potential Severity of Red Light Running in Anchorage II	0	\$120,000	\$0
63031	Field Evaluation of Precut Thermal Cracks	0	\$72,000	\$0
76307	Dust Control Product Mix Design & Quality	0	\$144,000	\$0
76319	Use of Steel Fiber Reinforced Rubberized Concrete in Cold Regions	0	\$90,000	\$0
76287	Pile Extension Pushover Software	0	\$72,000	\$0
76317	Catastrophic Icefall Hazard Assessment	0	\$50,000	\$0
76289	Developing Guidelines for 2-Dimensional Model Review	0	\$60,000	\$0
76283	Paperless NEPA	0	\$120,000	\$0
76285	Peer Exchange – NEPA Assignment	0	\$30,000	\$0
76321	RWIS Power Sources, Phase 2	0	\$50,000	\$0



FFY15 Projects

T2-12-20 Improving Engineering Education Delivery – Phase I

Principal Investigator: Dr. Robert A Perkins, P.E.

Funding: \$30,000 (SP&R) + \$30,000 (AUTC)

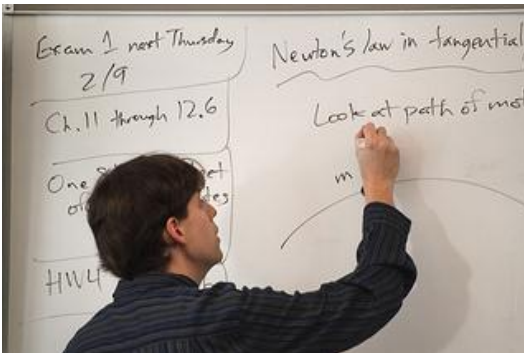
Project Manager: Carolyn Morehouse, P.E.

Report Published June 2014; Closed FFY15

http://www.dot.state.ak.us/stwddes/research/assets/pdf/fhwa_ak_rd_14_04.pdf

Review academic literature on non-traditional teaching techniques and materials, evaluate these techniques in the classroom, and partner with universities and other state Departments of Transportation on academic curriculum development and delivery.

Benefits to the State: Study of alternative methods for learning including web based training, video conferencing, recorded training sessions and information packages for producing transportation engineering modules.



T2-13-03 Transportation Asset Management

There are two research projects associated with TAM

Transportation Asset Management Information System

Principal Investigator: Cambridge Systematics, Inc.

Funding: \$1,333,078

Project Manager: Carolyn Morehouse, P.E.

Completion date October 2015

This research project was established to have an outside entity make recommendations for planning and implementing a Transportation Asset Management System and Data Solution to support an Asset Management program in the Department.

Benefits to the State: This project made recommendations for improved data management for the department. These recommendations can lead the department toward creating a system that all employees can easily use and for the department to maintain. It will strengthen the ability of data programs to support core business functions of the department. It will improve the data quality throughout the organization. Short term benefits include the drafting of a data and information technology policy and procedure and associated manuals. Cambridge also completed an asset management information system maturity assessment that will help in drafting our TAM Plan for FHWA.



Predictive Pavement Modeling

Principal Investigator: APTech, Inc.

Funding: \$60,000

Project Manager: Carolyn Morehouse, P.E.

Completion date December 31, 2018

This project also includes hiring APTech to develop and calibrate performance prediction models for statewide pavement management that consider Alaska conditions and pavement/treatment types.

Benefits to State: The updated model will allow for improvement in predictive capability of pavement conditions on state roads.

T2-13-21 Improving Quality Workshop

Principal Investigator: Billy Connor (UAF – AUTC)

Funding: \$40,000 SP&R + (\$40,000 AUTC)

ADOT&PF Project Manager: Carolyn Morehouse, P.E.

Completion Date: November 2015

This project consists of a series of webinars on Pavement Design and Construction followed by a Workshop to discuss best practices and recommendations for Materials.

Benefits to the State: This collaborative project supports and promotes a partnership with the Alaska University Transportation Center (AUTC) to identify and promote additional opportunities for the partnership to support ADOT&PF's core value of Improving Quality as defined in its "Strategic Plan".



83988 AASHTOWare Investigation

Principal Investigator:

Funding: \$350,000 SP&R

Project Manager: Carolyn Morehouse, P.E.

Completion Date: December 2017

AASHTOWare Preconstruction is software packaged designed for transportation agencies. The software allows for automating processes during the planning, design and construction of a project. This project will test and evaluate AASHTOWare modules to determine if DOT&PF should implement statewide. Use project information from each region to evaluate pros and cons for a transition to AASHTOWare from current systems.

Benefits to the State: DOT&PF can reduce data entry time by connecting systems for reporting. Data can be entered once during the life of a project and used in different modules. AASHTOWare has been used in other states to connect to IRIS and it can replace a current database.

76321 RWIS Power Sources Phase 2

Administration & Policy

2015 Annual Report

Principal Investigator: TBD
Funding: \$50,000 SP&R
Project Manager: Carolyn Morehouse, P.E.
Completion Date: December 2016

Benefits to the State: The ADOT&PF Research Advisory Board asked RD&T2 to identify improved reporting efforts to, if possible, increase effectiveness in promoting deployment and awareness of the section's activities within the ADOT&PF.

Six Road Weather Information System (RWIS) stations' environmental sensors have been using propane generators for the past 12 years. The generators and electronics have failed. Phase 1 completed last year research options for remote power for these sensors. The objective of this phase 2 is to design, build, deploy and evaluate an off grid power source prototype. The power source will be evaluated for performance, maintenance, operations and sustainability.

Benefits to the State: Improved efficiency by reducing power module as compared to the power module propane generators. The new power sources will provide opportunity for strategic deployment at known weather problem areas.

T2-13-20 Enhancing Research & Technology Deployment through Program Recording

Principal Investigator: Patrick Casey (CTC & Associates, LLC)
Funding: \$30,000 SP&R (spent \$5,000)
Project Manager: Carolyn Morehouse, P.E.
Completion Date: January 2014. Closed FFY15.

RD&T2 section DOT&PF exists to facilitate the identification, development, and deployment of research results and beneficial technologies in order to improve the delivery of transportation systems and services in Alaska. Federal and state regulations require annual reporting of the activities of the RD&T2 section. This is a subproject of Deployment FFY12-14.

T2-12-16 Rapid Research Response: Cordova Sectional Barge Study

Principal Investigator: Dr. Andrew Metzger, (UAA & AUTC)

Funding: \$45,000 (SP&R)

Project Manager: Carolyn Morehouse, P.E.

Completion Date: Report Published December 2014 Closed FFY15

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/4000-102cb.pdf>

This project will assist ADOT&PF's engineers evaluate the effectiveness & accuracy of the structural design for pile-guided floats for the ferry landing in Cordova.

This study began the evaluation of the Cordova floating ferry dock using the ANSYS AQWA software. The AQWA software models the effects of waves, wind and current on floating structures. Floating bodies are modeled as a point-mass with inertial and hydrostatic characteristics. As part of the study, the critical wave characteristic was defined. During the modeling it was found that AQWA can only model rigid bodies and that the Cordova floats experience a wide range of wave periods and directions. Consequently, AQWA requires adaptation to fully model the ferry dock at Cordova.

Benefits to the State: This research was not able to improve or validate structural designs and plans for ferry landings on the Alaska Marine Highway System due to the ambient conditions.

T2-08-02 Plastic Strain Limits for Reinforced Concrete

Principal Investigator: Dr. Mervyn J. Kowalsky (NCSU)

Funding: \$300,000 (SP&R)

Project Manager: Janelle White

Final Report Published in three volumes January 2015

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/4000-072v1.pdf>

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/4000-072v2.pdf>

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/4000-072v3.pdf>

ADOT&PF's bridge design engineers are challenged by many unknowns when designing reinforced concrete transportation structures to withstand Alaska's seismic loads. They must utilize concrete and steel strain limit states that have minimal experimental or theoretical basis. And while the strain limits that are typically utilized attempt to account for cyclic loading, there is no current basis for their selection. Furthermore, the strain limits typically proposed do not consider the effects of temperature. Lastly, while strain limits that occur early in the non-linear range are well established, the strain limits which define maximum structural capacity are less well defined.

The objectives of this research project are to propose strain limit states that account for low temperature effects and regional seismic load histories, and to develop an approach to allow ADOT&PF bridge design engineers to easily relate proposed strain limits to target displacements for design.

This project involves the use of analytical, numerical, and physical modeling to investigate plastic strain limits used for designing reinforced concrete structures. For typical ADOT&PF reinforced concrete circular column sections, the researchers are studying the role that load history plays on the selection of strain limits for key performance limit states such as serviceability, damage control, maximum load, and collapse. A determination will then be made if the strain limits are affected by seismic load history and temperature.

Consideration of these criteria will be made in order to recommend strain limits and how the limits can be utilized for displacement-based seismic design of bridges to achieve pre-defined levels of seismic performance under pre-defined levels of seismic hazard typical for Alaska.

Benefits to the State: The researchers provided design recommendations and examples of application for both a force-based approach (current practice) and a displacement-based approach. A workshop was conducted at the conclusion of this project that transferred knowledge and assistance so the ADOT&PF can improve the safety and reliability of Alaskan bridges.

T2-08-18 Life Cycle Cost Analysis for Alaska Bridge Components

Principal Investigator: Dr. Leroy Hulsey (UAF &AUTC)

Funding: \$150,000 (SP&R) State Funds Match 2008

ADOT&PF Project Manager: Carolyn Morehouse

Project closed in FFY15.

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/t20818.pdf>

Decaying infrastructure and limited renewal funds are moving our national transportation system toward crisis. Which bridges are past their service life? Which could function safely for another decade? What will it cost to replace them? The U.S. Department of Transportation has asked every state to develop a long-range plan (through 2030) for bridge replacement.

To meet this goal, Alaska must create a priority list and a plan to replace its own aging infrastructure. The accepted design life for a bridge is 75 years, but this arbitrary number does not take into account new building techniques, seasonal stresses, or variations in frequency and size of vehicles supported, to say nothing of environmental stresses like scouring, ice damage, and earthquakes. Bridges deteriorate in different ways, at different rates. A more accurate way to determine an existing bridge's service life is essential to the state's plan.

For this project, the research team collected data on environmental conditions, material aging processes, repair records, and current costs. Results are contributing to a process for conducting life-cycle cost analyses for highway bridges in Alaska.

Benefits to the State: This project could provide state planners and engineers the tools to estimate an average cost per bridge, as well as the upper and lower bounds of maintenance and/or damage costs.

T2-11-08 Structural Health Monitoring and Condition Assessment of Chulitna River Bridge

Principal Investigator: Dr. J. Leroy Hulsey (UAF & AUTC)

Funding: \$483,000 (SP&R)

Project Manager: Angela Parsons, P.E.

Phase 1 published August 2014; Phase 2 published September 2015. Project Closed in FFY15.

<http://www.dot.alaska.gov/stwddes/research/assets/pdf/4000-111b.pdf>

Bridge safety and performance are national transportation priorities. The purpose of this research project is to select and test an innovative structural health monitoring (SHM) technology and protocol for bridges in cold, remote locations. The project is intended to help the ADOT&PF improve the maintenance and repair of bridge structures, and to extend their service lives.

The research team studied the Chulitna River Bridge which is located near Milepost 133 on the Parks Highway. This bridge is regularly used by heavy overload vehicles, and is an essential link in the safe and efficient movement of people and commerce within Alaska. In 2011 a load rating and structural assessment of this bridge found that although the bridge inspected well, it rated more poorly than expected and recommended it for further analysis using a SHM system.

The first phase of this research involved selecting, configuring, installing, and testing an optimal SHM instrumentation and protocol for use on this bridge, with an eye toward extending this approach to bridges throughout Alaska. The report is located at the following link.

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/4000-111a.pdf>

The second phase of the project included continuing monitoring of the sensors to determine if the girders are over stressed under standard highway loads and permit vehicles, monitoring critical members and providing real-time alerts when sensing systems approach or exceed established limits, and creation of Finite Element models for estimating and evaluating the current condition and condition changes of the bridge structure response to static and dynamic loading.

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/4000-111b.pdf>

Benefits to the State: More effective bridge structural health monitoring (SHM) systems can provide structural response data, enable development of improved decision-making tools, conform and augment visual assessment, improve inspection credibility and subsequent load rating, assist transportation asset management efforts in assessing long-term bridge performance, optimize inspection schedules, maintenance schedules and dollars, and increase structure reliability.



Photos: Load testing of the Chulitna River Bridge's newly installed SHM system. Photo credit AUTC.

T2-12-12 Investigation of High-Mast Light Pole Anchor Bolts

Principal Investigator: Dr. Scott Hamel

Funding: \$80,000 (SP&R)

Project Manager: Anna Bosin, P.E.

Final Report Published October 2014; Closed FFY15

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/4000-117.pdf>

The goal of this project is to reduce the risk of a high-mast light pole failure due to the inability to maintain proper tightness of the anchor bolt nuts at the base of ADOT&PF's high-mast light poles. Research tasks include observing, measuring, and modeling the structural behavior of these fastening systems. The researchers will characterize the potential failure modes and recommend implementable actions to correct current installations and properly design future installations.

Two high-mast light poles on the Glenn Highway near Anchorage are being studied. The researchers modified standard anchor rods by drilling out and bonding strain gages into the center, and then connected them to a computer controlled data acquisition system to monitor during standard tightening procedure and for longer term ambient conditions. Preliminary findings show that several of the anchor rods yielded during the FHWA tightening procedure including establishing a snug-tight condition followed by 60 degrees of turn-of-the-nut method. The researchers note that the snug tightened fasteners for large diameter fasteners with short grip lengths are likely to exceed the recommended snug tight pretension range. However, if the degree of rotation in the turn-of-nut method was varied with the grip length/bolt

Bridges & Structures

diameter ratio, in addition to the existing recommendations about bolt diameter and grade, then final bolt pretensions may be more likely to fall within the desired range.

Benefits to the State: Increased safety and reliability of high-mast lighting structures in Alaska and reduced maintenance costs associated with currently necessary monitoring and tightening procedures. Recommendations on report- Increase inspections, Replace anchor rods with F1554 Grade 105. The project recommends the development of a new standard drawing with consultation with DOT&PF Staff.



T2-13-11 Reinforced Concrete Filled Pipes in Soils

Principal Investigator: Billy Connor, P.E. & Dr. Mervyn J.

Kowalsky (NCSU, UAF & AUTC)

Funding: \$330,000 (SP&R)

Project Manager: Janelle White

Completion Date: December 2016

The use of reinforced concrete filled steel pipe piles is common in Alaska and is gaining acceptance across the nation. It is often a preferred support system for bridges as these piles provide good seismic performance and can be driven rather than drilled in resulting in reduced construction cost and environmental impacts. This project supplements the T2-08-02 Plastic Strain Limits by conducting large scale testing of reinforced concrete filled pipe piles in soil media and structural analysis. The project will evaluate the impact of relative soil-pile stiffness on pipe pile strain limits, plastic hinge length and deformation characteristics.

Benefits to the State: This research will provide experimental validation of proposed models for concrete filled steel tubes forming pipe-soil systems, allowing Bridge engineers in Alaska and nationwide improved confidence in the structural analysis and use of these cost effective bridge support systems.



T2-14-06 Experimental Feature: Spray Applied MMA Bridge Deck Waterproofing Membrane

Principal Investigator: Richard Pratt, P.E., Chief Bridge Engineer, Statewide

Funding: \$29,000 (SP&R)

Project Manager: Carolyn Morehouse, P.E.

Estimated Completion Date: December 2017

This experimental feature evaluates spray applied methyl methacrylate (MMA) waterproofing membrane on the new bridge deck of the Phelan Creek Bridge under the Richardson Highway MP 201 Phelan Creek Bridge Replacement project. The post construction report submitted to FHWA in Dec 2014 evaluated bid cost, constructability, and effectiveness of the MMA membrane system compared to the currently used mastic asphalt membrane. One year post monitoring report is due Jan 2016. Two more years of monitoring will follow.

The MMA system provides a seamless membrane that readily accommodates variations in surface profile. It can be applied with temperatures as low as 32°F. The resins do not react with moisture. Consequently, it can be applied as long as the surface is “surface dry” and above the dew point. The system is applied in two contrasting color coded coats, which reduces flaws and improves quality control. The system features rapid installation. It is cured and load resistant within 1 hour. The MMA system has been successfully incorporated on many bridge decks around the world. Many locations have similar conditions and climates as Alaska. The durability of the system is further evidenced through its use on railway bridges where the ballast directly bears on the MMA membrane without failure.

Benefits to the State: If the MMA membrane performs as planned, it could save millions in traffic control costs and impacts to the traveling public on future bridge deck projects due to its shortened cure time, even when compared to the higher unit cost for the membrane. It also has potential to significantly save on bridge life cycle costs if it provides better deck coverage and longer lasting waterproofing than current methods.



T2-14-09 Seismic Load Path Effects in RC Bridge Columns

Principal Investigator: Billy Connor, P.E., Dr. Mervyn J. Kowalsky & Dr. James M Nau (NCSU, UAF & AUTC)

Funding: \$365,000 (SP&R)

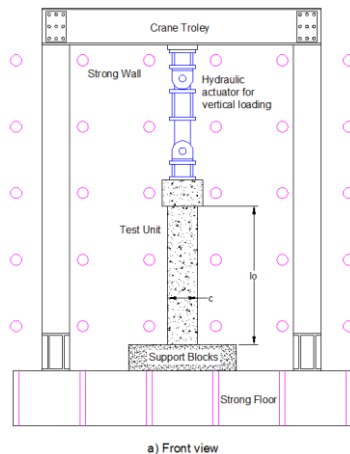
Project Manager: Janelle White

Estimated Completion Date: June 2017

The project studies the impact of multi-directional loading which could lead to adjustments in unidirectional strain limits

proposed for seismic design on reinforced concrete bridge columns. The project includes a literature research, load path testing and analysis, model calibration and investigation of load path effects of wall piers.

Benefits to the State: Revisions to wall pier design for the existing model. The research will account for out of plane displacement which can be used to determine minimum wall pier thickness requirements for given in plane and out of plane deformation demands.



Proposed wall prism test setup.

T2-14-17 Seismic Repair of Reinforced Concrete Bridge Substructures

Principal Investigator: Rudolf Seracino, Mervyn Kowalsky, and James M. Nau

Funding: \$280,000 (SP&R)

Project Manager: Janelle White

Estimated Completion Date: May 2018

The objective of this research is to develop a rapidly deployable post-earthquake repair technique for typical Alaska bridges that could provide extensive economic benefits by saving bridges that would otherwise be demolished after an earthquake.

Bridge column repair has been studied for some time with several established techniques for repair for shear and confinement critical columns. However, there is little data available on repair of columns that are otherwise designed to modern standards. Similarly, there is little data available on developing an understanding of when repair is truly needed, and when repair is truly no longer feasible.

Benefits to the State: The bridge design engineer will have access to pre-qualified repair techniques that could be rapidly deployed according to the damage level observed after an earthquake. The cost savings to the State of Alaska will be significant when bridges that would otherwise need to be replaced can be repaired. Further, the indirect economic and social impacts of not rapidly returning a bridge to service following an extreme event will be many times greater than the direct replacement cost, particularly considering the lack of redundancy in the Alaskan road transportation network.

76287 Pile Extension Pier Pushover Software

Principal Investigator: Michael Scott (Oregon State University)

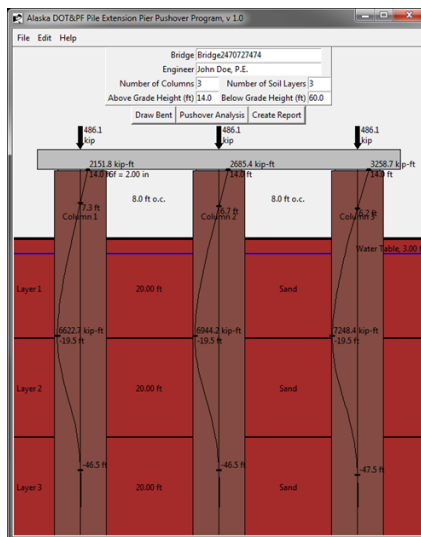
Funding: \$72,000 (SP&R)

Project Manager: Janelle White

Estimated Completion Date: October 2016

The objective of this research is to revise version 1.0 of the pushover software. Version 1.0 of the software requires a number of fixes, enhancements, and increased functionality in order to expand its range of application, increase productivity and reduce design and construction costs.

Benefits to the State: Increased functionality for design activities. By combining previously disparate analysis components in a single package, the software has proven, since its adoption by AKDOT&PF bridge engineers, to save time and money in the analysis and design of Cast In Shell Steel bridge bents.



T2-14-13 Underwater Pile Driving Noise Study

Principal Investigator: Alex McGillivray, JASCO Inc.

Funding: \$65,000 FFY 2014 & \$130,000 FFY 2015

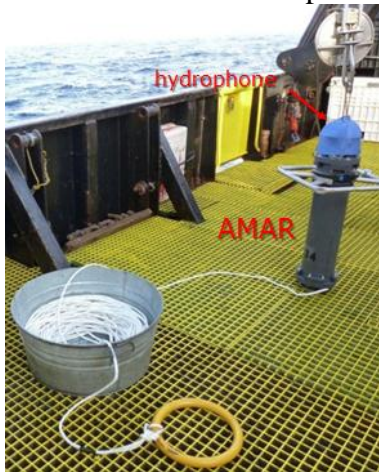
Manager: Janelle White

Champion: Taylor Horne

Completion Date: December 2016

Pile installation activities can exceed levels deemed harmful to species protected under the Endangered Species Act and the Marine Mammal Protection Act. For FFY14 Conduct literature review, develop an auditory test pile program approved by NOAA, NMFS and DOT&PF. For FFY15 conduct acoustic monitoring for pile installation to determine the hazard area for behavioral harassment. Data gathered from the auditory program will provide scientifically based observations pertinent to DOT&PF pile installation projects.

Benefits to the State: Coordination of DOT&PF, NOAA and NMFS to collect actual underwater pile driving and background noise levels which are applicable to current and future marine mammal protection requirements.



76283 Paperless NEPA

Champion: Taylor Horne, Statewide Environmental Manager

Principle Investigator: TBD

Funding: \$120,000 (SP&R)

Project Manager: Carolyn Morehouse

Completion Date: Fall 2018

Many states have comprehensive environmental approval and tracking systems. Alaska DOT has no system for tracking, securing and archiving environmental approvals and documents. The research objective is to coordinate with stakeholders and perform a literature search recommendation report for a paperless NEPA system. The system would be implemented by using a STIP project.

Benefits to the State: Reduce the time needed to complete environmental documents during project development. Reduce the potential for errors. Secure document approval hierarchy. Produce smart forms to reduce time and effort developing environmental documents.

Peer Exchange – NEPA Assignment

Principal Investigator: Project Canceled

Funding: \$25,000 (SP&R)

Project Manager: Janelle White

Completion Date: To be Closed

The purpose was to conduct a workshop to discuss the details of administering programs with four other states which have a NEPA assignment program. This was already organized by State of Oregon.

T2-10-04 Phase II: Development of an Unstable Slope Management Program

Principal Investigator: Lawrence Pierson, Landslide Technology, Inc., & Peter Hardcastle, R&M Consultants, Inc.
Funding: \$1,150,000 (STP) total funding \$4,000,000
Project Manager: Barry Benko, C.P.G.
Completion Date: December 2017

This project is being completed in coordination with T2-13-08. Collect and assess necessary data to develop and deploy a new DOT&PF Unstable Slope Management Program. The condition ratings for Dalton Highway and all NHS routes in northern region are complete.

Benefits to the State: The USMP is part of the overall Geotechnical Asset Management Program and focuses on one class of geotechnical assets: soil and rock slopes. This project is still in its initial stages for two areas: (1) inventory and condition survey to identify, assess, and rate our unstable slopes for hazard and risk; and (2) developing a knowledge base about our slopes, their condition over time, and how to manage the slopes on a lifecycle cost basis to optimize performance in support of our transportation system.



*Drilling of the soil and rock slope on Glenn Highway
Photo: Terry Barber*

T2-12-01 FY 11 CTIP Unstable Slope Management Program (USMP), WFL

Principal Investigator: Dave Stanley, C.P.G (ADOT&PF) with Landslide Technology, Inc. (Portland, OR)
Funding: \$80,000 (Western Federal Lands Coordinated Technology Implementation Program)
Project Manager: Barry Benko, C.P.G.
Completion Date: December 2014; Submitted Project Closure Form in FFY 15; no final report for this project.

Provided support to FHWA - Federal Lands Highway Division by adapting and demonstrating ADOT&PF's Unstable Slope Management Program (USMP) for use by several federal lands agencies (Bureau of Indian Affairs, National Park Service, Federal Lands Highways, U.S. Forest Service and U.S. Fish & Wildlife Service) associated with the Coordinated Technology Implementation Program.

Benefits to the State: Further development of the USMP by adapting and deploying USMP to federal agencies for implementation of asset management for slopes and further refinement of the hazard and risk management aspects of the USMP along with more advanced aspects of geotechnical asset management including estimates of service life and development of condition indices, service levels and performance measures

T2-12-15 Use of Lidar to Evaluate Slope Safety

Principal Investigators: Dr. Andrew Metzger & Keith Cunningham (UAF & AUTC)

Funding: \$115,000 (SP&R) + \$50,000 (PACTrans)

Project Manager: Anna Bosin, P.E.

Completion Date: Final Report Published April 2015. Project Closure begun in FFY 15

<http://www.dot.alaska.gov/stwddes/research/assets/pdf/4000-121.pdf>

Evaluate the potential for light detection and ranging (LiDAR) technology for mapping and managing unstable slopes. Mobile vehicle-mounted laser-scanning equipment will be used to collect data on two unstable slopes along Alaska's highway system. The researchers will analyze the data and prepare analytical geospatial based tools and/or models useful for developing unstable slope management program.

Benefits to the State:

This project will produce improved tools for managing unstable highway slopes. When implemented, this will create cost-effective and proactive slope remediation which will increase traveler safety and reliability of highway corridors.

T2-12-21 Geotechnical Asset Management

Principal Investigator: Various

Funding: \$1,933,055 Research out of \$2,700,000 (STIP)

Project Manager: Barry Benko, C.P.G.

Completion Date: October 2016

This effort will create Geotechnical Asset Management (GAM) program architecture, research and develop: performance

measures, methods for predicting future performance of assets, and analysis methods. Create inventory and condition survey for assets. Monitor performance of assets over time and compare to performance measures. Provide decision-making support to agency management on maintenance, repair and rehabilitation alternatives.

Significant progress was made in 2013, including continuing development of a formal development plan, inventory data compilation for material site, retaining wall, and unstable slope assets, risk evaluations, and pilot GAM implementation in high-risk transportation corridors.

Benefits to the State: The GAM program is an important element of the overall implementation of best transportation asset management (TAM) practices for AKDOT&PF. The GAM program defines the role that geotechnical assets take in both primary roles like rock slopes, and in supporting roles such as embankments supporting pavement structure. The research for this project will take the Department many steps forward in understanding the characteristics of geotechnical assets as to the length of service life, condition during service, appropriate service levels and performance measures, incorporation of risk management, determination of life cycle costs, identification of critical data elements required, and development of the means to store and use the data in support of a decision-support framework for managing our transportation system.

T2-13-08 Unstable Slope Management – Phase II

Principal Investigator: Darren Beckstrand
Landslide Technology

Funding: \$1,700,000 (STIP)

Project Manager: Barry Benko, C.P.G.

Estimated Completion Date: December 2016

This effort continues the development of the Unstable Slope Management Program (USMP), initiated in 2009. In Stage I of program development, the investigators compiled a database of the “Top 1500” unstable slopes, refined the slope rating system, and created a web page portal to the data.

Under the scope for this research project, the investigators will finish the architecture of the database system and continue populating the inventory by adding the remaining unstable slopes in the road network, with key transportation corridors receiving priority in the work sequencing. Asset management elements will be incorporated into the USMP in the areas of service life prediction, establishing services levels and performance measures and initiating development of analysis tools to determine life cycle cost of slopes in support of decision-making for transportation corridors. Ultimately the database and webpage will be migrated to Department servers, and the website will be made available to the public.

Benefits to the State: Unstable slopes along the State’s routes present critical risks to safety and mobility in the transportation system. This research effort will enable the realization of sound asset management, resulting in the most economic allocation of resources to unstable slopes.

T2-13-12 Experimental Feature: Long Term Monitoring of Ice-Rich Cut Slopes at Dalton Highway MP 9

Principal Investigator: Dr. Xiong Zhang (UAF & AUTC)

Funding: \$40,000 (SP&R)

Project Manager: Carolyn Morehouse, P.E.

Completion Date: December 2014. Project Closed FFY15

This project is a follow on to project T2-11-05 Experimental Study of Various Techniques to Protect Ice-Rich Cut Slopes. http://www.dot.state.ak.us/stwddes/research/assets/pdf/fhwa_ak_rd_13_13.pdf Researchers monitored the performance of the test section and techniques used on the Dalton Highway 9 Mile Hill construction project for a year. The results are contained in the following report

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/4000-113b.pdf>

Benefits to the State: This research will result in recommendations and guidelines for design and construction. This will ensure proper application of successfully tested mitigation approaches on future construction projects which require cuts in ice-rich permafrost.



Test sections constructed on the Dalton Highway 9 Mile Hill North project. Photo credit AUTC.

T2-13-18 Geotechnical Asset Management - Stage II

Principal Investigator: Various

Funding: \$80,000, (Other STIP project)

Project Manager: Barry Benko, C.P.G

Completion Date: December 2016

The project supports four research contracts for developing Geotechnical Asset Management (GAM) concepts for state Departments of Transportation: GAM plan development; a risk management framework for GAM; Service life, service level, performance measures and condition indices; and Life Cycle Cost Analysis for geotechnical assets.

The Federal Highway Administration (FHWA) is participating in funding these GAM-related research projects through an Infrastructure Research & Technology (IRT) program allocation to research and develop Geotechnical Asset Management principles and practices for eventual deployment in Alaska and other state or local government transportation agencies. An important aspect of these deliverables is that they are created specifically for a broader audience than Alaska transportation agencies.

Benefits to the State: Deliverables will include:

- An executive level summary,
- Individual graphics suitable for use in FHWA publications and pamphlets,
- PowerPoint presentation slides,
- Other deliverables that may be developed during the course of the work and the execution of the project's Communication Plan.

The final content of the additional deliverables will vary from project to project. Each project will include a communication plan based on NCHRP Report 610, "Communicating the Value of Transportation Research" and will address these deliverables tailored to the subject or the individual contracts.

64230 GAM through Thermal Modeling of Highway Embankments for Dalton Highway Reconstruction Projects (T2-14-11)

Principal Investigator: Steve McGroarty and Jeff Currey

Funding: \$145,000

Manager: Anna Bosin, P.E.

Estimated Completion Date: December 2019

Road embankments constructed on permafrost must be thermally stable in order to minimize long-term maintenance costs. Past thermal modeling studies have determined that the most critical model input parameter are soil surface temperatures. Typically, site-specific soil temperatures are not available and are estimated using air temperature records and a modifying *n*-factor. Material type, vegetation cover, and snow cover all affect *n*-factors and need additional site-specific studies under Alaskan conditions.

Leverage an upcoming reconstruction project on the Dalton Hwy to design thermally stable embankments with thermal monitoring instrumentation to study performance of insulation board. Will also determine site-specific thermal model *n*-factors for future thermal modeling, and develop relationship between snow depth and winter *n*-factors. Results will be used to improve thermal models.

Geotechnical & Foundations

2015 Annual Report

Benefits to the State:

This project will help refine thermal modeling to design future embankments constructed, or existing embankments reconstructed, on permafrost to facilitate design of the least expensive thermally stable embankment. This will reduce maintenance.

64238 Haines Highway Debris Flow Source Study (T2-14-14)

Principal Investigator: Drs. Ronald Daanen and Gabriel Wolken, DGGs

Funding: \$63,000 FFY 2014 (SP&R) & \$80,000 (STIP) FFY 2015

Manager: Anna Bosin, P.E.

Estimated Completion Date: Project Complete FFY14.

Waiting to financially close, delay in processing invoices.

Debris flow events are occurring with increasing frequency within the Haines Highway Debris Flow Corridor (MP 16- 24). M&O expended approximately \$335,000 on equipment and labor responding to debris flow events in this highway segment in 2013 alone. DOT lacks baseline data characterizing the upslope source areas. Produce high resolution orthophoto and detailed DSM of the two most active sites (MP 19 and 23). Deploy and ground temp sensors. Conduct a repeat aerial survey, creation of orthophoto and DSM, which will enable researchers to quantify and map the total amount of debris movement and to portray source material origination. Results will be crucial to design of future mitigation of debris flow hazards.

Benefits to the State: Reduction of hazard to the travelling public, reduction of risk to the Department, maintaining consistent mobility.



T2-12-11 Estimating Future Flood Frequency and Magnitude in Basins Affected by Glacier Wastage

Principal Investigator: Anna Liljedahl, (UAF & AUTC)

Funding: \$80,000 (SP&R) + Deployment \$15,000

Project Manager: Carolyn Morehouse, P.E.

Completion Date: December 2014, Closed FFY15

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/4000-119.pdf>

The research will collect field measurements of weather and temperature to develop hydraulic models which characterize contemporary changes and trends in hydraulic flows from glacial streams. The Final Report will recommend engineering criteria and parameters for use in the design of bridges and culverts located in drainage basins with a component of glacial runoff.

Benefits to the State: The research is expected to result in better predictions of peak flows from streams affected by melting glaciers. Analyzing this component of flow along with rainfall data will result in more reliable designs for hydraulic structures.



*Sagavanirktok River showing stream barbs near Deadhorse, June 2009.
Photo: Dr. Horacio Toniolo.*

76289 Developing Guidelines for 2-Dimensional Model Review and Acceptance

Principal Investigator: Horacio Toniolo, (UAF)

Funding: \$60,000 (SP&R)

Project Manager: Janelle White

Completion Date: October 2017

The research team from UAF will use SRH-2D, RAS-2D and IRIC to model two projects. The primary numerical models will be used in two different morphological settings: moderate and significant contractions. Results between the various models will be compared. Guidelines for preferred model will be prepared.

Benefits to the State: Guidelines will be prepared which will define what is “acceptable” or “comparable” when reviewing 2-D modeling results.

Maintenance & Operations

2014 Annual Report

T2-10-12 Performance of Dust Palliatives on Unpaved Roads in Rural Alaska

Principal Investigator: Dr. David L. Barnes (UAF & AUTC)

Funding: \$40,000 (SP&R) + \$40,000 (AUTC)

Project Manager: Dave Waldo

Report Published October 2014, Dust Control Field Guide for Gravel Driving Services completed July 2015. Project Closed FFY15.

<http://www.dot.alaska.gov/stwddes/research/assets/pdf/dust-cntrl-fg.pdf>

The project centered around three aspects of fugitive dust: threats to safety, health, and infrastructure due to loss of surface aggregate. Several key topics address these aspects: how dust forms, measuring dust, preparing the road for palliatives and stabilizers, dust management, and the economic analysis of the use of dust management.

The studies most unique facets are introduction new procedures to measure dust in rural Alaska, and managing dust with air quality as a guiding principle.



Both for public health and cost-effectiveness considerations, researchers wanted to know how much fugitive dust must be suppressed to meet regulatory standards

Benefits to the State: Research findings will assist local dust managers assess the severity of dust issues by providing tools for measurement and mitigation more practical for rural settings. To help implement this project, the more comprehensive research report was condensed and restructured into the “Dust Control Field Guide for Gravel Driving Surfaces”.

76317 Catastrophic Icefall Hazard Assessment (Literature Review Only)

Principal Investigator: David Scapato (Scarptec Inc)

Funding: \$50,000 (SP&R)

Project Manager: Anna Bosin

Estimated Project Completion: February 2016

This is the first phase of for Scarptec to review AKDOT&PF historical icefall documentation from events at 7 locations within DOT&PF highway ROW and complete a literature review of national and international practices and products. Lastly, the Contractor will conduct a web-based meeting to the Department staff that describes the project, results, and recommendations for implementation

Benefits to the State: Icefall on roads can be dangerous to drivers. This is the first stage to combine all the research to date to determine if further research in this area is needed.

Maintenance & Operations

2014 Annual Report

T2-12-13 Maintenance Decision Support System (MDSS)

Principal Investigator: Billy Connor, P.E. (UAF & AUTC) in Partnership with the National Center for Atmospheric Research (NCAR)

Funding: \$225,000 (Planning SP&R) + 26,585 FFY15(State)

Project Manager: Ocie Adams

Completion Date: December 2015

The project evaluated and refined a software system to help roadway maintenance personnel optimize their snow and ice control operations. The system analyzed historical weather conditions and forecast data and prescribed optimal strategies for plowing snow and applying anti-icing treatments to roadways based on weather and pavement condition observation and forecasts. The ADOT&PF's Fairbanks maintenance district piloted the technology along roadway corridors with various weather microclimates in an effort to fine tune the predictive capabilities of the software and data collection system.

Benefits to the State: By improving weather and roadway condition assessment during winter storms and then optimizing snow and ice control efforts, ADOT&PF and local transportation agencies should be able to provide safer road conditions while minimizing costs. Additionally, minimizing the use of deicing and anti-icing agents promises environmental benefits and reduced impacts to roadway users. Deliverable: web-based only Fairbanks pilot. This project has already saved Maintenance money. A larger project is being funded out of HSIP for the Kenai area.

T2-13-09 Rapid Research Response: Testing and Screening Surface Materials for the Yukon River Bridge – Phase II (60533)

Principal Investigator: Dr. J. Leroy Hulsey (UAF & AUTC)

Funding: \$167,000 (Rapid Research SP&R) & \$50,000 (M&O)

ADOT&PF Project Manager: Carolyn Morehouse, P.E.

Completion Date: December 2015.

This research project is the second stage of T2-10-07 Testing and Screening Surface Materials for Alaska's Yukon River Bridge. The purpose is to find a more durable material to replace the timber decking. The timber used for the deck is going up in cost due to reduced logging in quality old growth forests. If the time between replacements could be extended, money and human power could be saved or directed toward other projects. This project recommends a product to extend the life of the timbers.

Benefits to the State: Finding a more durable and cost effective bridge decking solution for this critical route will save the State money over the long term through reduced road closures and maintenance costs.



Yukon River Bridge

T2-13-13 Evaluate Pre-sawn Transverse Thermal Cracks (63031)

Principal Investigator: Juanyu “Jenny” Liu (UAF – AUTC)

Funding: \$50,000 SP&R

ADOT&PF Project Manager: Anna Bosin, P.E.

Final Report Published August 2015

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/t21313.pdf>

Road-width thermal cracks (major transverse cracks) are perhaps the most noticeable form of distress on asphalt concrete pavements throughout the colder regions of Alaska. In these cold areas it has as not yet been possible to prevent this crack type from forming. To date, this appears to remain true regardless of paving material, embankment material, or construction method. A review of research and testing conducted in the Fairbanks area about 30 years ago shows that the technique of precutting thermal cracks in the pavement during construction has real potential for minimizing pavement distress associated with transverse cracking.

This research project will monitor and evaluate the recently reconstructed Richardson Highway project (Mile 340-346, near North Pole) which included sections with presawn cracks and a control section without presawn cracks. The researchers will use visual inspections, laboratory evaluations of asphalt core samples, and numerical simulation studies to make recommendations for future effective design and construction practices to control thermal cracking in asphalt concrete pavements.

Benefits to the State: The ADOT&PF spends a significant amount of money each year crack-sealing pavements. If a

successful pre-cutting method can be determined it could provide significant savings in pavement preservation dollars each year and contribute to better performance of Alaska’s valuable pavement assets.



Photo: Pre-cut pavement section on the Richardson Highway near Moose Creek. Photo credit Bob McHattie and Dr. Jenny Liu.

76291 Field Evaluation of Precut Transverse Thermal Cracks

Principal Investigator: Juanyu “Jenny” Liu (UAF – AUTC)

Funding: \$72,000 SP&R

ADOT&PF Project Manager: Anna Bosin, P.E.

Completion Date: December 2016

This project continues the research on Road-width thermal cracks. This project includes monitoring three locations for 2 years.

This research project will monitor and evaluate three locations: 1) Phillips Field Road, Fairbanks; 2) Richardson Highway MP 343-344; and 3) Parks Highway MP 245-252. Contract includes literature review, recording field observations and maps of cracks, cost analysis of the M&O savings for precutting compared with traditional thermal crack M&O, recommendations, and final report with web presentation to staff. Peers from Montana State University and Washington State University will provide support and review.

Benefits to the State: The ADOT&PF spends a significant amount of money each year crack-sealing pavements. This project will recommend a presawn crack design and details so Alaska saves pavement preservation dollars each year and contribute to better performance of Alaska's valuable pavement assets.

T2-13-14 Wicking Fabric Design Specification

Principal Investigator: Dr. Xiong Zhang (UAF & AUTC)

Funding: \$125,000 (SP&R)

ADOT&PF Project Manager: Dave Waldo

Completion Date: December 2015

H2Ri wicking fabric is a new geotextile manufactured by TenCate Geosynthetics. Which is the same product used in T2-13-10. It contains both a high modulus polypropylene yarn for reinforcement and a nylon wicking yarn which can absorb and transport water for drainage under unsaturated conditions. Therefore the fabric can serve as reinforcement it has the potential to dehydrate the subgrade and base course and consequently improve the performance of pavements.

This research will build on the ongoing monitoring of the Dalton 9 Mile test section (project T2-13-10). It will develop design guidance, determine product limitations, and cost benefit values for engineers to use in deciding when and how to use the fabric.

In order to assess the fabric's ability to wick 73 feet, an indoor flume was assembled and instrumented at M&O warm storage in June of 2015. Data was gathered into the fall and the final report is expected to be completed on time.

Initial results indicated the fabric successfully transmitted water the length of the flume. Some decrease in wicking is occurring at the joints where the fabric is overlapped.

Benefits to the State: Use of this fabric may allow use of low quality, locally available materials to build roads and airport. It has the potential to bring significant savings in construction, maintenance and repair cost for roads in wet, swampy areas and areas of thawing permafrost. When properly used, it has proven to have the ability to wicking the water out of the pavement structure and eliminate the frost heave and subsequent thaw weakening.

T2-13-10 Experimental Feature: Tencate Mirafi® H2Ri Wicking Fabric

Principal Investigator: Jeff Currey, NR Materials Engineer

Funding: \$30,000 (SP&R)

ADOT&PF Project Manager: Dave Waldo

Completion Date: December 2016

The freezing of moisture in the ground can cause heaving. Under roads this can cause damage that leads to increased

maintenance costs. ADOT&PF partnered with AUTC to research a possible solution. The use of the building fabric, Mirafi Nylon Wicking Fabric, could help prevent saturation of the ground that causes frost heave damage. The fabric is an impermeable much like a rain jacket. When installed properly it keeps much of the moisture out of the material that the road is built on. No moisture, no problem.

The fabric was installed by the Department's Contractor on the Dalton Highway MP 197-206 Reconstruction project. A post construction report was submitted to FHWA in 2013. Year 1 was not monitored and reported on but year 2 was. It will be monitored by ADOT&PF for one more year summer 2016. The results will help engineers design safer roads that require less maintenance. Preliminary field results show the fabric is removing water from the embankment. The test section once a maintenance issue is now functioning well. Monitoring report due end of 2015.

Benefits to the State: The use of construction fabric in building roads in Alaska should extend road life, especially in areas particularly susceptible to frost heaving.



Photo: Wicking fabric installation at Dalton Highway MP 110.5 Beaver Slide. Photo credit AUTC.

76319 –Use of Steel Fiber Reinforced Rubberized Concrete in Cold Regions

Principal Investigator: Osama Abazza

Funding: \$90,000 (SP&R)

Project Manager: Anna Bosin

Estimated Completion Date: December 2017

Studded tires can cause significant rutting issues in Alaska on asphalt pavement. This project will attempt to use a concrete mix design to preserve the road surface. This project will create material samples and test for rutting resistance, comprehensive strength, friction and freeze/thaw properties. Once the sample has passes these lab tests a test panel will be added to a Central Region Design project for field testing. The Principle investigator will monitor the panel installation and make recommendations for future monitoring.

Benefits to the State: Potential cost savings if this mix design lasts longer than conventional asphalt mix designs.

T2-13-17 Evaluation Low Temperature Pavement Cracking

Principal Investigator: Tonya Burrit (AK DOT&PF - Central Region Materials)

Funding: \$8,000 SP&R

Project Manager: Anna Bosin, P.E.

Project Completed October 2014; PowerPoint Deliverable.

Closed in FFY15.

The purpose of this research is to assess the actual performance of recently constructed highway projects that used asphalt pavements that were specially modified to reduce low

temperature cracking. Modified asphalts add to the cost of paving projects, so it is important to determine if their use has actually resulted in reduced cracking.

This research involves conducting field measurements to evaluate and characterize pavement cracking on representative roadway segments. This analysis will also involve consideration of existing lab tests and mix designs.

Deliverables from this project will include an interim compilation of the work done to date under previously funded research, and a final report and presentation to ADOT&PF materials, M&O, and construction staff.

Benefits to the State: The knowledge gained through this research effort is expected to be used by ADOT&PF materials engineers when designing future projects to achieve better performing asphalt pavements with reduced maintenance costs for crack sealing and patching which will help lower the life-cycle costs of Alaska's valuable highway pavement asset

T2-13-19 Experimental Feature: Polyester Concrete Approach Slabs

Principal Investigator: Leslie Daugherty, P.E., Bridge Engineer, Statewide

Funding: \$51,000 (SP&R)

Project Manager: Carolyn Morehouse, P.E.

Completion Date: December 2017

This experimental feature evaluates polyester concrete for approach slabs on the Parks Highway MP 239-252 Rehabilitation construction project. A post construction report was submitted to FHWA in Dec 2014 that compared structural performance of various types of slabs to include polyester concrete, Class-A concrete, and paved asphalt approaches without a slab. The polyester concrete is high-strength, rapid-setting, and water impermeable. The concrete provides protection from chlorides and other contaminants to help protect the steel reinforcement giving longer life. Superior abrasion and skid resistance allow for a safe and durable driving surface. With a rapid curing time, traffic was allowed to drive on the slab in about 4 hours which was beneficial on the Parks Highway during the middle of summer. Polyester concrete does not crack or delaminate even through extreme freeze/thaw cycles and has a higher compressive strength than conventional concrete. Year 1 monitoring is complete and a report was submitted to FHWA in Nov 2015.

Polyester concrete use in Alaska has been limited to a bridge deck overlay on the Susitna River Bridge. However, numerous states, such California, Washington, and Nevada, have used this system for bridge deck repairs and overlay projects on major highways. In states like Washington and California where traffic volume is high and this product has been used for

over a decade, results show the concrete is performing as expected with no major signs of wear.

Benefits to the State: This research will determine if polyester concrete may be a practical, cost saving alternative to traditional concrete methods for approach slab and deck construction. If the polyester concrete performs as planned, it could save millions in traffic control costs and impacts to the traveling public on future bridge retrofit and deck projects.

T2-14-05 Experimental Feature: Fiber Reinforced Polymer Composites for Culvert Repair

Principal Investigator: Jeff Stutzke, P.E., Northern Region
Hydraulics Engineer

Funding: \$25,000 (SP&R)

Project Manager: Dave Waldo.

CANCELED due to scheduling problems in construction

This experimental feature would have tested the effectiveness of fiber reinforced polymer (FRP) composite liners (panels) in traditional corrugated metal culverts on the Parks Highway MP 239-252 Rehabilitation project near Healy. We are looking for a similar project.

FRP panel use has been limited to New England states with the oldest installation being a little over 3 years in the state of Maine. Preliminary results show the panels are performing as expected with no signs of wear. The FRP panel system is used on culverts 36” and larger as access for installation on anything smaller would be difficult. The panels are usable on any surface of the culvert. Areas where culvert damage is overhead, panels are suitable for top surface repairs, and can be used to

cover and support weaknesses in the culvert. Weirs and baffles may also be included if needed for fish pass purposes. The process of installing the FRP panels will allow both travel lanes to remain open with minimal interference to traffic. Expected life of the FRP panels is expected to outlast the service life of concrete which is approximately only a few decades.

Benefits to the State: If the use of FRP panels is successful, their use could provide the State with significant life cycle cost savings on culvert repairs.

T2-14-08 Revisions to the Alaska Flexible Pavement Design Software & Manual

Principal Investigator:

Funding: \$105,000 (State Funds)

Manager: Stephen Saboundjian, P.E.

Estimated Completion Date: RSA 80K June 30, 2015. Engine has been replaced but the software has bugs. Rewrite the manual.

Update the Alaska Flexible Pavement Design (AFPD) software and incorporate WesLEA, a software developed by the US Corps of Engineers. Review, test and evaluate the software. Update the pavement design manual.

Benefits to the State: Updated AFPD software will be able to operate in a Windows 7 or Windows 8 operating system, currently ADOT&PF and its consultants have been using Windows XP machines or virtual XP machines to perform pavement design on Windows 7 machines. This is not an option under Windows 8

T2-14-12 Characterization of Alaska Hot-Mix Asphalt containing Reclaimed Asphalt Pavement (RAP)

Principal Investigator: Dr. Jenny Liu

Funding: \$155,000

Manager: Anna Bosin, P.E.

Estimated Completion Date: June 2016

DOT&PF highway construction specification now allows up to 15% RAP in the wearing course of a roadway pavement, and up to 25% RAP in the binder or base course layer(s). The materials engineering properties of these HMA mixes specific to Alaskan materials containing RAP will be properly characterized for use in pavement design software. This project will prepare representative laboratory-mixed specimens using local materials and conduct laboratory performance test to determine the engineering properties of the mixtures. It will update the database of material properties in the “AK Flexible Pavement Design Manual” for use in the pavement design software, and a potential revision of the HMA specification to increase the limit of RAP in HMA.

Benefits to the State: A better understanding of RAP’s engineering properties will improve pavement design and produce more reliable value engineering and life-cycle cost analysis. Increased use of RAP material will decrease construction costs, preserve virgin aggregate resources, and divert materials from the waste stream.

T2-14-15 Mix Design – Fly Ash Rapid Response Project

Principal Investigator: Cole Sonafrank, CEO Suitable Alaskan Materials, LLC

Funding: \$26,000

Manager: Anna Bosin, P.E.

Final Results Received June 2015

Materials available for embankment construction in remote areas of Alaska are often highly frost-susceptible and are subject to rutting and pumping during spring break-up either wet or dry conditions. Geopolymer concretes and soil cements using coal fly ashes have been investigated and the chemistry proven. Field testing is needed to demonstrate value. Conduct optimization of mix design with alkali and fly ash materials with the local borrow sources in a Fairbank area laboratory.

Benefits to the State: Utilize a waste product to improve poor quality local embankment material. This project results showed that this is not viable option at the time.

76307 -Dust Control Product Mix Design

Principal Investigator: David L. Barnes, Ph.D., P.E.

Funding: \$144,000 (SP&R)

Project Manager: Dave Waldo

Estimated Completion Date: December 2018

Develop a test method which will aid in the selection of palliatives, establish the mix design for site specific use of dust palliatives and liquid stabilizers, determine surface material requirements for their use, and recommend qualified product lists. Establish guidance for designers and a dust palliative construction specification laying out requirements and/or

guidance for the various palliatives on the market, the mix design procedure, and other supportive information to support test protocols and design criteria.

Benefits to the State: A uniform lab and field testing procedure, as well as mix design procedures, will allow for widespread use of an assortment of dust palliatives and soil stabilizers for multiple transportation applications. This will ultimately reduce life cycle costs of our road system, improve road and runway safety, and improve quality of life and health for residents.

T2-11-02 Geosynthetic Design Guidelines & Construction Specifications Review & Update

Principal Investigator: Eli Cuelho (MSU-WTI)

Funding: \$16,000 (SP&R) + \$73,500 (State GF)

ADOT&PF Project Manager: Anna Bosin, P.E.

Closed FFY15 Final Report published 2014

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/4000-102.pdf>

Engineers strive to provide safe and effective transportation corridors and facilities that are economic to construct and maintain. ADOT&PF routinely uses geosynthetics (planar products manufactured from polymeric material) to create innovative design solutions for soil stabilization, soil reinforcement, separation, mechanically stabilized earthen structures, embankments, drainage, erosion control, pavement, and silt fences. However, the department's specifications and design practices are over five years old and do not account for the rapidly evolving world of geosynthetics technologies and design practices.

The main objective of this project was to provide recommendations that will assist the ADOT&PF to update Alaska's geosynthetic design guidelines and construction specifications to provide for the most economical geosynthetic selection while minimizing conflicts and promoting competition. The research team included nationally recognized experts in the field of geosynthetics for transportation engineering applications, and conducted a reviews of current geosynthetic design and construction practices in Alaska, historic and future uses of geosynthetics within the state, design and construction practices from other state and federal sources, and synthesized this information to adequately update Alaska's geosynthetic design and construction practices. The researchers also conducted a training course in Alaska to transfer the results of this project and assist ADOT&PF engineers to effectively and efficiently utilize geosynthetics in design and construction.

Benefits to the State: Recommendations to update design and construction specifications that will be suitable for direct implementation by ADOT&PF staff.

T2-11-11 Financial Impact of Fines in Unbound Pavement Layers

Principal Investigator: Juanyu "Jenny" Liu Ph.D., P.E.-AUTC

Funding: \$90,000 (SP&R)

ADOT&PF Project Manager: Anna Bosin, P.E.

Report Published October 2014 Project Closed FFY15

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/4000-105.pdf>

In Alaska's spring months, ice thawing underneath road pavement weakens roads and other transportation

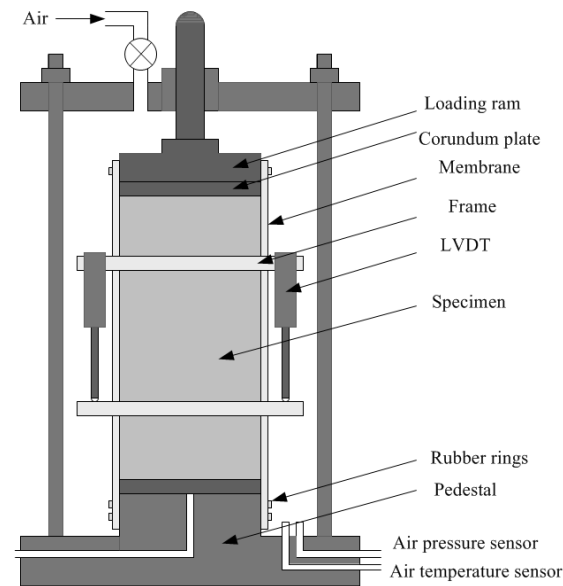
infrastructure. This causes great expense to the state and inconvenience and safety hazards for private and commercial motorists. This project examines how the fines in the base materials that a road is built on affects susceptibility to frost heaving and support for loads during the spring thaw.

Too much fines in base material can cause serious road problems. In the winter, the freezing horizon moves down through a road into the base material. Fines act like a wick, drawing moisture up, which conglomerates in lenses of ice that expand. During the expansion, material gets pushed around to make room for the ice. This can lead to heaves in the road. In spring, when the ice melts, these spots will be weakened and become sunken.

The current policy on allowable fines in base material is at a set percentage. While this is good for keeping fines at low levels, research shows this may not be necessary. A recent study done at UAF shows that the type of material and the setting it's in may have an effect on the susceptibility of the road to frost heaving.

This is important. Replacing material to build a road can add large costs to a project. This project will examine the way content of fines affects frost heaving in materials with different moisture content and temperature gradients.

Benefits to the State: Knowing what acceptable fines content is for different materials in different settings will allow for less hauled material, saving the state money, without affecting road performance.



T2-08-16 Application of a Non-Traditional Soil Stabilization Technology: Lab Testing of Geofibers and Synthetic Fluid

Principal Investigator: Billy Connor, P.E. (AUTC)

Funding: \$200,000 (State Funds)

Project Manager: Steve Saboundjian, P.E.

Project closed in FFY15

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/60392.pdf>

Gravel is practically nonexistent in western Alaska. Gravel is often needed to build infrastructure such as roads or runways. The cost of importing gravel can exceed \$200 per cubic yard. These costs can be dramatically reduced if local soils can be made usable in place of imported gravel.

This project is investigating a new technique for using geofibers and a synthetic fluid to stabilize the loose, sandy, and silty soils typical of western Alaska. Lab tests measured how well these new materials might improve poor foundation soils.

Results showed that fibers can double or triple the strength of the soil. Addition of synthetic fluids adds some strength as well. Their primary function is to reduce moisture sensitivity of the fine-grained material. A two-part chemical additive has proven to increase the strength of sands, silts, and clays at a lower cost than imported gravel. This project is the basis for a field application of these new materials. Testing of soil to determine the indirect tensile and resilient modulus tests on Tanana silt, Horse Shoe Lake Sand, and Fairbanks silt. Describe the use of fibers, synthetic fluids and two-part soil stabilizers for base stabilization.

Benefits to the State: Synthetic fluids and geofibers proved to strengthen weak soils. The research findings from this study will directly benefit a wide range of transportation construction projects by enabling the use of locally available materials, providing significant reduction in overall construction costs. This project updated the stabilization manual to include the findings of this research.

T2-10-01 Foamed Warm Mix Asphalt Lab Testing: Experimental Features in Highway Construction

Principal Investigator: Juanyu Lui Ph.D., P.E. and ADOT&PF NR Construction/Materials
Funding: \$29,986 (SP&R)
ADOT&PF Project Manager: Anna Bosin, P.E.
Project Closed FFY15

One way to reduce the cost of paving is to find ways to reduce the amount of energy it takes to apply asphalt to a surface. Hot mix asphalt (HMA), used predominantly on paving projects, is typically spread at temperatures between 280° and 320°F. When road crews use warm mix asphalt (WMA), applied at significantly lower temperatures (250° to around 270°F), they reduce the energy requirements and costs of highway paving.

Researchers wanted to see if WMA could be applied without adversely impacting pavement performance in Alaska. They worked with ADOT&PF on a paving project near Tok, Alaska. The team experimented with one form of WMA that involves adding small amounts of water (as steam) to the asphalt mixer system. The investigators collected samples on site. They conducted laboratory tests to assess how this WMA technique works and to determine if there is any significant difference between how HMA and WMA pavements performed. Tests included material characterization, rutting potential, resistance to fatigue, moisture susceptibility, and performance under low temperatures. Results show that the engineering properties of the asphalt mixture are not significantly affected by adding steam during production. Liu recommended that tests on field-collected, field-compacted specimens for foaming WMA could provide more representative and definitive results.

Benefits to the State: Foamed warm mix has been found comparable in strength and durability. It is used in projects routinely, reducing the cost of paving by saving energy that it takes to heat the asphalt to mixing and application temperatures.

Safety & Traffic

T2-12-10 Whittier Tunnel Operations Study

Principal Investigator: DOWL HKM, Thomas L. Moses, Jr., P.E.

Funding: \$150,000 (SP&R) +\$50,000 (SP&R)

Project Manager: Robert Wright & Mike San Angelo, P.E.

Report Published August 2014; Project Closed FFY15.

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/4000-118.pdf>

Conduct operational research on the Whittier Access Tunnel with the objective of improving vehicle and freight operations scheduling of this unique multimodal facility.

Benefits to the State: The Whittier Access Tunnel was opened to the public in 2000 and is maintained and operated by ADOT&PF and the Alaska Railroad Corporation. This research project will investigate the existing scheduling matrix that blends vehicle traffic with railroad usage to understand if there are opportunities to improve peak traffic flows and increase efficiencies. The consultant and contractor will also review the initial assumptions that created the schedules and investigate how those assumptions have changed by identifying the current stakeholders that rely on this transportation asset.



T2-12-07 Whittier Tunnel Signal System Investigation

Principal Investigator: DOWL HKM, Thomas L. Moses, Jr., P.E.

Funding: \$150,000 (SP&R)

Project Manager: Mike San Angelo, P.E.

Project Closed FFY15

http://www.dot.state.ak.us/stwddes/research/assets/pdf/fhwa_ak_rd_14_06.pdf

Investigate the causes and recommend technical and operational solutions for the Whittier Access Tunnel for the traffic signal system. This project coupled with T2-12-10 will give operational recommendations to improve vehicle and freight operations scheduling of this unique multi-modal facility.

Benefits to the State: The results of this study will help ADOT&PF and the Alaska Railroad improve operations and maintenance of the Whittier Tunnel multimodal facility.



T2-12-18 Review of Power Sources for Alaska DOT Road Weather Information Systems, Phase I

Principal Investigator: Richard Wies, Jr., (UAF & AUTC)

Funding: \$40,000 (SP&R)

Manager: Angela Parsons, P.E.

Final Report Published September 2014; Closed FFY15

<http://www.dot.state.ak.us/stwddes/research/assets/pdf/4000-122.pdf>

This research project involves studying the ADOT&PF Road Weather Information Systems (RWIS) sites that are currently installed off the power grid. The first generation of RWIS power generation units have outlived their economic lives – they are failing and are not cost effective to repair. The researchers will evaluate the state-of-the art in alternative power sources such as wind, solar, and fuel cells along with the latest in weather monitoring systems, and recommend improved equipment and power configurations and operating scenarios for each of the subject RWIS sites. In the next phase of the project, the researchers will work with DOT&PF to develop and test the most promising prototype system to install and test at one of these sites.

Benefits to the State: The results from this project will help the ADOT&PF provide for the safe and efficient movement of people and goods on Alaskan highways by investigating and recommending innovative remote off-grid power systems to improve the efficiency and reliability of the Road Weather Information System.

T2-13-15 Value of Depressed Medians on Divided Highways in Alaska

Principal Investigator: Dr. Ghulam Bahm & Dr. Osama Abaza (UAA – AUTC)

Funding: \$150,000 SP&R

Project Manager: Anna Bosin, P.E.

Completion Date: December 2016

The population of Alaska is steadily increasing, especially in the city of Anchorage. As a result, traffic volume is higher, and the demand to add lanes to existing highways in order to relieve congestion is increasing. In Alaska, an expressway or freeway is a high-speed (≥ 50 mph), multilane, divided highway with partial access control. These divided highways typically utilize wide medians.

During the Alaskan winter, where snow accumulates in medians from October to April, drivers can lose control of their vehicles in slippery road conditions. Wide medians with heavy snow serve as a refuge to absorb the impact of a crash. However, in order to provide additional through lanes, cater to the needs of higher traffic, and keep traffic congestion to a minimum, these wide medians could be replaced with narrow ones which may reduce the median's ability to function as a safety cushion. These depressed wide medians also act as snow storage areas, allowing snow to be plowed on both sides of the road. Eliminating these medians will reduce the available snow storage space and require plowing all of the snow to the right, increasing the snow load to one side of the road.

The main objective of this project is to compare the benefits of depressed wide medians (vee ditch) with other types of

medians (narrow medians and no snow storage) in terms of safety, operations and maintenance. This will include analysis of historical crash data along with snow storage observations and vehicle tracking observations after snowfall to evaluate non-crash reported run off the road type incidents. The researchers will compare known high speed urban arterials with narrow medians (no vee-ditches) and no snow storage and additional lanes to improve traffic flow.

Benefits to the State: The results of this research will be valuable in helping Alaska's highway designers to determining appropriate engineering alternatives to deal with increasing traffic volumes in Anchorage and the surround areas.

Photo: The research team is compiling photos from car mounted GPS equipped video cameras to analyze runoff the road events. Photo taken on the Glenn Highway near Eklutna in December 2013 by Scott Thomas, ADOT&PF Traffic and Safety Engineer.



T2-13-16 Optimizing Highway Patrol Investment Levels

Principal Investigator: Billy Connor (UAF – AUTC)

Funding: \$100,000 SP&R

Project Manager: Anna Bosin, P.E.

Completion Date: December 2016

State crash data shows fatal crashes occur more often on rural high speed highways, and higher volume highways. The highest density of severe crashes occurs within the State's four designated Safety Corridors. There is a need to optimize highway enforcement performance levels (and in turn optimize the State's funding) so that highway travel is no longer a leading risk.

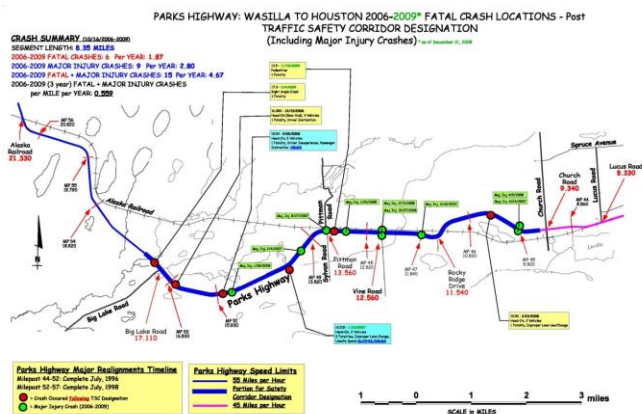
How can enforcement be directly linked to road safety when officers provide multiple duties away from roads? Reductions in citations or arrests could falsely indicate staffing reductions are possible when they may actually be needed to continue the trend.

This research project will focus on documenting the benefits of enforcement presence and the costs associated with enforcement presence on some of the higher risk road segments in Alaska. The study is expected to include the use of GPS based automated tracking technologies to quantify the presence of enforcement patrol vehicles in the Matanuska-Susitna area safety corridors. The study will develop a benefit/cost relationship for fatal and major injury crashes compared to the cost of the enforcement hours and produce a sensitivity analysis to optimize the cost vs benefit of reduced crashes.

Benefits to the State: Annual audits of the Traffic Safety Corridors emphasize the importance of increased enforcement to combat aggressive driving, DUIs and speeding, but do not quantify how much additional enforcement is needed. This project's approach of tracking officer presence will provide a full picture of enforcement impacts on our highways.

Data collected could be presented graphically, comparing "hours" of police presence by year against crash experience by severity, citation, or aggressive/impairs violations. Having this information organized could reveal unrecognized correlations and permit a new level of decision-making to be applied to safety and enforcement efforts on State Highways, helping to optimize the State's investment in law enforcement

Photo: This map shows an analysis of fatal crash locations on a Parks Highway Safety Corridor, Graphic from the Alaska Highway Safety Office website http://www.dot.alaska.gov/stwdplng/hwysafety/safety_corridor_s.shtml



T2-14-07 Experimental Feature: Wavetronix® Radar Traffic Detection

Principal Investigator: Sarah Schacher, P.E., Northern Region Preconstruction
Funding: \$35,000 (SP&R)
Project Manager: Dave Waldo
Estimated Completion Date: December 2018

This experimental feature will test the effectiveness and constructability of Wavetronix® Radar on two major arterials (Johansen Expressway and Airport Way) in Fairbanks as compared to traditional in-ground loops and video detection currently employed at signalized intersections in Fairbanks

Wavetronix® radar is a radar based detection system for intersections that can effectively detect vehicles in weather conditions that can cause problems for typical video based detection systems. Because the detection uses radar and not light, like video detection, environmental factors like low light, shadows, and heavy ice fog don't have as pronounced of an effect on the system capability to detect vehicles.

The product was successfully installed at eight intersections on Airport Way in Fairbanks. Post Construction report was submitted to FHWA Jan 2015. To date there is a noticeable decrease in false calls due to environmental factors and the accuracy of detection has improved for all intersections, translating to improved cycle times in all directions. Year 1 report is due Jan 2016.

Devices were installed in the last four intersections on the Johansen Expressway in the fall of 2015, and will be monitored over the winter. A post construction report is due Jan 2016.

Benefits to the State: If the Wavetronix© system proves to be effective, it could replace in-ground loops and video detection for signal systems in Alaska. This is expected to provide significant maintenance cost savings and reduced impacts to the traveling public due to malfunction during commonly occurring weather

T2-14-16 Modeling Passing Lane Behavior on 2-lane Highways

This project will create design models to predict the passing risk level at a variety of configuration son two lane rural highways in Alaska. The following are two projects support the modeling effort.

Analyzing Driver Behavior in Passing Zones with Differential Speed Limits

Principal Investigator: Ghulam Bham, Ph.D., Osama Abaza, Ph.D., (Co-PI)-UAA

Funding: \$165,000 (SP&R)

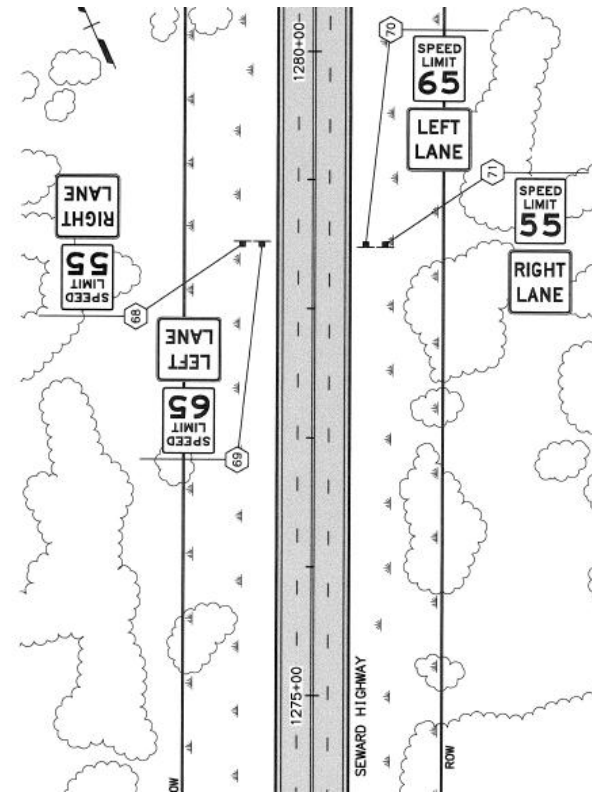
Project Manager: Anna Bosin, P.E.

Estimated Completion Date: June 2017

This project follows a previous AKDOT&PF funded driver simulation study that evaluated signing and striping scenarios in rural passing lanes to recommend optimal passing maneuvers. Implementation of that study’s results followed by including a new signing configuration of differential speed limits for the passing lanes between MP 59-66 of the Seward Highway in the AKDOT&PF Central Region paving project during summer, 2015. This study will conduct a before/after analysis to examine the real-world effects of differential speed

limits on traffic flow characteristics, along with drivers’ perception of this change.

Benefits to the State: Recommendations and a final report could help define optimal characteristics for passing lane efficiency.



Modeling Passing Zone Behavior and Sight Distance on Rural Two-Lane Highways

Principal Investigator: Billy Connor P.E. (UAF – AUTC),
Nathan Belz, Ph.D. (UAF – AUTC)
Funding: \$110,000 (SP&R)
Project Manager: Anna Bosin, P.E.
Estimated Completion Date: December 2017

UAF researchers will conduct a driver-simulator-based study in partnership with University of Idaho to investigate passing maneuvers in two-lane rural highways under different geometric configurations and for different driver groups and for different vehicle types. Passing decisions will be modeled using data that are collected using scenarios modeled after segments of interest along the Seward Highway, Parks Highway, Glenn Highway, and Richardson Highway. Participants in the study will complete a driving simulator session and a questionnaire to further documenting the characteristics of their behavior. In addition to the driver simulator study, the researchers will use AASHTO SHRP2 naturalistic driver study data to validate the driver simulator study and model the passing maneuver based on this data.

Benefits to the State: The outcome of the project will provide the ADOT&PF's with models that can be used to predict the risk level on two-lane rural highway and may contribute to modifications to striping specifications and improved maintenance operations for rural highways in Alaska.

T2-12-14 Improving Passing Lane Safety and Efficiency for Alaska's Rural Non-divided Highways

Principal Investigator: Billy Connor, P.E. (UAF & AUTC);
Ahmed Abdel-Rahim & Brian Dyre, (UofI)
Funding: \$60,000 (SP&R) + \$60,000 (AUTC)
Project Manager: Anna Bosin, P.E.
Report Published July 2014 Project Closed in FFY15
<http://www.dot.alaska.gov/stwddes/research/assets/pdf/4000-120.pdf>

This study will develop novel highway lane markings and signage based on a scientific understanding of human perception and decision making (i.e., human factors) and will assess the potential of these safety interventions for reducing speed and risky passing behavior by conducting a series of driving simulation experiments.

Benefits to the State: Reduce the number of crashes that occur relative to passing lanes on Alaska's non-divided rural

76293 Frequency & Potential Severity of Red Light Running in Anchorage

Principal Investigator:
Funding: \$80,000 (SP&R)
Project Manager: Anna Bosin, P.E.
Estimated Project Completion June 2017

This study will evaluate a minimum of six intersections during fall and winter conditions. Will collect signal timing data and video at each location for analysis.

Benefits to the State: Reduce the number of crashes that occur relative to red light running

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T2-14-04 Rapid Research Response FFY 2014-16

Principal Investigator: Various

Project Manager: Carolyn Morehouse, P.E.

Completion Date: Varies by project but all must be completed by December 2016

The Rapid Research Response program supports a portfolio of research projects, technology transfer, and workforce development activities to rapidly respond to opportunities to improve practices, procedures, and processes within the department as they arise and on an ad hoc basis. The account is funded through a revolving line item in the section’s work program entitled “Rapid Research Response”.

The research response project funds the following types of research activities:

- Generally short term, high priority research projects to provide or address urgently needed information and or problems.
- Augment existing research projects to take advantage of unforeseen opportunities where timing is of the essence. During the course of a research project, the researchers may identify a previously unforeseen opportunity or method worthy of exploration to enhance the research and provide more useful results. The “Rapid Response” funds allow timely response to such opportunities.
- Research coordination and advisory services with national, university, and other state research programs.
- Unique and timely research and technology demonstration efforts.
- Policy-related research to address the immediate needs of decision-makers.

Benefits to the State: DOT&PF can conduct research in a short period of time with quick results for immediate implementation.

Project Title	Project #	Amount	Contact
Fly Ash Mix Design	T2-14-15	\$26,000	Anna Bosin, P.E.
Specialized Testing Asphalt/AKDOT&PF Asphalt Binders (AUTC/Queens University)	64006	\$26,015	Anna Bosin, P.E.
Eagle Monitoring	64006	\$33,000	Janelle White

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Experimental Features Principal Investigator: Varies
 Funding: \$145,000 (Federal)
 Project Manager: Carolyn Morehouse, P.E.
 Completion Date: varies

The Federal Highway Administration (FHWA) Experimental Features Program encourages innovation in state highway design and construction. Experimental features incorporated into highway projects under this program are eligible for federal funding participation, which is normally limited to more proven and conventional items. Another advantage of the Program is that if an experimental feature fails for any reason, the FHWA will pay for its repair or replacement. Experimental features are often physical objects, however, can also be a new technique for using conventional materials. The RD&T2 Program maintains an account to support evaluations of Experimental Features for a time period requested by FHWA, normally 3-5 years.

Benefits to the State: DOT&PF can conduct research and evaluate experimental features during construction and monitor results.

Project Title (construction project)	Research Project #	Amount	Estimated Completion Date
Spray Applied MMA Bridge Deck Waterproofing (Rich MP 201 Phelan Cr Bridge)	64317	\$29,000	Dec 31, 2018
Wavetronix Radar Detection (Johansen & Airport Way PM)	64321	\$35,000	Dec 31, 2018
Polyester Concrete Approach Slabs (Parks MP 239-252)	T2-13-19	\$51,000	Dec 31, 2017
Tencate Mirafi Wicking Fabric (Dalton 197-200)	T2-13-10	\$30,000	Dec 31, 2016

Pooled Fund Studies FFY 2015

Principal Investigator: Varies
 Funding: \$179,000 (SP&R)
 Completion Date: various

Benefits to the State: When significant or widespread interest is shown in solving transportation-related problems, research, planning, and technology transfer activities may be jointly funded by several federal, state, regional, and local transportation agencies, academic institutions, foundations, or private firms as a pooled fund study. The FHWA Transportation Pooled Fund (TPF) Program allows federal, state, and local agencies and other organizations to combine resources to support transportation research studies. ADOT&PF participates in the following pooled fund studies. Details and status are available at <http://www.pooledfund.org/>.

Supplemental Research & Technology Program

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Title	Study ID	Lead Agency	ADOT&PF FFY 2015 Funding	Project Website/ADOT&PF Technical Lead
FFY 2015 Funding				
Roadside Safety Research Program	TPF-5(114)	Washington	\$50,000	http://www.pooledfund.org/Details/Study/345 Jeff Jeffers
Clear Roads Winter Highway Operations	TPF-5(215)	Minnesota	\$60,000	http://www.pooledfund.org/Details/Study/446 Mike Coffey
Assessing Roadway Traffic Count Duration and Frequency Impacts on AADT Estimations.	TPF-5(292)	FHWA	\$6,000	http://www.pooledfund.org/Details/Study/534 Jennifer Anderson
Simplified SPT Performance-Based Assessment of Liquefaction and Effects	TPF-5(296)	Utah Department of Transportation	\$13,000	http://www.pooledfund.org/Details/Study/538 David Hemstreet
Aurora Program	SPR-3(042)	Iowa Department of Transportation	\$25,000	www.pooledfund.org/Details/Study/189 Jack Stickel
Validation of Tsunami Design Guidelines for Coastal Bridges	Solicitation # 1332	Oregon Department of Transportation	\$25,000	www.pooledfund.org/Details/Solicitation/1332 Rich Pratt

Alaska Technology Transfer

2015 Annual Report

Housed within ADOT&PF's Research Section, Technology Transfer (T2) provides support to federal, state, and local governments and other transportation personnel. We are comprised of three programs, integrated to provide a seamless training and technology transfer service.

Local Technical Assistance Program: \$300,000

LTAP is a national network of centers funded by FHWA. LTAP's mission is to foster a safe, efficient, and environmentally sound surface transportation system by improving skills and increasing knowledge of the transportation workforce and decision makers. Each LTAP center adapts its program to address the unique challenges faced by the customers it serves. LTAP's primary focus is on:

- training events and programs
- newsletters and tech briefs
- library services.

National Highway Institute: \$350,000

Provides transportation-related education programs to AK DOT&PF employees to help improve the quality of the state's highway system by enhancing economic growth, improving public safety and quality of life, and promoting environmental stewardship. This is accomplished by technology transfer to the planning, design, construction, and maintenance personnel working for Alaska's transportation infrastructure.

T2-13-06 Rapid Technology Transfer: \$100,000

State of Alaska program designed to respond to high-value, un-programmed needs related to training and technology transfer. Funds are limited to courses, projects, programs, or equipment that will benefit the maximum number of stakeholders. Use of funds should result in cost savings, leveraging of external

resources, or enhancement of partnerships. Program ends June 31, 2016.

CY 2014 Program Dashboard

Total number of training sessions: **118**

Total number of participants: **2,368**

Total number of participant hours: **22,352**

T2 Highlights

- Completed Dust Control Field Guide for Gravel Driving Surfaces.
- Updating Training Management System to include a training plan development tool and a supervisor notification system.
- Working with regions and statewide sections to identify content for alternate delivery and just-in-time learning
- Established beta training portal by adding several recorded web and VTC events.
- Developing on-line training program with eleven modules pertaining to gravel road design and maintenance. Partnering with UAF's Alaska TTAP - completion early 2016.
- Specialized training on gravel road inspection and maintenance planning to Fairbanks North Star Borough
- On-going management/delivery of the ATSSA and Alaska CESCL training programs.